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Using Participatory Video for Smallholder Farmer Training in Malawi

A Report from the GCFSI and LUANAR ICTD Project Team

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EXECUTIVE SUMMARY

In June and July of 2014, a team of researchers from the Michigan State University (MSU) Global Center for Food Systems Innovation (GCFSI) and the Lilongwe University of Agriculture and Natural Resources (LUANAR) investigated the potential of using participatory videos to augment the work of Malawian agricultural extension agents in their efforts to impart new agricultural practices to smallholder farmers. The team's effort was part of a multi-pronged research program initiated by GCFSI aimed at enhancing Malawian maize farmers' resilience to climate change and in particular to answer the question, Where and how can multipurpose legumes be scaled for sustainable intensification of maize systems; and what would the potential impacts be, in the medium term, across the food system in Malawi?

Background

The Information and Communication Technology for Development (ICTD) team at GCFSI explored an approach that has been used extensively in India by the non-governmental organization (NGO) Digital Green to help encourage adoption of new agricultural practices among rural farmers through the production and group-based screening of low-cost training videos with deep involvement by local actors in rural communities.

We conducted a baseline survey of access to and use of information and communication technology (ICTs), with a focus on mobile phones, in three rural communities in the Linthipe Extension Planning Area of the Dedza District of Malawi to inform decisions regarding the topics and methods to use in ongoing engagement with farmers. We then pilot tested participatory video training techniques in these communities using a quasi-experimental design in order to assess their effectiveness as a learning tool and in stimulating adoption of new techniques. Based on our survey results, interactions with agricultural extension officers, and interviews with farmers, two topics were chosen to test the effectiveness of participatory videos: one focusing on food preparation techniques that can improve nutrition and minimize food wastage, and a second focusing on mulching methods for soil conservation.

Key Findings

Through the baseline survey, we found that the penetration of mobile phones among smallholder farmers in this district was far lower than expected. Only 28.3% of households reported having a mobile phone; and, using household sizes to convert this to a population proportion, our data suggests that mobiles are possessed by an estimated 6.4% of the population. As commonly used mobile penetration statistics focus on subscription rates based on the number of subscriber identity module (SIM) cards sold, we estimated the non-unique subscription rate to be 19.9% in our sample, which remains much lower than the current 33% mobile subscription rate for Malawi provided by international data from the International Telecommunications Union (ITU) and the Group Spéciale Mobile Association (GSMA). Mobile ownership was strongly associated with other indicators of socio-economic status, demonstrating that, despite declining costs, the poorest farmers continue to lack access. Access among women was substantially lower than among men.

The participatory video pilot tests demonstrated that this approach yields short-term knowledge gains that are equivalent to, or, in some cases, better than live training methods. We measured the highest short-term learning where we were able to use both methods in an integrated fashion. Our efforts to measure adoption were constrained by the relatively short time period of the study, which resulted in limited time for adequate uptake of the technologies. Seasonal constraints also inhibited uptake of the mulching technique. Virtually all farmers expressed plans to try the techniques in the trainings, regardless of training modality, suggesting that there may be equivalent adoption rates over time.

Conclusions

GCFSI's work to understand how and where multipurpose legumes can be used to support sustainable intensification of maize systems in Malawi will depend on efficient and effective methods for informing farmers about such new farming approaches. Our pilot work on participatory videos has demonstrated that this approach can be an effective technique, if done in a manner that involves local participants in the production and screening. The baseline survey findings have implications for the viability of phone-based services that might provide agricultural information and other services to farmers. This strengthens the argument for focusing on other approaches to educating farmers, including both farmer field schools and intermediary-delivered video-based training.

Gender Implications

Findings reveal substantial gaps in access to mobile phones among women farmers, as well as gaps in skills in using various phone features. Participatory videos, however, offer a training approach that can help to overcome such access constraints, by enabling us to direct educational content to women, and involve them in productions and screenings.

Scaling Implications

The techniques piloted in this study have the potential to be scaled through our partnerships with LUANAR, Digital Green, the Ministry of Agriculture in Malawi and, in particular, its Department of Agricultural Extension Services (DAES), and other stakeholders. Moreover, the findings suggest that the participatory video approach can support the scaling of other innovations that depend on adoption by smallholder farmers to generate demand, including such innovations as climate resilient maize. Involving organizations such as Digital Green, however, would require significant funding resources, which would be beyond GCFSI capacity. Nonetheless, the approach can complement existing USAID programs in Malawi under the auspices of the Feed the Future program, including the New Alliance ICT Extension Challenge Fund.

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ACRONYMS

ACE	Agricultural Commodities Exchange
AEDC	Agricultural Extension Development Coordinator
AHCE	Auction Holdings Commodity Exchange
CRM	Climate Resilient Maize
DAES	Department of Agricultural Extension Service
EPA	Extension Planning Area
GCFSI	Global Center for Food Systems Innovation
GVH	Group Village Head
ICTD	Information and Communication Technology for Development
ICT	Information and Communication Technology
IFPRI	International Food Policy Research Institute
ITU	International Telecommunications Union
LUANAR	Lilongwe University of Agriculture and Natural Resources
MSU	Michigan State University
NGO	Non-governmental Organization
SIM	Subscriber Identity Module
USAID	United States Agency for International Development
USAID/Lab	US Global Development Lab

1. INTRODUCTION

The agricultural sector in Malawi faces a number of challenges, including inadequate extension service delivery attributed to low extension-farmer contacts.[1] In June and July of 2014, a team of researchers from GCFSI and LUANAR investigated the potential of using participatory videos to augment the work of Malawian agricultural extension agents in their efforts to impart new agricultural practices to smallholder farmers. The team's effort was part of a multi-pronged research program initiated by GCFSI and aimed at enhancing Malawian maize farmers' resilience to climate change. Building on a multi-year effort by MSU agronomic researchers, GCFSI sought to explore how and where the use of multi-purpose legumes, such as pigeon peas, could be intercropped with maize to 1) improve soil fertility and maize resilience to heat and drought, thereby enhancing maize yields, and 2) provide an additional source of nutrition for farm households. The ICTD project team sought to contribute to this effort by investigating new ICT-based techniques that could be used to help educate rural smallholder farmers about the benefits and methods of intercropping with multipurpose legumes once the agronomic researchers were ready to disseminate findings.

The ICTD team was led by MSU faculty members Charles Steinfield and Susan Wyche (Department of Media and Information) and LUANAR faculty members Hastings Chiwasa (Department of Extension) and Japhet Mchakulu (Department of Agricultural Education and Development Communication). Our team also consisted of MSU media and information studies PhD student Tian Cai; LUANAR students Patrick Tembo, Vinjeru Nyirenda, and Esther Ngwira; and University of Malawi students Martin Thodi and Hope Chidziwisano (supervised by University of Malawi faculty members Chimora Mikeka and Stanley Mlatho).

Our team partnered with the Ministry of Agriculture in Malawi and its Department of Agricultural Extension Service (DAES) [in particular, Mirielle Mkandawire, who serves as the agricultural extension development coordinator (AEDC) of the Linthipe Extension Planning Area (EPA), and her support staff] in order to carry out the research. Three agricultural extension officers—Lucy Mwalughali, Victoria Mhone, and Charles Tembo—supported our efforts in the field.

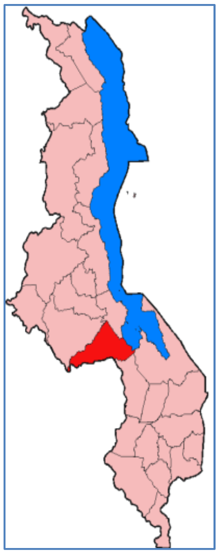
As noted, the team explored the use of participatory videos for smallholder farmer training. This approach has been used extensively in India by Digital Green to help encourage adoption of new agricultural practices among rural farmers.[2]

To benefit from their experience, we formed a collaborative arrangement with Digital Green, which enabled us to send two members of our team to India for several weeks so that they could observe their methods directly. Hastings Chiwasa from LUANAR and Tian Cai from MSU visited Digital Green's offices in Delhi, as well as a field site in the Karnataka region near Bangalore in late June and early July. Among the Digital Green staff working with our team were Rikin Gandhi, CEO; Suruchi Malik; Sharanbasappa Nadagouda; Keethiraj Siddapura; and Ashok Kumar from the Bangalore Digital Green Office. Nagagouda accompanied our team members during their field visit to Karnataka so that they could observe the production and screening of videos in a rural community. In Malawi, our team's work was concentrated in the Dedza District (see the red section in Figure 1), and specifically within the Linthipe EPA of the district.

[1] See Masangano, C. and C. Mthinda. 2012.

[2] See www.digitalgreen.org for an introduction to the participatory video approach as employed by Digital Green.

Figure 1. Malawi Districts



Source: English Wikipedia: http://en.wikipedia.org/wiki/Image:MW-Dedza.png

This area was selected primarily due to its proximity to LUANAR to facilitate access for team members and also the active engagement in agricultural production by the farmers in the area. In addition, several communities in this region have been studied by MSU and LUANAR researchers investigating the potential benefits of multipurpose legumes. This prior research further facilitated our ability to work in the region.

Our efforts during June and July were divided into two principal activities: 1) the completion of a survey in a sample of villages aimed at uncovering baseline information about farmers' use of ICTs, particularly mobile phones, to help us better understand the potential for ICT-based information delivery approaches in the region, and 2) the production, screening, and assessment of participatory videos in this sample of villages. The remainder of this report describes the methods used to conduct our survey and field test, key findings, and conclusions. Emphasis is put on how our project connects with other work within the GCFSI, especially in contributing to efforts to scale multipurpose legumes, gender issues raised by our research, and implications for future work by GCFSI, LUANAR, and the United States Agency for International Development (USAID). The report concludes with a discussion of potential next steps.

2. METHODOLOGY

2.1. Baseline Survey

In early June of 2014, the team developed a draft survey to improve our understanding of farmers' access to and use of ICTs. The survey instrument was developed collectively by MSU and LUANAR researchers, translated into Chichewa, and pre-tested in Mdatsitsa Village, a small farming community near LUANAR, to ensure that questions were understandable. LUANAR and University of Malawi students worked as enumerators who conducted face-to-face interviews guided by a questionnaire, recording their responses on a printed survey form. The survey was designed to collect information from respondents on the following:

1) Household composition, including gender, age, educational level, and sources of income for the household head as well as all other people living in the respondents' home.
2) Farming information, including farm size, types of crops grown, and whether crops are sold at the market or not.
3) Asset ownership, including information on the number and type of livestock raised, and other assets that might be owned, such as bicycles, TVs, and radios.
4) Primary sources of information on farming practices, pest and disease management, livestock, prices, seeds, and weather.
5) Whether anyone in the household owned a mobile phone, and if so, the details on each phone including the age, condition, price, and how it was acquired (e.g., bought new, bought used, or given as a gift).
6) For those with a phone, further information on phone usage was gathered, including information on who respondents call and text, calling and texting purposes, top-up

patterns (where, how often, how much), charging patterns (where, at what cost), and use of built-in phone features (e.g., calculator, calendar, music). Additional questions were asked to understand phone competence, such as frequency of texting, ability to delete texts, and ability to work with the contact directory. Finally, awareness and use of three mobile agricultural services available in the market were assessed: the Agricultural Commodities Exchange (ACE), Esoko, and the Auction Holdings Commodity Exchange (AHCE).

7) Those without a phone were asked if they ever borrow a phone, if they had ever owned one previously, and if so, why they no longer had one. If the respondent never owned a phone, we asked the reason they did not. Non-owners were also asked if they intended to purchase a phone in the future.

The survey was administered to a sample of 191 respondents within our study area using a multi-stage sampling procedure. First, we worked with the head of the AEDC in the Linthipe EPA to identify three similarly sized sections.[3] The Diamphwe, Chisiri, and Ndikuwa sections were chosen, with each containing approximately 20 to 25 villages. Within each section, one village cluster (known as a group village head or GVH) was randomly selected with each having between 200 and 500 farm households. The Lumwira GVH was chosen in the Diamphwe Section, the Chikufikani GVH in Chisiri, and the Kukada GVH in Ndikuwa (see Figure 2). Extension officers then worked with the village leaders in each of the selected GVHs to compile a list of all households, from which a random sample of 60-70 households in each was drawn using a skip interval method.

Once the names of selected households were drawn, enumerators visited each household and conducted oral in-person surveys in respondents' native language of Chichewa. Enumerators asked for the household head; or, if this person was not available, they asked to speak with another adult living in the home. All data collection for the baseline survey occurred over a two-week period in the first half of June 2014. Enumerators verbally obtained informed consent prior to the start of the survey, and a respondent in all of the 191 selected households agreed to participate, yielding a 100% response rate.

2.2. Participatory Video Field Test

Following analysis of the survey results, we worked again with the representatives from the Ministry of Agriculture to choose content to use in investigating the effectiveness of the participatory video technique.

Figure 2. Study Sites

Source: Adapted by the authors from Google Maps.

Our original intention for this test was to prepare video content aimed at improving farmers' abilities to use their mobile phones to access agricultural information and services, as our earlier research had demonstrated that many rural smallholder farmers lacked awareness and basic skills for accessing these emerging services.[4] However, due

[3] A section represents a region consisting of a set of contiguous village clusters within an EPA, and an extension officer is normally assigned to a specific section. Sections are further subdivided into village groups, with one village in the group considered the group village head (GVH).

[4] This work is detailed in Steinfield and Wyche (2013).

to the low level of mobile phone access found in our survey (as detailed later in the results), we decided to focus on other content for the pilot test. Following discussions with extension agents and focus groups with farmers in each of the study areas, two topics were chosen for the test: one focused on instructing farmers on a food preparation technique and a second focused on proper methods for using maize stalks for mulch to help conserve soil nutrients on farm plots. For both topics, extension agents were already planning live demonstrations in the study period, and farmers in the focus groups expressed an interest in learning more about them.

2.2.1. Producing Participatory Videos

Video-based training has gained in popularity in development circles in recent years, with one survey finding that nearly 80% of development organizations in the food sector had used video to train farmers (Van Mele 2011). It is lauded for reaching low literate and less educated populations, being more cost-effective than traditional training methods, and helping to bridge gender divides by making information access more equitable across men and women farmers. Participatory videos seek to involve local participants in various ways in the overall production process. Studies show that when videos reflect the local context and feature actors who are culturally similar to the audience, they are rated more highly (Chowdhury, Van Mele, and Hauser 2011; Geroski 2000). As noted earlier, one of the most successful implementations of the participatory video method is the Digital Green project. Findings from research evaluating this approach suggest it is 10 times more effective per dollar spent than the conventional extension train and visit method (Gandhi et al. 2009). The Digital Green guidelines were instrumental in helping us develop our test videos, which incorporated the following steps:

1) Conduct a community needs assessment to identify the types of information needed prior to selecting video content, as well as assess prior knowledge of the information.

2) Create a story to guide video production that highlights the benefits of the techniques that are the subject of the training, while ensuring that everything needed to adopt them is locally available. Additionally, incorporating humor and other entertaining components, such as songs and dance, helps to increase engagement. Finally, having the videos reviewed by local extension workers and other local actors prior to screening is important.

3) Screen the videos in a relatively small group setting in the community, with opportunities for discussion, and use this screening to assess learning outcomes.

4) Get additional feedback after the screening to help improve the video and to assess knowledge gain and rate of uptake and adoption.

Hence, we worked closely with local extension officers and lead farmers to help produce the videos, which prominently featured farmers from the region as actors. One difference between our approach and Digital Green is that our video footage was shot and edited by a student who was studying video production at MSU. We did this due to the lack of time needed to train extension personnel in video production, as well as the lack of resources needed to equip all of the participating extension agents with the necessary hardware and software. Further work is needed to assess whether the extension agents would be able to produce compelling video material on their own, although Digital Green experiences in India suggest this is possible. An alternative approach that could provide for sustainable video production capacity would involve using LUANAR students for this purpose.

The extension workers recommended four local farmers to be the actors in the two videos. In the food preparation video, two local women and one local man acted in the video and demonstrated the technique, with all dialogue in Chichewa. In the mulching video, one local male farmer and one male extension worker were the actors. Both videos were edited by a video specialist and vetted by the AEDC of the Linthipe

EPA and the extension workers. Several modifications were made after the review. The videos were screened in the villages in local community buildings, such as churches and schools, using battery powered pico projectors.[5] Video production took place in the second week of July 2014, while screenings occurred in the third week of July 2014. A photo of one of the screenings of the food preparation video can be seen in Figure 3. We gathered feedback after the screenings to assess learning, and returned a week later to assess adoption. The MSU-based team members left Malawi at the end of July 2014.

2.2.2. Experimental Design

A quasi-experimental design was used to assess both learning and adoption of the techniques addressed in the videos. The design compared two different training modalities: 1) a live demonstration that is the traditional approach used by extension officers, and 2) a video training mode where farmers only saw a 15-minute video demonstration. It was quasi-experimental in the sense that we were not able to randomly select and assign respondents to conditions; but rather, assignment to conditions was based on a participant's geographic location. Moreover, all farmers in the treatment villages were able to attend the live or video demonstrations depending on what was offered in their location. Hence although this approach leads to a selection of participants with some prior interest in the topics, such selection bias applies equally across all treatments, so any differences can still be attributed to the differing treatments. The video training was shown in one village area (Chikufikani for food preparation; Kukada for mulching), while the live demonstration was provided in another (Kukada for food preparation; Chikufikani for mulching).

Figure 3. Screening the Food Preparation Video in a Local School in the Chikufikani GVH

Source: Kirk Mason.

In addition, we were able to investigate the effectiveness of using both modalities in an integrated fashion for the mulching video in Diamphwe, enabling us to see if the combined approach yielded better results than exposure to live demonstrations or video alone.[6] The participants first attended an in-person training session led by the extension worker, then watched a video containing the information, and finally observed a field demonstration with group discussion. As noted earlier, for each training session, all farmers in the selected village groups were invited to attend.

A total of 301 farmers participated in the training pilot tests, including those exposed to the videos, the live demonstrations, or the combined treatment. Table 1 summarizes the number of participants in each experimental condition as well as training locations.

[5] The food preparation video can be viewed online at https://www.youtube.com/watch?v=03SvbvU2RIU. The mulching video can be viewed online at https://www.youtube.com/watch?v=8daN7TtWSI8. A short documentary of the entire project, including both the baseline survey and the video pilot test, can be viewed at https://www.youtube.com/watch?v=VPvWIhzVbh8.

[6] We were not able to test the combined approach with the food preparation video in Diamphwe because the extension agent already had provided a live training before our pilot testing began.

Table 1. The Location and Number of Participants by Training Method

	Training Methods			N
	Traditional only	Video only	Combined	
Food preparation	N=59 Location: Kukada, Ndikuwa Section	N=66 Location: Chikufikani, Chisiri Section	N/A	125
Mulching	N=56 Location: Kukada, Ndikuwa Section	N=61 Location: Chikufikani, Chisiri Section	N=59 Location: Lumwira, Diamphwe Section	176

Source: Authors.

2.2.3. Measures Used to Assess Learning and Adoption

Interviews were conducted in all training groups at three different points in time. Student enumerators from LUANAR conducted all interviews in Chichewa.

First, prior to each training session, a pre-training knowledge test was used to assess how much participants already knew about the topic. Once the live demonstration and/or the video screening had concluded, a second post-test interview was conducted, enabling us to estimate the extent to which any knowledge was due to the training rather than due to prior experience. Finally, a third interview was conducted in an effort to estimate the potential prospects for adoption of the training techniques, although our short time in the field limited our ability to make realistic assessments of long-term effects. Approximately seven to ten days after the training sessions were held in each location, enumerators returned and asked participants if they had tried any of the techniques covered in the training.

Knowledge related to the training topics was measured by creating an index from a series of questions that asked participants to describe what they learned from the training. For example, for the mulching training, interviewers asked participants seven open-ended questions:

1) What is your understanding of minimum soil disturbance agriculture?
2) What are the benefits of using this type of agriculture?
3) What are the types of materials that can be used in minimum soil disturbance agriculture?
4) How should plant material be distributed for mulching?
5) When should plants be planted on the field with mulching?
6) What is the recommended plant practice?
7) What is the recommended time for fertilizer application?

A score was determined by counting all of the correct responses (note that some questions had multiple responses). Incorrect or "don't know" responses were scored as 0, while each correct response was worth one point. The maximum possible score for the mulching topic was 20.

For the nutrition and food preparation topic, participants were asked four open-ended questions:

1) What nutrition can you get from the egg-coated leftover nsima and egg-coated pumpkin flowers?
2) What are the benefits of preparing egg-coated leftover nsima and egg-coated pumpkin flowers?
3) What are the steps to prepare egg-coated leftover nsima?
4) What are the steps to prepare egg-coated pumpkin flowers?

An index was created in the same manner as that used to assess mulching knowledge, and in this case, the maximum possible score was 17.

To evaluate the participants' likelihood of adoption of the techniques discussed in the food preparation training, participants were asked if they had cooked either of the meals in the time since the session. Similarly, we asked participants from the mulching training if they had attempted to practice mulching in any of their gardens or farm plots in the time since the session.

3. FINDINGS/ANALYSIS

In this section, we first describe the results from the baseline survey, followed by the findings from our pilot test of the participatory videos.

3.1. Baseline Survey Findings

3.1.1. Basic Sample Description and Contrasts between Phone and Non-Phone Households

Of the 191 respondents in our survey, 66 (34.6%) were men and 125 (65.4%) were women (see Table 2). Many of the women who responded were not, however, heads of households, as most households were reported to be headed by men (143 or 74.9%) with only 48 (25.1%) headed by women).

Table 2. Socio-Economic Status Indicators by Mobile Phone Ownership

	Non-Phone Households N=137 (71.7%)	**Phone Households N=54 (28.3%)**	**All N= 191**
Education Level of Household Head	No school 29.3% Some primary 63.9% Completed primary 4.5% Some secondary 2.3% Completed secondary 0.0% scale mean=1.80	No school 11.8% Some primary 45.1% Completed primary 17.7% Some secondary 17.7% Completed secondary 7.8% scale mean=2.64****	No school 24.5% Some primary 58.7% Completed primary 8.2% Some secondary 6.5% Completed secondary 2.2% scale mean=2.03
Farm Size	1.79 acres	2.52 acres**	2.00 acres
Sell Crops	81.8%	100% ††††	87.0%
Livestock	cattle=0.14 goats=0.83 chickens=2.66 pigs=0.55	cattle=0.50* goats=1.41* chickens=5.15*** pigs=1.54***	cattle=0.24 goats=0.99 chickens=3.37 pigs=0.83
Other Household Assets	bicycle 33.6% TV 1.5% radio 41.6%	bicycle 74.1%†† TV 3.7% (n.s.) radio 66.7%††††	bicycle 45.0% TV 2.1% radio 51.3%

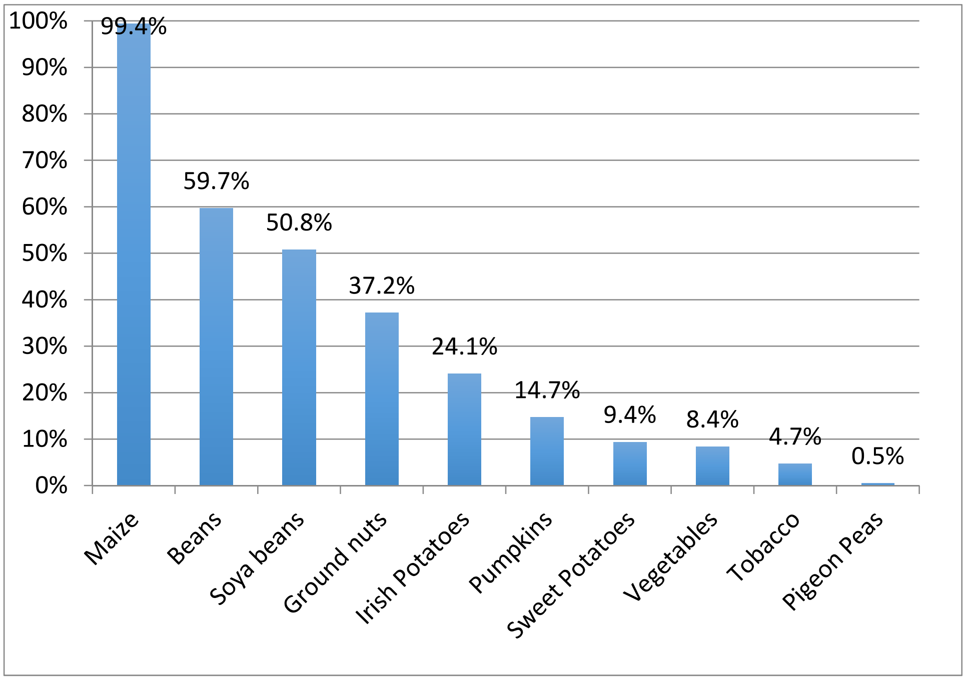
Source: Authors.

* t test contrasting phone and non-phone households, p<.05, ** p=.01, *** p=.001, *** p=.0001; scale range: 1=no school to 5=completed secondary

† chi-square contrasting the distributions among phone vs. non-phone households, p=.05, †† p=.01, ††† p=.001, †††† p=.0001—all chi-square probabilities estimated using likelihood ratios.

The majority of household heads (56.9%) had not completed primary school, with only 7.8% completing secondary school. The average household contained 5.23 people, including all children and adults who slept and dined in the home. The average farm size in the sample was two acres. Most farmers sold at least some of their output at a local market. Few raised much livestock, with a typical smallholder farm not owning any cows, but averaging approximately one goat, three chickens, and one pig. Slightly more than half of the households (51.3%) had a radio, while slightly less than half (45.0%) had a bicycle. Only 2.1% of the households reported having a TV, and none of the households were connected to the electrical grid. A few (16.3%) did report having access to some form of electricity – mainly a solar powered light (7.4%) or a battery (6.3%). All but one of the farmers in our sample grew maize (99.4% - see Figure 4). Other crops grown included beans (59.7%), soya beans (50.8%), groundnuts (37.2%), Irish potatoes (24.1%), pumpkins (14.7%), sweet potatoes (9.4%), misc. vegetables (8.4%), tobacco (4.7%), and pigeon peas (0.5%). Nearly two-thirds (64.9%) indicated that they intercropped maize with other crops, including with beans (40.0%), soya beans (13.1%), and groundnuts (5.8%). As shown in Table 2, only 28.3% of the households reported having a mobile phone. We contrasted the phone and non-phone households, and across nearly every indicator of socio-economic status, households owning a mobile phone appeared to be better off. Household heads in phone-owning households were more educated on average, owned larger farms, were more likely to sell their crops at the local market, had more livestock, and were more likely to own other assets such as bicycles and radios. Our finding that 28.3% of households owned a mobile phone does not allow comparisons to commonly published mobile penetration rates, however, since it does not take into account the number of people living in each household.

Figure 4. Distribution of Crops Grown by Farmers in the Sample



Source: Authors.

Rather, most estimates typically look at the number of SIM cards registered per 100 people in a given population. Not only can a phone owner have more than one SIM card, but non-owners also may have one or more SIM cards that they used on someone else's phone. We asked about SIM card ownership when respondents said there was a phone in the household. The total population represented by the households in our survey (i.e., including all individuals reported to be living in each household) was 999, with an average of 5.23 people per household. Of the 54 phone-owning households, eight reported two phones and one reported three phones, yielding a total of 64 phones. This would result in a phone penetration of only 6.4%, which is surprisingly low.

Multiple SIM cards (for Airtel and TNM, the two primary mobile operators in Malawi) were reported for only eight of the 64 phones, yielding a total of 72 SIM cards reported. This would yield a mobile subscription rate of just 7.2%, which is also quite low.

To be fair, it is very likely that there were some SIM cards in households without phones. To develop an estimate for this, we asked all respondents who reported no phones in their household if they owned a SIM card, and 11.7% said yes. If we assume that the same proportion of non-phone owners with a SIM actually have two SIM cards as phone owners (14.8%), and apply this to the total estimated population of non-phone owners (999-54 or 945), then we can derive a somewhat rough estimate of SIM card penetration in the communities we surveyed. As shown in Table 3, there were 72 reported SIM cards among phone owners, plus 126.93 estimated SIM cards among the non-phone households) yielding an estimated 198.93 total SIMs among 999 people, for a SIM penetration of 19.9%, much lower than the national estimate of 33%.

Table 3. Estimating the Subscriber Identity Module (SIM) Penetration

	Estimated Number	Estimated Percent
Phone owners reporting one SIM	64	6.41%
Additional SIMs reported in phone owning HHs	8	0.80%
Estimated number of non-phone owners with one SIM (11.7% of non-phone HH)	110.57	11.07%
Estimated additional SIMs among non-phone owners (using same proportion – 14.8% as multiple SIMs in phone HHs)	16.36	1.64%
Total estimated SIMS	198.93	19.91%
Total estimated to have no SIM or phone	800.07	80.09%
Total estimated population in sample	999	100.00%

We would argue that this figure represents a substantial overestimate, however, since it is unlikely that many of the small children reported among the households would have a SIM card. In any case, it is clear that mobile phone access is simply not widespread among rural Malawian farmers.[7] Interestingly, an additional 37 respondents reported having previously owned a phone, representing 19.4% of the sample. This illustrates the fluid nature of phone ownership. The primary reasons for no longer owning a phone were that it was sold to earn money (41%), broken (35%), or lost or stolen (22%). The primary reason that most respondents reported for not having a phone is the cost. Hence, phone ownership is clearly associated with socio-economic status, providing evidence that even though costs have fallen dramatically over the past decade, it remains out of reach for the poorest families. This creates a barrier to the reliance on mobile phones for delivering agricultural information and services to smallholder farmers in Malawi.

3.1.2. Gender Differences in Mobile Phone Ownership and Use

Women made up nearly two thirds (65.4%) of the respondents in the sample, with a quarter of the households headed by women (Table 4). Male respondents (48%) were three times more likely to report having a phone in the household than female respondents (17%). When women were the heads of the household, there was a significantly lower probability of there being a mobile phone, as only four of the 48 female-headed households reported having a phone, compared to 50 of the 137 male-headed households.

[7] Borrowing a phone is, however, relatively common, especially among relatives. More than half of the respondents (57.5%) from non-phone households reported occasionally borrowing a phone from a relative in order to make a call.

Table 4. Gender Differences in Mobile Phone Ownership

	Men **N=66 (34.6%)**	**Women** **N=125 (65.4%)**
Phone in household	Male respondents 48%	Female respondents 17%††††
Phone by HH head gender	Male headed households 35.0%	Female-headed households 8.3%††††
Owner gender across all phones	67%	33%
Previously owned phone (% of non-phone HH)	26.7%	26.7%

Source: Authors. † chi-square p=.05, †† p=.01, ††† p=.001, †††† p=.0001

Of the 64 reported phones, two thirds (43) were owned by men, and one third (21) were owned by women. Hence, by a number of different measures, men were clearly more likely to be mobile phone owners than women. There were no differences in the reasons reported for never having owned a phone—virtually all in this position said it was due to the expense, and virtually all respondents without phones planned to get one sometime in the future.

Although women were less likely to have phones, contrary to findings reported in other studies, we did not find much evidence that women's phones were of lower quality, older, in worse condition, or acquired in a different way than men's phones. The estimated cost for women's phones was about 900 MKW less (about a $2.00 difference) than the cost of men's phones, but because of the small number of phones in the sample, this difference was not significant.

There were some noticeable differences in the ways that men and women use their mobile phones, although the small number of women with mobiles makes significance testing difficult (Table 5). Women were less likely to have a zero balance of credit on their phones. More than half the men phone owners reported a zero balance, and over a third said that they topped up only when needed, a pattern not common among women. The majority of men and women top up daily, however.

Some differences in call purposes were observed. Men reported less calling for emergency or health-related reasons, and more for business purposes than women. Men were significantly more likely to use their phones to call their agricultural extension officer than women.

Regarding texting patterns, men reported sending more texts than women, but this difference was not significant. However, men showed significantly greater phone competence than women on a few other indicators, including knowing how to delete and retrieve texts, and knowing how to add names to a contact list. Men also had a larger contact list than women. Both were equally likely to flash others, receive flashes, and use the Short Message Service (SMS) "please call me" service.

There was little use of mobile money in our sample, and few were aware of the available mobile services aimed at farmers such as Esoko, ACE, and AHCE. Men were more aware than women of ACE and AHCE.

Finally, men and women appeared to use the additional features in phones in similar ways, with the exception of the calculator, which men used more often than women.

Table 5. Gender Differences in Mobile Phone Use

	Men **N=43**	**Women** **N=21**
Amount of credit on phone	52.83 MKW 0 credit 53.1%	70.18 MKW (n.s.) 0 credit 13.6% †††† *
Top-up frequency	daily 56.3% weekly 9.4% monthly 0% only when needed 34.38%	daily 52.4% weekly 28.6% monthly 4.8% only when needed 14.3% (n.s.)
Avg. top-up amount	160.81 MKW	85.26 MKW (n.s.)
Sending/ receiving airtime	send airtime 16.1% receive airtime 15.6%	send airtime 20.0% (n.s.) receive airtime 15.8% (n.s.)
Phone charged	75%	57.89% (n.s.)
Top reasons for calling	friends/family 50.1% emergency/health 23.0% business/farming 20.1%	friends/family 45.7% emergency/health 41.3% † business/farming 8.7% †
Primary call recipients	family/friend 84% business/farm contact 16%	family/friend 100% business/farm contact 0%
Number of texts sent last week	4.3	0.8 (n.s.)
Texting knowhow	can delete 84.4% can retrieve 87.5%	can delete 45.5% †† can retrieve 50.0% ††
Can add a contact	93.8%	61.9% ††
Size of contact list	63.0	15.8 †
Ever call extension officer	37.5%	9.5% †
Aware of mobile agricultural services	ACE 28.1% AHCE 28.1% Esoko 12.5%	ACE 4.8% † AHCE 4.8% † Esoko 12.5% (n.s.)
Flashing	send 68.8% receive 84.4% please call me SMS 62.5%	send 77.3% receive 81.0% please call me SMS 45.4%
Ever use mobile money	6.3%	13.6%
Other features used	games 34.4% radio 46.9% alarm 50.0% calculator 87.5% internet 6.5% camera 28.1% music 40.6%	games 30.0% radio 45.0% alarm 25% calculator 45% ††† internet 9.5% camera 14.3% music 47.6%

Source: Authors. Note: *This may be due to the fact that many female phone owners (50%) reported not knowing how much credit they had on their phones. † chi-square p=.05, †† p=.01, ††† p=.001, †††† p=.0001

3.1.3. Mobile Phones and Information Sources Related to Farming

Our final set of analyses compared the primary sources of farming-related information among phone-owning and non-owning households (See Table 6). Across virtually every type of information, other than information on prices, there were significant differences in the distributions of responses between these two groups. Phone owners were more likely to receive information on farming practices, pests and disease, and livestock from their agricultural extension officers and from radio than from non-phone owners. Both relied extensively on traders for price information. Phone owners used the radio more than non-phone owners for information on seeds and weather. The greater use of radio among phone households is consistent with the socio-economic status differences, as phone owners were more likely to own a radio. Phones may be supporting increased interaction with extension agents–slightly more than a quarter of phone owners (26.4%) reported that they called their extension agents. In each information category, a larger share of non-phone households reported having no sources, pointing to potentially critical information deficits that they may face.

Table 6. Mobile Ownership and Farming Information Sources

Information sources for:	Non-Phone Households N=137	Phone Households N=54
Farming Practices†	Extension agent 51.1% Family member 8.0% Community member 12.4% Radio 16.1% No source 12.4%	Extension agent 61.1% Family member 3.7% Community member 1.9% Radio 25.9% No source 7.4%
Pests and Disease†	Extension agent 36.5% Family member 8.8% Community member 10.2% Radio 22.6% No source 21.9%	Extension agent 53.7% Family member 0% Community member 7.4% Radio 29.6% No source 9.3%
Livestock†	Extension agent 31.4 Family member 7.3% Community member 12.4% Radio 9.5% No source 39.4%	Extension agent 44.4% Family member 7.4% Community member 9.3% Radio 20.4% No source 18.5%
Crop Prices (n.s.)	Trader 48.2% Extension agent 7.3% Family member 4.4% Community member 11.0% Radio 13.9% No source 12.4%	Trader 51.1% Extension agent 11.1% Family member 3.7% Community member 7.4% Radio 24.1% No source 5.6%
Seeds††††	Extension agent 38.7% Family member 2.2% Community member 18.3% Radio 24.1% No source 16.8%	Extension agent 40.7% Family member 3.7% Community member 1.9% Radio 50.0% No source 3.7%
Weather††	Extension agent 1.5% Family member 1.5% Community member 7.3% Radio 62.0% No source 27.7%	Extension agent 0% Family member 0% Community member 3.7% Radio 87.0% No source 9.3%

Source: Authors.
† chi-square p=.05, †† p=.01, ††† p=.001, †††† p=.0001

Table 7. Pre-test, Post-test, and Knowledge Gain Mean Scores for All Training Sessions

Food Preparation Training (Score ranges from 0-17)				
	Live	Video	Combined	Significance test
Pre-test Score	0.14	0.08	N/A	t = N.S.
Post-test Score	12.44	12.32	N/A	N.S.
Change Score	12.31	12.25	N/A	N.S.
Mulching Video (Score ranges from 0-20)				
Pre-test Score	3.98	3.09	1.05	F = 13.24 p<.0001
Post-test Score	10.65	11.23	12.15	F = 2.91 N.S. at p<.05 level
Change Score	6.47	8.04	10.98	F=25.32 p<.0001

Source: Authors.

3.2. Results of the Participatory Video Pilot Tests

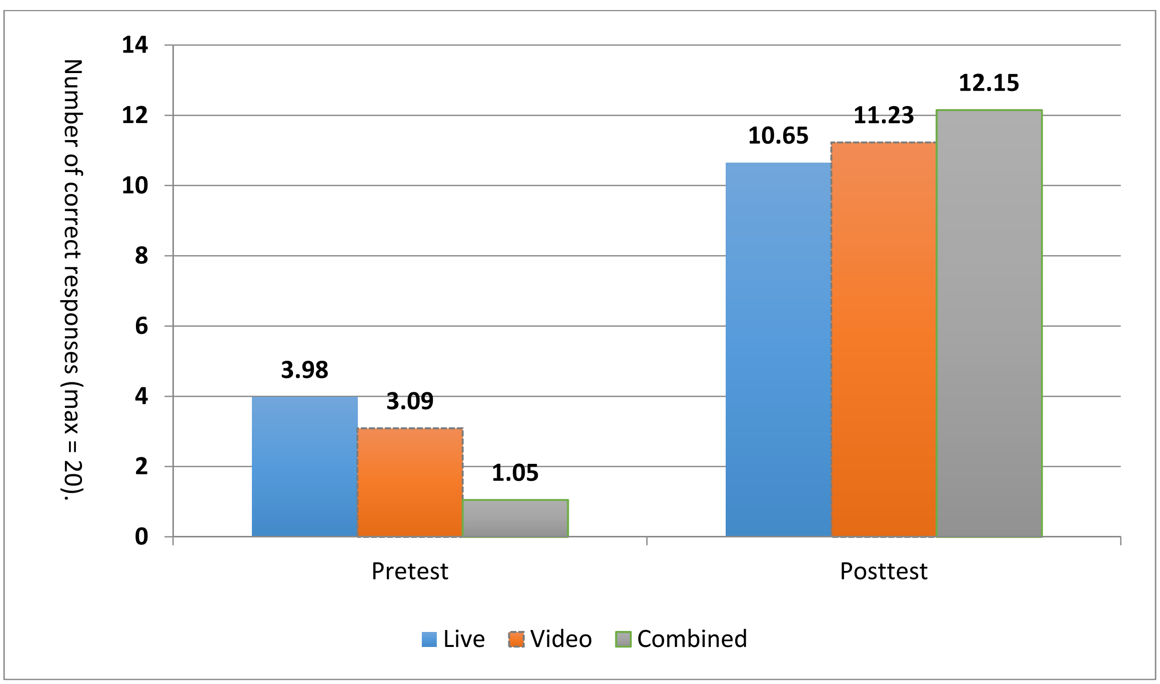
3.2.1. Short-term Knowledge Gains from the Training Sessions

For the food preparation training sessions, a pre-test of knowledge about the specific cooking techniques discussed revealed that few of the 125 participants in either the live training group or the video training group had any prior knowledge (see Table 7). The post-test knowledge scores demonstrate that there was, in fact, substantial, and largely equal, knowledge gain across both groups from the training with no statistical differences between the two groups. Hence, the video training was as effective as the live training in terms of short-term knowledge gain.

In the mulching training sessions, there were small-but-significant differences in prior knowledge across the three treatment groups: live, video, and combined (Table 7). After the training, knowledge levels increased across all three groups, with a slight-but-not-statistically-significant trend that suggested the highest post-test score in the group receiving the combined treatment. When using change scores, this effect becomes more apparent, as the combined treatment group showed the largest short-term knowledge gain, the video the second largest increase, and the traditional training the smallest increase. These differences were statistically significant. The gain in knowledge across the three groups is displayed in Figure 5.

Regression analyses were conducted to examine the relationship between learning and other demographic factors such as age, gender, educational level, household size, and the size of the participant's farm for each of the pilot test. As shown in Table 8, in the food preparation training sessions, women with more education and from larger households demonstrated significantly higher gains in knowledge across both treatment modes. There was a slight tendency for older participants to learn more, but farm size did not correlate with knowledge gains.

Figure 5. Knowledge Gains across the Three Mulching Training Types



Source: Authors

Table 8. Multiple Regression Predicting Food Preparation Knowledge Gains

Variables	Estimate	Standardized Beta	t Ratio	Sig.
Intercept	8.37	0	8.67	p<.0001
Age	0.02	0.18	1.88	p<.10
Gender	0.52	0.22	2.36	p<.05
Education	1.23	0.25	2.71	p<.01
Farm Size	-0.02	-0.03	-0.15	N.S.
Household Size	0.30	0.25	2.77	p<.01
Training mode (video)	0.05	0.03	0.30	N.S.
Training mode (live)	-0.05	-0.03	-0.30	N.S.

$F(6, 106) = 3.59$; $p < .01$; $R2 = .17$, adjusted $R2= .12$

Corroborating the earlier comparisons in Table 7, there was no influence, even after controlling for demographic factors, of training mode: participants in the live session and video session demonstrated equal gains.

In the mulching training sessions, there was a slight negative relationship between educational level and knowledge gains (Table 9), although this is simply due to the fact that those who had completed primary school scored higher on the pre-test (mean = 4.78) than those who had not (mean = 2.15).

Beyond that, no other demographic factors were related to knowledge gains. Corroborating the earlier comparisons from Table 7, being in the combined treatment group predicted a significantly higher knowledge gain, while being in the live treatment group predicted a significantly lower knowledge gain.

These findings lend support to the notion that integrating live demonstrations with video can promote greater learning among smallholder farmers, at least for this topic.

Table 9. Multiple Regression Predicting Mulching Knowledge Gains

Variables	Estimate	Standardized Beta	t Ratio	Sig.
Intercept	9.96	0	8.46	p<.0001
Age	-0.02	-0.09	-1.10	N.S.
Gender	-0.30	-0.07	-0.95	N.S.
Education	-0.69	-0.15	-2.03	p<.05
Farm Size	-0.01	-0.02	-0.28	N.S.
Household Size	0.01	0.00	0.03	N.S.

Training mode (combined)	2.96	0.61	6.94	p<.0001
Training mode (video)	-0.61	-0.13	-1.59	N.S.
Training mode (live)	-2.34	-0.49	-5.15	p<.0001

F(7, 138) = 9.66; p < .0001; R2 = .33, adjusted R2= .29

3.2.2. Preliminary Tests of Adoption Following Training Sessions

As noted earlier, interviewers returned approximately a week after each training session to each site to see if participants had tried any of the techniques. We caution that this type of measure cannot tell us if long-term behavioral change has occurred. Nonetheless, we wanted to see if video-based training could encourage farmers to try out the new practices in the short term.

For the food preparation training, we were able to re-interview 98 of the 125 participants. Enumerators asked if they had tried to cook either of the dishes. More than 60% had cooked mkute (the egg-coated leftover nsima) for their family after the training, and around 40% of them cooked it twice within seven days (Table 10). The most common reason given for not trying this dish was not having any leftover nsima.

Only a third had attempted to cook chiluwe due to difficulties obtaining pumpkin flowers. As shown in Table 9, participants in the live training group were more likely to have tried cooking mkute. Several respondents from the video training group mentioned that not being able to taste the meal was a problem and made them hesitant to cook it for their families. Virtually all participants across both groups indicated that they planned to try it in the future, however.

Few farmers reported trying mulching in the short time period between the follow-up interviews and the training sessions. Of the 136 farmers who were available for these follow-up interviews, only 17 (12.5%) had tried mulching in their fields. In addition, most of those who did only experimented with mulching on a small portion of their land. Those in the live group were more likely to have tried it. In focus group interviews after the training, however, we learned that most farmers in the video and combined groups already had used their maize stalks for making fire and feeding animals, and therefore had none available for mulching.

Table 10. Adoption of Food Preparation and Mulching Techniques

	Live	Video	Combined	Significance *
Tried Mkute (egg-coated nsima)	75.6%	50.9%	N/A	p<.01
Tried Chiluwe (egg-coated pumpkin flower)	33.3%	30.8%	N/A	N.S.
Tried Mulching	26.2%	4.1%	8.9%	p<.001

* using chi-square

In addition, farmers indicated that it would take considerable time to prepare the mulch and transport it to their farm—more than the period we had for the follow-up interviews. Finally, farmers indicated they were busy with other agricultural activities such as preparing land for the rainy season or cultivating in their *dimbas* (gardens). Although we were not able to conduct an adequate test of the effect of training modality on mulching adoption, virtually all participants across all groups planned to try it at some point in the future, and more than half indicated they would do so the following season.

4. CONCLUSIONS

4.1. Supporting Efforts to Scale Multipurpose Legumes

The baseline survey and participatory video pilot work has yielded a number of critical insights that can help support efforts by GCFSI and others to scale the use of multipurpose legumes in Malawi. One primary component of such scaling efforts will be improved outreach and education for smallholder farmers. Our pilot work on participatory videos has demonstrated that this approach can be an effective technique to inform farmers about multipurpose legumes if done in a manner that involves local participants in the production and screening. In terms of knowledge acquisition, participatory videos performed as well as or better than live demonstrations, and results suggest that a combination of live training with video yields the best results. Although more work is needed to provide a better test of long-term behavioral change, the initial results suggest that this method can be a valuable development tool.

The ability to reuse videos once they are produced can further aid scaling efforts by reducing costs for smallholder farmer training. It not only extends the potential reach of training content to more farmers who might not have been able to attend live demonstration sessions, but allows farmers to review content when they desire.

Our baseline survey contributed additional insights that can be relevant for efforts to scale multipurpose legumes. The finding that mobile phone penetration remains very low in the rural areas we studied has implications for the viability of phone-based services that might provide agricultural information and other services to farmers. This strengthens the argument for focusing on other approaches to educating farmers, including both field schools and intermediary-delivered video-based training.

4.2. Interactions with Other GCFSI Projects

4.2.1. Synergies

There are a number of potential synergies between our project work and other GCFSI work in Malawi. First, work by researchers studying climate patterns and new growing techniques better suited for the changing climate of Malawi can provide critical information for farmers. This information can form the basic instructional material to be incorporated into participatory videos, once findings from these projects are translated into recommendations for practice.

Second, our work also connects with GCFSI efforts to understand the value chain for multipurpose legumes, and increase farmers' access to markets for these commodities as well as access to the inputs needed to grow them. Market information systems will be a key component of market access efforts. Our baseline findings suggest that multiple methods will be needed to improve access to inputs and access to markets, and a strategy for disseminating information cannot rely exclusively on mobile phone services. Efforts to form farmer groups where the few available phones might be shared may be one approach. Given our finding of farmers' overwhelming dependence on traders as their source of market information, however, we will need to find new ways to bring this information to farmers. We also believe that using participatory videos that focus on better understanding how to use and market multipurpose legumes will aid in this effort.

Our work has synergies with the work by the gender team, in that the research can provide valuable insights that can help guide efforts to provide training in a manner that addresses gender-based constraints. Video-based training can be a powerful tool in this regard, as we can specifically target women, for example, by relying on female actors and having all-female screenings to ensure that their voices are heard during discussions.

Finally, our work directly intersects with the work of GCFSI researchers studying the ways that formal and information education systems can help address skill gaps and improve multipurpose legume value chains. The video-based training method can be an important component of informal training and workforce development, including topics related to food processing and food safety, for example. Moreover, it suggests a role for students in tertiary institutions who may become the video producers of this training material while working with extension officers during internships and field attachments.

4.2.2. Antagonisms

The lack of phone access suggests that it will be difficult to rely on many of the current efforts to use mobile phones to provide information and other services to farmers. This will hinder some of the more promising market information systems and other market access services such as mobile financial services. Efforts to encourage farmers to adopt mobile phones and learn to use available services will have to be ongoing.

4.3. Gender Issues

A number of gender issues surfaced in this project work. The survey revealed significant disparities in access to and use of mobile phones. This highlights the challenges that mobile agricultural services will face in reaching women. Although more efforts to increase mobile phone adoption and mobile phone competence among women need to be made, we were encouraged by the response to the participatory videos. Women were interested in the food preparation training, and we included both men and women as actors in the video on this topic, which both the male and female participants appeared to appreciate. Many women attended the screenings and learning appeared to occur equally well across genders.

4.4. Implications for GCFSI

The project provides some useful direction for GCFSI in its efforts to find practical solutions to the many food system challenges it studies. We have provided a preliminary test of an innovative method that can be used to help disseminate GCFSI and US Global Development Lab research findings to the most difficult to reach stakeholders—rural smallholder farmers. This has direct relevance to GCFSI work in Malawi, in that the teams of researchers identifying the most fruitful approaches to growing, marketing, and consuming multipurpose legumes require methods for disseminating this information to all relevant stakeholders.

As part of our work, we were able to build a solid partnership with Digital Green, LUANAR, and the representatives from the Ministry of Agriculture and the extension officers in the region. GCFSI should work with Digital Green and partners in the region to help extend the ability to use the participatory video technique. It is important to note, however, that funding that would be required to have Digital Green implement their approach in Malawi at scale would exceed GCFSI capability, and would therefore require other donor support. On a smaller scale, however, an immediate target of opportunity is to focus on the findings from the agronomic research on climate resilient maize, such as that conducted by USAID/Lab and by Sieg Snapp's team at MSU as the topic for the next set of participatory videos in Malawi. Further out, this approach can be used in other regions of the world.

4.5. Implications for LUANAR

A primary implication for LUANAR is that the research suggests curriculum development that will help them build the capacity to employ the participatory video method in their own outreach and extension activities. New courses on video production and video-based training can be developed, perhaps with collaboration between the Extension and Rural Sociology Department and the Agricultural Education and Development Communication Department. Researchers from LUANAR should be encouraged to seek funding to continue testing and refining the approach, and working closely with Digital Green and GCFSI to create the infrastructure that will enable scaling.

Students from LUANAR with field attachment requirements could work with extension agents throughout the country, helping to produce and screen videos in rural villages, and supporting the collection of data on usage and effectiveness. Ongoing content for the videos will be generated by research from across the university. Finally, infrastructure needs to be put into place to maintain an archive of the videos, facilitating their reuse as network infrastructure in the country improves.

4.6. Implications for USAID/Lab

A number of implications for USAID and the US Global Development Lab can be drawn from the findings in this report. First, the baseline survey provides rare details on both the access to mobile phones and the nature of use by smallholder farmers in rural Malawi. These data run counter to widely-held assumptions about mobile phone penetration, and reveal the breadth of the urban-rural access gap. In addition, access and use constraints faced by women provide further input that can inform USAID/Lab policies related to the role of mobiles in supporting agriculture in rural Malawi. Such findings suggest that ongoing USAID/Lab programs aimed at using mobiles for development, including mobile money programs, will face an uphill battle in such regions. They highlight the ongoing need for outreach programs aimed at improving mobile phone access, along with those that illustrate the instrumental benefits of mobile phone ownership and use in agriculture. In addition, the findings reinforce our understanding of the need for gender-sensitive programs that directly address the specific challenges faced by women. Examples of such efforts, like the GSMA and USAID-sponsored Connected Women program, are good examples of the types of programs needed in this region.

The participatory video findings also have implications for USAID/Lab efforts, especially in their ongoing efforts to bring innovations like climate resilient maize (CRM) to scale across the world. Participatory videos can be an important complementary tool for increasing the demand for CRM (and other innovations ready for scaling), as they can help broaden smallholder farmers' awareness and provide context-sensitive arguments for adoption. In addition, local barriers to CRM adoption and use can be identified and mitigated in the village-based discussions that take place during video screenings. Given GCFSI's relationships with LUANAR, the Malawian Ministry of Agriculture, and Digital Green, we believe Malawi represents an ideal test bed for assessing the potential of this method for growing demand for CRM.

In addition, other USAID efforts in Malawi may benefit from an increased use of the participatory video approach. USAID Feed the Future programs, and in particular, the work of the New Alliance for Food Security and Nutrition may find such techniques useful. Participants in the recently unveiled New Alliance ICT Extension Challenge Fund[8] may find the results of this project to be particularly relevant to their efforts.

5. NEXT STEPS

The next steps in this research include

1) deepening the partnership with Digital Green to bring their expertise to Malawi;

2) testing the effectiveness of the participatory video approach in concert with such approaches as farmer field schools to increase uptake of climate resilient farming techniques, including use of new climate resilient maize and use of approaches for sustainable intensification of maize that include intercropping with multipurpose legumes;

3) expanding the training of LUANAR students to increase the pool of experts with skills in video production;

4) developing the capacity of extension agents to work with LUANAR students and faculty in the production and screening of videos;

5) creating a method through which local communities can rescreen videos on demand; and

[8] http://agrilinks.org/blog/new-alliance-ict-extension-challenge-fund-two-key-challenges

6) developing improved methods of monitoring and evaluation of the participatory video approach over the longer term.

We believe these steps provide a blueprint for ongoing interaction with the LUANAR innovation hub and can be supported by a mix of funding from GCFSI and external sources, including: 1) GCFSI support for LUANAR hub research, 2) medium-level innovation grants from GCFSI aimed at evaluating innovations that have been piloted tested, and 3) potential supplementary funding from USAID, either through direct support from the regional mission or through other programs.

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