#7414 DIGITAL PLATFORMS FOR BOOSTING FARMER KNOWLEDGE: TWO CASE STUDIES IN KENYA AND UGANDA

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ABSTRACT

The aim of this paper is to share rich insights on issues, and to identify knowledge gaps present on farms in two contexts in East Africa. This paper describes the experience of Precision Agriculture for Development (PAD), an international NGO, in developing and implementing digital advisory platforms for smallholder farmers in Kenya and Uganda. In Kenya, PAD has developed and deployed MoA-INFO, a large-scale SMS platform, on behalf of the Ministry of Agriculture, Livestock, and Fisheries. MoA-INFO provides free agronomic recommendations to more than 460,000 Kenyan smallholder farmers. The two-way SMS platform allows for the collection of data from farmers which, in turn, informs the customization of agronomic advice provided to farmers. In Uganda, PAD has developed an IVR (Interactive Voice Response) service to provide free agronomic advice to coffee farmers in Western Uganda. The service consists of a combination of push calls (pre-recorded audio messages) sent to farmers and an automated call center which allows farmers to record questions and receive answers from an agronomist for free and in their local language.

INTRODUCTION

Approximately 80% of African farms, equivalent to 33 million farms, are two hectares or less in size. Many smallholder farmers do not have access to the resources and information they need to improve productivity and yields on their farms. Lack of knowledge of Good Agronomic Practices (GAPs) means that many farmers fail to realize their full yield potential. Moreover, extension workers, who are responsible for disseminating GAPs to farmers, are spread too thin to be effective. For example, as of March of 2019, there was one extension worker for every 1,800 coffee farmers in Uganda. This paper describes the experience of Precision Agriculture for Development (PAD), an international NGO, in developing and implementing two digital advisory platforms for smallholder farmers in Kenya and Uganda.

Precision Agriculture for Development (PAD) works with partners to develop, pilot, test, and scale mobile phone-based solutions that deliver appropriate information to smallholder farmers, with the goal of increasing agricultural productivity, farmer incomes, and environmental sustainability. Three core principles inform our approach: 1) the application of insights from behavioral economics and user-centered design to create appropriate and actionable agricultural messages, 2) an iterative and interactive process of innovating, testing, and refining through A/B trials and rigorous impact evaluations, and 3) operating at scale. In our model, scaling, innovating, and learning work together.

In 2018, PAD worked with the Kenyan Ministry of Agriculture, Livestock, and Fisheries (MoALF) to launch an advisory service (MoA-INFO) to provide farmers with free SMS advisory messages, delivered in English and Swahili, throughout the growing seasons. This service was initially launched to address the Fall Armyworm crisis sweeping the African continent, but has since been expanded to incorporate content across 10 value chains on GAPs from pre-planting to post-harvest. In addition, the service provides decision support tools to assist farmers to make informed decisions about which maize and bean seeds to plant, which

fertilisers to apply, and whether pesticides are appropriate based on the scale of pest infestation. This service has reached more than 460,000 farmers. To implement this service, PAD partnered with Safaricom to register users from among its existing subscriber base, and with the Kenya Agriculture and Livestock Research Organization (KALRO) and the Centre for Agriculture and Biosciences International (CABI) to develop agronomic content.

As part of the Uganda Coffee Agronomy Training Program (UCAT - https://www.ucat.coffee), PAD has built a coffee GAPs advisory service and automated call center for a sub-sample of robusta coffee farmers in Uganda. Selected farmers receive weekly advisory training on GAPs and have access to an automated question & answer IVR (Interactive Voice Response) platform. Farmers are able to: (1) listen to advisory messages again and access past messages (2) record a question for a local agronomist (3) listen to the answer to their question given by the agronomist and (4) listen to past questions and answers they have asked. The platform is available to selected coffee farmers free of charge in four languages and can be accessed through any basic feature phone.

MATERIALS AND METHODS

To assess the needs of farmers and characterize their interests and priorities, we first present an overview of farmer interactions on the MoA-INFO and UCAT digital platforms. In both settings, we have conducted multiple rounds of surveys with users to collect feedback on content, which in turn is used to develop more relevant agronomic advice.

PAD uses A/B testing to iterate the design of the MoA-INFO service. By assessing relative engagement against changes in framing, timing or type of required response PAD is able to implement rapid updates to improve user experience and engagement. PAD also conducts phone surveys with farmers to assess their knowledge and practices to better understand what information is most important to them, and to assess how they are internalizing the MoA-INFO recommendations. PAD also pilots other channels for sharing information with farmers. In April-June 2020, PAD offered an information service for banana farmers via IVR and in November-December 2020, PAD is operating a service for tomato farmers on Telegram, a messaging app.

In Uganda, PAD designed several experiments in an effort to improve farmer engagement with the platform. To increase the pick-up rate of weekly advisory calls, we used an A/B test to identify whether it was more efficient to send farmers a reminder twenty-four hours or one hour before receiving the call. We used a similar methodology to determine whether farmers were more likely to listen to the full advisory call if the recording's voice matched the gender of the farmer. Finally, we tested whether providing farmers with non-financial incentives (airtime credit) increased their propensity to record a question for our agronomists.

We also present results from different types of experiments (RCT, A/B trials)

RESULTS & DISCUSSION

Kenya

In one A/B test administered on the MoA-INFO platform, we assessed two messages inviting users to conduct a self-survey of their field for Fall Armyworm. We randomized a regular message[9], which advertises the tool keyword ("CHECK" or "ANGALIA"), and a

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[9] **Regular message:**

Hi. Now is a great time to scout your maize for Fall Armyworm! Send CHECK to 40130 for help scouting your maize.

message which instead takes the users directly into the monitoring tool, bypassing the first question. Of the two different message phrasings, the second, "make it easy"[10], formulation stimulated two percent more recipients to initiate the tool. Moreover, of farmers who initiated the tool in response to either message, those responding to the "make it easy" message were more likely to complete the test. Overall farmers responding to the "make it easy" message demonstrated a 6% higher completion rate when compared to farmers who initiated the tool after having received the "regular message".

We also investigated the timing of these invitations (7 AM, 12 PM, 3 PM and 6 PM). Messages sent at 6 PM returned the highest number of users who accessed the monitoring tool, but not by a great deal (1 to 2% improvement over other times). The midday message, while eliciting the lowest commencement rate, resulted in the highest completion rate across the four times. Intuitively, midday is a time when it is most likely that farmers will be in their fields; a requirement for undertaking and completing the assessment tool. The midday message resulted in significantly better information generation than the 7 AM message. Comparisons in the completion rate between the 3 PM and 6 PM rates were not statistically significant, but both were below the completion rates associated with the midday call.

Based on the results of the A/B test, the service was re-designed to send the advisory tool at midday using the "make it easy" phrasing. In conjunction with improved farmer targeting, the monitoring tool was pushed to farmers 77,568 times in the 2019 Kenyan short rains season (October-January). A sample of 50,779 farmers received messages (some received it more than once); 16,234 invitations were accepted for the survey (21% of invitations; 32% as a share of farmers) and 5,213 surveys were completed (10.3% of farmers, but 32% of those who initiated the tool). Of the 5,213 farmers who completed the test, 1,934 were encouraged not to use pesticides because it would not be cost effective for them while the rest were encouraged to use pesticides to address the infestation. The phrasing of the "make-it-easy" message has also been adapted for use in other messages sent to farmers inviting them to receive content.

Table 1 below shows results from a pilot MoA-INFO polling survey, which highlight how questions on user knowledge, adoption, and reasons for non-adoption of priority recommendations, can be combined to identify recommendations that might be most susceptible to an information intervention. In this case, we highlighted misconceptions around maize thinning and planting fertilizer-use to be particularly fertile areas for shifting behavior with information. The survey was administered to 214 randomly selected MoA-INFO maize farmers.

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[10] '**Make it easy' message:**
Are you ready to assess the extent of Fall Armyworm (FAW) damage on your farm and receive advice? You will need to go to your shamba [farm]. A. Yes, B. No

Table 1. Summary of survey responses of MoA-INFO users (N= 214)

Recommendations	Knowledge	Adoption			Reasons for Non-Adoption					Reasons for Sub-optimal Adoption	
	% Farmers Aware of Best Practices	N	% Adoption	# Non-adopters	Financial constraints (N)	Time constraints (N)	Information constraints (N)	Unavail-ability (N)	Other reasons (N)	Financial constraints (N)	Limited availability (N)
Early Planting	68.5	212	58.5	88	34.2% (14)	36.6% (15)	2.4% (1)	2.4% (1)	24.4% (10)		
Manure/Compost Use	76.2	214	48.1	111	3.6% (4)	9% (10)	10.8% (12)	72.1% (80)	4.5% (5)		
Manure/Compost Quantity		103	28.2	74							
Planting Fertilizer Use		214	79.0	45	37.8% (17)	2.2% (1)	48.9% (22)	0% (0)	11.1% (5)		
Planting Fertilizer Quantity	57.9	169	57.4	72						91.3% (63)	1.5% (1)
Maize Thinning	73.0	125	30.4	87	0% (0)	3.5% (3)	62.1% (54)	-	34.5% (30)		
Weeding	74.3	214	90.2	21	0% (0)	33.3% (7)	23.8% (5)	-	42.7% (9)		
Top-dressing Fertilizer Use		214	68.2	68	61.3% (38)	1.6% (1)	22.6% (14)	0% (0)	14.5% (9)		
Top-dressing Fertilizer Application	72.0	146	57.5	62	45% (27)	20% (12)	18.3% (11)	-	16.7% (11)	95.5% (42)	2.3% (1)

Uganda

In Uganda 4,407 coffee farmers are registered on our platform. Since the beginning of the programme in October 2019, 1,311 questions have been recorded by farmers and answered by our agronomist team. The pick-up rate of advisory IVR messages varies between 70% and 75%, and 76% of users listen to at least 90% of the message content. In terms of user satisfaction, approximately 80% of surveyed farmers (N=40) reported discussing the content of our messages with their family and friends, which helps to diffuse our advisory content beyond the population of registered farmers.

We have designed several A/B tests to improve farmer engagement on the UCAT service. For example, we assessed the effect of sending a dramatised version of our weekly message relative to the regular, non-dramatised, framing (dramatised messages emphasize the risk of not applying the recommendations in the message, while non-dramatised messages put the emphasis on the benefits). We found that the pick-up rate was 3 percentage points lower among recipients of dramatised messages.

We have also assessed whether sending a reminder to farmers increases the likelihood of their picking up our calls. Running the experiment for 8 weeks, we found that receiving a reminder increases the pick-up rate by 9%. The impact was mainly driven by reminders received 24 hours in advance, as opposed to reminders received one hour in advance.