Implementation Plan Narrative

USAID Grant #: AID-OAA-F-13-00015

Project title: "Investigating the Impact of Cell Phone based Agricultural Extension"

The below narrative is part of the first milestone deliverables being prepared for USAID. The narrative outlines the specific project activities that will take place prior to the delivery of each milestone.

M#	Deliverables	Schedule	Description
1	*Implementation plan & Outcome Indicators*	April 1st to April 15th (2013)	• The overall project timeline is established keeping in mind the specific deliverables required by USAID • Outcome indicators are developed and finalized based on the finalization of the research design • On-going discussion and development with the project partner
2	*Sampling procedure; Audit study field plan; Agriculture extension content schedule*	April 16th to May 15th (2013)	• Sample selection with project partner is finalized, randomization across research households complete • Audit study research design, survey instruments and field plan finalized. • In collaboration with the project partner the agricultural extension content is developed and finalized for the duration of the project intervention. Content will reflect the seasonal needs of farmers as well as the specific requirements of the project partner.
3	*AO training report; Audit study field summary; Phone survey 1 report; AO service delivery report*	May 16th to July 7th (2013)	• Training of all new treatment households on AO usage and product features completed. • Audit study field work completed. • First round of the phone survey completed. This phone survey will focus on collecting supplemental baseline data and seasonal planting information. • AO service delivery (intervention) initiated for treatment households.
4	*AO usage report; Phone survey 2 report; Qualitative study survey instrument; Learning vs. Persuasion research design*	July 8th to August 15th (2013)	• AO usage data analysed and the first usage report compiled. • Second round of the phone survey completed. • Qualitative study survey instrument drafted and piloted in collaboration with the project partner. • Learning vs. Persuasion research design finalized and implementation plan developed. • On-going AO service delivery • Data entry and analysis of Audit study data
5	*Status report on weekly broadcast; Qualitative study completion report; Phone survey 3 report*	August 16th to October 31st (2013)	• On-going AO service delivery • On-going review of AO usage data • Phone survey three administered • Qualitative study completed in collaboration with project partner • Willingness to Pay study initiated

M#	Deliverables	Schedule	Description
6	*Endline report; Draft of working paper/project report; draft of WTP marketing/pricing analysis; Policy Brief*	November 1st to April 1st (2014)	• On-going AO service delivery • WTP field work completed. Data entry, cleaning and analysis work. • Phone survey 4 (final) administered • Endline survey administered • Consolidated usage report compiled and analysed
7	*Final Impact Analysis report; Summary project implementation report; 'Next Steps' & cost effectiveness calculations report*	April 2nd to June 30th (2014)	• Data cleaning preparation • Data analysis, drafting of reports, refinement and finalization of all reports.

Additional Information:

Willingness to Pay Experiment

We will employ the Becker-Degroot-Marschak (BDM) method to elicit the buyer's willingness to pay (WTP) in an incentive compatible way. This would consist of marketing AO as a subscription based service and then giving randomized discounts to purchasers drawn from a right-triangle distribution from zero to the pre-determined market price. More explicitly, after revealing the 'market price' for the product, we will ask potential buyers to state their willingness to pay for the product explaining that if their bid is above the randomly generated discounted price, they will be able to buy the product at the discounted price. However, if their bid is below the randomly generated discounted price they will only be able to buy the product at the full 'market price'. These games will be played using scratch cards and a phone-based call-in system to collect the respondents bid price prior to revealing the offer price, a method which has been tested and utilized by the CMF research staff over the past three years in other studies.

We have not finalized the specific price point (ie. market price) which we will be citing in the willingness to pay experiment. However our long standing project partner, the Development Support Centre, which has over five years of experience working with the AO service, estimated the 'willingness to pay' of their member farmers as between Rs.50 and Rs.200 (approximately $1 - $4) per year. At this price AO would need to reach between 15,000 and 20,000 subscribed farmers to break-even, which we believe is feasible given the estimated market size of approximately 300 million Indian farmers with access to a mobile phone.

Scaling-up of AO

Efforts toward the goal of scaling-up the AO product will be incorporated throughout the duration of this research study. In fact, much of the progress in this regard will be made during the initial project phases. The project's implementation partner, the Better Cotton Initiative, has a network of over 40,000 cotton farmers across six states in India and is continuing its' expansion. BCI traditionally uses in-person agricultural trainings sessions to support and inform their member farmers. Their interest in AO as a supplemental outreach and training product provides a platform for scaling the product to a much larger market. Therefore, development of this relationship and securing of the partnership will act as a vital step in our efforts to facilitate the scaling of AO.

Additionally our initial implementation partner, the Development Support Centre, is currently exploring the feasibility of the product as a fee-based service for its members. Over the next 12 months we will continue to support their outreach

and business development efforts, in particular by sharing our willingness to pay experiment results in order to assist DSC in gauging an appropriate market price for the product.

Our technology partner, Awaaz De, is further utilizing USAID funding for development of additional features which will enhance the product's scalability. Within a few months new services such as peer-to-peer forwarding of messages, phone-based surveys, and specification of available service features by client will be available in the AO product. We firmly believe that these additional features strengthen the usability and marketability of the product and are an important aspect of the product's long-term scaling plan.

Finally, through CMF's dissemination efforts we will continue to market the product to various NGOs, government organizations and financial stakeholders. As this product has the potential to be utilized across a wide variety of fields (SMEs, micro-finance, health, education) presenting research findings on the impact of the service on subscriber behaviour should act as a powerful marketing tool. The dissemination of these results, as well as detailed explanations of the technology and how it operates, is a major way in which we plan to facilitate the scaling-up of this innovative technology.


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1
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3
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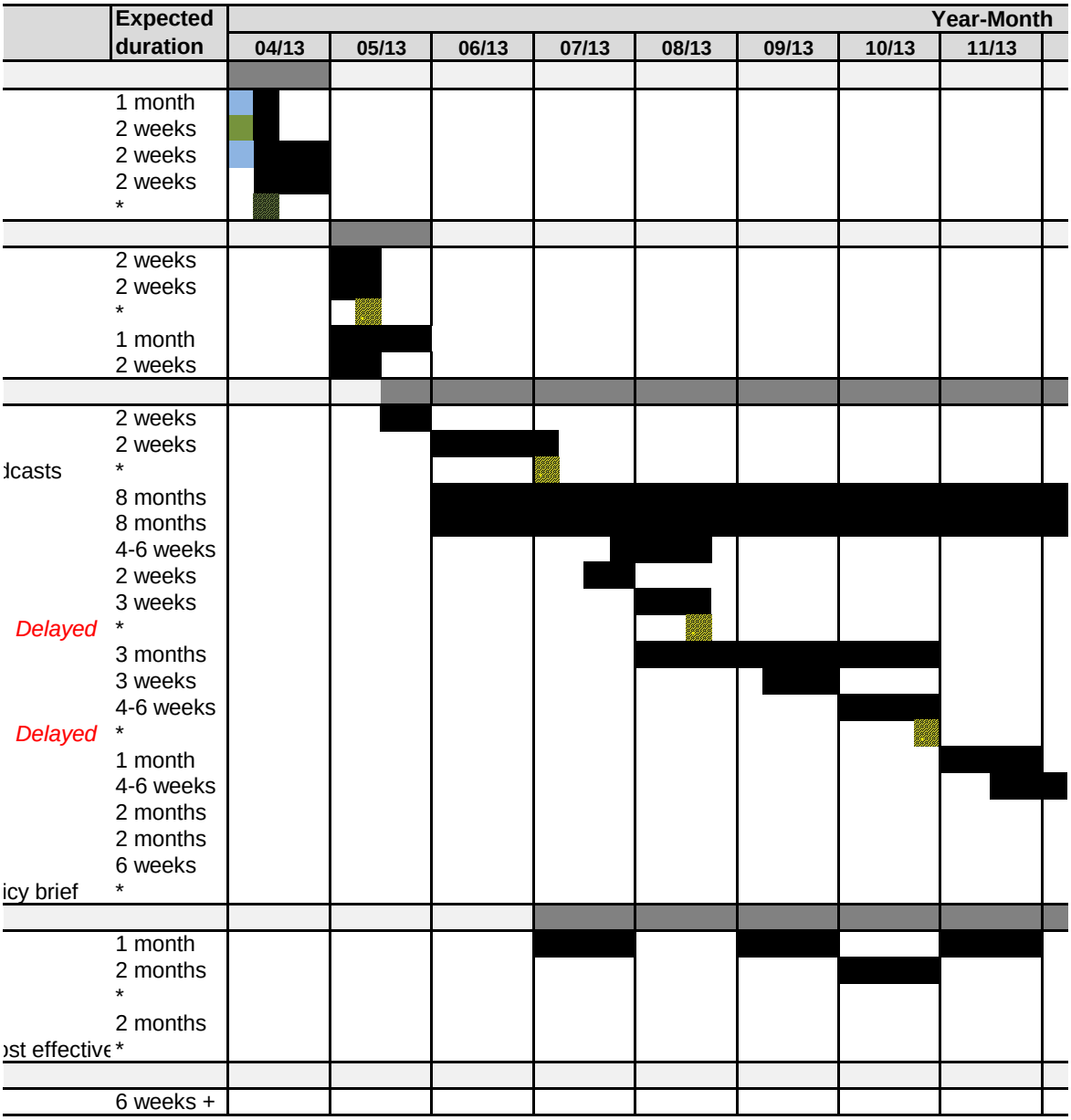
5

ases & Activities
Project initiation
Finalization of research design
Finalization of Implementation Plan & Outcome Indicators
Formalization of partnership between CMF and Better Cotton Initiative (BCI)
Sampling with BCI
TO USAID/DIV: Implementation Plan & Outcome Indicators
Design phase
Consultation and Development of Agri Extension Content
Research design and sampling procedure for Audit Study completed
TO USAID/DIV: Sampling procedure, Audit study field plan, Agri Ext. schedule
Training of intervention households on Agri Extension service
Development of survey instrument (phone)
Data collection and intervention
Audit study roll-out
Baselinephone survey roll-out
TO USAID/DIV: Training report, Audit study field summary, 1st phone survey report, status report on weekly broad
Weekly Agricultural Extension Broadcasts
High-frequency collection of usage data
Second phone survey
Selection of WTP households, Learning vs. Persuasion treatments finalized
Qualitative study survey instrument piloted
TO USAID/DIV: First usage report, second phone survey report, qualitative study survey instrument, L vs. P resea
WTP study roll-out
Qualitative study roll-out
Third phone survey
TO USAID/DIV: Status report on weekly broadcast, qualitative study completion report, phone survey 3 completio
WTP data entry–cleaning & analysis
Fourth phone survey
Consilidated usage report compiled and analyized
Endline paper survey roll-out
Endline survey data entry
TO USAID/DIV: End line report, draft of working paper/project report, draft WTP marketing/pricing report, final poli
Data analysis and report writing
Data cleaning and preparation
Data analysis, and drafting
TO USAID/DIV: First Draft of Impact Analysis & summary project report
Report refinement and finalization
TO USAID/DIV: Final Impact Analysis report, summary project implementation report, 'Next Steps' write-up and co
Dissemination
Dissemination

Milestone
Planned
In process
Overdue/Problem
Done!


Expected duration
Year-Month
04/13
05/13
06/13
07/13
08/13
09/13
10/13
11/13
1 month
2 weeks
2 weeks
2 weeks
*
2 weeks
2 weeks
*
1 month
2 weeks
2 weeks
2 weeks
*
dcasts
8 months
8 months
4-6 weeks
2 weeks
3 weeks
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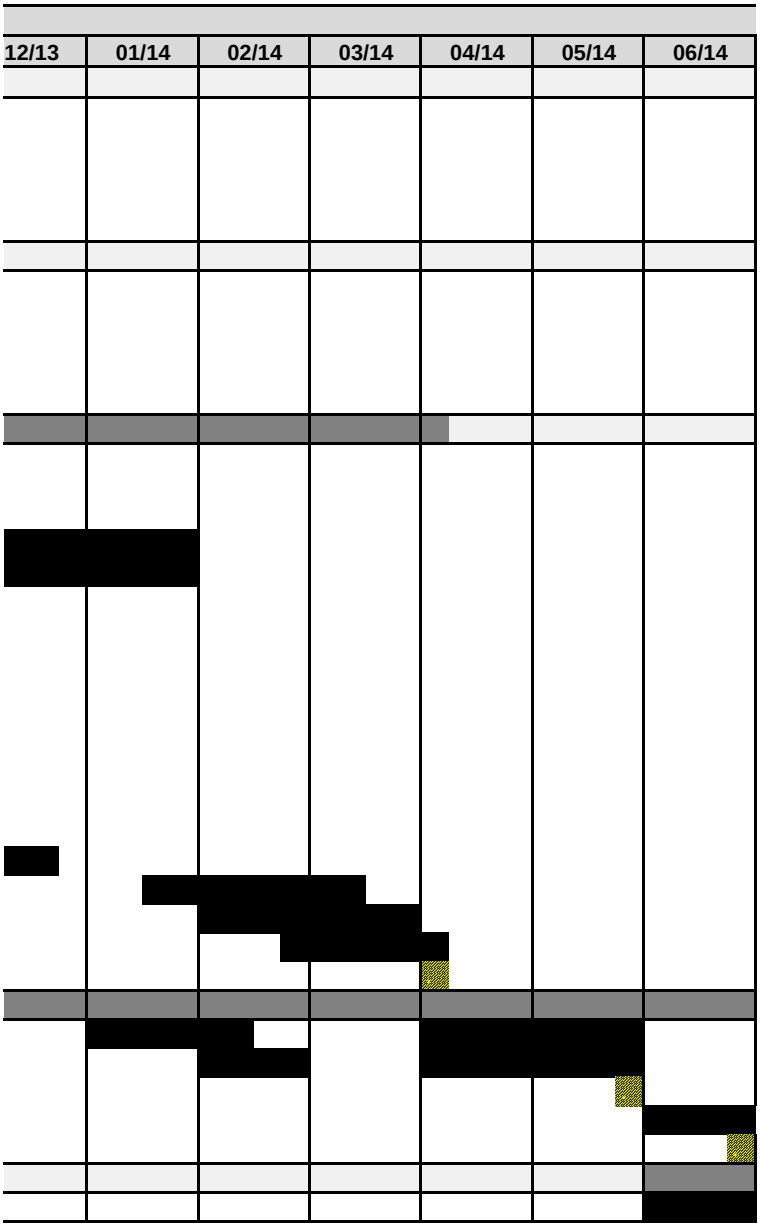
6 weeks +


12/13
01/14
02/14
03/14
04/14
05/14
06/14

Outcome Indicators

"Investigating the Impact of Cell Phone based Agricultural Extension" USAID Grant #: AID-OAA-F-13-00015

Impact	Outcomes	Proposed Indicators/Questions	Data Source
Change in respondent knowledge	Change in agricultural practices knowledge	Knowledge Index questions: Binary questions on overall agricultural practices	Phone surveys Endline survey; Questions developed and designed by agriculture expert
	Change in knowledge of Pests	Knowledge Index questions: Binary questions on pests knowledge Ex. "What type of pests does BT cotton provide resistance against?"	
	Change in knowledge on seed varieties	Knowledge Index questions: Binary questions on seed knowledge Ex. "Before sowing, what should be done with cumin seeds to prevent fungal diseases?"	
	Change in knowledge on optimal fertilizer and pesticide usage/options	Knowledge Index questions: Binary questions on fertilizer/pesticide knowledge Ex. "If you had the option of using 1 Kg of Sulphur/Contaf or 1 Litre of Monocrotophos, which would you use to most effectively treat powdery mildew in cumin?"	
Change in respondent adoption/ usage	Adoption/usage of fertilizers	Which fertilizers did you purchase? How much? Which did you use? How much?	Phone surveys Endline survey
	Adoption/usage of pesticides	Which pesticides did you purchase? How much? Which did you use? How much?	
	Change in overall management practices	Questions on labor, soil treatment, and irrigation	
Change in yield and revenue	Change in cotton/crop yield	Amount harvested the previous season	Baseline data Endline survey
		Quantity of crop sold	
	Change in total farm revenue	Quantity of crop sold; Price per unit	
		Total value of output	
Change in the value attributed by farmers to traditional extension services	Changes in information sources	Do you solicit or receive any advice on XYZ? From whom?	Phone surveys Endline survey
		What sources of information do you use to make agricultural decisions on XYZ?	
		Of these, what are your top two sources for agricultural information?	
	Access/usage of information	AO Usage: Did you use the AO service? In what capacity?	Usage Data from server[1]

[1] This will also be used to monitor the project and keep track of individual usage and link usage to farmer demographic characteristics such as income, age, education, etc.

M 2.1: Note on randomization and sampling of households

The sample size for our Avaaj Otalo (AO) project in Madhya Pradesh includes 2893 farmers, for whom we have received baseline data from our partner organization, Better Cotton Initiative- Solidaridad Cotton Solution Network (BCI-SCSN). These 2893 farmers (affiliated with BCI-SCSN's field partner, Action for Social Advancement) are divided across four production units (PU). Within each production unit, farmers are further grouped into about 313 learning groups (LG) of 1-20 farmers. All BCI-SCSN training and extension is provided through these LGs.

Treatment assignment was done using simple randomization instead of stratifying similar LGs across groups, by grouping them into triplets (tranches) using an index of characteristics. We initially tried to stratify similar LGs across treatment groups by using a z score, but this consistently showed higher than statistically probable imbalance across groups when using tranch-fixed effects. Also, since the number of clusters we used is greater than 300, McKenzie et.al (2008) [1] suggest that simple randomization is a better option.

The code for randomization creates a set of z-scores using LG- level means for learning group size, yield, cotton acreage, profit and total area of irrigation. The z-scores were then summed into a single score, and we dropped LGs above the 99th percentile and below the 1st percentile. This was to get rid of outlier LGs, which meant six LGs were dropped from our sample. Our current sample of 2893 farmers is split across 307 LGs.

These LG's were then divided across three groups by creating a random variable, sorting it and then using the modulus function. Group 1 consisted of all treatment farmers, Group 2 was 50 percent treatment and 50 percent control, and Group 3 consisted of all control farmers. Within Group 2 LGs, farmers further needed to be assigned to treatment and control. To do this, we created another random variable, ordered people in Group 2 LGs using this random variable and again, used the modulus function to assign a person to treatment or control. Each extra person in odd-sized Group 2 LGs was randomly assigned to treatment or control. Our final sample consists of 1453 treated farmers and 1440 control farmers.

The following diagram is illustrative of the randomization for this study:

 Treated farmers  Control farmers

Type	LGs	Group (Notes)
Treated learning groups	 ...  102 learning groups, 1000 farmers	1 (100% treated)
	 ...  103 learning groups, 906 farmers	2 (50%)
Super control	 ...  102 learning groups, 987 farmers	3 (0%)

[1] Bruhn, Miriam & McKenzie, David, 2008. "In pursuit of balance: randomization in practice in development field experiments", Policy Research Working Paper Series 4752, The World Bank.

M 2.3 Weekly broadcast updates for farmers

Push calls for AO farmers in Madhya Pradesh started on 21st September 2013. These push calls were rolled out in phases. Once roughly 50 percent of a learning group (LG) completed the preliminary phone survey, the treatment farmers in that LG would begin to receive push calls. All 1453 farmers receive two kinds of push calls. First is the technical cotton push call – this provides weekly information to cotton farmers on best crop practices based on local weather and soil conditions. Second is the BCI push call- this provides information on the best agricultural practices for cotton as recommended by our partner organization, Better Cotton Initiative – Solidaridad Cotton Solutions Network (BCI-SCSN). The BCI push call reiterates the material covered by BCI during its monthly learning group training sessions. Our local agronomist in Madhya Pradesh is responsible for creating all push call content.

Within the first month of launching the AO line in Madhya Pradesh, we have sent out 5 BCI push calls and 8 technical push calls. These push calls provided information only for cotton through the Kharif season. Below is a table that shows the broadcasting date and duration of push calls that have been sent out to treatment farmers in September and October 2013.

Date of Broadcast	Content	Duration (in seconds)
25-Sep-13	Welcome Message	230
26-Sep-13	How to use AO	260
25-Sep-13	Technical Cotton	170
14-Oct-13	BCI	110
5-Oct-13	BCI	160
7-Oct-13	Technical Cotton	130
9-Oct-13	Technical Cotton	160
14-Oct-13	BCI	190
15-Oct-13	Technical Cotton	290
17-Oct-13	Technical Cotton	275
18-Oct-13	BCI	170
21-Oct-13	Technical Cotton	270
24-Oct-13	Technical Cotton	250
25-Oct-13	BCI	235
30-Oct-13	Technical Cotton	255

M 3.1: Avaaj Otalo training in the form of demonstrations for new respondents completed

Treatment farmers in our sample were provided access to mobile-based agricultural advice through Avaaj Otalo (AO) in September 2013. As we rolled out this intervention, we wanted to carry out training in the form of demonstrations for all new respondents. The purpose of this was to build initial trust in the system, and also to ensure that respondents are able to use AO to its maximum potential. Respondent training was administered with the help of Action for Social Advancement (ASA), our field partners associated with Better Cotton Initiative – Solidaridad Cotton Solutions Network (SCSN). ASA has many years of extensive field experience in Madhya Pradesh, particularly in our study region. Training was carried out over a period of two months in September-October 2013.

How was training provided?

AO training was provided at the learning group level. Learning groups (LG) refer to a group of 1-20 farmers that meet twice a month for BCI training on best practices for agricultural management, specifically for cotton. Training was first provided to the staff members of our field partners, ASA. These staff members, particularly the Village Resource Persons (VRPs) are responsible for conducting these bi-monthly BCI meetings, and act as the point of contact between the farmer and BCI-SCSN. Initially, we conducted a two-day training session in the field to train over 60 VRPs on how to explain AO to the respondents in the field. We explained how AO works, including the missed call service facility provided by AO which allows users to record questions, listen to other farmers' responses and share agricultural experiences. Other than the live demonstration during training, all ASA staff members were also provided with a training template that could be used as a resource during in-person farmer training.

Following this, trainings were conducted across the different LGs to cover all 1453 of our treatment farmers. VRPs provided live demonstrations of AO at the LG meetings, explained the benefits of AO and gave respondents the AO phone number. During this live demonstration, the VRP would call in to the AO line, show the respondents the different features they could access and also record a question.

Monitoring of training

AO trainings were monitored through random in-person checks across different LGs. Additionally, the local agronomist based in Madhya Pradesh also made frequent field visits. Monitoring of training was to ensure that all respondents were receiving training, and also to check the information provided during training. We also received bi-weekly updates from BCI-SCSN about the number of LGs that had received AO training. Additional checks were implemented using phone calls to a random subset of farmers to check if they had been trained by the VRPs.

M 3.2: First round of phone surveys for new treatment respondents completed

The first round of phone surveys for the Avaaj Otalo (AO) study participants in Madhya Pradesh began in September 2013. This phone survey was designed to collect information on agricultural practices in Kharif 2012 for key variables including agricultural inputs, yields, income and agricultural knowledge. It also examines farmers' perceptions of local Farmer Producers Companies (FPCs) – a farmer-run establishment that is involved in sale of agricultural inputs and procurement of cotton (and other crops) from its members. Lastly, we try to identify the main sources of agricultural information that farmers rely on, prior to the intervention being administered. *Please refer to the attached document for a copy of the baseline phone survey.*

The phone survey was administered to our entire study sample of 2893 farmers (1453 treatment, 1440 control). Each survey took about 15-20 minutes to complete, for which respondents were compensated with a mobile top-up of 30 rupees. These surveys were conducted over a period of two months. At the end of the first round, we successfully completed 2232 surveys. The table below provides a final status of the first round of phone surveys, by treatment group.

Status	**Treatment**	**Control**	**Total**	**Percentage (%)**
Completed	1115	1117	2232	77.1 %
Incomplete	41	54	95	3.2%
Unreachable	249	223	482	16 %
Refusals	48	46	94	3.2 %
Total	**1453**	**1440**	**2893**	**100%**

Note: Unreachable numbers include all cases were the respondent does not answer the phone, the phone is switched off, the line is out of service or the number is incorrect. We tried to follow-up with these respondents with the help of our field partner, Action for Social Advancement (ASA). The table above shows the final status after three rounds of follow-up in the field by ASA staff.

Sit-in-Observation Study Summary

HK Seo

February 22, 2014

Introduction to Methodology and Sample Description

The Sit-in-Observation study reports a correlation analysis conducted on a sample of recorded conversations between farmers and agrodealers. The study analyzes the relationship between words mentioned in each conversation and the products prescribed at the end. The details, predictions and results are reported in Section 5.

In the first round of the Sit-in-Observation study, 36 agrodealer shops sampled from Chuda and Limbdi townships were reached, although only in 34 were conversations concerning cotton pesticides observed.[1] The shops represent about 80% of all agrodealer-shops in the two townships, whose combined population amount to a quarter million. Surveyors sat in at an agrodealer-shop for approximately four hours and recorded interactions between the agrodealer and customer farmers. The recordings (written transcripts) included points such as crop problem/ailment, requested products by farmer and agrodealer prescriptions. Farmers' dialogue and agrodealers' dialogue were transcribed so that such attributes as number of appearance of specific words could be analyzed. Among the 191 sales conversations and corresponding prescriptions analyzed, 55% prescribed mono; 19% prescribed imida; 64% prescribed a less harmful and more effective alternative to mono as recommended by agronomists.[2] In 40% of the conversations, mono and an alternative to mono were both prescribed. The average number of pesticide asked for was 0.8. The average number of pesticides prescribed was 1.9.

In the following year (2013), we conducted additional sit-in observations for 24 other agro-dealer shops. Of the 151 sales conversations that we observed and analyzed, about 50 conversations concerned cotton pesticides. Of these, 46% prescribed mono and about 21% prescribed imida. The average number of pesticides was 1.6.

Appendix I information further reports recommended product offerings and prices information from surveying the agrodealer-shops, as well as information about the competitive structure and pricing policy of the supply side of the market. We conducted two rounds of inventory analysis with agro-dealers (36 in the first round, and 24 in the second round) to analyze which products are more commonly stocked by the input dealers. Over 90% of the agro-dealers stock monocrotophos, acephate and imida. The summary results from this inventory analysis can be found in Appendix Table 2.

The next sections discuss the specific predictions and results of the experiments.

Evidence for Bias-Catering and Overselling

[1] Chuda comprises 39 villages and 90,000 population. Limbdi comprises 64 villages and 160,000 population. Both belong to Suredranager district, Gujarat, India.

[2] The alternative is defined to be imida, acephate or acemataprid. Please see Appendix I information for further discussion.

Rational sellers may be able to profit from the presence of a buyer's belief in a product's specious efficacy. First, I clarify two terms used in this section. I define "bias-catering" to be the act of responding to a signaled bias. I define "overselling" to be any attempt of product sales based on specious reasons, whether their marketing potential was signaled by the buyer or not. Thus overselling includes bias-catering. These considerations lead to the following prediction for the market under scrutiny:

Prediction 4 (Bias-catering): Suppose in agrodealer-shops, some farmers signal their high potential to be sold mono by expressing their belief in its specious efficacy. Then informed agrodealers will recognize this as an opportunity to sell more mono bundled on top of another more potent pesticide, and oversell accordingly.

I test this prediction by analyzing 240 recorded conversations (as part of the sit-in observations conducted in 2012) between farmers and agro-dealers. The conversations analyzed are of the following form. The farmer goes first, describing a problem and possibly requesting specific pesticides. The agrodealer then responds with his prescription. A field experiment asking farmers to present randomly assigned scripts would have been desirable, but since most farmers and agrodealers have preexisting relationships, it was not possible to conduct such an experiment without either hurting previous trust in relationships or making the conversations unnatural. I highlight below three selected conversations that hint at some efforts of overselling in action, before reporting a statistical correlation study that provides some speculative evidence as to the extent of bias-catering and overselling present in this market.

The first selected conversation illustrates "ambiguity from mixing":

"A farmer complains of aphid in his cotton crop. The agrodealer prescribes him monocrotophos and acephate."

Mixing pesticides occurs often in cotton pest management, because the common perception is that mixing can help save labor cost compared to applying pesticides separately.[3] For controlling a single pest type, however, the recommended agronomy-informed policy is to apply one pesticide. This is because most pesticides are substitutes. For instance, all pesticides of the organophosphate class, to which mono and acephate belong, work by inhibiting the same neurological enzyme called cholinesterase. In the case that acephate already inhibits cholinesterase, mono cannot add much further control. The two main classes of pesticides discussed in this paper, the organophosphate and neonicotinoid classes, are also substitutes for each other.[4] These considerations highlight the idea of economic threshold (ET), the level of pest infestation where the estimated benefits of treatment cover the cost of that treatment. If the level of infestation is below the threshold, the cost of treatment would exceed the benefits and the farmer would make a loss by applying the treatment. Application of a single pesticide demonstrated to be potent is capable of bringing down pest infestation levels to below ET, obviating the need for the application of another pesticide. Many of these details are missing in the conversation above.

The second kind of effort may be represented by the message of a popular concept "pesticide for growth" as has been repeatedly discussed in this paper. Consider the following conversation:

"A farmer requests a pesticide to spray on cotton crop. The agrodealer tells the farmer that monocrotophos is very good for growth and sucking pests."

Pesticides can contribute to cotton growth via controlling for pests, but they do not share the same kind of growth-enhancing property with fertilizers, water or the sun. Yet there is a tendency to ascribe a directly growth-enhancing property to pesticides on top of their ability to control for pests.

[3] Although the time savings may in reality be small..

[4] Mono and acephate are organophosphates. Imida and acemataprid are neonicotinoids. Please see Appendix I discussion for further information.

Third, consider the following remark by an agrodealer:

"Corozon-7 will stop leaves from falling, champion is a good pesticide, and imidacloprid is good for jassid."

Note that all products recommended in the quote are pesticides. The problem of "falling leaves" mentioned is a representative symptom of infection by jassid, a common sucking pest. However, the response suggests that by matching a specific symptom mentioned to a different pesticide, the agrodealer may be able to market more products than perhaps are needed by the farmer. Given the farmers' habit of mixing and lack of a tendency to experiment with separate combination of pesticides, as discussed in the next section and in Appendix II, such a recommendation may lead to persistent overselling and overuse of pesticides in this market.

Finally, perhaps mono is also getting an extra psychological pull from the fact that it has been used for a long time by cotton farmers historically and is well known throughout this farming community. In other words, perhaps the farmers are suffering from a status quo bias.[5] The above discussion demonstrates many possible ways in which an illusion of a specious efficacy can provide incentives for overselling. I now report the results of a general correlation study run on all 240 conversations (from both 2012 and 2013).

Columns 1-3 of Table 1 report coefficients obtained from linearly regressing the number of prescribed pesticides in each conversation on specific phrases that occurred in the conversation, with varying levels of controls. Column 3, in particular, includes all specific as well as generic names for pests that were mentioned in the conversations, all cotton health symptoms such as the colors of the leaves, and all other specific pesticide names, mentioned by either the farmer or the dealer. When the farmer mentions "pesticide for growth" he is likely to be recommended 0.6 to 0.9 pesticides more pesticides than if he does not. When the agrodealer mentions "pesticide for growth" in response, the number of pesticides recommended also goes up by 0.5 products. Since these variables were not randomly assigned, implications of endogeneity problems cannot be overcome and we cannot make causal interpretations with a strong degree of confidence. Yet the high correlations suggest that agrodealers may be exhibiting a strong catering tendency in response to a demand cue that may have no relevance to actual pest control objectives.

A similar trend can be seen in columns 4-6, which regresses whether or not the agrodealer ended up prescribing mono on the same variables as in columns 1-3. When the farmer mentions "pesticide for growth," he is 23% to 41% more likely to be prescribed mono. While the coefficients are not significant, when the agrodealer mentions "pesticide for growth" in his prescription, the farmer is around 12% more likely to be recommended mono. In a regression not reported here, I also examine the coefficient measuring the increase in the number of pesticides recommended when the farmer mentions pesticide for growth, after subtracting mono from the picture. While with mono included the coefficients range between 0.6 and 0.9 as mentioned above, with mono excluded the coefficients drop to between -0.2 to 0.4.[6] These results support the interpretation that when a farmer mentions "pesticide for growth," perhaps signaling belief in a specious efficacy of pesticides, he is very likely to be recommended another pesticide on top of other products that agrodealers usually recommend, and furthermore that there is a 40-50% chance that the extra pesticide recommended is mono.

Figure 1 below illustrates this idea graphically. Relying on the regression reported in column 3, the left-hand panel predicts the number of prescribed pesticide by whether the farmer mentioned "pesticide for growth," with all controlled variables held at means. Relying on the regression in column 6, the right-hand panel

[5] Status quo bias has long been discussed in the literature. See Samuelson and Zeckhauser (1988).
[6] The chi-squared statistics testing whether these coefficients are the same range between 10 and 18.

predicts the probabilities of the agrodealer prescribing mono by whether the farmer mentioned "pesticide for growth." I have scaled the y-axis on the right-hand-panel so that the predicted probability of prescribing mono at means given that the farmer does not mention "pesticide for growth" is aligned with the corresponding baseline number of pesticides prescribed by the agrodealer. The absolute height by which the probability of mono prescription given the signal "pesticide for growth" is greater than the baseline probability can be compared against the absolute height by which the predicted number of pesticides given the signal is greater than the baseline number prescribed. This offers a visual sense of what proportion of the extra number of pesticide prescribed may be coming from extra mono prescription in response to farmer mentioning "pesticide for growth."

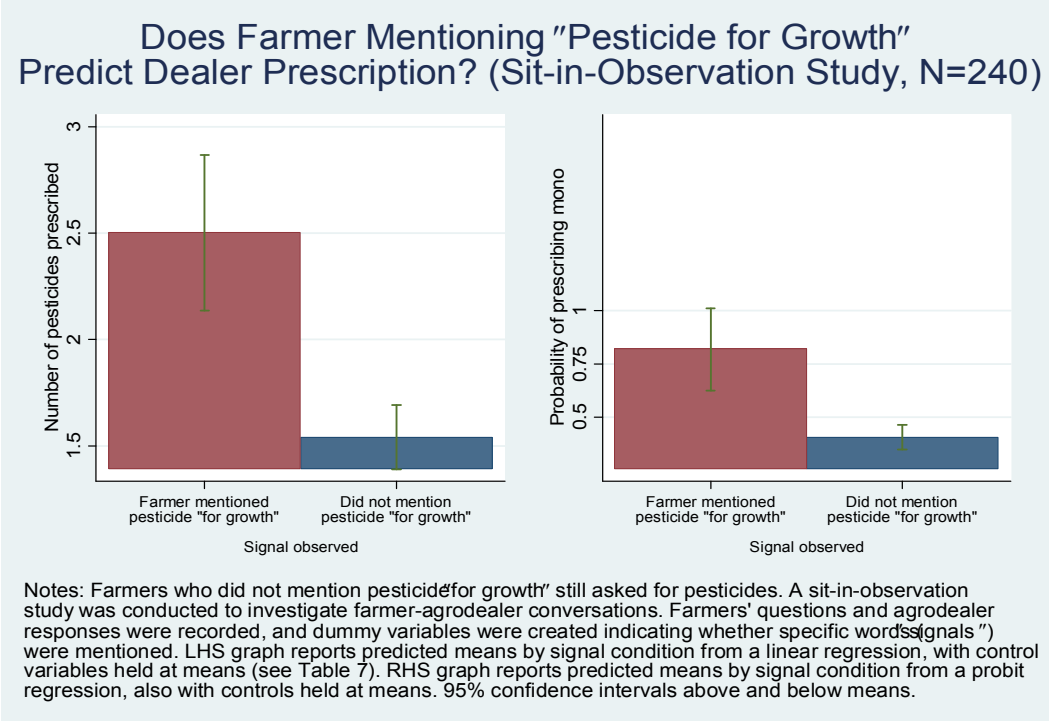


Figure 1. Does Farmer Mentioning "Pesticide for Growth" Predict Dealer Prescription? (Sit-in-Observation Study, N=240)

In columns 4-6, we also see that the chance that agrodealer prescribes mono gets significantly reduced when a farmer mentions names of substitutes superior to mono such as "acephate" or "imida," or the phrase "sucking pest," a technical term for the class of pests that infest cotton. This may support the speculative interpretation that farmers being able to name the class of pest attacking their cotton, and/or being able to ask for a specific pesticide, may signal a degree of sophistication that makes the agrodealers conclude that it would not be profitable trying to oversell to these farmers.[7] On the other hand, controlling for all other codes, prescribing acephate increases the chance of prescribing mono by 36% to 44%, again suggesting that agrodealers are trying to bundle mono with alternatives as much as they can.

Columns 7-9 run similar probit regressions with imida instead of mono as the explained variable. In contrast with the case for mono, when farmers mention the phrase "sucking pest," the likelihood of prescribing imida rises significantly, suggesting that agrodealers do seem to have the notion that imida is more effective than mono against sucking pests. While agrodealer mentioning "mix" perfectly predicts success of prescribing

[7] That is, unprofitable perhaps because agrodealers care about their relationship with sophisticated farmers who are less likely to buy products they do not need.

imida (thus the reported regressions were run without this variable), other evidence seems to suggest that agrodealers actually push back against prescribing imida if they could sell other products instead. For instance, an increase in the number of pesticides asked for by farmers, as well as the condition that agrodealers prescribe mono or acephate, decreases the likelihood of prescribing imida. These trends seem to suggest that while agrodealers recognize the potency of imida, they are not necessarily more likely to sell imida if they can market other products.

Again, because none of the explanatory variables above were randomly assigned, strictly causal interpretations cannot be made and other unobserved variables that may explain the trends above cannot be ruled out. Yet the overall trends generally fall in line with the prediction of overselling that began the discussion of this section. Most tellingly, farmers asking about "pesticide for growth" are likely to get them prescribed an extra pesticide on top of the 1.6 already being recommended and that mono may account for 40% of this extra prescription. This trend is perhaps not surprising, given that evidence suggests that competitive pressures may be high among agrodealers who depend on revenues for livelihood, and seller incentives do not seem to be aligned with research-recommended practices.[8]

A picture that emerges from this analysis is one in which a dubious notion can work its way into creating an extra, perhaps needless, demand for a product. The next questions I investigate concern why such a demand would persist in an environment in which learning may neither be physically impossible nor demanding.

Appendix I. Cotton Pesticides and the Cotton Pesticide Market

Appendix Table 1 reports results from a survey conducted by the author on local experts concerning the pest-control efficacies of mono and imida. The respondents included four directors and horticulture officers from Department of Agriculture, Government of Gujarat; an agronomist from Krishi Vigyan Kendra (KVK), Navsari Agriculture Universit; and directors and managers from Atul Ltd., BASF Pesticides, Cadium Crop Care, Coromandal Pesticides, Krishi Rasayan Exports, Pyramid Chemicals and Redox Agrotech Private Ltd. The experts were contacted either by phone or email. They were asked to answer two questions: 1. "If you had to choose between using 1L of Imidaclorpid or 1L of Monocrotophos or both against cotton pests for Bt cotton, which would you choose?"; 2. "For Bt cotton pests, is it always more effective to use Imida only than to use a mixture of Imida and Mono?" For question 1, 8 out of 12 experts surveyed answered that they would use imida only, and another answered that he would use thiomethoxam only, which is a neonicotinoid of the same class as imida and of a different class than mono. Two out of 12 experts answered they would use both pesticides. For the second question, 10 experts, or over 80% those surveyed, answered that using imida alone always dominates a mixture of mono and imida. For more information on pest resistance to organophosphates including mono developed over time since their introduction in 1970s, as well as more recent research on imida's efficacy for cotton pest control, please see Kishaba (1971), Georghiou (1990), Roush et al (1990), Kranthi (2001), Bambalawe et al (2004), Jhansi (2004) and Zalom et al (2005).

The Indian cotton pesticide market is about $2 billion in size. Mono accounted for 70% of all cotton pesticides produced in India in 2007, with its level of production having increased since. A natural question that arises for an economist studying this market is why the largely competitive and unregulated market is not able to

[8] For further discussion on the competitive structure of this market, please see Appendix I.

communicate better information, especially regarding health implication and efficacy, about its products to consumers.

If an analogy could be made to the cigarette industry, perhaps it is scarcely surprising that cigarette companies engage in little public health information campaign about their products.[9] What remains puzzling, however, is why companies that hypothetically produce cigarettes that are harmless to health and offer more pleasure do not engage in more aggressive advertising campaigns, supposing identical costs of production. Indeed, we do not have safe cigarettes, and it is easy to imagine if we did the producers would advertise that there are healthy alternatives.

According to an interview by the author with a top executive at a large Indian agribusiness, the agrochemical channel in India is very standardized, with large manufacturers commanding most of the market share. International companies such as DuPont, Bayer Crop Science and Dow, as well as Indian generic players Excel, Tata, United Phosphorous, and Upl all have produced both mono and alternatives such as Imidacloprid. The points of sale to the farmer are village level dealers. Manufacturers may supply the dealers directly or via state dealers. No single manufacturer has a lock on the dealers. Margins tend to be relatively constant, hovering at around 8 to 10 percent at sales.

It is not difficult to see how in such an environment, no manufacturing firm has an incentive to inform the endline consumers of the superior benefits of alternatives to mono such as Imidacloprid, especially if consumers are prone to buying both products together at larger total quantities. Competition between manufacturers may be driving down prices to efficient levels, but under the assumption that firms prefer larger revenues with proportional profits, education is not preferable as it can only decrease revenues and thus profits—the "curse of education," as it were, as discussed by Gabaix and Laibson (2006) among others. Likewise, agrodealers do not have any incentive to debias customers, either, if they are receiving approximately constant margins from each unit of sales.

As my final point of discussion for this appendix section, I present results from a survey on product offerings by 36 agrodealer shops sampled from Chuda and Limbdi townships, each comprising 39 villages and 90,000 population and 64 villages and 160,000 population, respectively, within Suredranager district, Gujarat, India. The shops represent about 80% of all agrodealer-shops in the two townships. The summary statistics are given in Appendix Table 1. Thirty brands offer imida, 15 of which also seen to offer mono.[10] Imida's unit price is about 25% more expensive than mono's. Recall that in Appendix Table 1, expenditure levels on mono and imida were comparable.

Survey evidence suggests that imida prices per unit application are on average 0% to 25% more expensive than mono prices, although the variance of the surveyed imida prices is high. These statistics give partial support to the discussion above. If many manufacturing brands are engaging each other in a Bertrand competition, carrying costs will be brought down to competitive levels.[11] Multiple agrodealer-shops in a given village may also bring down the retail prices to competitive levels, resulting in constant markups after fixed costs.

[9] I thank Shawn Cole for this discussion.

[10] DuPont and Bayer Crop Science have recently stopped producing mono in India due to international pressures, and indeed their names were not found among the brand name mono sold by the shops surveyed. Including them in the list of manufacturers who also produce imida would bring the number up to 17.

[11] The executive we interviewed mentioned manufacturing companies engage in a lot of kickbacks and under the table gifts such as "trips and watches" to attract agrodealers to sell their product instead of others'.

Table 1—Relationship between Products Prescribed and Messages Coded in Conversations between Farmers and Agrodealers (Sit-in-Observation Study, N=240)

Dependent variables:	Number of Pesticide Products Prescribed			Prescribed Mono			Prescribed Imida		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Codes:									
Farmer mentions "pesticide for growth"	0.670***	0.671***	0.961***	0.238**	0.277***	0.417***	-0.049	-0.049	0.011
	(0.162)	(0.156)	(0.187)	(0.084)	(0.091)	(0.101)	(0.069)	(0.057)	(0.069)
Farmer mentions "sucking pest"		0.262	0.498**		-0.263**	-0.166		0.138**	0.163**
		(0.268)	(0.226)		(0.109)	(0.120)		(0.059)	(0.073)
Farmer mentions "mono"		-0.252	-0.105		0.636***	0.723***		0.184**	0.204**
		(0.240)	(0.226)		(0.132)	(0.151)		(0.083)	(0.085)
Farmer mentions "imida"		-0.179	0.009		-0.286*	-0.216		0.552***	0.546***
		(0.292)	(0.324)		(0.159)	(0.168)		(0.115)	(0.118)
Farmer mentions "acephate"		0.230	0.278		-0.559***	-0.448***		0.081	0.041
		(0.256)	(0.267)		(0.161)	(0.169)		(0.126)	(0.124)
Agrodealer mentions "vegetative growth"	0.587***	0.595**	0.388	0.122	0.126	0.122	0.020	0.066	-0.134
	(0.197)	(0.227)	(0.247)	(0.125)	(0.176)	(0.220)	(0.095)	(0.101)	(0.125)
Agrodealer mentions "mix"	0.237	0.271	-0.008	0.021	-0.170	-0.422	(perfect success)	(perfect success)	(perfect success)
	(0.376)	(0.369)	(0.337)	(0.284)	(0.458)	(0.509)			
Agrodealer mentions "sucking pest"		-0.252	-0.179		0.342*	0.325*		0.157	0.186*
		(0.262)	(0.319)		(0.176)	(0.188)		(0.097)	(0.110)
Number of pestidies asked for by farmers		-0.154	-0.183		0.061	-0.001		-0.243**	-0.208***
		(0.206)	(0.237)		(0.082)	(0.087)		(0.074)	(0.069)
Prescribed mono							-0.162***	-0.092	-0.099
							(0.064)	(0.069)	(0.078)
Prescribed imida				-0.224***	-0.169	-0.122			
				(0.098)	(0.131)	(0.145)			
Prescribed acephate				0.364***	0.499***	0.444***	-0.049	-0.038	-0.097
				(0.071)	(0.092)	(0.100)	(0.062)	(0.065)	(0.076)
Constant at means				0.459***	0.459***	0.456***	0.201***	0.148***	0.139***
				(0.035)	(0.038)	(0.041)	(0.027)	(0.025)	(0.026)
Constant	1.649***	1.788***	1.172***	0.281***	0.193***	0.104**	0.325***	0.216***	0.131**
	(0.096)	(0.123)	(0.186)	(0.044)	(0.045)	(0.042)	(0.046)	(0.047)	(0.061)
Observations	240	240	240	240	240	221	240	240	215
R^2	0.118	0.162	0.320	0.189	0.368	0.413	0.056	0.256	0.362
All other coded variables as controls	-	-	25	-	-	24	-	-	24

Notes: A sit-in-observation study was conducted to investigate farmer-agrodealer conversations. Farmers' questions and agrodealer responses were recorded, and dummy variables were created indicating whether specific words were mentioned. Columns 1-3 report linear regressions. Columns 4-9 report derivatives at sample means given by probits. Suppressed controls include all specific as well as generic names for pests that were mentioned in the conversations, all cotton health symptoms such as the colors of the leaves, and all other specific pesticide names, mentioned by either the farmer or the dealer. For probits, "Contants" are constants at zeros and Delta-method standard errors are reported. Robust standard errors are reported for linear regressions. *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

Appendix Table 1—Local Mono and Imida Product Offerings (Sit-in-Observation Study)

Total number of mono offerings	70
Total number of imida offerings	59
Total number of unique mono brands	37
Total number of unique imida brands	30
Total number of unique brands offering both mono and imida	15

	Obs.	Mean	Std. Dev.	Min	Max
Prices of mono offerings	70	399.1	69.9	175	500
(winsorized at 5%)	(70)	(400.3)	(66.6)	(240)	(500)
Prices of imida offerings	59	529.3	323.5	174	1708
(winsorized at 5%)	(59)	(520.7)	(293.9)	(210)	(1140)
N (Agrodealer shops)					36

Notes: These results are from the first round of sit-in observations conducted in 2012. Original product offerings came in various units, and the prices in this table come from normalized figures at per 1L for mono and per 300ml for imida. Manufacturer recommended dosage of application per acre is 1L for Mono and 300ml for Imida.

Appendix Table 2—Inventory Analysis of Major Agricultural Inputs (2012 and 2013)

Pesticides	%	Fertilizers	%	Bio-Products	%
Acephate	93%	Urea	10%	Tricoderma	18%
Monocrotophos	92%			Neem Products	15%
Imida	90%	DAP	8%	Pheromone Trap	7%
Acetamaprid	73%	Ammonium Sulphate	3%		
Phosphamidon	20%				
Endosulphan	3%				
		N(Agrodealer Shops)	60		

Notes: The above figures include two rounds of inventory analyses conducted in 2012 and 2013. 36 agro-dealers were interviewed in 2012, and another 24 interviews were completed in 2013. Agro-dealers were asked about the major agricultural inputs they stock to understand the type of inputs that are available to farmers. % here refers to the % of agro-dealer shops that stock a particular product

M 3.4: Weekly broadcast status

Following the completion of the first round of phone surveys, our sample of 1453 treatment farmers continue to receive two push calls a week through the Avaaj Otalo (AO) line. This includes a technical push call –providing agricultural advice based on local crop and weather conditions – and a BCI push call – providing information on best agricultural practices (primarily for cotton) as recommended by our partner organization, Better Cotton Initiative – Solidaridad Cotton Solutions Network (BCI-SCSN). With kharif season coming to an end, push call content on cotton was slowly phased out in November. With the onset of rabi, the technical cotton push call was replaced with push calls on wheat and gram, which are primary rabi crops in the study region.

In the four months since the start of the study in September 2013, we have sent out a total of 36 push calls. In November and December alone, we broadcasted 21 push calls including 11 technical push calls and 10 BCI push calls. Below is a table that shows the broadcasting date and duration of push calls that have been sent out to treatment farmers in November and December 2013.

Date of Broadcast	Content	Duration (in seconds)
01-Nov-13	BCI	140
06-Nov-13	Cotton	270
08-Nov-13	BCI	190
13-Nov-13	Cotton	205
15-Nov-13	BCI	150
20-Nov-13	Cotton, Wheat, Gram	242
22-Nov-13	BCI	225
27-Nov-13	Cotton, Wheat, Gram	164
29-Nov-13	How to Record Question	153
04-Dec-13	Cotton, Wheat, Gram	240
06-Dec-13	BCI	110
11-Dec-13	Wheat and Gram	140
13-Dec-13	BCI	136
18-Dec-13	Wheat and Gram	180
20-Dec-13	BCI	102
25-Dec-13	Wheat and Gram	280
27-Dec-13	BCI	102
01-Jan-14	Wheat and Gram	240
03-Jan-14	BCI	100
08-Jan-14	Wheat and Gram	250
10-Jan-14	BCI	108

DISTRICT Name: [ ]Taluka Name: [ ] VILLAGE Name: [ ]

Baseline Survey (Phone)

Introduction and Consent Form

A. Hello. My name is _____. We're from ASA, CMF, and Harvard University, conducting a study on how different sources of agricultural information affect your agricultural practices. The current phone survey isapproximately 30 minutes long, with Rs. 30 mobile top-up as compensation.

Interviewer Check Point			
1	Are you Mr. /Ms. _____?	Yes—1	→2
		No—2	→4
2	Is this a convenient time for this survey?	Yes – 1	→5
		No – 2	
3	When should we call you back?	Date	
		Time	
		(Call back)	→2
4	Is Mr. /Ms. _____ available? (If yes, ask the phone to be passed.)	Yes—1	→1
		No—2	→3
		#incorrect—3	End.
5	Are you the main agricultural decision maker of your household?	Yes—1	→B.
		No—2	
6	Could you give us the decision maker's name and phone number?	Name:	
		Phone #:	
		(Start over)	→1

B. Okay.First, we would like to provide you with some information about this study. This study will involve two telephone surveys, one today, and one next year.

Interviewer Check Point			
	(DO NOT READ. Check if the respondent is in the treated group or control group. If treated, repeat the following message. If not, skip.)	Treated – 1	
		Control – 2	

[TREATMENT GROUP ONLY: In addition, you may be offered access to a free, telephone-based agricultural advice service. You may ask questions about cotton, and we will also provide agricultural advice.]

C. Participation in this study is purely voluntary. The study may help ASA provide better services to its farmers.You may decline to answer any question, and you may choose to stop participating at any point.

D. There are some important things for us to tell you about the data we collect:First, your data will be kept confidential. An electronic copy of this interview will be retained at Harvard University, without any personally identifiable information. The copy may be made available to other researchers. If you have questions about the study, you may call us back at this numberor contact Niriksha Shetty at 9769122890, or Toni Wegner, coordinator for the protection of research participants, at +1 617 496 9952.

In order to learn how farmers respond to information and better improve the service, we would like to also collect data from the Better Cotton Initiative, which maintains records of your agricultural activities.

Do you agree to participate in this study?
1. Yes
2. No ➔ End

D. Demographic Information

DISTRICT Name: [ ]Taluka Name: [ ] VILLAGE Name: [ ]

	Please answer these last five demographic questions.				
D1	What is your age? (If unclear, ask for range.)	Age: _____		(Age range: _____)	
D2	(Record gender)	Male—1		Female—2	
D3	How many years have you been involved with agriculture?			_____years	
D4	Do you own agricultural land? (If no, skip to 6.)	Yes 1			
		No 2		→6	
D5	How many BIGHAs of agricultural land do you own?			Area (BIGHA):	
D6	What was your agricultural revenue last year?			Rs.	
D7	What is your education level?	Standard1	1	Standard9	9
		Standard2	2	Standard10	10
		Standard3	3	Standard11	11
		Standard4	4	Standard12	12
		Standard5	5	Diploma	13
		Standard6	6	Degree	14
		Standard7	7	No school	15
		Standard8	8	Other	888

Y. Yield						
	Please answer the following questions for the last Kharif (2012) season.					
Y1	Did you sow any cotton last Kharif'12? (If no, skip the rest of this section.)				Yes – 1	
					No – 2	→P
Y1a	How many BIGHAs of cotton did you sow last Kharif'12?					
Y1y	How many MAN of cotton did you harvest in total last Kharif'12?					
Y1s	How many times did you sell your cotton last kharif?				#	
		Date of sale	Quantity Sold (Man)	What was the price you received per Man	Did you sell this cotton to an FPC (1) or other trader (2)?	
Y1s_1	Sales 1			Rs.	1 2	
Y1s_2	Sales 2			Rs.	1 2	
Y1s_3	Sales 3			Rs.	1 2	
Y1s_4	Sales 4			Rs.	1 2	

P. Pesticide Usage

Which pesticides have you purchased and/or used in last Kharif 2012?

	Used			**Purpose**	
	Yes(1) /No(2)	Quantity (Kg/ L/g/ ml)	Total Cost (Rs.)	Did you purchase this to treat: 1 Specific pest, 2 Sucking pest, 3 Boll worm, 4 All pests	(If 1) Which specific pest was it? (Use Code)
1. Monocrotophos	1 2			1 2 3 4	
2. Imidacloprid	1 2			1 2 3 4	
3. Acephate	1 2			1 2 3 4	
4. Acetamaprid	1 2			1 2 3 4	
5. Thiamethoxam	1 2			1 2 3 4	
6. Triazophos	1 2			1 2 3 4	
7. Fipronil	1 2			1 2 3 4	
8. Difenthuron	1 2			1 2 3 4	
9. Profenofos	1 2			1 2 3 4	
10. Abecmamectin	1 2			1 2 3 4	
11. Copper Oxychloride	1 2			1 2 3 4	
14. Other 1 (name)	1 2			1 2 3 4	

DISTRICT Name: [ ]Taluka Name: [ ] VILLAGE Name: [ ]

15. Other 2 (name)	1 2			1 2 3 4	
PC	Comments				
Surveyors Check Point					

Codes for Purpose

1	2	3	4	5	6	7	8	9
Spotted bollworm	Pink bollworm	Heliothis	Prodenia	Aphid	Jassid	Thrips	White fly	Milibug

10	11	12	13	888	999
Wilt	Root Rot	Bacterial Blight	Leaf Spot	Other	Don't know

F. Fertilizer Usage				
F1_1	Which chemical fertilizers did you use for cotton?	**Used? (Y=1, N=2)**	**Quantity (Kg/L/g/ml)**	**Total Cost (Rs.)**
	A. Urea	1 2		
	B. Ammonium Sulfate	1 2		
	C. DAP	1 2		
	D. Murate of Potash (MoP)	1 2		
	E. N-P-K grade fertilizers	1 2		
	F. Micronutrient Fertilizer	1 2		
	F1. Zinc sulphate	1 2		
	F2.Boron	1 2		
	F3. Magnesium			
	G. OTHER (specify)	1 2		
	G1.	1 2		
	G2.	1 2		
F1_2	Which organic fertilizers did you use for cotton?	**Used? (Y=1, N=2)**		**Total Cost (Rs.)**
	A. Manure/Compost/FYM	1 2		
	B. Neem / Castor cake	1 2		
	C. OTHER (specify)			
	C1.	1 2		
	C2.	1 2		
FC	Comments			
Surveyors Check Point				

TM. Usage of Traditional Methods						
TM1	Have you applied any bio-control methods to control pests or diseases last Kharif?			Yes—1 No—2	→AI	
TM2	What biological method have you used? (ASK ALL)		**Used**	**Quantity (Kg/L/g/ml/Number)**	**Cost (Rs)**	
	A. T-guard		1 2			
	B. 5-leaf extracts		1 2			
	C. Installation of Sticky cards (yellow/blue)		1 2			
	D.Spraying of Neem form or Neem seed kernel suspension		1 2			
	E. Installation of pheromone trap		1 2			
	F. Release of Chrysoperla		1 2			
	G. Use of Tricoderma		1 2			
	H. Other (Specify)					

DISTRICT Name: [ ]Taluka Name: [ ] VILLAGE Name: [ ]

	I1.		1 2		
	I2.		1 2		

H. Harvesting Techniques					
	Please answer the following questions for the last Kharif (2012) season.				
H1	Did you sometimes pick cotton before the morning dews have evaporated?	Yes – 1	No – 2		
H2	Did you gather insect-infested, stained and hard locks as well as locks picked up from the ground in a separate bag?	Yes – 1	No – 2		
H3	Did you cover the cotton with cotton cloth or tarpaulin when picking cotton?	Yes – 1	No – 2		
H4	Did you start harvesting cotton after at least 50% of the bolls in the field have opened?	Yes – 1	No – 2		
H5	Did you mix different varieties of cotton together during harvesting or storage?	Yes – 1	No – 2		
H6	Was your storage floor concrete?	Yes – 1	No – 2		
H7	Was your storage floor covered with cotton or plastic cloth?	Yes – 1	No – 2		
HC	Comments				
Surveyors Check Point					

C. Farmer Producer Companies						
	Please answer yes or no to all questions that apply for COTTON last kharif?					
C1	Have you heard of Farmer Producer Companies? (If no, skip this section.)1732	Yes – 1	No – 2			
C2	Are you a member of FPC (If yes, skip sub-questions)?	Yes	1	→3		
		No	2			
	Why not? **(NOTE: Ask respondent about every source.)**	Yes 1	No 2	Dk 999		
	1. Have you not received enough information about FPC?					
	2. Is the FPC membership fee too high?					
	3. Did you not have enough cash on hand?					
	4. Were FPC input prices not lower than trade shops'?					
	5. Did the FPC not have enough input varieties?					
	6. WereFPC cotton prices not higher than other trader prices?					
	7. Was the FPC too far?					
	8. Was the FPC purchase timing inconvenient?					
	9. Did you not expect FPC to be sustainable?					
	10. Were you willing to join but just haven't yet bought shares?			→6		
C3	What is the name of the FPC?	NAME	CODE			
C4	How far is the FPC office from your farm?	__km				
C5	How much did you give to become a shareholder of your FPC?	Rs.				
C6	Have you purchased any product from your FPC last kharif?	Yes	1			
		No	2	→CC		
C7	Have you purchased any pesticides from your FPC last kharif?	Yes – 1	No – 2→8			
C71	What was the total cost?	Rs.				
C8	Have you purchased any fertilizers from your FPC last kharif?	Yes – 1	No – 2→9			
C81	What was the total cost?	Rs.				
C9	Have you purchased any seeds from your FPC last kharif?	Yes – 1	No – 2→10			
C91	What was the total cost?	Rs.				
C10	Have you sold any cotton to your FPC last kharif?	Yes – 1	No – 2			
CC	Do you have any other reasons or comments you wish to let us know? (Verbatim.)					
	Thank you for your patience. Now we are almost finished.					
Surveyors Check Point						

AI: Sources of Agricultural Information	
	INTERVIEWER NOTE: Do not mention Avaaj Otalo by name in these sections as an option.

DISTRICT Name: [ ]Taluka Name: [ ] VILLAGE Name: [ ]

	INTERVIEWER NOTE: Use the ladder scale provided to rate trust in information sources. A rating of 1 means least trustworthy whereas a rating of 10 means most trustworthy.				
AI.1	In the last kharif, did you ever receive agricultural advice from a government extension worker?		YES	1	
			NO	2	
AI.2	What sources of information do you use to make agricultural decisions? **(NOTE: Ask respondent about every source.)**	Yes (1) / No(2)	Trust in Source (Score from 1 to 10)		
	1. Past experience	1 2			
	2. NGO Cellphone-based Extension	1 2	(Name _____)		
	Others	Name _____			
	3. Government extension worker	1 2			
	4. NGO Trainings / Learning groups	1 2	(Name _____)		
	Others	Name _____			
	5. Other farmers	1 2			
	6. Agroshop / Trader / Agent	1 2			
	7.Digital Green	1 2			
	888. Other (Specify)___	1 2			
AI.3	Of these sources in AI.2, what are your top two sources for agricultural information—these can be media or persons?				
	(USE AI.3 numbers for CODE)	FIRST: _____	SECOND: _____		
	NOW WE WILL GET MORE SPECIFIC ABOUT DIFFERENT AGRICULTURAL INFORMATION.				
AI.4	What is your most important information source regarding:	TOPIC		SOURCE	
	(USE AI.3 numbers for CODE)	1.Crop decision			
		2.Soil/field preparation			
		3.Seeds			
		4.Fertilizers			
		5.Pest management			
		6.Water			
		7.Weather			
		8.Harvesting			
		9.Prices			
		10.Storage/sales			
		Other		(specify)	
AI.5	Have you given any agricultural information to a peer in your learning group last kharif?		Yes	1	
			No	2	→6
AI.51	What was the most important information you exchanged?		AI.5 CODE	Record verbatim	
AI.6	Have you received any agricultural information from a peer in your learning group last kharif?		Yes	1	
			No	2	→7
AI.61	What was the most important information you exchanged?		AI.5 CODE	Record verbatim	
AI.7	Have you given any agricultural information to a peer outside of your learning group last kharif?		Yes	1	
			No	2	→8
AI.71	What was the most important information you exchanged?		AI.5 CODE	Record verbatim	
AI.8	Have you received any agricultural information from a peer outside your learning group last kharif?		Yes	1	
			No	2	→AIC
AI.81	What was the most important information you exchanged?		AI.5	Record	

DISTRICT Name: [ ]Taluka Name: [ ] VILLAGE Name: [ ]

		CODE	verbatim	
AIC	Comments			
Surveyors Check Point				

K. Knowledge Index				
	Please answer the following last five questions.			
K1	What type of pests does BT cotton provide resistance against?	Boll worms	1	
		All pest and diseases	2	
		Sucking pests	3	
		Any Other (Specify)	888	
		Don't Know	999	
K2	If you could use 50 kg (1 bag) of Murate of Potash or 50 kg (1 bag) of 12-32-16 , which of the two would you use to add potash to soil?	Murate of Potash (MoP)	1	
		12-32-16 grade	2	
		Other	888	
		DON'T KNOW	999	
K3	After flowering stage, which type of fertilizers are advised to spray to stop the falling of flower buds and for good development of balls?	Micronutrient – Zink,Boron,Mg	1	
		Urea/DAP	2	
		Other	888	
		Don’t know	999	
K4	Which pesticide would you use to control heavy infestation of THRIPS?	Fipronil/profenofos/abemectin	1	
		Imida/pride/thiamexotham	2	
		Monocrotophos	3	
		Other	888	
		DON'T KNOW	999	
K5	Which fungicide would you spray to control LEAF FLIGHT / BOLL DROP on your cotton?	Copper oxychloride	1	
		Mancozeb/Carbendazim	2	
		Other (Specify)	888	
		Don’t Know	999	
Surveyors Check Point				

Thank you very much for taking this survey. Your responses will be kept confidential. Your phone will be reimbursed Rs. 30 for your time. Hope you have a great day.

M 4.1 Willingness to pay study sample of households identified with implementation partners

The willingness to pay study was conducted along with the final household paper survey in Surendranagar, Gujarat. Willingness to pay exercises were administered to all respondents including the 400 cotton farmers who received access to the *Avaaj Otalo (AO)* hotline, 400 farmers who had access to AO and received traditional in-person agricultural extension and 400 farmers who do not have access to AO and form the pure control group. In addition to these 1200 farmers, we also planned to include about 1000 "peers" who were not part of the study sample. Peers refer to non-study farmers who were listed as friends by our study farmers, live in the same village and discuss agricultural information with them.

Respondents were split across 40 villages in two districts of Surendranagar – Sayla and Chotila. Our surveyors would attempt to reach all 1200 study respondents (30 in each village), followed by the peer households listed in that village. 75% of respondents would participate in a willingness to pay game that would ask them if they would like to buy AO at a series of decreasing price points (ranging from Rs. 490 to Rs.0). Following this, they were given a pre-assigned scratch card where their randomized offer price is listed (ranging from Rs. 40 to Rs. 240). If the scratch card price is lower than their demand price then the respondent could buy the product at the discounted price. The other 25% played a simple "take it or leave it" willingness to pay exercise where they would simply be asked if they are willing to purchase the service at Rs. X, where X is randomized between Rs. 40 to Rs. 240. The study will take about 20 minutes to complete and farmers will be offered Rs. 30 in mobile top-up as compensation. *Please see attached for a copy of the willingness to pay survey for both exercises that were administered to respondents.*

AGRICULTURAL INFORMATION CONSENT FORM

An Impact Evaluation of a Mobile Agricultural Extension Program

Willingness to Pay Exercise

Shawn Cole, Harvard Business School; Nilesh Fernando, Harvard Kennedy School

The purpose of this study is to understand the demand for an agricultural information service and to market to you an agricultural information product. The study is a part of our AO study. Your participation in this exercise and survey will take about 30 min. If you have any questions about the study, they will be answered for you.

For your participation in the study, you will receive a phone top-up value of Rs. 30 as an official thank you from the researchers at Harvard University.

Your participation in this study is purely voluntary, and you may withdraw your participation or your data at any time without any penalty to you. You may decline to answer any question. Additionally, your relationship and activities with DSC, Sajjata Sangh (SS) or other NGOs will not be affected by your answers in this survey at all. No one except the CMF research team will be able to see your personal information. Your responses will also not be shared in an identifiable manner with DSC, SS or other NGO staff.

Your data will be kept completely confidential in a secure location in the Ahmedabad CMF office. Once the research is completed, the paper documents will be destroyed. An electronic version of the data will be stored at Harvard Business School, without any personally identifiable information. These data may be made available to other researchers, again without any personally identifiable information.

You can also contact Ishani Desai (email ishani.desai@ifmr.ac.in) at +91 79 4007 3682/3 at the Ahmedabad Office of Centre for Microfinance. If you feel you have been treated unfairly, or you have questions regarding your rights as a research subject, you may contact the Director of the Institute of Rural Management Anand (IRMA), Dr. Vivek Bhandari, at 02692 261230 (Ext: 601) or by email at vivek@irma.ac.in.

Harvard contact.

Do you agree to participate in the study?

YES……. 1

NO……... 2 → END

We may record this survey to improve the quality of our survey in future rounds. This recording will be kept completely confidential following already outlined data security procedures.

Do you agree to have this survey recorded?

YES……. 1 → BEGIN SURVEY

NO……... 2 → DO NOT RECORD, BEGIN SURVEY

SECTION M: MARKETING

Instructions: Open the envelope with the village name matching the respondents' village name. Record the envelope code below.

M.1 ENVELOPE CODE: _____

(READ FROM ENVELOPE)

Envelope will also reveal if the farmer is assigned to W1 or W2 group

SECTION W1. WILLINGNESS TO PAY – BDM (75% see W1, 25% W2.)

Read the following message:

Now, you have a good idea about the AO service and how this service may help you make agricultural decisions. We will be playing a game with you, where you can tell us what the maximum you are willing to pay *now* for the service is. A random price has been chosen among some numbers, and it is written on the scratch card. We are now going to read off each number in a descending order and you can tell us at which point you would be willing to purchase the service. We will write your stopping point here on the left-hand panel, and scratch the right-hand panel. If your number is higher than the scratched number, you will be able to purchase AO at this lower price.

W1.1 Do you understand how the game works?

YES…….. 1 → Continue

NO…….. 2 → Explain game again

Avaaj Otalo Scratch Card Example

YOUR DEMAND	Scratch Here RANDOMIZED OFFER PRICE

On winning the game, you will actually get the product at the lower price and we will also provide AO training. Please be reminded that it is in your best interest to say "YES" at the point of your true willingness to pay. Only when your "YES" point above the scratch card price, will you have access to the service. Please give your true demand price as if the scratch card number is higher than your price you will NOT be able to purchase the service.

W1.2 Are you ready to play this game and purchase the service?

YES ……. 1 → Continue with WTP Exercise Part A

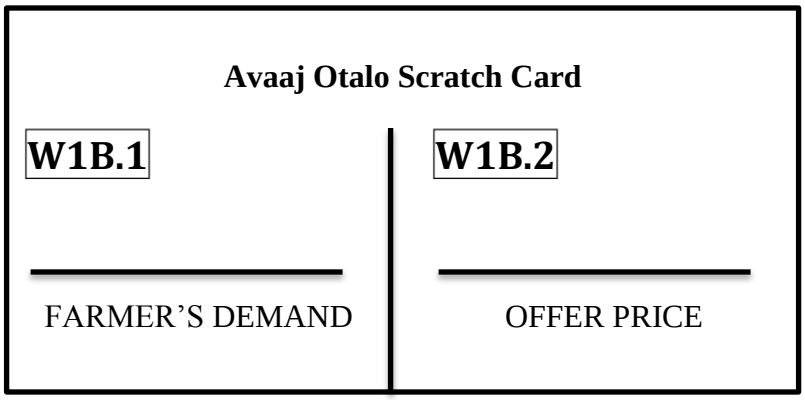
NO ……. 2 → SKIP to P.1 and record Rs. 0 as demand

PART A: EXERCISE

Note: Make sure the farmer is alone without other farmers around. Do not mention any numerical values apart from the ones mentioned in this script. Make sure the farmer understands this exercise and that they need to answer honestly.

W1A.1	Would you buy the product at Rs. 490?	1 (Yes)	> SKIP to Part B
		2 (No)	
W1A.2	Would you buy the product at Rs. 390?	1	> SKIP to Part B
		2	
W1A.3	Would you buy the product at Rs. 290?	1	> SKIP to Part B
		2	
W1A.4	Would you buy the product at Rs. 240?	1	> SKIP to Part B
		2	
W1A.5	Would you buy the product at Rs. 190?	1	> SKIP to Part B
		2	
W1A.6	Would you buy the product at Rs. 140?	1	> SKIP to Part B
		2	
W1A.7	Would you buy the product at Rs. 90?	1	> SKIP to Part B
		2	
W1A.8	Would you buy the product at Rs. 40?	1	> SKIP to Part B
		2	> Read next message
W1A.9	Rs. 40 is the lowest price at which you can bid. There is nothing lower. Would you buy the product at Rs. 40?	1	> Go to Part B
		2	> SKIP to P.1; Record 0 on card

PART B: SCRATCH CARD



Instructions: Call the Ahmedabad office operator to give them the price and get the correct scratch card. Tell the phone operator the UID of the respondent. The operator will tell you which number scratch card to use. DO NOT USE JUST ANY SCRATCHCARD. Write down the respondent's willingness to pay price on this card and tell the operator their willingness to pay (price they said YES to).

Give the scratch card to the respondent so they can get their randomized price.

W1B.3	Is the offer price (W1B.2) less than the demand price (W1B.1)?	1 YES	→ Go to 1/WB.4
		2 NO	→ Skip to 2

1. If the scratch price is LOWER than the WTP price read:

Congratulations! Your randomized price is lower or equal to your willingness to pay so you can get the service at the price of Rs. **XXX**. After I collect Rs. **XXX** from you, we can start the missed call service on your mobile and give you AO training.

NOTE: Please collect the funds immediately.

WB.4	Does the respondent give you the exact amount?	1 YES	SKIP to P.2
		2 NO	Record reason below; Skip to P.1
WB.5	REASON:		

IF MONEY IS COLLECTED, THEN RECORD PHONE NUMBER FOR SERVICE HERE:

_____

2. If the scratch price is HIGHER than the WTP price read:

Your randomized price is higher than your willingness to pay so you cannot get the service at the price at your willingness to pay.

SECTION W2. WILLINGNESS TO PAY – TOLI (75% see W1, 25% W2.)

Read the following message:

Now, you have a good idea about the AO service and how this service may help you make agricultural decisions. We would like to offer the service to you at a price of Rs. **XXX.**

(NOTE: Rs. **XXX** is written in the marketing letter.)

W2.1 Would you be willing to purchase the service?

YES…….. 1 → go to 1/W2.2

NO…….. 2 → skip to 2

1. If farmer says YES:

Congratulations! You can get the service at the price of Rs. **XXX**. After I collect Rs. **XXX** from you, we can start the missed call service on your mobile and give you AO training.

NOTE: Please collect the funds immediately.

W2.2	Does the respondent give you the exact amount?	1 YES	SKIP to P.2
		2 NO	Record reason below P.1
W2.3	REASON:		

IF MONEY IS COLLECTED, THEN RECORD PHONE NUMBER FOR SERVICE HERE:

_____

2. If farmer says NO:

Thank you for your participation. GO TO p.1

SECTION P. Post Game Questions (for all respondents)

P. Post Game Questions				
P.1	Why did you choose not to purchase AO or why is your demand 0? **(Don't read options. Pick the best option.)**	Too expensive	1	End survey & give topup
		Don't have money right now	2	
		Do not need information	3	
		Information is not relevant/useful	4	
		Don't understand what AO is	5	
		Other:	888	
P.2	Why did you choose to purchase AO?	Record verbatim below		
	Reason:			

End Survey and Give topup

I, _____, CERTIFY THAT I HAVE RECEIVED A TOP-UP OF Rs. 30 FOR PARTICIPATING IN THE AGRICULTURAL INFORMATION SURVEY WITH CMF-DSC-SAJJATA SANGH.

DATE:

INTERVIEWER NOTE: RECORD THE TOP-UP SERIAL NUMBER: _____

THANK THE FARMER FOR HIS TIME AND PARTICIPATION.

If money was collected then proceed to **AO Training Section T**

If money was not collected then **END HERE**

SECTION T: TRAINING SCRIPT for AO

Step 1: Introduce AO

The number is 079 – 3014 – 2000. I will send this number via SMS to you right now. Please save the number under "Avaaj Otalo" in your phone and/or record it in your diary, if you use one.

NOTE TO TRAINER: PLEASE SMS THE NUMBER TO RESPONDENT RIGHT NOW. MAKE SURE THE RESPONDENT STORES THIS NUMBER UNDER "AVAAJ OTALO." THE RESPONDENT SHOULD ALSO WRITE DOWN THIS NUMBER IN HIS DIARY IF HE USES ONE.

I will tell you a little more about the service and we will call into the number so you can see how it works in just a couple minutes. But first, I want to make sure that you understand that you are receiving this service for Kharif 2013 and Rabi 2013-2014 for the phone number registered with us. Your cellphone number has thus been registered to receive the missed call service. All you have to do is give a **MISSED CALL** to this number and the system will call you back within **TEN** seconds. It is **VERY IMPORTANT** that you let us know if your number changes otherwise, you won't realize the benefits from this service. I am leaving this business card with the phone number you should contact if you change your primary phone number at any point in the next year. The number is 8469112709.

Step 2: LIVE DEMONSTRATION
5 minutes

KEY MESSAGES:

- 079 – 3014 – 2000
- Farmer understands how to use Prashan-Javaab.

NOTE TO TRAINER: PULL OUT YOUR CELLPHONE AND DIAL THE NUMBER, HANG UP AS IN A MISSED CALL, AND ONCE THE SYSTEM CALLS BACK, LISTEN TO THE WELCOME MESSAGE AND THE FIVE DIFFERENT OPTIONS. ALSO, YOU DO NOT NEED TO FOLLOW THIS SECTION STEP-BY-STEP, TAKE NOTE OF THE QUESTIONS AND CONCERNS THE FARMER HAS AND ADDRESS THOSE IN THE LIVE DEMONSTRATION.

Tell respondent the following:

Okay, so now we will dial the AO number, and give it a missed call. The system will call you back within TEN seconds.

DIAL AND LISTEN TO WELCOME PROMPT AND FIVE FEATURES.

So you just heard the welcome message and five options you can access on Avaaj Otalo. Let's try out the Prashan-Javaab service. So we press "1."

PRESS 1. HEAR THE OPTIONS AGAIN.

Now, we press "1" to record our own question and "2" to listen to questions and answers of other farmers for all crops. Additionally, you can also press "3" to only hear messages on COTTON, "4" for messages only WHEAT, "5" for messages only on CUMIN and "6" for messages only on CASTOR. First, let's listen to the questions of other farmers, so we press "2."

PRESS 2. LISTEN TO SOME MESSAGES.

So, you see that we have some choices also when we start listening to the message. We can press "1" to listen to the next message if we are not interested in the message currently playing, or you can press "2" to record a response; press "3" to get more information (these will include keys for pause, replay, rewind etc.) and to go back to the welcome message, you can press "0." These keys remain consistent throughout the service and you can use them at any point once you have already accessed the feature you want.

PRESS "1" TO SKIP TO ANOTHER MESSAGE OR PRESS "0" TO GO BACK TO WELCOME PROMPT.

Okay, so now, we can do a trial recording of a question on the service. So at the welcome prompt, we press "1" to go to Prashan-Javaab and then press "1" again to record a question.

PRESS "1" AND PRESS "1" AGAIN. ENCOURAGE THE FARMER TO SAY SOMETHING SHORT. FOR EXAMPLE, MY NAME IS _____.

Once we have recorded, if the recording is CLEAR and CORRECT, we can press "1" to record. Or press "2" to re-record or press "3" to remove the message in case you change your mind about the question. If you press "1," your question gets recorded and will go to DSC for listening and approval. For now, since this is a trial, we will press "3" to remove the message.

In this way, we can access ALL FIVE FEATURES of AO by simply following the prompts as they come. To go back to the "Welcome" message at any point during the call, press "0."

The FIFTH section is particularly useful also as it is your PERSONAL INBOX. For instance, if you recorded a question, the system tries to call you back with an answer three times, but if for some

reason you could not be reached, how would you access the response? What you have to do is after the welcome message, press 5 and the responses to your questions will be hosted there. This way you do not have to peruse the entire QnA forum to find answers to only your questions.

Would you like to practice anything else? Or try another section? *FOLLOW FARMER'S REQUEST.*

Step 3: Five Features of AO and Push messages
10 minutes

KEY MESSAGES:

- Five Features accessible anytime: (1) Prashan-Javaab, (2) Announcements, (3) Radio Program, (4) Experience-sharing, (5) Personal Inbox
- Voice SMS weekly on cotton, wheat and cumin
- Voice SMS will be advice conditional on region, weather and crop phase and will be developed by an agricultural expert in response to the information needs of farmers for the following week

Tell respondents the following:

"Now that we have shown you the basic service, let me tell you in some detail about the FIVE features of AO and then we can practice any of these features if you'd like.

So let's recap. When you call the 079-3014-2000 number, you should leave a missed call. **The phone will ring for 30 seconds giving you 30 seconds to hang up, after which the call will be terminated. If you allow the call to be terminated, the system will not call you back. Once you dial the number, cut the call after a few rings.** So, just be sure to hang up the phone after a few rings.

Once you leave a missed call, the AO system will call you back within **TEN** seconds. When you pick up this phone call, you will hear a "WELCOME" tune and message.

At this point, you have FIVE option to choose from:

NOTE TO TRAINER: USE THE BROCHURE AND THE PHOTO PACKAGE TO POINT TO THE FIVE FEATURES. ALSO MAKE SURE THAT THE FARMER IS ENGAGED AND UNDERSTANDING WHAT YOU ARE SAYING. ASK HIM AFTER EACH FEATURE WHETHER HE UNDERSTANDS WHAT YOU HAVE JUST SAID.

(1) The FIRST feature is PRASHAN-JAVAAB. You have to press "1" to access this feature after the welcome message. This section allows you to record any questions you have on your agriculture and also listen to questions by other farmers and record responses to these questions. You can either choose to listen to all messages farmers have asked in the past or you can listen to crop-specific advice on four crops, which are cotton, castor, wheat and cumin. In a few minutes, we will show you how this section works.

NOTE: ASK WHETHER FARMER UNDERSTOOD THIS. ALSO, TELL HIM THAT WE CAN PRACTICE LATER WHATEVER HE DOES NOT UNDERSTAND.

(2) The SECOND feature is ANNOUNCEMENTS. You can access this section by pressing "2" after the welcome message. This feature allows you to listen to most recent messages about agricultural conditions. These messages give you timely and scientific agricultural advice conditional on weather and crop phase. You can also record responses to these announcements. So use this section to get the most updated information on your agriculture.

NOTE: ASK WHETHER FARMER UNDERSTOOD THIS. ALSO, TELL HIM THAT WE CAN PRACTICE LATER WHATEVER HE DOES NOT UNDERSTAND.

(3) The THIRD feature is RADIO PROGRAM. You can access this section by pressing "3" after the welcome message. This feature allows you to access past radio broadcasts of Sajjata Sangh's popular agricultural radio broadcast show called "Sajjata no Sangh, lave kheti ma rang." These programs are about fifteen minutes long and give agricultural information in an entertaining, play-based format.

NOTE: ASK WHETHER FARMER UNDERSTOOD THIS. ALSO, TELL HIM THAT WE CAN PRACTICE LATER WHATEVER HE DOES NOT UNDERSTAND.

(4) The FOURTH feature is EXPERIENCE-SHARING. You can access this feature by pressing "4" after the welcome message. This section allows you to record your own farming experiences as well as listen to those of other farmers. You should use this section to share your innovative and beneficial practices so that your fellow farmers can learn from you.

NOTE: ASK WHETHER FARMER UNDERSTOOD THIS. ALSO, TELL HIM THAT WE CAN PRACTICE LATER WHATEVER HE DOES NOT UNDERSTAND.

(5) The FIFTH feature is a PERSONAL INBOX. You can access this feature by pressing "5" after the welcome message. This section allows you to listen to all the messages you have ever posted onto the line and the responses to those messages in one easy place.

NOTE: ASK WHETHER FARMER UNDERSTOOD THIS. ALSO, TELL HIM THAT WE CAN PRACTICE LATER WHATEVER HE DOES NOT UNDERSTAND.

Do you have any questions about any of the features?

So what I have just told you is about how YOU can call into the AO service whenever you want. There is another component to the service that I would like to tell you about today.

We will also be sending you WEEKLY VOICE-MESSAGES, which will be crop- and region-specific. The content of the voice message will vary depending on the crop phase. The push message will also give you information about weather. This weekly message will be delivered on WEDNESDAY. You will receive a call during the day from the AO number. Once you pick up the call, you will be able to hear the full recorded message, which will be anywhere from 2 to 5 minutes. You may be prompted to at the end of the call to answer a question. Please cooperate to answer these questions as they are very important for the success of our study.

Step 4: ENCOURAGEMENT
2 minutes

KEY MESSAGES:

- You will receive an answer to your question in a maximum of TWO days.
- Remember you have missed call service, just give 079-3014-2000 a missed call.

Tell respondent the following:

So we have now shown you the basics of this service. We really encourage you to use it for any agricultural questions you may have at any time. At maximum, you will hear back from us within TWO days. Remember there is no added charge to asking a question or getting any other advice on Avaaj Otalo for the one year of this study. If you have ask a question that may other farmers have asked, you will still get a response to the question but your question will not be posted up on the line for everyone else to hear.

And, remember no questions you ask are silly. Do not be shy or afraid to ask about something that you don't know. There may be many like you who have similar questions on pesticides, fertilizers, seeds, field or soil preparation, etc. Questions like: How much to use? What kind to

use? In what dosage? When to use? and many, many others. You also don't have to say your name or anything else that will reveal your identity if you do not want to. And, you are under no obligation to follow the advice that you are provided with on Avaaj Otalo. But at the same time, know that CMF – AKRSP team will take the utmost care in giving you the best answers for your questions. We have people on our team who have degrees in Agriculture from local universities and many years of field experience.

This advice is simply there for your use if you decide to use it. Just remember that the questions you ask and the advice you receive may be of benefit not only to you, but to other farmers in your village and also other farmers all across Gujarat.

So to recap:

You should use AO because it is:

- Timely, trust-worthy, and scientific agricultural advice
- Friendly, easy to understand language
- Gives you a chance to connect with fellow farmers all over Gujarat
- ALL this with just a missed call to **079-3014-2000**

We thank you for your time today and hope that the service benefits your family and your farmer friends.

M 4.2 Complete piloting and design for qualitative study

The purpose of this qualitative study is to evaluate the quality, promptness and effectiveness of information provided by our mobile-based agricultural helpline, *Avaaj Otalo (AO)*. We are interested in looking at factors that affect take-up and usage of AO, whether the information is able to cater to different needs of the customers, and also factors that help build trust in information and communication technologies (ICTs) like AO. In order to explore these questions, we plan on using a number of tools such as administrative data provided by the AO system which allows us to look at usage across the different features provided by AO and household survey data which collects feedback from respondents about the information provided via AO. Additionally, we will also conduct more intensive focus group discussions with a smaller subset of farmers to facilitate a deeper understanding of user feedback about AO.

These focus group discussions will be conducted with our study sample in Sayla and Chotila, following the completion of the willingness to pay study here. We plan on reaching about 80 respondents in total, conducting 8 focus group discussions (with 10 respondents in each). 4 groups of farmers were identified in each district – i) treatment group farmers who decided to purchase AO in the willingness to pay study, ii) treatment group farmers who chose not to purchase AO in the willingness to pay study, iii) control group farmers who chose to buy AO in the willingness to pay study and iv) peer group farmers (listed by study farmers as friends that they share agricultural information with during the initial listing) who chose to buy AO in the willingness to pay exercise. At the time of implementing these meetings, the treatment group will have been using AO for about 27 months, while the control and peer group will have had AO access only for about 3 months.

The focus group questionnaires were designed to get feedback from all groups of farmers on quality and promptness of AO information. Specifically, we try to answer the following questions: Does the quality of AO information vary for different agricultural inputs? Do farmers value AO more as a reminder of agricultural information they already know or as a source of new information? Are there any technological or institutional barriers in the adoption of AO? Would farmers like to see changes in the existing AO system? Do farmers trust AO information? *Please see attached for a copy of the focus group discussion questionnaires that will be administered to the respondents.*

By posing these questions to all four groups, we hope to gain both positive and negative feedback about both the AO system, and the information provided through it. These focus group discussions were piloted in our regional field office with the help of experienced field staff, who have been working on this study for over two years. Each focus group discussion is designed to be about 60 minutes long and will be moderated by our local field staff. Farmers will be provided Rs. 50 in mobile top-ups as compensation for participating in this study.

M 4.3 New treatments to identify mechanism of change (learning vs. persuasion) finalized and rolled out

The purpose of this exercise is to identify whether learning or persuasion is the primary mechanism through which AO changes outcomes. Learning vs. persuasion treatments were administered to our treatment sample (1453 respondents) in Madhya Pradesh as part of the weekly broadcast message. This study was conducted over four weeks in the Rabi season, with farmers receiving information primarily about wheat.

For this study, our local agricultural expert designed two sets of messages (learning and persuasion) for four different agricultural topics based on local weather and crop conditions. For the first two weeks, farmers received different combinations of the messages for the first two topics. For instance, some farmers received a combination of a learning message for the information on fertilizers and a persuasion message on micronutrients. Another group of farmers received a persuasion message for both fertilizers and micronutrients. These messages would be incorporated into both the weekly technical push call as well as the BCI push call, with the same learning/persuasion content sent out in four different push calls.

Farmers were randomized into 16 groups and then randomly assigned the message combination. They would receive some combination of the learning and persuasion messages for the first two topics in the first half of the month, and another combination of the other two topics in the second half of the month. The table below shows the different combinations of messages that were sent out to farmers by group.

Week	**Group**	**Learning or Persuasion**	**Message**	**Recording Length (Seconds)**
Week 1 & 2	1,4,5,11	0,0	It is advisable to spray urea @ 100 gram per pump in wheat during this period. It is also advisable to spray micronutrients fertilizer i.e. Micromix Grade-4 @ 100 gram per pump	20
Week 1 & 2	3,9,10,15	0,1	It is advisable to spray urea @ 100 gram per pump in wheat during this period. Also, it is advisable to spray micronutrients fertilizer i.e. Micromix Grade- 4 @ 100 gram per pump in wheat since it allows better growth and development during grand growth stage, higher production and improvement in quality of seeds by providing nutrients like zinc, boron, etc.	30
Week 1 & 2	2,7,8,14	1,0	During winter, wheat crop is unable to uptake the nutrients through its roots, often resulting in yellowing of crop or stunted growth. Thus, it is advisable to spray Urea fertilizer @ 100 gram per pump. Also, during this period it is advisable to spray Micronutrients fertilizer i.e. Micromix Grade-4 @ 100 gram per pump	30
Week 1 & 2	6,12,13,16	1,1	During winter, wheat crop is unable to uptake the nutrients through its roots, often resulting in yellowing of crop or stunted growth. Thus, it is advisable to spray Urea fertilizer @ 100 gram per pump. . Also, it is advisable to spray micronutrients fertilizer i.e. Micromix Grade- 4 @ 100 gram per pump in wheat since it allows better growth and development during grand growth stage, higher production and improvement in quality of seeds by providing	40

			nutrients like zinc, boron, etc.	
Week 3 & 4	1,2,3,6	0,0	It is advisable to stop wheat irrigation after the last at dough stage i.e 100-105 DAS. Also, during grain feeling stage it is advisable to spray fungicides like Mancozeb (Dithan-45) @ 45 gram per pump or Carbendazim @ 30 gram per pump	25
Week 3 & 4	5,8,10,13	0,1	It is advisable to stop wheat irrigation after the last at dough stage i.e 100-105 DAS. Also, during grain feeling stage, to prevent seed-borne diseases like spots on seeds which destroys seed quality, it is advisable to spray fungicide like Mancozeb (Dithan-45) @ 45 gram per pump or Carbendazim (Bavistin) @ 30 gram per pump	35
Week 3 & 4	4,7,9,12	1,0	It is advisable to stop wheat irrigation after the last at dough stage i.e 100-105 DAS because if you apply irrigation after that period, it may lead to more water content, increasing the chances of seed-borne disease developments and destroy the quality of seeds. Also, during grain feeling stage it is advisable to spray fungicides like Mancozeb (Dithan-45) @ 45 gram per pump or Carbendazim @ 30 gram per pump	35
Week 3 & 4	11,14,15,16	1,1	It is advisable to stop wheat irrigation after the last at dough stage i.e 100-105 DAS because if you apply irrigation after that period, it may lead to more water content, increasing the chances of seed-borne disease developments and destroy the quality of seeds. Also, during grain feeling stage, to prevent seed-borne diseases like spots on seeds which destroys seed quality, it is advisable to spray fungicide like Mancozeb (Dithan-45) @ 45 gram per pump or Carbendazim (Bavistin) @ 30 gram per pump	45

Note: In the learning or persuasion column, 1 refers to a "learning" message which explains the scientific reasoning behind adopting certain agricultural advice and 0 refers to the "persuasion" message, as highlighted in the message column.

M 4.4 Weekly Broadcast Status

For the months of January and February, push calls focused primarily on rabi crops (wheat and gram). For the BCI push call, we sent out information primarily on labor rights. The weekly technical rabi push call also included learning vs. persuasion content (about 1 minute long) that was incorporated into the weekly push calls that changed based on local crop and weather conditions. These push calls are designed under the supervision of our local agronomist, who has extensive experience in the study region.

As of February 2014, we have sent out a total of 49 push calls (since the start of the service in September 2013). In the months of January and February alone, we have sent out a total of 15 push calls (8 technical push calls and 7 BCI push calls). The table below shows a breakdown of the push calls by date, topic and duration.

Date of Broadcast	**Topic**	**Duration (in seconds)**
03-Jan-14	BCI	100
08-Jan-14	Wheat and Gram	250
10-Jan-14	BCI	108
15-Jan-14	Wheat and Gram	260
17-Jan-14	BCI	120
22-Jan-14	Wheat and Gram	260
24-Jan-14	BCI	142
29-Jan-14	Wheat and Gram	294
31-Jan-14	BCI	154
05-Feb-14	Wheat and Chilli	315
07-Feb-14	BCI	144
12-Feb-14	Wheat and Chilli	293
14-Feb-14	BCI	102
19-Feb-14	Wheat and Gram	267
26-Feb-14	Wheat and Gram	298

Usage/Familiarity with AO

Which AO feature do you use the most?
How often do you use missed call service?
Which feature of AO is least useful for you?
Who provides AO information?
What was your main source of agricultural info before AO?
Which other sources of info do you use right now?
How is AO different from other sources of info?

Customer service

Why did you buy AO

With console:

Overall experience with AO
What do you have to say about the quality of AO information?
Do you think AO provides prompt advice?
Have you had any bad experiences while using the phone line
What is one advantage of AO compared to traditional extension
What is one disadvantage of AO compared to traditional extension

With content:

Can you describe problems in the field that have been solved by AO
Has AO helped reduce cost of farming/increase production
Have you had any bad experiences using AO advice in field?
Have you experienced problems with timing of AO information? If yes, how?
Do you value AO more for the new information you learn or because it reminds you of information regularly?
Have you benefitted by following AO advice? If yes, how?

Variations based on input type

Which topic do you think AO provides the best information for?
Are there particular topics for which you need regularly updated information? Does AO provide this information?
Has AO advice for any inputs improved production? If yes, for which input?
Have you ever faced input unavailability for any input recommendations? If yes, for which topic?
What source do you rely on for info on seeds/fertilizer/pesticides? (all separate)

Trust in AO

Which current source of info do you trust the most?
When you adopt AO advice, do you test it on a smaller scale first?
Do you trust AO advice? If no, why not?

What motivated you to start using AO (prior familiarity with AKRSP, one-on-one AO training, etc.)
What led you to trust the advice provided by AO (results seen by others, customized information, regular communication etc)
Have you ever discussed AO advice with input dealers? If yes, what kind of discussions have you had?

Potential Changes/Improvements to AO
Any additional features that you might benefit from?
What do you not like about AO?
Would you recommend any improvements to the existing system?

Final Comments/Observations

Usage/Familiarity with AO

Have you used AO since the start of the project? If no, why not? (and then skip rest of the usage qs)
How often do you use missed call service?
Which feature of AO is least useful for you?
Who provides AO information?
What was your main source of agricultural info before AO?
Which other sources of info do you use right now?
How is AO different from other sources of info?

Customer service

Why did you not buy AO?
Would you have purchased AO if you could buy at some other time of the year (not during peak cotton
Do you regret not purchasing AO?
What would have motivated you to purchase AO?

With console:

Overall experience with AO
What do you have to say about the quality of AO information?
Do you think AO provides prompt advice?
Have you had any bad experiences while using the phone line
What is one advantage of AO compared to traditional extension
What is one disadvantage of AO compared to traditional extension

With content:

Can you describe problems in the field that have been solved by AO
Has AO helped reduce cost of farming/increase production
Have you had any bad experiences using AO advice in field?
Have you experienced problems with timing of AO information? If yes, how?
Do you value AO more for the new information you learn or because it reminds you of information
Have you benefitted by following AO advice? If yes, how?

Variations based on input type

Which topic do you think AO provides the best information for?
Are there particular topics for which you need regularly updated information? Does AO provide this information?
Has AO advice for any inputs improved production? If yes, for which input?
Have you ever faced input unavailability for any input recommendations? If yes, for which topic?
What source do you rely on for info on seeds/fertilizer/pesticides? (all separate)

Trust in AO

Which current source of info do you trust the most?
When you adopt AO advice, do you test it on a smaller scale first?
Do you trust AO advice? If no, why not?

What motivated you to start using AO (prior familiarity with AKRSP, one-on-one AO training, etc.)
What led you to trust the advice provided by AO (results seen by others, customized information, regular communication etc)
Have you ever discussed AO advice with input dealers? If yes, what kind of discussions have you had?

Potential Changes/Improvements to AO
Any additional features that you might benefit from?
What do you not like about AO?
Would you recommend any improvements/changes to the existing system?

Final Comments/Observations

ı season)

Usage/Familiarity with AO

Did you know about AO prior to purchase?
If yes, whom did you hear about AO from? What did you know about AO?
Have you noticed your friends benefit from AO? If yes, how?
How often do you use AO since purchase?
Which feature of AO is least useful for you?
Who provides AO information?
What was your main source of agricultural info before AO?
Which other sources of info do you use right now?
How is AO different from other sources of info?

Customer service

Why did you buy AO?
How did you expect to benefit from AO?

With console:

Overall experience with AO
What do you have to say about the quality of AO information?
Do you think AO provides prompt advice?
Have you had any bad experiences while using the phone line
What is one advantage of AO compared to traditional extension
What is one disadvantage of AO compared to traditional extension

With content:

What information did you expect AO to provide?
Can you describe problems in the field that have been solved by AO
Has AO helped reduce cost of farming/increase production
Have you had any bad experiences using AO advice in field?
Have you experienced problems with timing of AO information? If yes, how?
Do you value AO more for the new information you learn or because it reminds you of information
Have you benefitted by following AO advice? If yes, how?

Variations based on input type

Which topic do you think AO provides the best information for?
Are there particular topics for which you need regularly updated information? Does AO provide this information?
Has AO advice for any inputs improved production? If yes, for which input?
Have you ever faced input unavailability for any input recommendations? If yes, for which topic?
What source do you rely on for info on seeds/fertilizer/pesticides? (all separate)

Trust in AO

Which current source of info do you trust the most?
When you adopt AO advice, do you test it on a smaller scale first?

Do you trust AO advice? If no, why not? (skip next two questions if no)
What motivated you to start using AO (prior familiarity with AKRSP, one-on-one AO training, seen other farmers benefit etc.)
What led you to trust the advice provided by AO (results seen by others, customized information, regular communication etc)
Have you ever discussed AO advice with input dealers? If yes, what kind of discussions have you had?

Potential Changes/Improvements to AO
Any additional features that you might benefit from?
What do you not like about AO?
Would you recommend any improvements/changes to the existing system?

Final Comments/Observations

Usage/Familiarity with AO

Did you know about AO prior to purchase?
If yes, whom did you hear about AO from? What did you know about AO?
Have you noticed your friends benefit from AO? If yes, how?
How often do you use AO since purchase?
Which feature of AO is least useful for you?
Who provides AO information?
What was your main source of agricultural info before AO?
Which other sources of info do you use right now?
How is AO different from other sources of info?

Peer Usage:

Had you ever used AO on your friend's mobile prior to pruchase? If yes, what did you use it for?
Did your friends ever pass on AO advice to you? If yes, on what topic?
Did you ever benefit from AO advice prior to buying AO? If yes, how?

Customer service

Why did you buy AO?
How did you expect to benefit from AO?
Has it happened that your friend bought AO but you did not? Why do you think this happened?

With console:

Overall experience with AO
What do you have to say about the quality of AO information?
Do you think AO provides prompt advice?
Have you had any bad experiences while using the phone line
What is one advantage of AO compared to traditional extension
What is one disadvantage of AO compared to traditional extension

With content:

What information did you expect AO to provide?
Can you describe problems in the field that have been solved by AO
Has AO helped reduce cost of farming/increase production
Have you had any bad experiences using AO advice in field?
Have you experienced problems with timing of AO information? If yes, how?
Do you value AO more for the new information you learn or because it reminds you of information
Have you benefitted by following AO advice? If yes, how?

Peer Usage:

Has your friend benefitted from AO? How?
Has AO helped improve your friend's agricultural knowledge?
Do you have more agricultural discussions with your friend after buying AO?

Variations based on input type

Which topic do you think AO provides the best information for?

Are there particular topics for which you need regularly updated information? Does AO provide this information?
Has AO advice for any inputs improved production? If yes, for which input?
Have you ever faced input unavailability for any input recommendations? If yes, for which topic?
What source do you rely on for info on seeds/fertilizer/pesticides? (all separate)

Trust in AO

Which current source of info do you trust the most?
When you adopt AO advice, do you test it on a smaller scale first?
Do you trust AO advice? If no, why not? (skip next two questions if no)
What motivated you to start using AO (prior familiarity with AKRSP, one-on-one AO training, seen other farmers benefit etc.)
What led you to trust the advice provided by AO (results seen by others, customized information, regular communication etc)
Have you ever discussed AO advice with input dealers? If yes, what kind of discussions have you had?

Potential Changes/Improvements to AO

Any additional features that you might benefit from?
What do you not like about AO?
Would you recommend any improvements/changes to the existing system?

Final Comments/Observations

Mobile- based agricultural extension – Usage, trust and willingness to pay:

A case study of Avaaj Otalo (AO) in Surendranagar, Gujarat

March 2014

Table of Contents

I. Introduction

Given that half of the Indian population is actively involved in agriculture, there is a strong demand for timely and effective agricultural information.[1] The Government of India has relied primarily on traditional agricultural-extension i.e. in-person extension conducted by agents, to meet this need. However, the reach of these extension services is limited- less than six percent of the agricultural population report having received these services (Glendenning, Baby and Asenso-Okyere (2010)). The adoption of low-cost information and communication technologies (ICTs) to provide agricultural extension provides an attractive alternative, particularly because it addresses many drawbacks of traditional extension – lack of timely information, covering extreme geographical distances and lack of accountability.

This case study provides a qualitative analysis of our two-year experience evaluating a mobile phone-based agricultural extension service with cotton farmers in the district of Surendranagar in Gujarat, India. As mobile phone markets in India rapidly expand, especially into rural India the use of mobile phone-based agricultural extension provides a timely, regular and low-cost alternative to traditional extension. One such example is Avaaj Otalo (AO), a mobile phone-based hotline that provides weekly agricultural advice to farmers, answers their questions and allows them to share their agricultural experiences with one another. Through a randomized evaluation of AO, we hope to demonstrate that mobile-based agricultural extension can serve as a valuable means of providing farmers the agricultural information they lack, improving their agricultural knowledge and reduce their dependence on input dealers by providing expert and unbiased advice that is easily accessible.

Through this case study, we analyze the experience of AO users to gauge their views on the quality of service provided by AO, factors that influence their willingness to pay for this service, and other feedback that would help improve the quality of information that they get through AO. The information and findings in this report are based on a variety of data: i) , Administrative data logged to the AO server which tracks real usage of the study participants including the

[1] This figure is calculated using estimates from the 2012-2013 Indian Ministry of Labor report.

frequency and duration of content accessed ii) Self-reported data collected through three household paper surveys, and shorter phone surveys which gives us information on user feedback about AO and iii) Focus group discussions were conducted with different groups of study participants to gauge quality of the service provided. Each focus group discussion involved a group of 5-8 farmers, and lasted for approximately 60 minutes. We conducted a total of 8 focus group discussion over the course of four days. These discussions took place in the local language, Gujarati, and were moderated by our local agronomist who has many years of experience working in the study region of Surendranagar, Gujarat. Respondents were given Rs. 50 in mobile top-ups as compensation for participating in this exercise.

II. Overview of Avaaj Otalo

A. Overview of extension provided by AO

The study "The Value of Advice: Evidence from Mobile Phone-Based Agricultural Extension" evaluates Avaaj Otalo, an intervention that provides farmers with weekly agricultural advice based on local weather and crop conditions through an automated voice message. This service also includes access to a hotline that allows farmers to ask questions, listen and respond to other farmers' questions and share their own experiences. This innovative information technology service was originally developed by Neil Patel as part of a Berkeley-Stanford research project on the interaction between humans and machines in coordination with Tapan Parikh who was closely involved with the Development Support Center (DSC) in rural Gujarat.

In order to implement this study, we partnered with DSC, who have contributed extensively to the roll-out of this study by sharing their technical expertise and knowledge of the field. On the recommendation of DSC, we reached out to another local NGO, Aga Khan Rural Support Program, India (AKRSPI) to act as our field partner and enable interaction with local farmers. Under the guidance of DSC and AKRSPI, we piloted the intervention in May 2011 with a sample of 60 farmers. To implement the actual study, we identified a total sample of 1200 farmer households in two districts of Surendranagar, Sayla and Chotila where AKRSPI has a strong field

presence. 800 random households would serve as the treatment group and receive toll-free access to the AO line. 400 of these farmer households also received traditional physical extension, while the other 400 did not. The control group was made up of another 400 farmers. Initial one-on-one AO training was provided to the treatment farmers to explain the different features and benefits of AO. Following this, training was repeated again at the time of the household paper surveys conducted every year. Field staff personally visited the respondents to ensure they had an active AO line and explained to them the different features they could access using AO.

All farmers in the treatment group (800 in total) receive a push call from the AO line once a week. This included information on crop planning, weather, irrigation, input decisions, harvesting etc. primarily for cotton in Kharif season and for wheat and cumin in the Rabi season. The intervention was rolled out in August 2011, and participants received push calls for two years, ending in August 2013. Over this period, we have broadcasted a total of 95 push calls. Table 1 shows the breakdown of push call content by major crops and agricultural topics for the duration of the study.[2]

[2] A total of 95 push calls were sent from August 2011-2013, with an average duration of 5 minutes each. All push calls contains information on multiple themes.

Table 1. Categorization of Push Calls by Crop and Topic

Crop	% of Push Calls	Topic	% of Push Calls
Cotton	62.10	Pests/Pesticides	76.84
Cumin	37.80	Crop Planning	45.26
Guvar	8.40	Other	3.16
Brinjal	5.26	Fertilizer	31.58
Castor	6.31	Weather	27.37
Chilli	2.10	Irrigation	13.68
Wheat	28.42	N	95
Groundnut	4.21		
Millet	0.00		
Sorghum	3.51		
Gram	4.21		
Juwar	4.21		
N	95		

In addition to the weekly push calls, treatment farmers were also given access to a toll-free hotline that connects them to the AO platform. Through this hotline, they can record questions that are answered by our local agricultural expert, listen to questions recorded by other farmers, share their experiences with other farmers and listen to older push calls.

B. Overall AO Usage

Given that treatment farmers used AO for a period of two years, we were interested in computing some basic usage statistics based on the frequency and duration of calling in to the AO line. Table 2 reports the take-up and usage of AO throughout the duration of the study. Almost all of the usage is by farmers who were given access to AO (treatment respondents), with only fourteen farmers who did not have AO access (control respondents) calling in to the AO line in two years.[3] As of August 2013, two years after commencement of the service, 67.5 % of the treatment group had called in to the AO line, making an average of 11.32 calls. The mean

[3] Usage statistics were collected on the AO server. Column 3 report an Intention to Treat (ITT) estimate of the difference in means (and robust standard errors) between the treatment groups i.e. AO+AOE group and the control group. Here, AO refers to those treatment farmers who were randomly selected to receive AO access only. AOE farmers were randomly selected to receive access to AO along with two rounds of physical extension. *** Significant at 1% level; ** significant at 5 % level; * significant at 10% level.

usage for treatment respondents is around 120 minutes. Average number of questions asked by the treatment group is 1.51, with 16.3% of the treatment group responding to a question. On an average, treatment farmers have listed to 43% of push call content (Column 3). We can see that over the course of the study, there has been substantial usage among treatment farmers. Despite this, there are still a number of farmers who have access to AO but are not using it, indicating potential barriers to access, maybe lack of awareness, resistance to adopting new technologies – issues we explore in Section V.

Table 2. Take-up and Usage of AO

	Control	Treatment	Treatment-Control	
	Mean	Mean	ITT	
Called in to the AO line	0.01	0.69	0.68	***
	(0.11)	(0.46)	(0.02)	
Total duration of calling in time	0.04	120.66	120.79	***
	(0.45)	(360.16)	(12.99)	
Number of calls made	0.01	11.32	11.33	***
	(0.11)	(35.22)	(1.27)	
Avg. call time	0.04	5.94	5.89	***
	(0.45)	(8.54)	(0.31)	
% of total push call listened	0	0.43	0.43	***
	0	(0.19)	(0.01)	
Listened to greater than 10% of total push call time	0	0.95	0.95	***
	0	(0.22)	(0.01)	
Number of questions asked	0.01	1.51	1.51	***
	(0.05)	(4.03)	(0.15)	
Number of responses to questions	0	0.17	0.17	***
	0	(0.73)	(0.03)	
Number of responses to announcements	0	0.41	0.41	***
	0	(1.45)	(0.05)	

Table 3 shows the breakdown of questions that have been asked by treatment respondents using AO. These questions are categorized by crop type and agricultural topic. Until August 2013, we had a total of 2097 questions that local agricultural experts had responded to. Among crops, the most commonly asked questions relate to cotton (46%). Across crops, the majority of questions relate to pest management (54%).

Table 3. Categorization of questions by crop and topic

Crop	Percent	Topic	Percent
Cotton	46.18	Pests/Pesticides	54.16
Cumin	7.26	Crop Planning	17.46
Guvar	5.68	Other	15.39
Brinjal	3.08	Fertilizer	7.41
Castor	2.79	Weather	4.23
Chilli	2.16	Irrigation	1.01
Wheat	2.07	Marketing	0.29
Groundnut	1.35	Government	0.05
Millet	1.35	N	2079
Sorghum	1.15		
Gram	0.96		
Juwar	0.58		
n/a	15.92		
Other	6.2		
N	2079		

C. Interim Findings

Given the substantial usage of AO among treatment farmers, we would expect to see improvements in agricultural outcomes and behaviors for the treatment group. This information is tracked using household data collected through paper surveys in the field and phone surveys. Interim findings from the first round of paper surveys in June and July 2011, and a phone survey consisting of 798 respondents completed in November 2011 are documented in a working paper titled *The Value of Advice: Evidence from Mobile Phone-Based Agricultural Extension* (Cole and Fernando (2012)) . The phone survey includes the entire control group

along with a randomly selected group of treatment farmers comprising of half of the group that receives only AO advice, and half of the group that receives AO advice along with extension.

From the usage statistics above, we can see that there is high demand for agricultural advice. Findings after the first seven months of AO usage show that as treatment farmers adopt AO, they tend to turn less towards other farmers and input dealers for agricultural information, indicating greater trust and reliance on mobile-phone based agricultural information. We also observe a change in pesticide management practices. Within seven months, there has been an increase in the adoption of more effective pesticides (such as imida and acetamapride) and reduced expenditure on harmful pesticides (for instance, monocrotophos). These changes in behavior continue to be monitored using the household surveys to determine if these results remain robust, even two years after the study.

The paper also states that treatment farmers tend to sow greater quantities of cumin, with more treatment farmers growing cumin as compared to the control group. This is particularly significant since cumin is an extremely lucrative crop, and farmers need to have specialized knowledge in order to cultivate it. More importantly, we have provided substantial information on cumin cultivation as reflected in Table 1 and 3. We see some relationship between AO use and education levels, with more educated farmers making more calls in to the AO line and more likely to ask a question. However, more educated individuals are no more likely to call in to the AO line than their less educated counterparts. However, differences in education level do not significantly impact other outcomes like pesticide use, sowing decisions, etc.

Finally, we explore if advice from AO contributes to an increase in the knowledge of the farmers as observed by farmers' ability to answer basic agricultural questions. However, we do not observe major differences between the treatment and control group in terms of agricultural knowledge. This seems to imply that farmers tend to apply the information they receive through AO without actually understanding or retaining it. Through further qualitative and quantitative analysis, we hope to identify the different mechanisms through which AO impacts agricultural behavior.

We have followed up this initial work, with two additional household paper surveys in the summer of 2012 and 2013. Through the comprehensive information gathered through these surveys, we are interested in exploring if the results mentioned above still hold true to gauge how the use of AO impacts outcomes, behavior, learning and trust in information and communication technologies (ICTs) like AO.

D. Willingness to Pay Study

At the end of the most recent household paper survey in July and August 2013, we conducted a short willingness to pay (WTP) study to determine how much people would pay to subscribe to a mobile-based agricultural extension service like AO. These WTP exercises were conducted with three different groups of farmers – farmers who has access to AO (treatment group), farmers who did not have free access to AO (control group) and friends of study respondents (peers). We planned on reaching roughly 2000 farmers to participate in this exercise, 1200 from our current sample and 800 additional peers.

Respondents participated in two types of WTP exercises. 75 percent participated in a bidding game where they were offered the opportunity to buy AO at different price points such as Rs. 40, 90, 140, 190 and 240. Following this, they received an offer price from a randomly assigned scratch card. If the bid was less than the offer price, farmers had the opportunity to buy AO at this discounted price. The remaining 25 percent played a simpler version of this game, where they had to decide if they would buy AO at a pre-determined random price point. The exercise was designed to last about 15 minutes, and participants were given training in how to use AO if they chose to buy in to the service.

From the three groups we had about 460 respondents who chose to buy AO. 195 of these were treatment farmers, 82 were control and 183 were peer farmers. AO service for these farmers was started in August 2013. This service is now managed entirely by our partner organization, DSC. Subscribers have purchased this service for a period of one year.

Given the above exercise, we are interested in exploring factors that might have affected the willingness to pay for a service like AO. For instance, what are some barriers that farmers face in being able to access and start using a service like AO? Furthermore, are there additional limitations that prevent the adoption of mobile phone-based agricultural advice? Do these barriers vary by input type or agricultural season? Do farmers trust AO information? Why are farmers motivated to purchase AO? These are some questions we will attempt to answer in the following sections.

III. User feedback on AO

A. Quality of AO customer service

Are customers satisfied with the quality of customer service they receive from AO? Household survey data and results from the focus group discussions show that user feedback about AO varies by crop type, input type, topic of advice etc. focus group discussions were conducted with four different groups of farmers who participated in the willingness to pay (WTP) exercise discussed above – treatment farmers who purchased AO, treatment farmers who had been using AO but did not buy into the service after WTP, farmers who were not randomly assigned to receive free access to AO (control respondents) who bought in to the service, and finally, friends of study respondents (peers) who chose to buy AO. These focus group discussions, including about 50 farmers in the districts of Sayla and Chotila, were designed to analyze user views on quality of AO – both in terms of ease of using the system as well as content provided through AO. Farmers, including those who did not purchase AO during the WTP exercise, mostly said that they had an overall positive experience with AO. No one reported any negative experiences in the field with AO advice or with purchase decisions made on the basis of AO recommendations.

Of all the features available through the AO system, farmers seem to find the weekly push calls the most useful given that it provides regularly updated information. All farmers who participated in the focus group discussions reported listening to weekly push calls, but fewer said that they used the missed call service. About 50 percent of the farmers also reported using the *Question and Answers* feature if they had specific questions. Many farmers cited the promptness of AO customer service as a motivation for relying on AO for advice. While the customary timeframe for a response is two days, almost all farmers reported getting a response to their question within the same day itself.

In terms of content, farmers claimed that they received useful advice from AO, which is relevant to them. This was also observed in the household survey data, where 87% of the 748 farmers who have access to AO, report receiving some kind of AO information that was of interest to them Among all the topics that AO provides information on, pesticides, seeds and fertilizer usage seem to be the most popular as seen below in Table 4.[4] The popularity of pesticide information among AO users was also observed during the focus group discussions. Farmers claimed that AO information on pesticides reduced their dependence on agro-dealers, and also allowed them to crosscheck the recommendations being made by these input dealers.

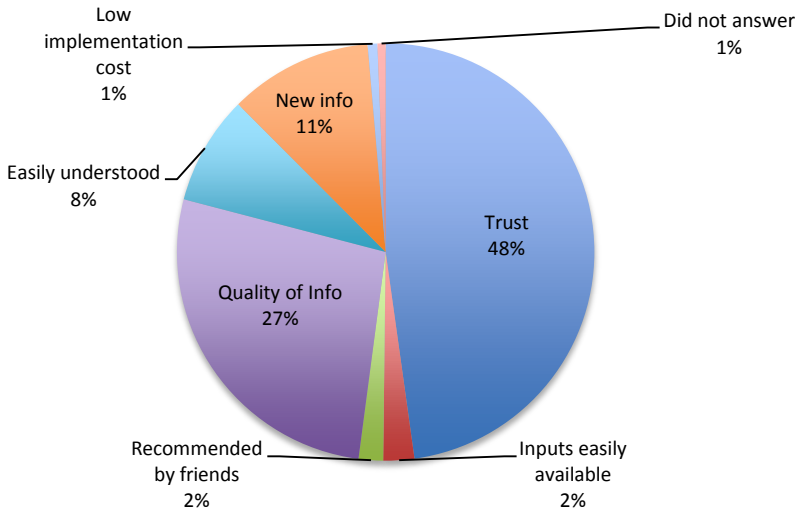
Table 4: AO topics of most interest to user

Topic	% of users
Pesticide Usage	0.61
Seeds	0.42
Fertilizer Usage	0.38
Field preparation/Sowing	0.07
Irrigation Usage	0.05
Weather Information	0.05
Pest and Diseases Identification	0.01
N	748

[4] During the household survey, each respondent could cite two topics of interest to them that AO provides information on, giving us a total of 1189 topics for the 748 respondents surveyed.

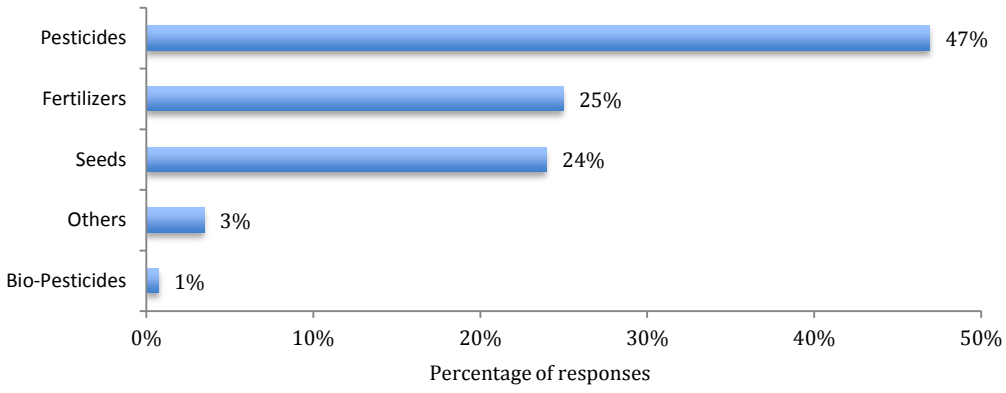
Given that farmers report receiving interesting and relevant information, we are interested in exploring how many users actually use the advice they get from AO, and if there are any benefits from this advice. Based on household data, 67% said that they followed AO advice for one or more topics of advice. As seen in Figure 1, among those who have followed AO advice , 48 percent said that the most important reason they followed AO advice was because they trusted the information we provided. 27 percent said that AO provided better information than other sources. During focus group discussions, respondents expanded upon this by highlighting that they have always had good experiences with AO. For instance, Bharatbhai (name changed to protect PII), a respondent who has been using AO for two years said that using AO over the years has saved him both time and money. He elaborated on an incident where is his crop was affected with a pest (Aphid), which had spread over a large part of his crop. On the recommendation of AO advice, he used the pesticide acetamapride, which showed excellent results. In this case, the input dealer had recommended monocrotophos which is not as effective and more expensive. Other reasons are that AO information can be accessed at any time and from any place, and allows them to be self-reliant. About 11 percent said that they implemented AO advice because they received information that they did not know before and wanted to try out something new.

Figure 1. For all AO topics: Most important reason for following AO advice



Similarly, among those who report following AO advice for one or more topic, 87 percent purchased inputs or other items based on this advice. Figure 2 demonstrates that the most common purchase items were pesticides, followed by fertilizers and then seeds. Interestingly, reasons for following AO advice or purchasing a particular item varies by input type i.e. seeds, pesticides and fertilizers- a question that is further explored in the coming sections.

Figure 2. For all AO topics: Inputs purchased using AO advice



B. ICT-based Extension vs. In-person 'Traditional' Agricultural Extension

One of the most important advantages of AO according to farmers is the ease with which information can be accessed. Farmers valued the fact that information on AO could be accessed at any time and from any place. Given the lack of regular follow-up from traditional extension methods, AO is attractive to respondents because they get updated demand-driven information, as and when required. For instance, many farmers mentioned that they could ask a question whenever they felt like it, and the response time was quick. This was highly beneficial to them since they did not have to travel to the local agricultural university or wait for a government extension worker to visit his village.

Despite the high demand for agricultural information provided by AO, we can see, based on usage statistics, that there is still further scope to reach out to more farmers. Clearly, there are limitations that need to be addressed to facilitate the successful spread of new technologies

like AO that aim to make the dissemination of agricultural advice and easier and more effective process. As we attempt to study these issues, one of the key questions to consider are the relative advantages or disadvantages of ICT-based extension as compared to in-person 'traditional' agricultural extension. For instance, are there some types of information that simply cannot be communicated over the phone?

As seen in Appendix A, focus group discussions conducted with the different groups were designed to analyze the pros and cons of ICT-based extension. Particularly, we tried to gauge if there are certain types of information that can be communicated only via physical demonstrations. Although the AOE group did receive two rounds of physical extension, this involved indoor training by our agricultural experts. We did not conduct regular field demonstrations since this would involve the use of significant resources. In comparison, private companies have the resources to conduct in-field demonstrations in order to promote their agricultural inputs.

These focus group discussions reveal that while ICT-based advice has the potential to permeate through developing economics and transform the way information is being delivered (particularly in the case of the agricultural sector), there are still some barriers to overcome. Perhaps the most obvious would be technological constraints, especially the lack of comfort and trust in adapting to new technologies (like the missed call service facility available via AO). Another potential drawback might be the lack of physical evidence to support the advice being disseminated via mobile phone, primarily in the case of advice on seeds. In the case of pesticides, farmers have the option of testing a new product out on a smaller piece of land to observe the results. As a result of this, farmers seem more open to trying out new pesticides and fertilizers, allowing services like AO greater room to impact these decisions. We can see that the adoption and implementation of AO advice shows variation based on the amount of risk involved, and more specifically, the type of input. The barriers to adoption of ICTs like AO are discussed in further detail in Section V of this paper.

C. Variation in adoption of AO advice by input type

AO provides advice to farmers on a number of topics including seeds, pesticides, weather, irrigation and fertilizers. As seen in Table 4, respondents were most interested in AO for information provided on pesticides, seeds and fertilizers. For the purpose of this report, we will explore how AO take-up and usage varies based on the respondents' interest in these aforementioned inputs. For instance, are farmers more likely to change their behavior for one input rather than others? Are there input-specific limitations that prevent adoption of AO advice? Does the quality of AO information vary by input type? We rely on findings from household survey data and focus group discussions to answer these questions.

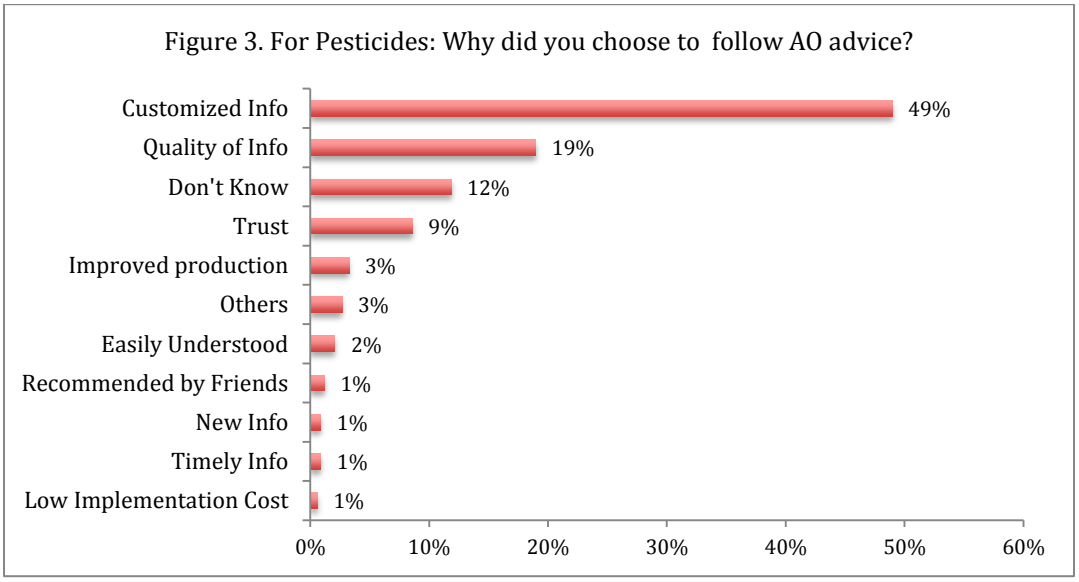
Focus group discussions revealed that farmers have different needs when it comes to advice for different input types. For instance, farmers expressed that they were more open to changing agricultural behavior when making decisions about pesticide usage as compared to seeds or fertilizer usage. Respondents also seemed to be more open to external help on pesticide usage, while relying primarily on past experience for fertilizer and seed purchase decisions. The following sections explore the differences in AO usage and take-up based on input type for pesticides, fertilizers and seeds.

For pesticide usage:

Based on the household survey data for the respondents mentioned above, 61% of the 748 farmers listed pesticide usage as a topic of interest. About 73 percent of those that had listed 'pesticide usage' as a topic of interest stated that they had also followed AO advice on this topic. Given this strong interest, we were interested in exploring why people follow AO advice for pesticides. We attempted to answer this question in the household surveys in two ways – first, respondents were also asked to explain verbatim why they chose to follow AO advice, and second, respondents were asked to choose the most important reason for following AO advice from a number of pre-decided options. This survey design was to ensure that we do not lose out on valuable data by missing out on either question. Figure 3 and 4 compare the responses

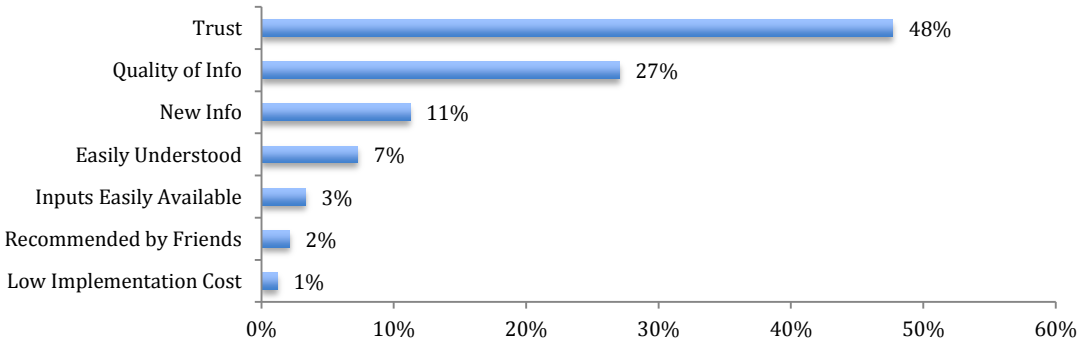
to these two questions to analyze factors that influence adoption and implementation of AO advice, particularly for pesticides.

Figure 3. For Pesticides: Why did you choose to follow AO advice?



We can see that demand driven information (i.e. customized information) is one of the most important factors for respondents' reliance on AO information for pesticides. Respondents further elaborated upon this during the focus group discussions citing the need for timely and regularly updated information for pesticides, more so than for seeds or fertilizers. We assume that this is because the information for pesticides is not something farmers can foresee i.e. these decisions cannot be made in advance unlike decisions regarding fertilizers or seeds. The type of information they require for pests and pesticide management is constantly changing based on local crop and weather conditions- a need that AO is able to meet.

Figure 4. For pesticides: Most important reason for following AO advice

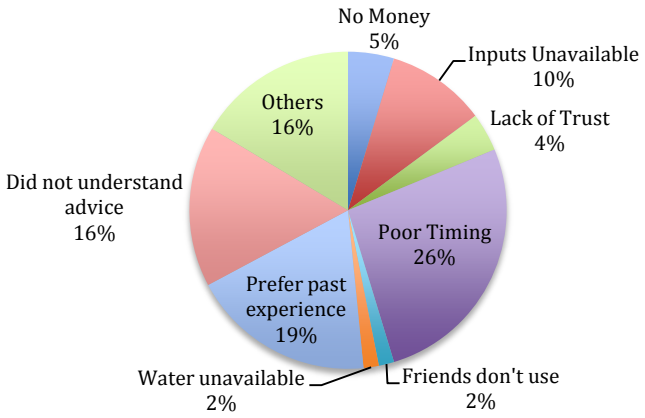


Another point of interest is the emphasis that respondents place on the quality of information provided by AO. 27 percent state that the most important reason they had for following AO advice is that it provides better information than other sources (Figure 4). Similarly, 18 percent said that they followed AO advice because they like the quality of information, when asked to state their reasons verbatim.

48 percent listed trust in AO as the most important reason for following AO advice on pesticide usage (Figure 4). This is particularly relevant, since many claimed that use of AO advice on pesticides had reduced their reliance on agro-dealers, lowering their agricultural cost. Rather than buying 3-4 different pesticides that an agro-dealer recommends, farmers are able to cut costs by requesting only the pesticide they require, a factor that must have contributed to an increase in trust in AO advice for pesticide management.

Of the 61% of treatment respondents that listed pesticide usage as a topic of interest in the household survey, about 65 percent bought pesticides on AO recommendation. However, some (roughly 10 percent as seen in Figure 5) expressed that they faced input unavailability for some pesticide recommendations in local village markets or found these inputs too expensive to buy. 26 percent cited inappropriate timing – focus group discussions revealed that many times farmers' fields were not afflicted with a particular pest or disease at the time of push calls, making the information inapplicable to them. Less than 1 percent (5 farmers) said they do not trust AO information on pesticides. From this data, it is apparent that farmers are more receptive to AO advice on pesticides, allowing AO greater scope to influence decision-making for this subject. This was further reiterated with many farmers saying that AO provides best information on the topic of pesticide usage during the focus group discussions.

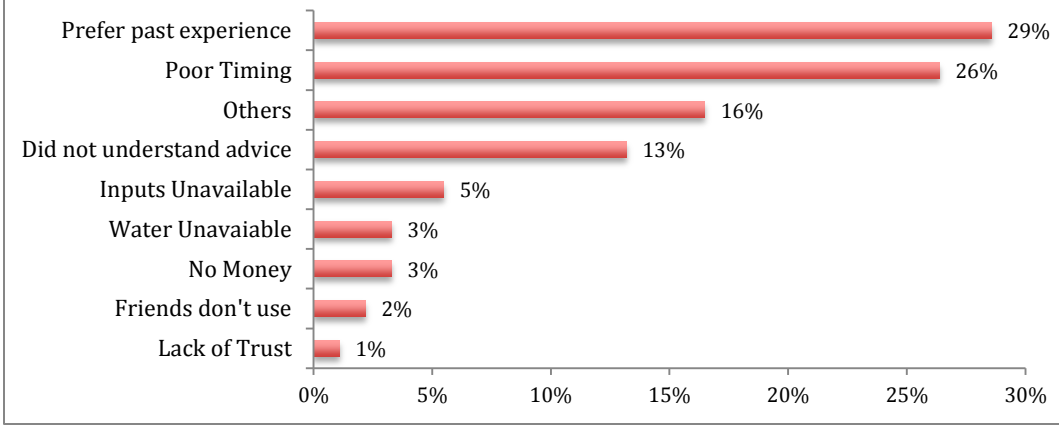
Figure 5. For pesticides: Reasons for not following AO advice



For fertilizer usage:

Focus group discussions reveal that while farmers are not too flexible about changing fertilizer purchase decisions, they are interested in information on dosage and frequency of fertilizer application. Of the 38% of farmers that listed fertilizers as a topic of interest, 57 percent said that they bought fertilizers based on AO advice. Survey data also shows that urea and Di-Ammonium Phosphate (DAP) are the most commonly used fertilizers, with farmers relying primarily on past experience to make these decisions. Further evidence is provided in Figure 6 which looks at why farmers do not follow AO advice (despite listing it as a topic of interest). Of the 91 respondents that fall under this category, 29 percent said that they had no need for this information since they followed past practices. Another 26 percent listed inappropriate timing- this is possibly because our fertilizer recommendation did not coincide with their crop phase, due to late or early sowing decisions.

Figure 6. For fertilizers: Reasons for not following AO advice



From the focus group discussions, it appears that farmers considered it more risky to change decisions for fertilizers and seeds than pesticides. However, some farmers expressed trust in AO information for fertilizers because it was consistent with their past experience. Others also said they used fertilizer advice because they had seen good results from this advice in the past. Table 5 below shows the most important reasons for respondents following AO advice on fertilizers, with trust in AO, better quality of information and provision of new information again listed as important reasons (similar to advice on pesticide management).[5]

Table 5: For Fertilizers: Most important reason for following advice

Reason	% of users
Trust	0.48
Quality of Info	0.29
New Info	0.11
Easily Understood	0.09
Inputs easily available	0.02
Low Implementation Cost	0.01
N	191

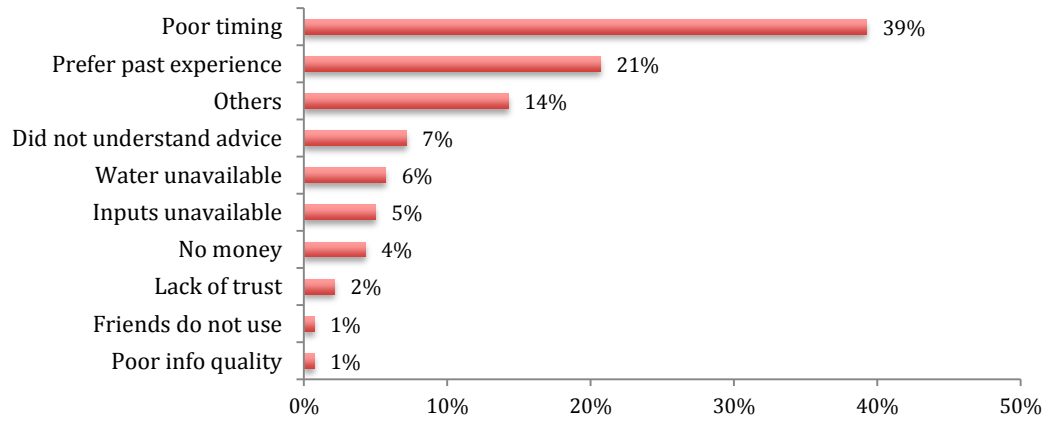
For seeds:

Inflexibility in terms of seed purchase choices can be primarily attributed to the fact that farmers were unwilling to experiment with new seeds, unless they had seen a plot demonstration of the same. For instance, farmers attended demonstrations by local

[5] These 191 respondents include those who listed fertilizers as a topic of interest but chose not to follow AO advice on this topic as reported during the household surveys

government extension workers or visited the local agricultural university to get information on seeds. The scope of AO to influence seeds seemed to be limited – this is possibly due to the risk factor involved in planting an unknown seeds or due to the fact that crop planting decisions had already been made at the time of AO advice on seeds. Again, past experience was the primary source for information on seeds. This is further illustrated in Figure 7, with 39 percent of the 140 that did not follow AO advice on seeds stating that this was due to inappropriate timing, and 21 percent claiming that they did not need new information. One potential explanation of the inappropriate timing of AO advice is that farmers tend to stick to their past decisions and might potentially buy seeds well before sowing decision, limiting the impact of a service like AO.

Figure7. For seeds: Reasons for not following AO advice



Of the 48% surveyed farmers with access to AO, that listed seeds as a topic of interest, about 50 percent purchased seeds based on AO recommendation. For cotton, the most common purchases were Vikram and Rasi, with other AO recommendations not featuring high on the list. For cumin, the most commonly purchased seed variety was Gujarat Cumin-4. We speculate that the reason those interested in seeds made input purchase decisions based on AO advice is that some of our seed recommendations coincided with the current practices (as in the case of Vikram-5 and Rasi seeds). Thus, AO advice might not have actually impacted farmer behavior when it comes to decisions on seeds, since it is difficult to isolate this effect.

D. Variation by respondent type

Over the two years that this evaluation was conducted, access to AO was provided to 800 randomly selected respondents. All the qualitative household survey data mentioned in this paper was collected from these farmers. At the end of the study, following the willingness to pay exercises, access to AO was also provided to those farmers who were randomly selected to not receive access to AO (control farmers) and to friends of study respondents (peer farmers), on purchasing the service. The service was made available to all those who purchased it as part of the WTP exercise, starting August 2013. After four months of usage, we conducted focus group discussions with the different groups using AO to understand how usage varies based on prior exposure to AO, expectations associated with AO, frequency and duration of usage, etc. Some questions we hope to answer through these focus group discussions include how peer effects affect the take-up of AO? How does usage of the new users compare with the older ones? What influenced people from non-treatment groups who have not used AO ever before to buy into this service?

Less than 10 percent of the farmers from the control group, who bought in to the AO service and participated in the focus group discussions, had heard about the service. The major motivation for this group buying in to AO seems to be the attractiveness of an alternative source of information, which was available to farmers at a reasonable price. On the other hand, the friends of study respondents i.e. the peer farmers had often heard about AO from their farmer friends. While only 4-5 farmers had actually called into the AO line using their friend's cellphone, many reported that their friend often passed on agricultural information from AO to them. Gopalbhai, a friend of our study farmer, mentioned that although he had never dialed in to the AO line, it came highly recommended by his farmer friend as a useful facility that provided good agricultural information. This gave him the reassurance to buy in to the service, especially as he had seen evidence of his friend benefitting from this advice. They wished to benefit from AO like their friends, which is why they chose to buy into the service. What was particularly interesting is that while farmers shared agricultural information with one another, not many seemed to know about the final purchase decisions made by other farmers.

We had an overwhelmingly positive response from new AO users during this round of focus group discussions, and were interested in comparing usage among these different groups after purchase. Given that frequency of calling into the AO line was particularly high among treatment farmers at the beginning of AO service, we anticipated similar trends among the users who had recently started using AO. We analyze administrative data from the AO system for the 462 respondents that purchased AO during the willingness to pay (WTP) exercise From August-November 2013.

Table 6: AO usage by respondent type

Type of farmer	Received AO marketing	Purchased AO	Pct. of farmers that called into AO	Usage (Aug-Nov 2013)	
				No. of calls	Avg. number of calls/farmer
Treatment	574	195	47%	846	4.34
Control	249	82	43%	650	7.93
Peer	610	183	51%	1203	6.57

Table 6 tell us that average number of calls per farmer is higher for the peer and control group. This is expected given that past trends show high initial usage, given that users are excited about and adapting to a new system. During the WTP exercise, we also asked those who did not buy AO to list the main reason for choosing to do so. Most people seemed to understand the exercise and the service they were being offered, with only 3 respondents saying that they did not understand what AO was all about. We expected that peer and control farmers would be less likely to purchase AO since they hadn't used it before. Also, we thought it would be interesting to see how much of a factor pricing would be in purchase of AO. For most farmers, the most common reason for not buying AO was liquidity constraints – they either thought that it was too expensive or they did not have the money to actually pay for the service.

IV. Trust in AO

Given that many respondents had listed trust in AO advice as a primary reason for using AO, we thought it would be interesting explore factors that have contributed to building trust in the advice provided by AO using the focus group discussions. A few questions of interest to us were – why did people initially trust AO enough to start using it? Why have users consistently been using AO and implementing AO advice? To what extent do users trust this information? Has AO affected trust in other sources of information?

Prior to AO, farmers relied primarily on past experience and input dealers for agricultural advice. While most still trust past experience the most, many expressed a shift toward AO advice and reduced dependence on input dealers. Farmers mentioned that they have become less reliant on agro-dealers, often simply visiting input dealers for purchase and not advice, or crosschecking advice provided by input dealers with AO advice. Farmers seem to value AO more for the new advice it provides, rather than its use as a reminder of agricultural information. This seems to be a popular reason for farmers buying in to the service as well. Kalubhai, 30 (name changed due to PII) states that having used the service for free over the past two years, he is still willing to pay a one-time fee to subscribe in to the service as the benefits outweigh the costs, particularly in the form on new information. He mentions AO advice to purchase Tryzophos in order to control whitefly, a new piece of agricultural advice that helped save costs and still produce effective results. Many stated that AO information had helped improve their knowledge about agriculture, reducing their dependence on external sources that might not always work in their best interest. For instance, many farmers said that they could now rely on AO for weather information rather than on word-of-mouth since this information was much more accurate or timely. Another example can be seen in the case of input purchase decisions, where private companies and local agro-dealers are often recommending more products than needed or marketing the more expensive product to the farmer. By providing both generic brand names and the actual product names for each recommended input, and also recommending frequency and dosage of application, AO ensures that farmers do not end up overspending on unnecessary inputs. Additionally, farmers now have an alternative source of

unbiased advice with which they can compare the prior market-oriented advice that they were receiving.

Trust in AO can be decomposed into two factors – initial take-up and continued usage of the service. Most farmers said that prior familiarity with AKRSPI, which had already been working Surendranagar for many years, helped build their trust in AO. This is particularly important to highlight the role of a local implementing partner when introducing innovations like ICTs in a new area. Farmers were familiar with AKRSPI and thus, felt comfortable trying out a new service like AO. Another motivating factor was the one-on-one training that our field staff provided the respondents – both at the time of the household paper surveys and during the WTP exercise (for those who purchased the service). Farmers felt they could trust AO because of the personalized training they received. This also made them more comfortable with the service. Nathabhai (name changed to protect PII), a regular user of AO over the past two years reiterated this view during the focus group discussions saying that the personalized training he received during the initial roll-out of AO made him more comfortable using the service, and made the advice seem more credible which encouraged him to continue to dial in to AO.

Usage and implementation of AO advice has slowly built up trust over the years. For the farmers using AO during the two-year course of the study, many started to trust AO advice because a number of recommendations were similar to the practices they had been following earlier. This allowed them to trust AO information, and slowly experiment with newer suggestions. Very few farmers who used AO advice said they experimented on a smaller scale before implementing AO advice in their entire field, demonstrating a high level of trust. Most seem to have heard about benefits of AO from their friends or other farmers in the village and followed AO advice. Having used AO, they witnessed improved production and crop quality at a lower price, which then cemented their trust in AO.

V. Expanding the scope of AO

While we can see substantial trust and high usage among current AO users, this service still has tremendous scope to be scaled up further. Even within the study, it is possible to expand the reach of AO to the respondents who are not currently using the line. In order to do so, we need to identify the barriers – both institutional and technological- that prevent the take-up and adoption of advice from AO (which can also be applicable to other ICTs).

A. Barriers to adoption of AO

During the focus group discussions, some farmers expressed misgivings in implementing AO advice without actually being able to witness a demonstration. Many said that one reason they preferred traditional extension to AO was because they could see actual plot demonstration or computer demonstrations of outcomes of different agricultural recommendations. Others also mentioned the lack of a physical presence as a deterrent in their usage of AO. Since there was no physical authority providing the information, and many do not know where the information comes from, they feel that they cannot hold anyone accountable if advice provided by AO goes wrong. There were also a few who were reluctant to pay the fee for subscribing to AO, having received AO for free over the past two years. More often than not, this was despite the fact that they had used AO regularly in the past, and found the information useful.

Some farmers also mentioned that they sometimes faced technological difficulties in accessing different features of the AO line. While most seemed comfortable with the weekly push calls, roughly 30% of the farmers who participated in the focus group discussions said that they were not completely comfortable recording a question. Some also said that they often forgot the name of inputs by the time they went to the input dealers shops to purchase an AO-recommended input. They did not seem to realize that they could use the missed call service to listen to older push calls and recall earlier advice or input recommendations. While many of these barriers pose concerns to the spread of ICTs like AO, we are optimistic that as mobile phone markets continue to penetrate into developing economies and mobile phone capabilities continue to be enhanced, a number of these problems can potentially be mitigated.

B. Potential improvements/changes

Given that AO has been designed to improve farmer productivity and improve agricultural livelihoods, we were interested in getting feedback from the farmers about potential changes and improvements that would make AO more useful to them. This included potential changes to both the type of content provided, as well as to the system itself. While most seemed happy with the current service, we had a few interesting suggestions come up during the focus group discussions, some that even address the barriers to adoption mentioned above.

Many farmers requested information on market pricing of crops, saying that they regularly require this information. Another interesting suggestion was the broadcasting of AO advice via SMS or text messages. This comes from the technological challenges mentioned above, with many farmers saying that they do not recall input names mentioned in AO and would find it easier to have this information stored in a text message. While AO provided information primarily on cotton, cumin and wheat, many farmers suggested that we should provide information on other major crops, particularly vegetables such as chilli, guvar, brinjal and cash crops such as groundnut, many of which are grown throughout the year. This discussion was particularly valuable since it gave us interesting ideas on how the scope of AO can be expanded to better serve the needs of farmers.

C. Potential impact of AO and similar ICTs

Based on the above findings, we speculate that the impact of AO and other similar ICTs might vary based on different market characteristics. Perhaps the first step to identifying areas in which ICTs like AO can be most useful is to analyze where they get information for different inputs from, and also the amount of trust they place in these different sources. At the start of the study, farmers' self-reported sources on information for almost all inputs are other farmers, followed by input shops (Cole and Fernando (2012)). A year from the start of this project, household survey data reveals the extent to which AO affected these sources of information in making agricultural decisions. Table 7 shows that across all major decisions, we can see

increased reliance on AO and greater trust on mobile-phone based information. Less than 1% of all respondents who participated in this survey report government extension workers as an important source of information, highlighting the limitations of the reach of traditional agricultural extension.

Based on the findings above, we can also speculate that mobile-phone based advice is more likely to have an impact in decisions where the problems are of a more dynamic nature such as pesticide management, as compared to more one-time decisions as in the case of fertilizers and seeds. Further evidence to support this claim can be found in the qualitative household survey data in Table 4, with most farmers demanding information from AO on pesticide management demonstrating an interest in adapting their behavior to this new advice. Another factor that might impact the usefulness of ICTs like AO is the risk and cost involved in making agricultural decisions. The decision of sowing usually involves larger risk since the entire harvest hinges on this, and also involves considerable investment at the start of the season. On the other hand, with pesticides and to some extent, fertilizers, farmers have more room to experiment with smaller areas and in smaller doses, reducing both the cost and the risk factor involved.

Table 7. Importance of Information Sources for Agricultural Decision Making

	Cotton Pesticides			Cotton Fertilizers			Cotton Seeds			Wheat Pesticides			Cumin Pesticides		
	Control	Treat		Control	Treat		Control	Treat		Control	Treat		Control	Treat	
	Mean	ITT		Mean	ITT		Mean	ITT		Mean	ITT		Mean	ITT	
Past Experience	0.023	-0.031		0.020	0.013		0.018	-0.013		0.005	0.001		0.005	0.000	
	(0.149)	(0.030)		(0.142)	(0.010)		(0.132)	(0.015)		(0.071)	(0.004)		(0.07)	(0.01)	
Mobile-Phone Based Info	0.000	0.044	***	0.003	0.061	***	0.003	0.061	***	0.000	0.012	***	0.000	0.029	***
	(0.000)	(0.008)		(0.051)	(0.009)		(0.050)	(0.010)		(0.000)	(0.004)		(0.00)	(0.01)	
Other Farmers	0.399	-0.020		0.227	0.000		0.487	-0.029		0.023	0.005		0.126	-0.001	
	(0.490)	(0.025)		(0.419)	(0.032)		(0.500)	(0.041)		(0.149)	(0.011)		(0.33)	(0.02)	
Input Shops	0.440	0.004		0.099	0.016		0.286	-0.060		0.013	0.005		0.133	-0.026	
	(0.497)	(0.011)		(0.300)	(0.021)		(0.453)	(0.037)		(0.112)	(0.010)		(0.34)	(0.03)	

	Weather			Pest Identification			Crop Planning			Prices		
	Control	Treat		Control	Treat		Control	Treat		Control	Treat	
	Mean	ITT		Mean	ITT		Mean	ITT		Mean	ITT	
Past Experience	0.206	-0.159	***	0.427	-0.023		0.847	-0.031		0.193	0.011	
	(0.405)	(0.042)		(0.495)	(0.040)		(0.361)	(0.030)		(0.396)	(0.035)	
Mobile-phone Based Info	0.000	0.235	***	0.003	0.093		0.000	0.044		0.023	-0.018	
	(0.000)	(0.019)		(0.050)	(0.011)		(0.000)	(0.008)		(0.149)	(0.017)	
Other farmers	0.206	-0.078	**	0.342	-0.085		0.098	-0.020		0.314	-0.017	
	(0.405)	(0.035)		(0.475)	(0.034)		(0.298)	(0.025)		(0.465)	(0.038)	
Input dealers	0.013	0.015	*	0.530	0.021		0.020	0.004		0.010	-0.011	
	(0.112)	(0.008)		(0.500)	(0.042)		(0.141)	(0.011)		(0.100)	(0.010)	

Another aspect to be taken into consideration while speculating about the potential impact AO might have is the characteristics of the markets in which this service is being offered. It would be easier for ICTs like AO to have greater impact in markets where there is demand for alternative sources of information instead of the existing ones. For instance, in the study region of Surendranagar where AO was implemented, Table 7 shows reduced reliance on other farmers as a source of information, and as mentioned above, greater reliance on mobile phone based information. Additionally, AO also seems to reduce the dependence of treatment respondents on past experience, other farmers and input dealers across major agricultural decisions. These facts were corroborated during the focus group discussions, with Bhulabhai (name changed), a cotton farmer who tried using AO, citing a case where he went to the input dealer with a pesticide management problem and was recommended 4 different pesticides, which were quite expensive. When he checked on AO, his problem was solved with fewer inputs, dramatically reducing his costs and still saving his crop. These results seem to suggest increasing demand for mobile phone-based agricultural information, as an alternative to relying on input dealers or farmer friends for advice. Thus, ICTs like AO are more likely to prove useful in markets where users are looking to move away from profit or commission-seeking sources of advice.

VI. Conclusion

Based on this qualitative study, we can see that the role of mobile-based extension services like AO provide an interesting and increasingly relevant alternative to traditional extension. Of particular importance is that mobile-based extension overcomes the limitations of geography and also allows for continuous monitoring and feedback rather than a one-time extension visit. The importance of well-established local partners and one-on-one interaction are worth noting when looking to implement an ICT of this nature. At the same time, there are many institutional and technological barriers that are yet to be overcome by services such as AO. However, given the rapid spread and continuous capability-enhancement of mobile phones many of these problems will be mitigated over the coming years.

Of particular interest are the variations we have seen across input type for agricultural advice. Farmers seem to rely on AO most for pesticide advice, highlighting the market failures for unbiased and timely advice with farmers choosing to opt for mobile-phone based advice versus private companies and input dealers that might not always be acting solely in the interest of the customers. Some limitations in pesticide purchase include input unavailability and expensive inputs. While farmers are open to advice on fertilizers, they rely on AO more for information of dosage and quantity rather than type of fertilizer. Reliance on past experience and the finalizing of decisions in advance are deterrents to adoption of AO advice for fertilizer and seeds.

Finally, we can see that the scope of mobile-based agricultural extension is extremely vast, and has tremendous potential for expansion. For AO itself, we have the choice of adding features that provide information on prices or expanding to other crops. The mobile phone market across the world has been rapidly expanding, with many developing economies including India demonstrating high mobile phone penetration. For instance, as of 2010, mobile phone adoption had reached 60% of the total population in sub-Saharan Africa, roughly 70% of total population in East and South-East Asia and is almost as high as 80% of the total population in Central and South America (Aker, (2011)). As the cellphone markets continue to grow and farmers are increasingly willing to adapt to new technologies, ICTs like AO provide dynamic opportunities to improve agricultural livelihoods in developing economies like India and many others.

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Appendix

Focus Group Discussion Questionnaire

Respondents with prior access to AO (Treatment) who purchased AO

1. What has been your overall experience with AO so far?
2. What were your main sources of information before AO started?
3. What type of information do you get from AO (which topics)?
4. What is some of the new information/input names you learnt from AO (which you didn't know earlier)?
5. Have you used any of this new information in your field based on AO advice?
6. Why did you choose to use this new information/input?
7. Did you apply the advice /input provided by AO directly to the field or did you test it on a smaller scale before?
8. What are the main factors that have helped develop your trust on the information provided by AO?
9. Can anybody describe some problems they faced in the field and how these problems were solved by AO? (detailed)
10. What information sources do you rely on right now, other than AO?
11. Which current source of agricultural information do you trust the most? Why?
12. What factors influenced your decision to purchase AO?
13. Do you think AO has helped you in terms of reducing cost or increasing production?If yes, how?
14. Have you ever discussed AO with input dealers?
15. What are the features of AO you are using right now?
16. What is more valuable to you in terms of AO – regular reminders about agricultural information you are already aware of or availability of new information?
17. According to you what is most easy aspect of using the AO system?
18. What is the most difficult aspect of using the AO console?
19. What differs AO from other sources of information?

20. What is a major aspect that you do not like about AO?
21. What are some difficulties you faced in using AO?
22. Was there any information that you thought was not useful/relevant? Why?
23. What improvements in AO do you think would be more useful for farmers?

<u>Respondents who had prior to access to AO but did not buy in to the service</u>

1. Have you ever used AO, since the start of the project?
2. If yes, then:
    a. How was your experience of using AO?
    b. What type of information are you getting through AO (all topics)?
    c. What are the main topics of information you like on AO?
    d. Which were the AO features you used the most?
    e. Do you use any of the information advised on AO? (What type of advice)?
    f. Did you purchase any inputs based on AO advice? (Which inputs?)
    g. What is some new information/input name you learnt from AO, which you didn't know earlier?
    h. Have you used any of this new information in your field based on AO advice?
    i. Why did you choose to use this new information from AO?
    j. Did you use the new information on your entire field or did you test it on a smaller scale first?
3. What are the main factors that have helped develop your trust on the information provided by AO?
4. What information sources you are using right now other than AO?
5. Which source of information do you trust the most? Why?
6. Why did you decide against purchasing AO?
7. Do you think you would have benefitted had you purchased AO?
8. What would have increased your desire to purchase AO?
9. Do you think AO has helped you in terms of reducing cost or increasing production?
10. If yes, how?

11. According to you what is most easy and most difficult thing in using AO?
12. How is AO different from other sources of information?
13. What do you not like about AO?
14. What improvements in AO do you think would be most useful for farmers?

<u>Respondents randomly assigned to not receive AO access (control) who bought in to the service</u>

1. What has been your overall experience of AO after purchasing the service?
2. Had you ever heard about AO before you purchased the service?
3. If yes, what have you heard about AO?
4. If yes, from whom did you hear about AO?
5. How do you think AO would be useful for you?
6. What type of information did you expect AO to provide?
7. Have you ever noticed any of your friends or villagers benefit from AO information?
8. If yes, can you explain how? (detailed)
9. Have you made any purchase decisions based on AO advice?
10. If yes, have these decisions benefitted you?
11. If yes, How?
12. What are the features of AO you are using right now?
13. Of all the features in AO, which feature do you like the most?
14. According to you, what is most easy aspect of using the AO system?
15. According to you, what is most difficult aspect of using the AO system?
16. How is AO different from other sources of information?
17. What were your main sources of information before you purchased AO?
18. What information sources are you using right now other than AO?
19. Which source of information do you trust the most?
20. What is your main source of information other than AO right now?
21. Why do you trust that source?
22. What factors led to your decision to buy AO?
23. What do you not like about AO?

24. What are some of the problems you faced in using AO?
25. What improvements in AO would benefit farmers the most?

Friends of study respondents (peers) who bought in to the AO service

1. Have any of your friends used AO in the past two years?
2. Had you heard about AO from your friend before your decided to purchase the service?
3. Have you ever used the AO service on a friend's mobile?
4. If yes, did this help solve any of your agricultural problems?
5. Has your friend ever passed on any information from AO to you?
6. If yes, what is that information?
7. Did this information benefit you?
8. If yes, can you explain how?
9. Did your friend ever feel happy/proud about having access to AO service?
10. Have you ever compared information with any of your friends who use AO?
11. Have you or your friends ever talked about AO advice with input dealers? If yes, can you explain the discussion?
12. Have you ever followed the same agricultural practices as your friend who uses AO?
13. If yes, what was that? And how?
14. Do you think that AO information has benefitted your friend's crop in the past two years?
15. Do you think AO information has improved agricultural knowledge of your friend?
16. Do you think the kind of agricultural discussions you have with your friend have changed since you purchased AO?

M 5.2 Weekly Broadcast Status

As of March 2014, we have sent out a total of 52 push calls (from the start of the service in September 2013). During March 2014, weekly push call content focused on summer crops, primarily green gram and groundnut. These calls were broadcasted once a week, with a total of 4 push calls in March. These push calls are sent out to 1453 farmers, who are part of the treatment group for this project. The table below shows a breakdown of the push calls by date, topic and duration for the month of March.

Date of Broadcast	Topic	Duration (in seconds)
05-Mar-14	Summer Crops	292
12-Mar-14	Summer Crops	284
19-Mar-14	Summer Crops	260
27-Mar-14	Summer Crops	264

For the months of March and April, we will be sending out only one push call per week. Unlike earlier months, where we sent out both the technical push call (about relevant agricultural information based on local crop and weather conditions) and the BCI push call (about best agricultural practices for cotton based on the guidelines of our partner organization BCI-SCSN), we will send out only the technical push call for these two months. As mentioned above, these technical calls will focus on summer crops. The BCI calls will not be broadcasted since the agricultural season for growing cotton will start only in the kharif season (in May). Thus, these calls will resume only in May, with farmers once again receiving two push calls per week.

M 6.1 Weekly Broadcast Status (April-July 2014)

From the start of the service in October 2013, we have sent out a total of 66 push calls to the 1453 treatment farmers that are part of our study sample in Madhya Pradesh. Push call topics covered included cotton, summer crops, *rabi* crops (wheat, gram) and BCI push calls (providing information on best agricultural practices for cotton cultivation as outlined by the principles of our partner organization, Better Cotton Initiative (BCI).

As the table below shows, we have sent out a total of 13 push calls from April-July 2014. Push calls in April focused primarily on summer crops, including groundnut, green gram and chilli. With the start of *kharif* season in May, cotton-related content was broadcasted to farmers. Technical content focusing primarily on soil sampling and testing, along with information on seed choice and sowing were incorporated in these push calls. As we progress further in to this agricultural season, we have started to include information on other major input decisions including fertilizer and pesticide decision-making. The table below provides a breakdown of push calls from the past three months, including topic, duration and date of broadcast.

Date of Broadcast	Push Call Topic	Duration (in seconds)
02-Apr-14	Summer Crops (Groundnut and Green Gram)	250
09-Apr-14	Summer Crops (Groundnut and Green Gram)	244
16-Apr-14	Summer Crops (Groundnut and Green Gram)	240
23-Apr-14	Summer Crops (Groundnut and Green Gram)	261
30-Apr-14	Summer Crops (Groundnut and Green Gram)	260
07-May-14	Cotton - Soil Sampling and Analysis	287
14-May-14	Cotton - Seeds and Seed Treatment	252
21-May-14	Cotton - Nutrients and Fertilizers	275
28-May-14	Cotton - Seeds, Fertilizers, Seed treatment for sowing of irrigated cotton	243
04-Jun-14	Cotton - Seeds, Seed Treatment, Fertilizers	215
11-Jun-14	Cotton - Seeds, Seed Treatment, Fertilizers	320
18-Jun-14	Cotton - Fertilizers, Pest and Disease Management	290
25-Jun-14	Cotton - Weather, Fertilizers, Pests and Disease, Weed Control	250

M 6.2 Collection of Willingness to Pay (WTP) Data Completed

A key question while evaluating the impact of information and communication technologies (ICTs) is whether services which provide unbiased and efficient digital advice can be scaled to serve larger populations in developing countries. One way to capture this is to gauge users' willingness to pay for the service. We attempt to explore this question as part of our evaluation of *Avaaj Otalo (AO)* – a mobile phone based agricultural extension service- using different mechanisms to capture the willingness to pay (WTP) for AO. Analysing how demand for this product varies across different farmers is particularly important in understanding if products like AO can be self-sustainable, once the intervention has ended.

These WTP exercises were carried out in Surendranagar district, Gujarat during the months of June and July, 2013. These WTP exercises were carried out with four different groups of respondents – study farmers who had access to AO (treatment group), study farmers with no access to AO (control group), friends of study farmers (peers) and random non-study farmers who live in the same villages that the study was carried out in (extras). Within the treatment group, we had two separate sub-groups – treatment farmers who had access to AO and also received 'traditional' extension (in the form of physical demonstrations), hereafter referred to as the *AOE treatment group* and treatment farmers who only had access to AO (the *AOO treatment group).*

We estimate WTP using two different mechanisms - `take it or leave it' (TIOLI) and Becker-Degroot-Marschak (BDM) (1964). The table below shows the breakdown of those who participated in the different WTP test types (BDM vs. TIOLI) by respondent group.

Table 1: Sample Size

	Approached	Participated	BDM	TIOLI
Survey Group	1198	768	531	237
Treatment	800	542	375	167
Treatment (AEO)	401	268	176	92
Treatment (AOO)	399	274	199	75
Control (C)	398	226	156	70
Peers	714	376	282	94
Extras for WTP	327	234	175	59
Total Sample Size	2239	1378	988	390

75 percent of respondents were assigned the BDM exercise – a bidding game where they were offered AO at decreasing price points ranging from Rs. 40 to Rs. 500. Once respondents agree to purchase AO at a particular price point (bid price), they were given a pre-assigned scratch card where the randomized 'offer price' is mentioned. The randomized offer price could equal Rs. 40, 90, 140, 190 or 240. If the bid price was less than or equal to this offer price revealed by the scratch card, the respondent had the option of purchasing AO at this lower 'discounted' price. If the bid price is less

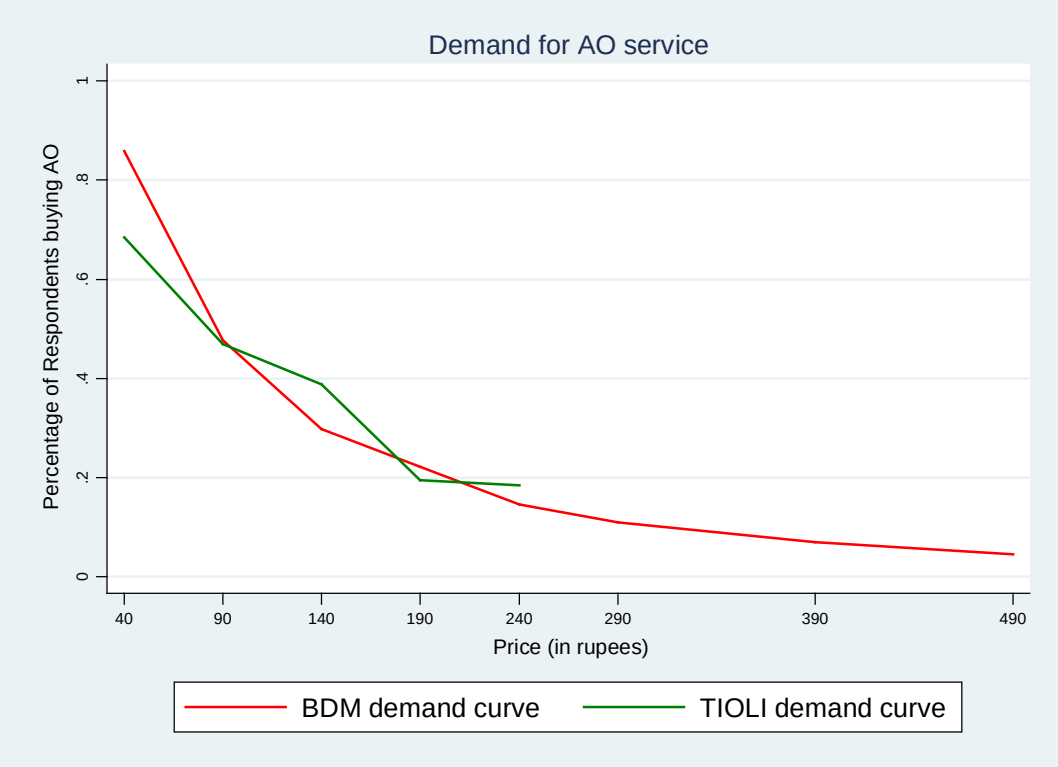
than the offer price, then the respondent does not get the service and does not pay anything. Participation in this exercise, including the decision to purchase AO is completely voluntary. The remaining 25 percent respondents were assigned a simpler exercise of `take it or leave it' (TIOLI), where they are simply offered the chance to buy AO at a randomized price point, ranging from Rs. 40 to Rs. 240.

The table below shows the distribution of bid prices for the BDM exercise and also the different price points that respondents were offered AO at in the TIOLI exercise.

Table 2 Distribution of Price Points by WTP exercise

	BDM Mechanism		TIOLI Offers	
Price	% Buying	N	% Buying	N
490	4.5%	1042		
390	6.9%	1042		
290	10.9%	1042		
240	14.6%	1042	18.4%	76
190	22.2%	1042	19.5%	77
140	29.8%	1042	38.8%	80
90	47.7%	1042	46.9%	81
40	86.0%	1042	68.4%	76

Finally, the graph below plots the demand curve observed in both WTP mechanisms, which is based on the data in Table 2.



M 6.3 Service Utilization until July 2014

Table 1 reports the take-up and usage of AO. As of July 2014, 10 months after the commencement of the service, roughly 58% of the treatment group had called in to the AO line, making an average of 3.4 calls. The mean duration of calling in time is roughly 11 minutes. Additionally, 22% of the treatment group has called in to listen to older messages while 24% has recorded a message on AO. Of the recorded messages, 16 % of the treatment group has asked a question, 10 % has responded to the weekly announcements and only 2% has responded to an earlier question. We also see that treatment farmers on average listen to 35% of total push call content.

All these statistics together represent the induced usage for treatment farmers. We hope that additional training and the arrival of peak Kharif season in the coming months will further help in increasing usage.

Table 2 provides a categorization of push calls and questions asked across crop and theme. Columns 1 and 2 report the content of push calls, which tend to focus on cotton (for the Kharif season), wheat and gram (for the Rabi season), and also on pesticide, fertilizer and irrigation information (The categories are not mutually exclusive). Columns 3 and 4 report the content of questions asked by treatment farmers. Unsurprisingly, a majority of the questions (55 %) relate to cotton. Across crops, popular question themes among treatment farmers are pest and disease information (28%) and seed choice and sowing information (24 %).

Table 1 - AO Usage Statistics

Dependent Variable	Control Mean	T-C ITT	
A. Total AO Usage			
Used AO	0.015	0.584	***
	(0.123)	(0.013)	
Total AO usage (minutes)	0.409	11.225	***
	(14.608)	(1.962)	
Number of calls	0.062	3.482	***
	(1.168)	(0.324)	
Avg. AO Usage (minutes)	0.013	1.296	***
	(0.357)	(0.184)	
Called AO, did not access any features	0.013	0.277	***
	(0.114)	(0.012)	
B. AO Activity			
Called AO to listen to messages	0.000	0.220	***
	(0.000)	(0.011)	
Total listening time (minutes)	0.000	5.736	***
	(0.000)	(0.668)	
Avg. listening time (minutes)	0.000	0.586	***
	(0.000)	(0.064)	
Recorded message on AO	0.001	0.241	***
	(0.026)	(0.011)	
Asked a question	0.000	0.165	***
	(0.000)	(0.010)	
Number of questions asked	0.000	0.260	***
	(0.000)	(0.022)	
Responded to a question	0.000	0.021	***
	(0.000)	(0.004)	
Responded to an announcement	0.000	0.100	***
	(0.000)	(0.008)	
C. Extent of Listening to Push Calls			
Percentage of total push call time listened to	0.000	0.344	***

	(0.000)	(0.007)	
Listened to greater than 10% of total push call time	0.000	0.803	***
	(0.000)	(0.010)	
Listened to greater than 50% of total push call time	0.000	0.257	***
	(0.000)	(0.011)	
N	1440	2893	

Notes

AO usage estimates are collected from the AO server from September 2013 to July 2014

Column 1 reports the mean and standard deviation for the control group

Column 2 reports the Intention to Treat (ITT) estimates for the difference in means (and robust standard error) among the treatment and control group.

Table 2: Categorization of Push Calls and Questions by Crop and Topic

Cell Contents	Push Calls N (1)	Push Calls % of Total (2)	Questions N (3)	Questions % of Total (4)
A. Crop				
Cotton	23	51%	372	55%
Wheat	14	31%	54	8%
Gram	12	27%	3	0%
Green Gram	9	20%	2	0%
Groundnut	9	20%	4	1%
Other	7	16%	8	1%
Chilli	3	7%	24	4%
B. Theme				
Pest and Diseases	33	73%	191	28%
Fertilizer	19	42%	45	7%
Irrigation	19	42%	9	1%
Seeds and Sowing	12	27%	161	24%
Flowering and Boll Development	9	20%	11	2%
Weed Control	8	18%	13	2%
Weather	7	16%	2	0%
Soil Management	2	4%	4	1%
Harvesting and Storage	1	2%	3	0%
Other			26	4%
N	45		677	

Notes: AO usage data has been collected from the server for September 2013-July 2014. We sent out a total of 45 push calls that provide technical agricultural information based on local crop and weather conditions. Each push call contains information on multiple crops/themes.

Cost-Effectiveness of Mobile Phone- Based Extension

The continued reliance of rural communities on agriculture as a source of livelihood emphasizes the need for timely, reliable and cost-effective agricultural information. Traditional sources of extension are often hindered by limitations which include monitoring difficulties, lack of accountability and the inability cover large geographical distances. The rapid spread of mobile phones across developing countries has revolutionized the cost and efficacy with which information can reach rural communities. Information and communication technologies (ICTs) have the potential to impact agricultural management practices by providing unbiased and efficient information at dramatically lower costs.

Our research evaluates one such ICT, Avaaj Otalo (AO) – a mobile phone-based technology that provides farmers with weekly time-sensitive agricultural advice, allows them to call in to a hotline to ask questions, receive answers from experts and listen to responses to questions posed by other farmers. Preliminary results from our study show high take-up of AO with positive impact on farmer behavior, particularly greater dependence on mobile phone-based information.

Despite the encouraging results, a key factor influencing the willingness of donors and governments to invest in ICT-based extension is the financial sustainability of such service. In order to determine cost-effectiveness, we must understand the demand for mobile phone-based extension. In order to gauge demand for AO, we carry out willingness to pay experiments in rural western India to determine if mobile phone-based extension is ready for financial success, allowing for expansion to larger populations across developing countries.

I. Take-up and Impact of AO

AO is a voice-based open source digital platform that has been designed using a touch tone navigation system with local language prompts, making it easy to use for farmers. This innovative service was originally developed as part of a Berkeley-Stanford research project by Neil Patel and Tapan Parikh in close co-operation with Development Support Center (DSC) – an NGO with extensive experience in agricultural extension in rural Gujarat. In a recently completed study, we partnered with DSC to identify 1200 households in Sayla and Chotila blocks of Surendranagar district. The sample includes respondents who grow cotton, own a mobile phone and are the chief agricultural decision-makers of their household. 800 households were randomly assigned to receive toll-free access to AO, with 400 of these households also receiving traditional extension. An additional 400 households served as the pure control group. [1]

Starting in September 2011, the 800 treatment group farmers receive weekly calls with agricultural advice ("push calls") from our local expert based on local crop and weather

[1] Shawn A. Cole and A. Nilesh Fernando (2012), "The Value of Advice: Evidence from Mobile Phone-Based Agricultural Extension" *Harvard Business School Working Paper 13-047*.

conditions. They also have access to a toll-free hotline that they can use to ask questions that will be answered by the local expert, respond to questions of other users, listen to older messages and also share their agricultural experiences. As of August 2013, two years after the commencement of the service, AO server data reveals substantial usage with 80% of the treatment group calling in to AO, making an average of 20.8 calls. Mean usage of AO is roughly 154 minutes, with 68% of treatment farmers calling in to listen to older messages, 39% asking a question and 16.5% responding to push calls. We also see that treatment farmers on an average have listened to roughly 31% of push calls.

Preliminary results from household survey data show that AO has had significant impact on farmer behavior.[2] Two years after the commencement of the service, treatment farmers are 70% more likely to rely on mobile phone-based information, with reported trust on this advice approximately 6.25 points higher than the control group. While the index for pest management practices across all crops is 0.06 standard deviation units higher for the treatment groups, we do not see statistically significant results for the impact of AO on treatment purchase and usage of recommended pesticides. The index for cotton fertilizer practices is 0.08 standard deviation units higher for the treatment group, with more treatment farmers purchasing ammonium sulphate (5%) – a commonly recommended fertilizer.[3] Finally, we see no significant difference between treatment and control groups in terms of impact of AO on agricultural knowledge retained by farmers. We also see moderate improvements in cotton yield (not statistically significant) and improvements in cumin productivity, an important side crop.

II. Demand for mobile phone-based extension

While mobile phone-based extension provides a low-cost and efficient alternative to traditional extension, its scalability is largely dependent on whether such services can succeed in a market setting. This depends crucially on consumer valuation of services like AO that provide "value-added" agricultural advice. In order to gauge customer demand for AO, we conduct a willingness to pay study in Surendranagar district in Gujarat, India. We use two different mechanisms to determine willingness to pay for AO – a simple "take it or leave it" (TIOLI) exercise and a modified version of the Becker-Degroot-Marschak (BDM)[4] exercise which adopts an incentive compatible elicitation mechanism. While TIOLI provides limited information (only at a single price point), BDM shows us a consumer's exact willingness to pay (by offering the user a menu of prices to choose from), providing an accurate measure of demand (Berry et al. 2012).

All 1200 respondents that participated in our recent study in Gujarat were approached to participate in the willingness to pay study. We also approached 714 additional farmers who

[2] In this note, we present preliminary results from our recently completed two-year study based on a final household survey that took place between July-August 2013.

[3] The indices aggregate information over multiple outcomes for which we expect unidirectional treatment effects. Each index consists of the average of the z-scores for each component of the index, with the control group mean and standard deviation as reference.

[4] Becker, G. M., Degroot, M. H. and Marschak, J. (1964), "Measuring utility by a single-response sequential method" Syst. Res., 9: 226–232. doi: 10.1002/bs.3830090304

were listed as friends of our study respondents and were involved in agriculture (hereafter referred to as "peers"). In case we were unable to reach peer farmers, we planned on approaching other farmers in the villages we visited, who were involved in agriculture, but did not belong to the treatment, control or peer group (hereafter referred to as "extra peers"). 75% of the total sample would participate in the BDM exercise, while the other 25% would receive the TIOLI version. In order to better understand how marketing might influence demand for AO, we also introduce randomized marketing messages varying across the following dimensions - impact of the service on yield, emphasis on AO's non-profit motive, peer satisfaction with AO and representation by local non-governmental organizations.

Table 1 shows that of the 2239 farmers approached from all groups, around 1378 consented to participate in this exercise. Of these, roughly 39% were from the treatment group, 16% from the control group, 27% from the peer group and 17% from the extra peers group. Once respondents had consented to participate in the study, surveyors would read out the marketing scripts that were randomly assigned to them. Each of these marketing scripts would also indicate if the respondent would participate in the BDM or TIOLI exercise.

Table 1: Sample Size

	Approached	Participated	BDM	TIOLI
Survey Group	1198	768	531	237
Treatment	800	542	375	167
Control (C)	398	226	156	70
Peers	714	376	282	94
Extras for WTP	327	234	175	59
Total Sample Size	2239	1378	988	390

Those participating in the TIOLI exercise would receive the option to buy AO at a randomly selected price point from a menu of prices ranging from Rs. 40 to Rs. 240. On the other hand, those who were assigned the BDM game would participate in a bidding auction where they were asked about their willingness to purchase AO at decreasing price points ranging from Rs. 490 to Rs. 40. Once the respondent has named a 'bid price' – the highest price point at which they are willing to buy AO, the surveyors would hand over the pre-assigned scratch card to the respondent.[5] These scratch cards would contain one of the following `offer prices' – Rs. 40, 90, 140, 190 or 240. If the offer price revealed behind the scratch card is lower than the bid price, the respondent could purchase AO at this discounted price. If the offer price is higher than the bid price, the game ends and the respondent cannot buy in to AO. If the

[5] All surveyors were assigned envelopes for each respondent with a unique id. For those assigned BDM (mentioned in this envelope), the surveyor would call a phone operator based in the local field office, and inform this operator about the respondent's unique id, the envelope id and the respondent's bid price. After this, the operator would provide the randomized scratch card number assigned to this respondent. Scratch cards were numbered from 1 to 5, each denoting an offer price of Rs. 40, 90, 140, 190 and 240.

respondent purchases AO, the surveyor would explain the basic features of AO and provide a demonstration. By purchasing AO under this exercise, respondents would receive mobile phone-based extension for one year, which includes information on cotton in the Kharif season, and wheat and gram in the Rabi season.

Table 2 shows the distribution of bids from the BDM exercise and the percentage of respondents willing to buy AO at the different price points in the TIOLI exercise. In Figure 1, we graph these results and observe downward sloping demand curves for both mechanisms.

Table 2 Distribution of Price Points by WTP exercise

	BDM Mechanism		TIOLI Offers	
Price	% Buying	N	% Buying	N
490	4.5%	1042		
390	6.9%	1042		
290	10.9%	1042		
240	14.6%	1042	18.4%	76
190	22.2%	1042	19.5%	77
140	29.8%	1042	38.8%	80
90	47.7%	1042	46.9%	81
40	86.0%	1042	68.4%	76

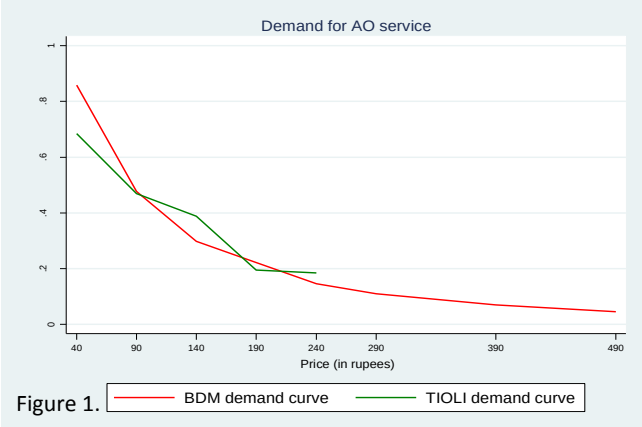


Figure 1.

III. Cost of offering AO

ICT-based extension, particularly advice provided via mobile phones is particularly attractive due to the low costs of information sharing associated with it. Along with the willingness to pay study, we look at usage patterns and costs from our service in Gujarat to provide an accurate estimate of the cost of offering AO. This, along with results from the willingness to pay study, will help us estimate if services like AO can be commercially successful.

The two important costs associated with providing the service are airtime costs (costs paid to the phone company for minutes used in providing content) and fees paid to the local agricultural expert for providing advice. Additionally, the service provider also charges a fixed monthly fee for hosting the line. In Table 3, we estimate costs for providing the service to a sample 1,000 farmers. Based on usage from our recent study in Gujarat, farmers on an

average use the service for 20 minutes of airtime (inclusive of outgoing and incoming calls) per month, leading to an airtime cost of Rs. 20,000 (Column 1). A full-time agricultural expert will be required to provide information to 1,000 farmers, earning roughly Rs. 20,000 per month (this can vary based on experience and qualifications). Monthly hosting (server management) fees are roughly Rs. 10,000.

Table 3. Cost of offering AO

Monthly Cost	(1)	(2)
Air time	INR 20,000.00	INR 20,000.00
Hosting Fee	INR 10,000.00	-
Agronomist	INR 20,000.00	-
Total Cost	INR 50,000.00	INR 20,000.00
Per-farmer Cost	INR 50.00	INR 20.00
Yearly Cost	600	240
Half-yearly Cost	300	120

Based on these calculations, the per-farmer cost of offering AO to roughly 1,000 farmers for a year is Rs. 600 per farmer (around $10 per year). For the willingness to pay study, we do not need to incur additional server management and agricultural expert costs since these can be shared with the current lines we are operating in Gujarat. Thus, the only cost we would incur is airtime, reducing yearly costs to Rs. 240 per farmer (Column 2), or roughly $4 a year per farmer, less than half the cost of a single round of physical extension.[6]

BOX 1. Replication of AO technology

We are currently expanding AO to Madhya Pradesh, India using a cluster-randomized experiment in order to further understand the mechanisms underlying adoption and diffusion of mobile phone-based extension. This study involves roughly 3000 farmers organized into 'learning groups' of 20-30 farmers each, with intensity of treatment (access to AO) varying across learning groups. Along with the willingness to pay study, this expansion will provide additional insight into how such extension services can be optimally implemented to ensure rapid adoption of sustainable agricultural practices, while also determining generalizability of previous findings.

Awaaz.de, our technology partners are currently working on expanding the capabilities and reach of AO technology. *Khedut Saathi (KS),* which literally means farmer's friend, provides voice-based agricultural advice to farmers across Gujarat. All subscribers receive two weekly messages, one on a seasonal agricultural topic developed by a local expert and another on a farmer's experience or feedback about the service. Within a year, Khedut Saathi has enrolled over 15,000 small-scale farmers. Pick-up rate of the outgoing messages has consistently stayed over 60%, with 50% of KS users using the 'forward to friend' component to share KS content with others. Mobile phone-based information via 'Streams' is also implement across education, health, entertainment and a number of other fields.

[6] We estimate that one round of physical extension costs roughly $8.5. These estimates are based on the physical extension conducted by our research team with the sample of 400 respondents in October 2011.

BOX 2. Alternative ICT-based Agricultural Extension Services in India

There are a number of other services that provide digital agricultural information to farmers across different platforms. Listed below are some of the most popular alternatives to AO currently available in the market:

I. *Farmer Call Center* provides farmers across India with access to a toll-free number, where farmers can call in and interact directly with call center agents and agricultural experts for specific queries. The service is completely free for all but provides not outgoing information.

II. Indian Farmers Fertilizer Cooperative Ltd. (IFFCO) Kisan Sanchar Ltd. (IKSL) broadcast five automated voice calls every day via mobile phones relating to agriculture. However, farmers are unable to ask questions or give feedback about the content. While there are no hosting charges, farmers are required to purchase a new Airtel mobile phone connection (exclusive to this cellular network), usually priced around Rs. 30 per sim-card.

III. *Reuters Market Light (RML)* provides price information via text messages in local languages. To subscribe in to this service, farmers have to pay a yearly fee of Rs. 250. This service provides information on prices across five markets and three commodities.

IV. *mKISAN Call Center (HANDYGO)* provide pre-recorded commonly asked agricultural information by crop and topic that can be accessed by calling in to a phone line. There are no outgoing messages and content is limited to the recordings. Subscribers have to pay a monthly fee of Rs. 30 per month.

IV. Can AO be offered as a for-profit service?

From the willingness to pay exercise above, we are able to see that BDM gives us an accurate measure of the demand for this service among our sample. By comparing these results with the cost of offering AO to respondents, we can determine if services like AO are ready to succeed in a market setting. Financial viability will be instrumental in determining if such services are self-sustainable, thereby influencing the potential for further scaling up.

From Table 2, we can see that the cost of offering the service for 6 months or so is roughly Rs. 300 including all costs associated with providing the service. If we assume shared hosting fees and agricultural expert costs, this cost is lowered to only Rs. 120 per month. Table 4 compares the willingness to pay estimates with different costs of offering the service, and determines if the service can be profitable. We look at a sample of 100 potential buyers, with cost estimates for six months i.e. one agricultural season.

Table 4. Profit Maximizing Price (For 100 Potential Buyers)

Price	% Buy	"Profit" (Cost=0)	"Profit" (Cost=120)	"Profit" (Cost=300)
40	86.0%	3440	-6879	-22357
90	47.7%	4293	-1431	-10016
140	29.8%	4179	597	-4775
190	22.2%	4212	1552	-2439
240	14.6%	3501	1750	-875
290	10.9%	3173	1860	-109
390	6.9%	2695	1866	622
490	4.5%	2210	1669	857

Notes: All prices are in Indian rupees (INR)

Additionally, as the number of farmers subscribing in to the service increases, the per-farmer cost will reduce with fixed costs shared among a larger group, and per unit costs for airtime falling as we subscribe to larger plans. Thus, in some cases, it seems possible to offer AO as a for-profit service.

However, these estimates only include costs associated with providing the service. A major stumbling block is customer acquisition costs i.e. costs associated with getting customers to subscribe to the line including product costs, marketing costs, etc. Moving away from the current system where AO is offered free of cost or at highly subsidized prices to farmers, to a system where farmers bear the full cost for using this service will be a challenging task. Previous research has shown that it might be extremely difficult to make the provision of local public goods "sustainable", emphasizing the importance of subsidized costs.[7] One solution is to provide AO to farmers with a higher willingness to pay, although this might create a "digital divide" since these farmers tend to be wealthier and more comfortable with new technologies. Thus, it appears that AO might still not be completely ready to succeed in a market setting, when offered to the average farmer.

[7] Michael Kremer and Edward Miguel (2012), "The Illusion of Sustainability", *The Quarterly Journal of Economics* 122(3)

THE EFFICACY AND FINANCIAL SUSTAINABILITY OF MOBILE PHONE-BASED AGRICULTURAL EXTENSION

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POLICY MOTIVATION/OVERVIEW

This policy brief describes lessons from a large-scale field experiment that has delivered mobile-phone-based agricultural information to cotton farmers in western India since 2011 (please see Box 1 for a detailed description).[1] According to a recent Indian national survey, just 5.7% of farmers report relying on information received from government extension programs.[2] Extensions based on information and communication technologies (ICTs) offer an exciting alternative model to low-outreach, in-person field programs, given that in-person programs are much more costly (by an order of magnitude) and are much more logistically challenged when information needs are time-sensitive and the contents require individual tailoring.

We find that, in rural western India, our mobile-phone-based service quickly becomes the primary source of agricultural information for farmers given access, and achieves a moderate impact on their behavior and productivity; we also find that the service, offered at no cost during our study, could not yet succeed as a market-based service, in which user fees cover the cost of service provision.

Mobile-based agricultural advice had important effects on farmer behaviour: 70% of serviced farmers switch to relying on our service for major agricultural decisions; in contrast, less than 1% of farmers from the control group report relying on any mobile-phone-based information. Serviced farmers spend less on harmful, banned pesticides and more on fertilizers, and experience moderate improvements in yield (3% in cotton and 20% in cumin, a major side crop). However, when we subsequently measure farmer willingness to pay for the service, we find that the average farmer is only willing to pay $2 for the service, although the cost of provision is close to $8 for a nine-month subscription. The service could be profitable if it only targeted farmers with higher willingness to pay, but these farmers tend to be wealthier and more comfortable with technology. Therefore, absent subsidies, the service may deepen the "digital divide."

The ICT-based service we study succeeds in winning deep trust of farmers, and exerts a meaningful influence on their practices. In this sense, an ICT-based information delivery model offers a sensible, low-cost alternative to more expensive traditional delivery programs, especially when the information requirements for recommended practices are time-sensitive, are individual-specific or, as in the case of pesticide use, carry important public health and environmental safety implications. Our findings do suggest that readily addressable informational inefficiencies cannot explain more than a moderate portion of the productivity gaps across countries.[3]

INTERVENTION

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[1] Shawn A. Cole and A. Nilesh Fernando (2012), "The Value of Advice: Evidence from Mobile Phone-Based Agricultural Extension" *Harvard Business School Working Paper 13-047*.

[2] Claire J. Glendenning, Suresh Babu and Kwadwo Asenso-Okyere (2010), "Review of Agricultural Extension in India: Are Farmers' Information Needs Being Met?" *IFPRI Discussion Paper 01048.*

[3] The productivity increase we find due to reducing informational barriers is on the order of 10%, whereas the yield difference between India and China, for example, is on the order of 200%. For background, see: Kelsey Jack (2013), "Constraints on the Adoption of Agricultural Technologies in Developing Countries." ATAI, J-PAL (MIT) and CEGA (UC Berkeley).

Our field intervention began in 2011 in collaboration with the Development Support Center (DSC), an agricultural NGO based in Gujarat State, India. Of the 1,200 cotton farming households sampled across 40 villages, 400 received mobile-phone-based information service via Avaaj Otalo (AO group). Another 400 received a traditional, in-person extension along with the AO service (AOE group). The remaining 400 served as the control group, and were precluded from access to AO.[4] The participants were on average 36 years old, owned 6.5 acres of land and earned US $288 per month.

Box 1. How does Avaaj Otalo work?

Avaaj Otalo (AO) uses an interactive voice response system (IVRS) to provide agricultural advice. The system can be accessed using a touch-tone system available on all mobile phones. The content is provided in local languages, friendly for illiterate farmers. The main features of AO are:

I. **Push Calls:** Farmers receive weekly agricultural advice based on local crop and weather conditions, with content developed by local agronomic experts.

II. **Pull Calls:** Farmers receive access to a toll-free helpline that provides a number of features to cater to the different information needs of farmers.
   a. *Q&A Forum*: record questions and respond to questions by other farmers
   b. *Announcements:* listen to older weekly agricultural messages
   c. *Radio archive*: listen to popular agriculture-based radio programs
   d. *Experience Sharing:* share relevant agricultural experiences with other farmers and listen to experiences of others
   e. *Personal Inbox*: review all messages recorded on the console, including responses

For more details, please refer to the website of our technology partner: www.awaaz.de.

POLICY IMPLICATIONS

I. **High demand for mobile phone-based information:** Eighty percent among those with access to AO called in to the AO line, making an average of 20.8 calls.[5] 70% of farmers reported switching to rely on AO information for major agricultural decisions from non-mobile-phone-based sources they had relied on previously. When asked about trust, the serviced farmers with access answered that they trust AO higher than their past experience or peers, compared to the control group farmers who reported to rely primarily on their past experience and peers in agricultural decision making. As for specific categories of information, the serviced farmers relied on AO mainly for information on weather (37%), pest identification (24%) and pest treatment (16%).

II. **Positive impact on agricultural practices:** We observed reduced expenditures on harmful and less effective pesticides (9%) and increased expenditures on more effective, recommended pesticides (3%), statistically significant only for one treatment subgroup. The index for pesticide management practices was 0.06 standard deviation units higher for the treatment group (but not statically significant).[6] The index for cotton fertilizer practices was 0.08 standard deviation units higher (statistically significant). If these trends

[4]No farmer was precluded from purchasing other commercially available ICT-based information service. As mentioned before, both the treatment and control farmers showed little demand for these other products.
[5] Average number of calls made is aggregated over the entire treatment sample (including those that did not call in to AO).
[6] The indices aggregate information over multiple outcomes for which we expect unidirectional treatment effects. Each index consists of the average of the z-scores for each component of the index, with the control group mean and standard deviation as reference. Standard impact evaluations use 0.1 standard deviation units as a benchmark for a successful positive impact.

continue, they alone could justify the scaling up of services like AO to wider regions, especially given the grave health and environmental implications of pesticide misuse.

III. **Improvement in yields:** We saw a moderate increase in average cotton yield of 20 kg/acre (3%), although this difference was not statistically significant. We also saw a marked increase in cumin yields, a risky but lucrative side crop that requires specialized knowledge to grow, with an average increase of 54 kg/acre (20%) among the serviced farmers (statistically significant).

IV. **Positive Effects on Peers and Peer Effects:** At the start of the intervention, we asked all farmers to list their top "information peers": other farmers with whom they are prone to exchange agricultural information. Peers of treatment farmers reported receiving information from the NGO running the service, and were more likely to plant cumin. We also measured spillovers on usage of the AO service among treated peers.

V. **Learning mechanism:** Answers that farmers gave to a series of agricultural knowledge questions we asked suggest that the general knowledge level of farmers did not increase with AO participation. Farmers seemed to map specific practices to specific problems and adopt practices on this basis, rather than via an improved understanding of the underlying scientific principles.[7] This suggests that effective information delivery should follow a bottom-up, question-bank type of model, rather than a top-down, infrequent educational-session type model.

VI. **Financial sustainability:** AO costs little, requiring approximately US$0.83 to service one farmer per month, inclusive of all airtime costs, staff time and technology fees. In contrast, a single round of traditional extension (educational demonstration by a government extension worker to a gathering of farmers) costs US$ 8.5 per farmer (based on extension provided to the AOE group). In our study, airtime was provided freely for farmers to encourage take-up (costing approximately US$0.31). If farmers paid airtime, the per-farmer operating cost of the AO service could be as low as US$0.52 per month. Costs could drop further as the service scales up, and pre-recording answers to common questions could also significantly reduce the time required of local experts to be spent on each question.

Figure 1 shows the downward sloping demand curve for the willingness-to-pay study conducted with the participating farmers. We find that the average willingness to pay for a nine-month long subscription to AO among study respondents is roughly Rs. 121 (US$2), not enough to cover the operating cost of servicing.[8] According to our calculations, it is possible to make the service profitable without subsidies by catering to only those with a higher willingness to pay. However, this might deepen the "digital divide" we already observe, since these respondents are usually less skeptical of new technologies and also wealthier.

VII. **Importance of face-to-face interaction in building trust:** Qualitative work reveals that initial face-to-face interaction is a key factor in encouraging take-up. DSC, our partner organization, has worked with farmers for many years in the field, helping to establish a baseline level of trust. In this study, we also used in-person usage training to engage with

[7] Ongoing research attempts to explore the relevance of different learning mechanisms in greater detail by providing respondents with two types of push calls: a "learning" version, which explains the scientific logic behind adopting a particular practice, and a "persuasion" version which simply provides recommended directions only.

[8] This 9-month subscription provides farmers with information for two crop cycles: the 'Kharif' season from July to November with information focusing on cotton, and the 'Rabi' season from November to February focusing on wheat and cumin crops.

the farmers at the initial stage, a factor we believe contributed to high adoption. In comparison, take-up has been low in other states where there were no initial face-to-face interactions (see Box 2). We are currently experimenting with different ways to engage with ICT users (by phone, in-person training or through local NGOs) to determine the most cost-effective way to encourage adoption of recommended practices.

Box 2. Replication and Scale-up of AO (Ongoing Research)

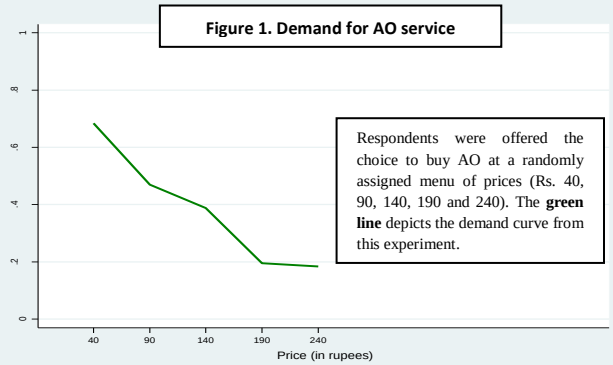
We are currently in the process of scaling up AO to provide extension to 3,000 cotton farming households in a neighboring state, Madhya Pradesh. In our study villages, farmers are organized into "learning groups" of 20-30 farmers each, with the proportion of farmers getting treatment varying across the groups. The design allows us to study spillover impacts. Furthermore, we are in the process of analyzing the precise mechanisms through which mobile-phone based information spreads decision to adopt recommended practices across social networks.

Our technology partner, Awaaz.de, has also rolled out a mobile phone-based extension service following the encouraging results from our previous research. Within a year, this service has enrolled over 15,000 farmers across Gujarat, India.

THE WAY FORWARD– Is AO Ready for Financial Success?

Our research demonstrates that mobile phone-based extension can cater to the dynamic informational needs of farmers in the presence of changing information requirements. The importance of timely information in the face of volatile weather patterns or unexpected pest attacks make services like AO extremely valuable given their adaptable nature and ability to provide regular follow-up. Mobile-phone-based extension is also a more cost-effective alternative to its traditional counterpart. Some of these services are being offered at very low costs, and these costs will drop further as the scale of the service increases. Our findings show that farmers are willing to pay for the service, with positive subsidies contributing to higher take-up. However, customer acquisition costs prove to be a major stumbling block. Moving away from a subsidized system to one where consumers participate in cost-sharing, or bear the entire cost of the service, will prove to be a challenging task. Thus, it is very likely that mobile phone-based extension, particularly AO, is still not completely ready to succeed on a commercial basis sold to low-income farmers.

Figure 1. Demand for AO service



Respondents were offered the choice to buy AO at a randomly assigned menu of prices (Rs. 40, 90, 140, 190 and 240). The **green line** depicts the demand curve from this experiment.

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Final round (Endline) of phone surveys completed:

The final round of phone surveys for the Avaaj Otalo (AO) study participants in Madhya Pradesh began in October 2014. The survey was split into two parts – each roughly 15 minutes long. The first part of the survey was designed to collect information on agricultural practices in Kharif 2013 and 2014 for key variables including agricultural inputs, yields, income and agricultural knowledge. Consistent with the first round of phone surveys, we also try to identify the main sources of agricultural information that farmers rely on to analyze the impact of AO. For the second part of the survey, we focus on understanding how AO has impacted information exchange through social networks. We also attempt to identify if AO information contributes to an increase in farmer knowledge. Finally, we collect feedback from farmers regarding their experience with AO to understand barriers to adoption as well as explore potential improvements for future scale-up.

The phone survey was administered to our entire study sample of 2893 farmers (1453 treatment, 1440 control). A respondent compensated 20 rupees in mobile top-up for each round of surveying. These surveys were conducted over a period of two months. We completed surveying in end-December 2014 (after 11 weeks). The table below provides a final status of the first round of phone surveys, by treatment group.

Status	**Treatment**	**Control**	**Total**
Completed	1201	1109	2310
Unresponsive	191	219	410
Refusals	87	62	149
Incomplete	9	9	18
Others	2	4	6
Total	**1453**	**1440**	**2893**

After the first round, we managed to survey roughly 80% of our entire sample. The second round of surveys was administered roughly three weeks after the respondent had completed the first round. The table below provides a final status of the second round of phone surveys, by treatment group.

Status	**Treatment**	**Control**	**Total**
Completed	1059	959	2018
Unresponsive	280	292	572
Refusals	145	115	260
Incomplete	21	16	37
Others	2	4	6
Total	**1453**	**1440**	**2893**

<u>Note:</u> Unresponsive numbers include all cases where the respondent does not answer the phone, the phone is switched off, the line is out of service or the number is incorrect. It also includes those respondents who are unavailable to take the survey at the time of attempting contact (after attempting to reach them a minimum of three times). We attempted to follow-up with these respondents with the help of our field partner, Action for Social Advancement (ASA). Village-level staff were compensated Rs. 10 in mobile top-up for each respondent they were able to track down. The table above categorizes respondents as 'unresponsive' if we were still unable to contact them after three rounds of follow-up by our field partners. 'Others' include reasons such as death, migration and ill health.

Summary of AO-2 Phone Survey Results – Impact Evaluation

'Avaaj Otalo' (AO), our mobile phone-based agricultural service, provided extension to 1453 cotton farmers in Madhya Pradesh from October 2013 to December 2014. Along with weekly agricultural advice calls designed to address local crop and weather conditions, farmers also had the option of using the toll-free hotline to call in and ask questions related to agriculture to be answered by a local agricultural expert, listen to responses to other questions given by the expert and also share their own experiences with other farmers. Information provided focused primarily on cotton in the Kharif season and wheat and gram in the Rabi season.[1]

As of December 2014, 15 months from the commencement of the service, roughly 66 percent of the treatment group had called in to the service, making an average of 4.3 calls (Table 2). These calls were on average roughly 11 minutes long. Additionally, roughly 26 percent of farmers called in to listen to older messages, and 16 percent responded to the weekly announcements. 12.5 percent of treated farmers recorded a question on the system, and this effect is even stronger for the farmers who underwent one-on-one training, with 18 percent of trained farmers asking questions. On an average, treated farmers listened to roughly 41 percent of the total outgoing call time. Together, this suggests that the extension service was used to quite a large degree by a considerable proportion of our treated group.

Preliminary analysis of the phone survey data reveals greater dependence on mobile phone-based information; 37.5% more treated farmers report using mobile phone-based advice as compared to the control group (Table 3).[2] Effect sizes vary across agricultural decision types, with the most impact observed on pesticide management (8%) and weather (7%). Across many decisions we also observe lower reliance on past experience (weather and soil management related decisions) and on input dealers (for pesticide and fertilizer related information). Table 4 and 5 reveal improvements in farmer input choices both in the case of pesticides and fertilizers. For instance, we see increased spending on imidachloropid, a commonly recommended pesticide (statistically significant for the trained group, increase of roughly 400 rupees). We also observe a 5 percent increase in the usage of tricoderma among the treated group, a traditional method highly recommended by local agricultural experts. Other than changes in farmer behavior, we also observe changes in agricultural learning as a result of the service.

We observe improvements in agricultural knowledge, particularly when we compare the treated group with the pure control group (where the learning group has no treated farmers). Using a knowledge index comprising of 5 agriculture-related questions posed to farmers during both rounds of surveying, we observe a statistically significant increase of 0.09 correct answers among the treated, and a slightly larger effect of 0.10 correct answers among the trained group (Table 7). Lastly, we examine heterogeneous effects of using the service across land, age and education. Table 8 reveals that treated farmers with above-median education tend to use the service for roughly 4 minutes longer. However, we do not observe any effects on the extensive margin i.e. more educated farmers do not necessarily call in to the AO line more often.

Future research will look into how AO affects information sharing through peer effects. We also plan on conducting a cost-effectiveness analysis of the service, to understand how information is absorbed and retained by farmers (learning v. persuasion) in greater detail and analyze feedback from our sample to better understand factors that can encourage further take-up and usage.

[1] Appendix Table 1 (A1) provides a breakdown of both push calls and questions asked by crop and topic. Over the course of the service, a total of 64 push calls were broadcasted, each roughly 3.5 minutes long. Please note that the categories are not mutually exclusive.

[2] The control group consists of 1440 cotton farmers spread across the same region in Madhya Pradesh, who received no access to the AO service (both incoming and outgoing)

M 9.1 Summary of Project Implementation

Our field intervention began in June 2013 in collaboration with Solidaridad Cotton Solution Network (SCSN) and their field partner Action for Social Advancement (ASA) in Madhya Pradesh, India. SCSN provided us with access to anonymized baseline data and contact information for roughly 3000 farmers across 4 different Production Units (PU)[1] and further divided at Learning Group (LG)[2] level within each PU.

Randomization was done first at Learning Group level, and then at the individual level. At the Learning Group level, LGs were divided into three groups; Group 1: LGs comprised of 100% treated farmers, Group 2: consisted of 50% treated and 50% control farmers and, Group 3 consisted of 100% control farmers. Our final sample included 2893 farmers.

The first round of phone surveys rolled out in September 2013. This phone survey was designed to collect information on agricultural practices in Kharif 2012 for key variables including agricultural inputs, yields, income and agricultural knowledge. Each survey took about 15-20 minutes to complete. The final round of phone surveys began in October 2014. The survey was split into two parts – each roughly 15 minutes long. The first part of the survey was designed to collect information on agricultural practices in Kharif 2013 and 2014 for key variables including agricultural inputs, yields, income and agricultural knowledge. The phone surveys were administered to our entire study sample of 2893 farmers (1453 treatment, 1440 control).

Following the first round of surveys, the AO service was rolled out to all treatment farmers in September 2013. For Kharif 2013, farmers received two weekly push calls ; the technical push call providing information on Cotton crop practices based on local crop and weather conditions and the BCI push call providing information on BCI minimum production criteria. Along with weekly agricultural advice calls designed to address local crop and weather conditions, farmers also had the option of using the toll-free hotline to call in and ask questions related to agriculture to be answered by a local agricultural expert, listen to responses to other questions given by the expert and also share their own experiences with other farmers. Information provided focused primarily on cotton in the Kharif season and wheat and gram in the Rabi season.

In order to familiarize users with the AO system and build initial trust, training was carried out over a period of two months in September-October 2013 Training was first provided to the staff members (Village Resource Persons) of our field partners. Following this, trainings at learning group level were conducted across the different LGs to cover all 1453 of our treatment farmers by trained staff.

Due to administrative delays in implementation of the service, we were able to roll out the service to all farmers only towards the end of Kharif season, missing out on capturing usage patterns during peak agricultural season for cotton farmers. Given that our sample included primary cotton farmers, we also saw low usage in the Rabi season. In view of this, we decided to provide half the treatment sample with 1-to-1 in–person AO training in May 2014 in order to sensitize them to the AO system and also encourage AO usage before the start of peak-Kharif season. At the end of the training farmers were also asked a short qualitative survey to ensure that they were able to understand the

[1] Rajpur (PU1), Thikri (PU2), Kasrawad (PU5) and Ojhar (PU6). These PUs are belongs to Khargone district of Madhya Pradesh State, India.

[2] A Learning Group (LG) consist of 1-20 farmers who meet about once a month with SCSN-ASA field staff in their village to learn and follow BCI guidelines.

information they are provided and identify any barriers that might prevent farmers from accessing the service.

Other than encouraging take-up and usage of the service, we are also keen to understand how farmers absorb and implement information received from AO. To this end, we carried out a 'Learning v Persuasion' exercise through January 2014 to identify whether learning or persuasion is the primary mechanism through which AO changes outcomes. Learning messages contained an intuitive explanation for the biological mechanism behind each input recommendation; Persuasion messages contained only the input recommendation without elaborating on the mechanism. Learning vs. persuasion treatments were administered to our treatment sample as part of the weekly broadcast message, with different groups of respondents receiving the same message. The purpose was to see to what extent agronomic information about why an input is recommended matter for adoption.

To complement our findings, we also carried out audit and qualitative studies to understand the situation in the field, by interacting with both agro-dealers (anonymously) and farmers. The audit study took place in Chotila and Sayla blocks of Surendranagar district of Gujarat State, India during November 2013. The purpose of this study was to identify the motivation and behaviour of agro-dealers while recommending inputs to farmers. For this round of audit studies, we observed 23 agro-dealers and had a total of 161 sit-in observations. Along with sit-in store observations, information on the inventory stored by these agro-dealers also has been collected. The qualitative study was conducted during November 2013. The purpose of this qualitative study is to evaluate the quality, promptness and effectiveness of information provided by our mobile-based agricultural helpline, *Avaaj Otalo (AO)*. We use a number of different data tools to gauge farmer feedback about AO including administrative data provided by the AO system which allows us to look at usage across the different features provided by AO and household survey data which includes feedback from respondents about the service. Additionally, 8 intensive focus group discussions were conducted with a smaller subset of farmers to facilitate a deeper understanding of user feedback about AO.

Finally, we stopped providing information at the end of Kharif 2014, with the last push call sent out on 15th December 2014. As a last step, we carried out the final endline survey, where we reached out to all farmers to collect information on agricultural practices, input usage, demographic information, etc. We also collected information on agricultural knowledge and feedback about AO usage. Phone survey data will be used along with the anonymized baseline data provided by our partner organization in order to evaluate the impact of the intervention on farmer outcomes, and allow us to better understand how to scale-up this service to even more farmers.

Timeline

Jun-July 2013	Initial baseline data received
August 2013	Randomization completed; AO software development
September 2013	Baseline Phone Survey Starts
September 2013	Intervention rolled out
September – October 2013	AO training of treatment farmers
November 2013	Audit/Qualitative Study
January 2014	Learning V. Persuasion Study
May 2014	1-on-1 Physical AO training
September 2014	Endline Phone Survey
December 2014	End of push calls

M 9.2 Next Steps Requires to Achieve Scale Up

While governments in developing countries spend considerably on traditional forms of agricultural extension, its implementation is hindered by numerous problems including bureaucracy, lack of accountability and the inefficiency of a one-size-fits-all model. Based on previous work, we've found high demand for mobile-phone based agricultural information among farmers in India, which provides farmers with timely, cost-effective and customized information (Cole and Fernando 2012). As the mobile phone industry continues to grow in India, it is becoming increasingly apparent that mobile-phone based extension is a viable and relatively inexpensive alternative to traditional sources of extension in India.

In order to scale up mobile phone-based extension across the country, our initial aim is to create a low-cost customized mobile phone-based agricultural advisory service that provides high-quality information, designed to optimize input and management practices. The end-goal of this service would be to increase agricultural output by 5-10% for as many as hundreds of millions of farmers, within ten years of implementation. The system is designed to encourage a two-way flow of information, with respondents receiving customized information compiled by agricultural experts based on local agronomic data gathered from remote sensors and soil samples, and also receiving information from farmers on a continuous basis which will allow it to further refine its prediction of best agricultural practices for a larger sample of farmers. The intended impact of this service is not only to improve agricultural productivity, but also improve livelihoods, reduce negative environmental impact by better input management and build a database with real-time access to farmer information.

We are currently assembling a team of experts to oversee the conceptualization and implementation process. Principal investigators include Michael Kremer (Harvard University), Shawn Cole (Harvard Business School), Daniel Bjorkegren (Brown University) and Raissa Fabregas (Harvard University) who have extensive experience in researching technology adoption and agricultural extension in developing countries. At the ground level, to optimize the execution process, we are also looking to hire a CEO to manage implementation and engage with potential partners, and also an agricultural expert who can provide regularly updated advice on best practices in agriculture in the implementation region. Finally, we are also looking to develop a software development team, which will be at the core of this service.

In order to achieve this scale up, our first step has been to identify potential partners (NGOs, contract farming organization, government partners, etc.), that will allow us to provide the service for free to a large number of farmers, helping us develop a database of active users. Initial partnership opportunities that we are currently exploring in India are with 'Farms n Farmers' which gives us the opportunity to provide end to end services to 100,000 farmers within 3 years, and also with 'Sajjata Sangh', a network of NGOs and Farmer Production Organizations (FPOs) that has access to a network of 25,000 farmers and has collaborated with us on a similar project before (Cole and Fernando 2012).

While philanthropic investment will fund the initial high costs of capital, the cost of transmitting information is expected to decline dramatically, as the reach of the mobile phone industry expands across the country. However, in order for this service to be successful beyond this initial stage, we need to look at other potential sources of revenue generation. To this end, we are looking at various alternatives such as potential advertising opportunities with input companies, collaborations with telecom companies, involvement of government organizations, international organizations, global technology firms like Facebook, Google, etc.