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)

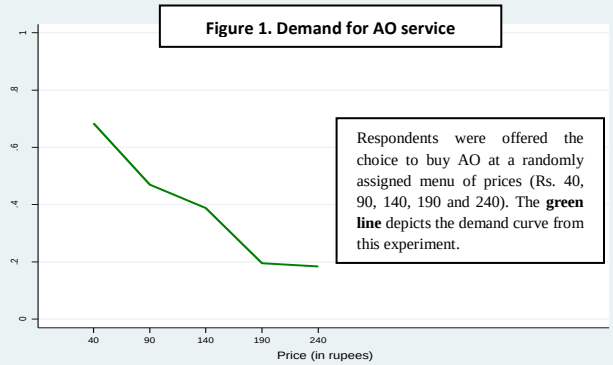
We are currently in the process of scaling up AO to provide extension to 3,000 cotton farming households in a neighboring state, Madhya Pradesh. In our study villages, farmers are organized into "learning groups" of 20-30 farmers each, with the proportion of farmers getting treatment varying across the 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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