DIGITAL TECHNOLOGIES FOR FINANCIAL INCLUSION OF SMALLHOLDER FARMERS

NEEDS ASSESSMENT IN THREE STATES OF INDIA

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Background

Financial instruments such as savings, loans, and insurance are critical tools in managing risk for smallholder farmers across the developing world. Although smallholder farmers are disproportionately affected by adverse events, they are the least likely to have access to formal loans, insurance, or bank accounts, leaving them less prepared to manage weather and disaster risk. As the effects of climate change intensify, building resilience—the ability to mitigate, cope, and recover from shocks and stresses without compromising future welfare—is essential for reducing rural poverty and improving food and nutrition security.

Digital technologies offer an opportunity to enhance financial inclusion and increase access to savings, credit, and insurance among smallholder farmers and the rural poor. Smartphone ownership, high-speed internet and the availability of high-resolution satellite imagery are rapidly expanding in developing countries. Combined with recent advances in computing, image processing, and data analytics, collecting and processing real-time, plot-level information on crop health and growth has become possible at low cost. This brings ample opportunities to improve financial inclusion among smallholder farmers. For instance, georeferenced data on farmers' fields allows for remote monitoring of weather and crop conditions, facilitating a rapid and automatic disbursement of index insurance payouts when extreme weather damages the crops.

Figure 1: Project locations

Formative findings also illustrate how smartphone images can improve upon satellite imagery for monitoring crop phenology and strengthen crop insurance (Hufkens *et al.*, 2019; Ceballos *et al.*, 2019). Existing crop loss verification mechanisms have limitations: indemnity insurance products suffer from high transaction costs and information asymmetries, whereas index-based products are prone to high basis risk and poor farmer engagement, perpetuating poor insurance coverage and take-up. Smartphone pictures, on the other hand, allow insurers to monitor crop conditions accurately and in near real-time, which can help overcome some of the weaknesses associated with index-based insurance while reducing the information asymmetries that have plagued indemnity insurance.

Leveraging recent advances in smartphone ownership and data collection, the “Seeing is Believing” project aims to deliver personalized agricultural advice and financial services to smallholder farmers across several sites in India. The project relies on a dedicated smartphone application with which farmers take pictures of their own fields (“eyes on the ground”) and uses visible crop characteristics to monitor crops. In 2018, the project won an award through the CGIAR Platform for Big Data in Agriculture Inspire Challenge to test alternative models for scaling: targeting a retail product for commercial crops in Haryana; bundling with credit in order to enable financial opportunities for smallholder farmers in Odisha; and integrating into an extension service that provides integrated pest management advisories through so-called plant doctors and plant clinics in Tamil Nadu and Pondicherry.

In this project note, we set out to explore important questions around this approach. Are these services perceived as providing real value compared to existing alternatives? To what extent are people interested and willing to engage in this model? Do farmers value the reduced basis risk for insurance, the improved access to credit, and the personalization of their advisories.

Haryana

In Haryana, the project has introduced Picture-Based Insurance (PBI), an insurance product providing coverage against individual crop damage as visible from smartphone pictures. The aim of PBI is to reduce basis risk as well as information asymmetries between farmers and the insurer, while improving product tangibility and trust through direct farmer engagement. To evaluate the sustainability and long-term socio-economic impacts of PBI, the International Initiative for Impact Evaluation (3ie) is funding a cluster randomized trial with 101 villages, offering insurance coverage over five production seasons in about 50 randomly selected villages.

At the start of the project, focus group discussions were held in six villages from two districts, followed by a baseline survey with 649 eligible tomato farmers across 72 study villages. The project focused on tomato farmers for four reasons: tomato cultivation can be highly profitable but requires a high investment; the national crop insurance scheme (Pradhan Mantri Fasal Bima Yojana or PMFBY) does not cover tomato production in Haryana; damage to tomatoes is easily visible from smartphone pictures; and tomato growers are often small and marginal farmers, aligning with IFPRI and 3ie’s pro-poor targeting goals.

Findings

Baseline data collection yielded several findings that helped to further shape the study design. First, we confirmed the assumption that tomato cultivation requires higher investments but is also prone to higher risk. Returns, at the same time, are low, potentially because tomato growing households are often landless and belong to scheduled castes: landless households face barriers accessing credit and insurance

and tomato growing households—especially women within these households—reported difficulties coping with crop losses. Providing insurance for tomatoes instead of staple crops such as wheat or rice can thus be pursued as a pro-poor targeting strategy. Finally, the data made more salient the need to assess potential impact heterogeneity in terms of whether a farmer grows tomatoes or staple crops.

Second, although the average farmer was willing to pay more for tomato insurance coverage than for wheat coverage, willingness-to-pay was low relative to commercial premium rates even for tomatoes (Figure 2). Furthermore, households with smaller landholdings—those for whom we would expect impacts to be largest—were willing to pay the least, potentially because of liquidity constraints. Although these findings point to PBI perhaps not being viable as a commercially-sustainable insurance product, one could consider providing premium subsidies for marginalized farmers as part of a social protection scheme. A relevant research question, then, is whether these premium subsidies have impacts beyond those of a conditional cash transfer. We will aim to address this question through the impact evaluation.

Third, the willingness-to-pay for insurance did not increase significantly when including advisories in the product description (Figure 2). Although this does not mean that farmers do not value the advisories, our findings suggest that demand for insurance would not improve by bundling with these additional services. In this sense, providing advisories remains a social interest activity to be pursued through public funding. For this, we will evaluate the impacts not only of insurance products as a stand-alone solution but also of insurance products when combined with the remote advisory services.

Figure 2: Willingness to pay

Source: Ceballos, Kannan and Kramer (2019).

Tamil Nadu and Pondicherry

In Tamil Nadu and Pondicherry, the project works in the context of Plantwise, a highly localized extension model developed by the Center for Agriculture and Biosciences International (CABI). The Plantwise program empowers qualified individuals as extension agents or Plant Doctors who provide in-person consultations to farmers during regular monthly or seasonal events known as Plant Clinics. Plant doctors provide accurate and reliable advisory services to farmers but are limited by their inability to reach farmers who either cannot visit clinics or require advice outside Plant Clinic dates. The Seeing is Believing project

has thus introduced picture-based advisories (PBA). Farmers can send pictures of their affected fields through a smartphone app. Plant doctors use these pictures, along with other submitted information and secondary weather information, pest and disease alerts, to provide farmers with remote real-time personalized advisories. This potentially improves their ability to reach more farmers at a lower cost and in a timely manner.

In preparation for the trial, we conducted focus group discussions with farmers, leaders of Farmer Producer Organizations (FPOs), plant doctors, and agronomy experts with two objectives: i) to understand the need for improved advisory services; and ii) to understand plant doctors' capacity to monitor and support the implementation needed to scale such a program. Focus groups were conducted in four districts in Tamil Nadu and one in the Union Territory of Pondicherry. At each of the five locations, a guided group discussion was conducted with plant doctors and agronomy experts to profile the Plant Doctor and Plant Clinic operations, to describe the village characteristics and activities, and to list the major crops and risks in the location. In two locations in Tamil Nadu, Plant Clinics were operated by the implementing organization together with FPOs. They provided services primarily for FPO members. In the remaining three locations, Plant Clinics were organized independently by the implementing organization through the Plant Doctors for all farmers in the village.

Findings

Focus group discussions revealed that in-person extension was highly effective in diagnosing and providing recommendations to farmers. Farmers could bring samples of affected crop and plant doctors could make use of portable devices to make an accurate diagnosis. Extensive in-person consultations at the clinic enabled Plant Doctors to provide recommendations that were appropriate given a farmer's current and past practices. However, on average only 10-15 farmers attended Plant Clinics, and Clinics were held infrequently, often not conducted as a routine activity but in response to farmer demand. In several cases, by the time the farmer visited the Plant Clinic, the pest or disease had affected a large portion of the field causing irreversible damage and Plant Doctors could only recommend preventive strategies for subsequent seasons. Moreover, Plant Clinics were focused heavily on pests and diseases and did not always provide advisories on management practices, weather forecasts, and technology adoption. Some farmers and Plant Doctors were therefore already informally communicating over popular messaging apps to obtain more real-time advice. PBA could provide a platform to formalize this communication and enable the provision of more accurate remote advisories.

In most villages, smartphone ownership was estimated to be between 20 and 60 percent, with nearly all farmers being able to access a smartphone in their household. This, together with an 87 percent literacy in Tamil Nadu, indicates that the potential for personalized remote advisories is high. The app should however have a user-friendly interface that makes it accessible to illiterate farmers as well. Tamil Nadu has less irrigation coverage and considerably higher risk of drought than other states in India. Other production risks identified by Plant Doctors and agronomy experts included irregular rainfall, high temperatures, pests, and diseases. They identified paddy—the dominant crop in the region—as being highly susceptible to all three risks. Although less widely cultivated, farmers particularly valued advisories for high risk, high return horticulture and floriculture crops such as banana, brinjal, gourds, and jasmine. Due to the high incidence of pests and diseases and the lack of coverage under the national crop insurance scheme in these crops, farmers also expressed interest in insurance that could cover idiosyncratic risks.

Plant Doctors were seen as promising intermediaries to assist with program implementation in a decentralized manner. As is typical of traditional public extension agents, the Plant Doctors were qualified or

highly experienced in agriculture and were either from nearby villages or had developed extensive rapport with local farmers through association. They could therefore ably assist in the marketing of the program.

Odisha

In Odisha, the Seeing is Believing project is partnering with Dvara E-Registry, a social enterprise that is developing a digital picture-based credit (PBC) model to expand access to credit for landless and marginalized farmers. In this model, financial institutions use georeferenced ground pictures of crops to monitor borrowers, facilitating the automatic and instant disbursement of credit when investments are due. Loans can be provided in combination with agricultural advisories to support farmers in their decision-making and enhance productivity, thereby improving farmers' ability to repay loans.

Relying on crop pictures in lieu of credit scores and in-person visits, PBC has the potential to reduce transaction costs associated with monitoring and can help address social gaps in access to collateral and availability of credit scores. At the same time, if social gaps in mobility and smartphone access prevent certain groups of people, for instance women smallholders and landless farmers, from sending in the crop images required to obtain PBC loans, this model could disempower already disadvantaged groups.

To review farmers' interest in this credit model and their ability to participate, we undertook a short screening survey and focus group discussions. The screening survey was conducted in 55 villages across 2 districts in Odisha. Focus group discussions with both men and women were conducted in 6 villages from Jajpur and Keonjhar districts.

Findings

From the survey, we found that 96% of the farmers did not have any outstanding loans from any formal institution. About the same percentage was interested in seeking credit for the main monsoon (Kharif) season. However, in the focus group discussions, most farmers reported not lacking access to credit for the Kharif season, given that most women were members of one or more microfinance groups through which they could borrow large sums of money. These loans could be repaid in weekly installments, providing more flexibility than agricultural loans that require a one-time repayment after harvest, which triggered fears around crop losses, low output prices, and a resulting inability to repay loans.

Focus group participants would also resort to the local moneylender, who lends at higher interest rates, but with the advantage that repayment durations may vary and may be done in multiple instalments. Another source of credit for many farmers in the focus group discussions was the local input dealer, with a farmer typically buying inputs using a down payment and smaller instalments over the course of the season. These borrowing arrangements—although informal and based on personal relationships and networking—seemed to work well for most farmers. Formal credit from banks and cooperatives was less common, which farmers attributed to corruption; specifically, they indicated that officials ask farmers to pay a bribe before processing their documents for formal loans.

Farmers appeared to be more interested in loans for the cultivation of crops such as vegetables and pulses during the winter (Rabi) season than for loans during the Kharif season. Growing crops during this season can be more expensive in terms of upfront investments given that it is the dry season and farmers need to invest in irrigation. At the same time, producing during this season can be more profitable, meaning that financial services that increase financing during Rabi can have potentially large benefits. They also appeared receptive to the idea of sending pictures to receive plot-specific advice, although this may not be a large enough incentive to send pictures for crop monitoring purposes.

Smartphone access remains a constraint to farmers' interest in digital credit products. While 50% of farmers in the screening survey reported having a smartphone in the family (either owned by them or by some other family member), only younger (and male) family members operated those, with other family members (and especially women) not knowing how to operate it. Moreover, younger household members with smartphones and women from landowning households rarely go to the fields, meaning that they would not be able to send in images for crop loan monitoring. Partly due to the above concerns, an alternative model, where an individual is identified in the village and tasked with sending in images for all the selected farmers in that village, is currently being tested.

A final constraint was found to be related to a heavy administrative trail and document requirements. In particular, the lending process needs to be as simple as possible, given that farmers already engage with informal lending sources and microfinance institutions that do not require as much screening and documentation. Digital products can fill in an important gap in this regard, highlighting an important area through which digitization of agriculture and financial services can help improve access to credit.

Conclusion

An increasing penetration of smartphones offers new opportunities to monitor crop phenology for small-holder farmers, using georeferenced smartphone pictures of a farmer's crops. Improved crop monitoring, in turn, can help strengthen agro-advisories and financial services such as insurance and credit. To assess the potential for scaling improved picture-based advisory, insurance, and credit services for small-holder farmers, we conducted a needs assessment in three states of India. This needs assessment provides a first answer to the viability of these different scaling approaches.

In Haryana, we found that tomato growers were disproportionately more often landless, suffered more risk, and had on average lower returns, suggesting that targeting these farmers is a more pro-poor targeting strategy than covering staples such as wheat and rice, and that there could be potential benefits for these farmers of interlinking insurance with personalized advisories on how to improve tomato yields. Willingness to pay for insurance offered either stand-alone or in combination with advisories remains low, indicating that a retail insurance program will likely be unsustainable, and that insurance for these farmers should be seen more as a social protection strategy.

In Tamil Nadu and Pondicherry, focus group discussions highlighted that personalized picture-based advisories could strengthen CABI's Plantwise program by providing Plant Doctors with a platform to reach more farmers than those who show up for Plant Clinics, and to provide timely advice during periods in which there are no Plant Clinics scheduled at a farmer's village. This could help focusing the advice on prevention strategies instead of cures. Given the lack of irrigation and the multiple production risks, farmers expressed strong interest not only in the personalized advisories but also in picture-based insurance products of the type offered in Haryana.

Finally, in Odisha, we found that farmers are not as credit-constrained as we initially assumed them to be, but lending is primarily conducted in informal ways. Interest in new credit products is primarily for high-risk, high-value crops grown during the winter season. Rigid application procedures, for instance due to a heavy paper trail, and side payments required from agricultural loan officers discourage borrowing. Digitizing the loan process could help strengthen the use of credit, but in doing so, key challenges around low smartphone ownership need to be overcome.

All in all, the use of smartphone images is perceived to add value compared to farmers' existing alternatives. Farmers value the reduced basis risk for insurance, the improved access to credit, and the personalization of their advisories, and with the right incentives, they are interested and willing to send in the images required for implementing this approach. Across all three states, interest is largest when targeting high-value crops with greater production risk. At the same time, access to smartphones is not universal in all three states and entails a constraint, particularly among more marginalized farmers who could potentially benefit from improved services the most.

The findings presented in this project note were based on surveys and focus groups prior to product implementation, and it is important to keep in mind that stated preferences do not necessarily result in actual take-up or impacts of the services. A future research priority will be to quantify the cost-effectiveness of these different modalities in improving smallholder farmers' productivity, profitability, and welfare.

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