SIAC Activity 1.2: Theme: Advancing Methodologies for Tracking the Uptake and Adoption of Natural Resource Management Technologies in Agriculture

Project Proposal

Title: Innovative use of mobile phone based applications in tracking adoption of Natural Resource Management Technologies in Indian Agriculture

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1. Background

As ICT technology has developed, adoption of mobile phones worldwide, including rural areas in India has advanced rapidly in recent years. With the increasing penetration of mobile networks and the explosion in handset numbers and subscribers, various mobile phone based agro advisory services have been initiated connecting farmers, extension and scientists in India (Mittal and Mehar, 2013). Automated decision tools that use mobile phones are being used as an effective mean to translate complex and multiple information streams into an effective data base. This kind of approach can be applied to collect information on adoption of technologies or even tracking impact. Such technologies have low deployment and administrative costs, flexibility to customize and are easy to learn and implement.

Thus, the objective of this study is to (1) develop an innovative mobile phone based data collection model; (2)To collect data on adoption and validate it with alternative methods; (3) to analyze the data collected and its validation by gender, land size and education level.

2. Research Design

a. Model proposed

In most of the CGIAR projects tracking adoption and documenting impact is an integral part of research. It is often done through household surveys which are extensive time consuming and costly. We propose to pilot the collection of information on adoption using mobile phones by developing a mobile phone based application interactive voice response system (IVRS) through which the targeted farmer groups will be contacted to collect adoption data. The piloting of this innovative model using mobile phones will help in testing a cost effective and less time consuming method of collecting farm/ household level data on adoption (or variables related with the adoption). This technology is better in terms of being cost effective and less time consuming, if there is a requirement of repeated data collection, it is most ideal if the cliental base is large (IpsosMinute, 2008)

A similar approach has been used to develop the Nutrient Manager for Rice (NMRice) where farmers provide information and data about their agriculture practices and land parameters, based on which fertilizer recommendations are generated as advisories to farmers specific to their farming conditions. CABI and Coffee board of India model CafeMovel is also based on IVRS technology.

The application will require limited literacy capability as it will enable farmers to respond in numbers to a voice interface that will be sequentially asking few questions to record the adoption of a particular technology. The proposed method is based on pull technology, is user friendly and literacy neural, as it is based on a number touch response system or technically called DTMF (Dual Tone Multi-Frequency) which is a global standard for audible tones and to navigate automated systems such as phone menus. Along with developing the application and the data logging system, this pilot project will also involve initial training of farmers on ways to use the application and to record the data. Lerer, Ward, and Amarasinghe (2010), showed that the validity and quality of data collected through IVRS can be improved by conducting a training schedule prior to the launch of the data collection system. Thus for this pilot we also require monitoring to assess if the farmers understand the process of data response. For this purpose it is proposed to use field scouts in project villages along with the research team to demonstrate the IVRS and responding techniques. We will have to make sure, it is demonstrated in a manner so as not to create bias in farmers' responses later when they actually respond to the survey through mobile phones.

b. Data and study location

A mobile phone based application will be innovatively applied to suit the requirement of collecting information on the adoption of various modern seed varieties and natural resource management technologies like the adoption of land laser leveller, Direct Seeding of Rice, residue management, diversification towards new crop like maize, legumes, zero tillage, nutrient recommendations etc. We will also test collecting data on new seed variety adoption, if new varieties were recently released in this location. We will focus on major crops like Wheat, Rice and Maize. IVR is a system that can be programmed to manage a variety of data collection and customer support needs. In research environment it is used to collect client's feedback. Usually one call is less than 5 minutes, the response is converted into data that gets transferred to data base worksheets automatically (IpsosMinute, 2008). Also the queries can be programmed logically so as to ensure consistency in the responses.

For the purpose of piloting it is proposed to test this method of collecting adoption information in selected villages of CCAFS benchmark locations in Karnal, Haryana covering around 600 or more households randomly selected from a larger data base of mobile phone numbers in this location which was collected as census surveys under CCAFS and that contains numbers of around 3000 households. This will be a 12 month study and thus will

allow us to capture information on uptake and adoption of natural resource conserving technologies for larger set of technologies used in rice wheat cropping system.

c. Benchmarking

Adoption is a dynamic process, although some estimates from the literature can be indicative of the adoption pathway, but there is no gold standard to test the reliability of this innovative model to collect data. Thus we propose three alternative methods that will be used to benchmark the adoption data collected though the mobile phones.

Model proposed- Collect adoption data on climate smart and natural resource management technologies through IVRS based surveys using mobile phones.

Alternative method 1: Expert Elicitation with extension agents, village heads, extension agents, scientists at Directorate of Wheat Research (DWR), Central Soil Salinity Research Institute (CSSRI) etc, Krishi Vigyan Kendra (KVK's), input dealers and custom hiring service providers will be undertaken to validate the results. For machine based technologies, custom hiring services are rendered through registered cooperatives and few large farmers. These service providers maintain a log of farmers, area services and time which can be used to benchmark the adoption of such technologies.

Alternative method 2: Baseline data of the CCAFS (2013) and CSISA (2011) projects, collect in the same location(s) can be used to give a benchmark number on adoption of these technologies by farm households.

Alternative Method 3: In a subset of the geography of the project, we can also test the validity by doing both the IVRS based data collection on adoption and conventional paper based short survey, where we would randomly assign the responding farmers to one of the tools.

3. Other Issues

a. Scalability and Generalization

Many mobile phone based data collection applications are already in use like e.g. Open data kit (ODK) which basically runs on Android phones (also in use in CSISA project), Nokia data gathering (NDG) which requires phones with QUERTY key pads, Epicollect that runs on androids and iPhones, data dyne working with Symbian based phones, and also openxdata that is workable with low end mobile models but not all (Brugger, 2011). But these have issues of scalability and generalization. Thus the IVRS technology proposed here will be able to collect data from users of all types of phone handsets and service providers thus increasing the reachability especially in rural environments where although the access to smart phones has increased it will still be a long way ahead until everyone has access to these high end phones.

The IVRS developed will also require minimum level of literacy as the survey instrument and questions developed will usually be answered in yes/ no or with codes, which will be registered in an operators log and the data will then be transferred to a datasheet. The system will be using local language for the survey which can be recorded in any language at a low cost. Further this approach can be expanded to large geographical areas at state and country level because of the high penetration level of mobile phones and the development of user friendly mobile applications in local languages.

The application will be neutral to any of the agricultural or natural resource management technologies and practices. The set of survey questions and the question sequence can be easily adapted on any technology and its adoption and can be customized in the system. Overall, the application developed to test this technology will be made simple enough so that it can be easily customized as per the location to the extent possible, and also to reduce the add-on costs of using this technology to other geographies. Cloud solutions/ applications are available to remotely host IVRS application, allowing different locations to be connected through one/ the same infrastructure.

If such a model can be demonstrated successfully then it will have great value in various other projects of CGIAR and NARS. In the conventional scenario, the enumerators have to deal with issues of time, travel cost, literacy, language, ethnicity etc. and projects face the issue of financial constraints. Thus many projects are not even able to do a follow up on adoption or monitoring and evaluation studies. There are also issues of bias in collecting information, or interpreting information from the enumerators point. We would expect several projects to adopt this technology for collecting their data as it is cost effective, quick to get the information and it limits the data collection bias due to involvement of enumerators.

b. Risk

The outcome of this innovative data collection model is to successfully test the validity of the method through which adoption numbers are generated. The application itself is limited by the fact that only short surveys can be conducted at one point of time. The prerequisite to make this data collection possible is that a data base of mobile phone numbers exists. If such a data base is not available this can lead to a delay in implementing this method. This can be resolved by splitting surveys and conducting the IVRS at different points of time. Also mobile number database can be compiled from various censuses and surveys conducted by different organizations in those geographies, if access is provided.

There is a risk on validity of the data collected through IVRS if the farmers are not able to understand the purpose of this survey and disconnect the phone, if the voice quality is poor due to poor network, or poor voice recording quality, or because the farmer is in a location where they can't hear the voice properly. These are hurdles, which can lead to either incomplete surveys or wrong understanding of questions and thus wrong responses. This can be mitigated, by letting farmers know about this method of data collection a priori. They are

used to respond to paper surveys, thus awareness on the new survey method will have to be created through the training module or project meetings or focus group discussions. For improving the voice quality, efforts will have to be made to record the survey content in local language and in good quality machines and studios. If the voice reachability is poor then the interview should be stopped and rescheduled at some other time. Technically logics have to be created within the system to recognize such voice issues.

There can be the risk of poor mobile network or change in government regulatory framework in making such calls to collect data. On the availability of a mobile network as such not much can be done, but it will be an issue only in highly remote locations. On government regulation; we might need authorizations from farmers to conduct such surveys and also would have to work with regulatory authorizes, which might not be always possible, but in CCAFS project we could cross one such hurdle as farmers number were registered not to receive the bulk messages. We worked out with Telecom Regulatory of India (TRAI) to get the permission after getting authorizations from farmers.

c. Selection Bias

The reviewers raised the issue of selection bias in use of application and thus issue of generalization to a larger survey population. They also pointed out that there might be an issue of correlation between adoption of NRM practices and the application. The issue of self-selection bias usually exists when technologies are demonstrated and farmers have to make decision on adopting it or not. Here we are not proposing a technology to be adopted by farmer but we are only proposing method to collect adoption data. The bias may arise if the mobile number of farmer is not available in the larger datasets, thus excluding him/ her from the survey process itself. Also unlike many other smart phone based applications where selection bias is high due to farmer's limited access to smart phones, internet, education, download ability of application on phone etc. Contrary to this, the proposed method is based on pull technology as explained earlier and in this technology we are initiating the call to farmer and thus the issue of self-selection bias reduces as the costs of getting the responses through the application is not on the farmer. Thus, even the likelihood of correlation between the actual adoptions of technologies with the use of application is very limited. A farmer contacted through IVRS might not have adopted a NRM technology but can still respond to this data collection method. There might be some bias, due to limited understanding of the way of responding through mobile phone which may lead to underestimation of adoption. But we plan to mitigate this by doing small demonstrations and farmer trainings to respond appropriately to this IVRS system. Bias may also arise when we take this tool to a level where farmers themselves start feeding in the data about their adoption to the IVRS system by dialing in and thus if the farmers are not adopters of these technologies then they might not even dial in to report adoption leading to self-selection bias. But that is not proposed in this project.

4. Links to larger projects

This project will have close linkages with the ongoing CIMMYT ICT based research in the CGIAR Research Project on Climate Change, Agriculture and Food Security (CCAFS). In the CCAFS project in the location of Karnal, Haryana there is an ongoing activity of disseminating information about climate smart technologies and conservation agriculture technologies using voice messages. These voice messages are used as intervention to make farmers aware about climate smart technologies and also to improve their adoption of these climate smart technologies. In the CCAFS project also a baseline survey was conducted in 2013 which covered 12 villages of Karnal district (approx. 600 HH's). Of these four villages are CCAFS benchmark sites or treatment villages and eight are control villages. In the treatment villages, the project technology dissemination is also undertaken through demonstration plots, experimental fields, visiting seminars, farmer's training etc. The proposed pilot can use these locations to collect adoption data adoption data on climate smart technologies like Zero Tillage, Land Laser Leveller, residue management etc. The baseline data also contain socio economic details of farmers, knowledge and awareness about the climate smart technologies and a database of mobile phone numbers of households. These information will be important to initiate this innovative model of collecting technology adoption data. CCAFS project baseline data will give us the base figures on the current level of adoption of various resource conserving technologies and mobile numbers of households will be used as inputs into this pilot.

This innovative model can also be used as one of the ways to collect data on adoption in the proposed Strengthening Impact Assessment in CGIAR' (SIAC) project on "the diffusion of adoption of improved varieties of major CGIAR mandated crops in South, Southeast and East Asia using expert elicitation method and available data". Under this project as well this IVRS model can be tested to supplement the expert elicitation and gather information from farmers which is actually not planned because of the huge costs required in such data collection if it done physically through household surveys.

Timeline: 12 Months

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