Testing the Local Enumerator Approach for Agricultural Data Collection

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ABSTRACT

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Technology adoption is widely regarded as critical to agricultural development. However, survey based data on technology adoption is costly to collect. This research is an attempt to lower this cost by using locally based enumerators and tablets. The hypothesis this research tests is that the 'local enumerator approach' will reduce costs while maintaining data quality. This hypothesis is tested by comparing adoption data collected through the local enumerator approach with that collected through a conventional survey in India. Means comparison tests indicate statistically significant differences in adoption estimates derived from the two approaches. Regression analysis, controlling for village fixed effects, covariates and enumerator fixed effects, is used to identify adoption measurement differences between the local and the conventional enumerator approaches. However, none of these analytical approaches are able to eliminate all the differences in adoption estimates, implying significant differences in data quality generated by these two approaches. The study design however was not able to control several potential confounding factors, such as enumerator training method, differences in questionnaire design, and data collection application tools that may have influenced data quality. Although costs are found to be comparable between the two approaches, over the long run, there is potential for costs of local enumerator approach to decrease relative to the conventional approach because of cost efficiencies. However, more effort is needed to ensure data quality before this approach can be considered a cost-effective and a reliable method of data collection in developing countries.

ACKNOWLEDGEMENTS

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ABBREVIATIONS

CAPI   Computer Assisted Personal Interviews

CEA   Conventional Enumerator Approach

CIMMYT   International Maize and Wheat Improvement Center

DSR   Direct seeded rice

GoI   Government of India

ICRISAT   The International Crops Research Center for Semi-Arid Tropics

IECC   Intra-enumerator correlation coefficient

LEA   Local Enumerator Approach

SRS   Simple Random Sampling

ZT   Zero till

1. INTRODUCTION

1.1 Motivation

Despite increasing urbanization, agriculture still has an important role to play in poverty alleviation and economic development. Seventy percent of the world's poor live in rural areas and are mostly dependent on agriculture for their livelihoods (World Bank 2015a). Likewise 70% of the population in countries classified by the World Bank as Low Income live in rural areas, indicating the limited extent of structural transformation in these countries (World Bank 2015b). Increasing agricultural productivity is key to both poverty alleviation and economic development.

Improved agricultural technology is critically important for increasing agricultural productivity. Transferring improved technologies to farmers in developing countries has long been a priority of governments and international organizations alike. However, farmers may not adopt a technology targeted to them for a variety of reasons which are well-documented in the literature (see for example Jack 2013; Feder & Umali 1993). To accelerate dissemination of improved technologies, governments and organizations need to track adoption and better understand reasons for farmers' adoption decisions.

However data on adoption of agricultural technologies in developing countries is limited and often out of date. Adoption studies are often based on micro surveys which are not nationally representative and cross sectional data which does not show the dynamics of adoption over time (Doss, 2006 & Feder & Umali, 1993). Attempts to measure adoption on larger scale and with lower cost have often been based on aggregation of expert estimations of adoption for the

location and crops within their focus geographies (Walker and Alwang 2015). For obvious reasons this approach is likely to lead to imprecise measurement.

Data collected directly from a representative sample of farmers is considered to be more accurate than data expert solicitation. Some type of farmer-level data requires more frequent collection to reduce recall bias, such as seasonal data related to area, production or transactional data including prices. Additionally, for tracking and monitoring, adoption and other data needs to be collected on a regular basis to be able to be used for timely policy decision-making.

The primary constraint to collecting data from the farmers, and doing so more frequently (or on a regular basis), is the cost of collecting that data. A reduction in the cost of collecting data implies a proportionate increase in the amount of data that can be collected within a fixed budget. This research tests a model that aims to reduce data collection costs - at least in the long-run - thereby potentially increasing the frequency of data collection.

1.2. The Local Enumerator Approach

The integration of communication and digital technologies such as mobile phones and tablets in conventional surveys can potentially reduce survey costs, speed up collection time and improve data quality (Caeyers et al., 2012). However even with these technologies there are costs that could potentially be eliminated. This is because the conventional enumerator approach usually depends on enumerators hired from urban areas who, after training, are sent individually or in small teams from village to village in a sampling area. Transportation costs, labor and per diem

therefore must be paid both to get enumerators to and from survey areas as well as between enumeration clusters within survey areas.

The approach tested through this research is to utilize local enumerators who live or are based in or near agricultural communities to complete interviews of farmers in their communities. With the local enumerator approach, data is collected by local enumerators using a tablet or smartphone and uploaded to a database through the internet. Once trained, these local enumerators could be available to carry out a range of agricultural data collection assignments for different data users. The local enumerator service could be managed by a domestic firm or organization and depending on the demand, could expand over time. This research tests three different practical applications of this envisioned local enumerator approach in India.

Advantages

The proposed research attempts to verify the effectiveness of the local enumerator approach (LEA) in measuring agricultural adoption. To be effective, the approach should yield comparable results to a conventional enumerator approach (CEA) at lower costs. The lower cost will likely be a result of eliminating enumerator transport and per diem costs. Additionally, implementation speed could be faster due to reduced time needed for reoccurring training and transport.

In addition to potential cost savings there are potential methodological advantages associated with the LEA. For one, the LEA makes it easier to carry out multiple rounds of data collection. McKenzie (2012) shows that when autocorrelation is low, power can be gained by carrying out multiple post-treatment measurements. Chao et al. (2012) find that revisits - that is returning to the business or household if the primary respondent is not available – have significant effects in

reducing bias and mean squared error of sample estimates. Revisiting respondents will obviously be easier for local enumerators than enumerators typically hired under the conventional approach. Finally, there may be some questions for which local enumerators can solicit more accurate responses based on their trustworthiness or local knowledge. An example is a local agricultural practice that outsiders may have difficulty explaining.

Disadvantages

There are also potential disadvantages that need to be taken into consideration. In general, they imply potentially lower quality data resulting from the local enumerator approach. These relate to the quality of enumerators the LEA is able to attract, lack of supervision during data collection, and the sampling method used to identify the respondents. It is not certain that the caliber of enumerators available in rural communities is as high as those typically available in cities from where survey firms typically draw enumerators in the conventional approach. Additionally, the LEA is more decentralized than the CEA and therefore quality assurance may be more challenging. Also, in the LEA the last tiers of sample selection (e.g., villages and farmers within the villages) need to be made by the enumerator, and it is possible that the sampling may be based more on convenience than on the principles of randomness. This research attempts to address these potential disadvantages and how it affects the quality of the data collected.

Another potential disadvantage of LEA is that for some types of questions respondents are less likely to be forthright with a community member (if the enumerator 'local') than with a stranger (as is likely with the conventional approach). An example is agricultural income. Finally, there is the issue of enumerator attrition having a stronger effect on the sample then in the case of a

mobile enumerator based survey. This is because with a conventional survey, if an enumerator drops out, other enumerators can be used to cover the households of the missing enumerator. Local enumerators however are responsible for a fixed local area and may have other work or domestic responsibilities that prohibit them from travelling elsewhere.

Sampling differences

The theoretical difference between statistical precision or power between the CEA and the LEA is unclear. This research utilized a two-stage cluster design with villages as clusters. In that case the difference in statistical power is a function of the number of clusters with more clusters leading to more statistical power. For the CEA, the number of clusters given a fixed budget is a function of adding an additional cluster which includes transport, additional wages and lodging. For the LEA, the number of clusters is likely a function of the cost of training additional LEs as local enumerators are by definition limited in the radius in which they can enumerate. Therefore, sampling differences depend on differences in cost structures between the two approaches that incentivize different survey design decisions.

Overview of research and objectives

This research attempts to verify the effectiveness of the LEA in measuring agricultural adoption. As mentioned, to be effective the LEA should yield comparable results to a CEA at lower costs. Therefore, this research tests whether or not indicators measured through the LEA are statistically indistinguishable from those measured through the CEA and compares the costs of the two survey methods. It also looks at whether measured differences are practically different in magnitude. Then it looks for differences in enumerators' characteristics across the LEA and CEA enumerators to see if that may explain measurement differences.

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Three variations of the local enumerator approach are evaluated. These variations are based on the interpretations of the model by three different implementing partners. The three partners were awarded funding to implement their version of the local enumerator approach based on their responses to a solicitation specifying basic parameters of our vision of the local enumerator approach. Therefore this research does not strictly evaluate the LEA as conceptualized and described above. Instead, by way of comparison to a conventional survey, this research assesses the effectiveness of the conception and implementation of the three different versions of the LEA in India.

The three different implementers of the LEA conduct studies of adoption of technologies in five different districts in India. Each implementer surveyed between 600 and 800 farmers per district in two districts. In Andhra Pradesh in Southern India, one implementer conducted surveys of water-conserving groundnut technologies in two districts. In Haryana and Punjab in Northern India, another implementer conducted surveys of wheat farming system technologies. Finally, in Haryana and Bihar in Northern India, a third LEA implementer conducted two surveys on also on wheat farming technologies. The CEA implementer conducted five surveys on adoption of the same populations in the same districts using similar sample sizes.

The analysis compares adoption measurement for each LEA with results measured by the CEA for the same population. After identifying statistically significant differences in means for adoption and adoption covariates between the different samples, village fixed effects and adoption covariates are used to account for unobservable village level differences that may affect

adoption estimate differences. Following this, enumerator fixed effects along with adoption covariates are used to attempt to explain the remaining differences in adoption estimates. Additional steps taken include a comparison of missing values across implementers as well as regressing enumerator characteristics on adoption outcomes and missing values to identify enumerator characteristics potentially responsible for differences between groups. Finally, cost comparisons are made based on actual survey costs for the four survey implementers.

Layout of paper

This introduction is followed by a relatively brief literature review that covers literature on three related topics: the local enumerator approach, computer assisted personal interviews (CAPI) and measurement error. The discussion of the literature on measurement error is subdivided into three parts: sources of measurement error, regression implications of measurement error and examples of measurement error related development research. Chapter three contains a description of the four implementers (3 LEA and 1 CEA) and the approaches they used to their surveys including sampling. It also describes the technologies whose adoption is evaluated here. Chapter 4 lays out the research framework, overviews methodologies, and provides a description of data and sampling to evaluate the local enumerator approach. Chapter 5 presents the results of the analysis. The final chapter discusses these results and draws conclusions.

2. LITERATURE REVIEW

2.1 Local enumerators

Using enumerators who live within the same area as respondents is not new. National census surveys, including in India and the US, have been carried out by local or community enumerators (Smith et al. 2007 & Royce 1986). In India, these local enumerators are often teachers who conduct interviews outside of their regular work time (GOI 2011a). In the 2011 census, enumerators had three weeks to interview between 125 and 150 households. Supervisors were responsible for five to six enumerators (GOI 2011b). Researchers have also used local enumerators. For example, Udry's research (1991) on credit in Northern Nigeria involved enumerators who lived in study villages over the one year study period and conducted monthly interviews under supervision from the author. Sitati et al. (2005) trained rural community members to act as enumerators for locals reporting crop raids by elephants. A health study in Tanzania utilized past project data collected from local teachers and health workers (Dotchin et al. 2008).

In addition to censuses and research designs, development projects have utilized local enumerators. The Community Managed Sustainable Agriculture Project, a government run project in Andhra Pradesh, India, reaches one million farmers in 11,000 villages. The program provides "community professionals" with information on sustainable agricultural practices to disseminate in their communities. Community professionals also collect data via cell phone on the effectiveness of the programs they are implementing (World Bank 2013). The Community Knowledge Worker (CKW) program, implemented in Uganda by the Grameen Foundation, trains CKWs to assist farmers in their community through information they receive via their

mobile phones. To make the program fiscally sustainable when program funding ends, CKWs

are trained to offer data collection services for other development organizations. However,

demand for this service is not yet clear (USAID 2011; private discussion 2014). Finally, FAO

and an NGO have set up a mobile-based drought early warning system in northern Uganda. To

provide timely data, the system depends on monthly data sent via mobile phone that is collected

by parish chiefs (WB 2013). A key difference between these three examples and the local

enumerator approach proposed here is that the local workers in the three examples above are not

paid exclusively to collect data.

While not always explicit, the motivations for using local enumerators vary across these cases.

For national censuses, using local enumerators is more logistically feasible than sending a team

of enumerators around the country. In northern Nigeria, Udry (1991) was concerned about

systematic non-sampling error introduced by the event-like nature of an interview with an

outsider. In the case of the Sitati et al (2005) research, the use of local enumerators was

imperative to be able to record observations as shortly as possible after they occurred,

presumably resulting in more accurate data. Likewise, the drought early warning system depends

on the timely data provided by local enumerators. Local enumerators also are advantageous for

panel data collection involving multiple enumerator visits. They also allow for easier revisits if

the targeted respondent is not initially available.

2.2 Mobile phone or tablet based data collection

Caeyers et al. (2012) compare results from interviews conducted by pen and paper (also referred

as PAPI—pen and paper based interviews) with computer assisted personal interviews (CAPI),

particularly for measuring household consumption. They look at both data errors as well as sample size reduction resulting from irreconcilable missing values. They do this by randomly assigning households to be interviewed either through pen and paper or through smartphone. The authors compare the number of data entry errors between the two methods and find that errors resulting in missing values are nearly eliminated through the electronic survey. A significant portion of this is because of the validation checks that can be built into CAPI. They find that CAPI reduced both the mean and variance of consumption estimates. They also find a negative effect of enumerator experience and education on survey errors and that this effect is smaller for the smartphone or tablet based survey. The implication of this finding is that for smartphone or tablet based surveys, the importance of the experience of the enumerator is reduced. This intuitive finding bodes well for the LEA.

Nevertheless, the importance of training should not be underestimated. For mobile phone and tablet data collection, training costs may need to be even higher given that the technology itself must be learned (E-agriculture, 2012). Training costs are also higher where more complex data collection applications and phone technologies are used (WB, 2013).

Several other lessons can be drawn from reviewing the experiences of others who have used mobile phone based data collection in developing countries. One is that the claimed advantages of cost savings and data integrity appear to be real. Cost savings come through reduced data cleaning cost because of better data integrity (USAID 2012). Data integrity can be improved through in digital questionnaires with skip logic as well as by the ability to reduce data fabrication through time stamps, geo-tagging and pictures (E-agriculture 2012). While these

technical approaches to reduce fabrication can be effective, it is also important to compensate enumerators well including giving bonuses for complete and accurate data submission (WB 2013).

2.3 Measurement error

There is a growing body of literature on measurement issues in agricultural and other surveys in developing countries. Increasingly, researchers are aware that methodological choices in survey design have significant effects on research results. Researchers are detecting and quantifying these methodological measurement-related issues and their implications through randomized experiments similar to the one we propose here (McKenzie and Rosenzweig 2012). This chapter briefly reviews several of the most relevant ones to our research topic. However, before proceeding to describe these studies, the chapter discusses the sources of measurement error and their implications for regression analysis.

Note that this research focuses primarily on measurement error or non-sampling errors. Sampling errors are any difference between the population N and the sample n. To correct for sampling error in complex surveys where simple random sampling has not been used such as cluster sampling, survey weights are needed and indeed are employed throughout this research (Brogan 2005).

Sources of measurement error

Three sources of non-random measurement error are relevant to this research: the questionnaire, the interviewer and the interviewee (Kasprzyk 2006 & SPO 2001). Note that data entry errors are expected to be minimized through the use of tablet based data collection (Caeyers et al. 2012).

The questionnaire can lead to several types of errors. This source of error is relevant to this research as each implementer used similar but not exactly the same questionnaire. One type of problem is specification problems, where concepts are not well defined and therefore ambiguous.

A closely related class of problems is wording problems, where confusing words may cause misunderstanding on the part of the enumerator and the respondent. The length of the questionnaire can also cause measurement error as respondents lose focus resulting in less accurate responses over time. Similarly, question order can affect measurement error. Not only does this affect the time from the start of the questionnaire to the question, it also influences how much contextual information precedes a question. Question order also affects assimilation, which is the likelihood that a respondent's answer to a question is similar to a response to a previous similar question. Response options can also introduce bias as categories chosen by questionnaire designers may omit important responses or the order of the categories influence which option respondents select (Kasprzyk 2006).

Interviewers play a key role in data quality. This may be through their skill in following accurately the logic and intent of the questionnaire as well as their ability to elicit and record accurate information from the respondent by both making them comfortable and not influencing their response. However, little is known about the characteristics associated with a good enumerator. To some extent, enumerator effects can be reduced through training and supervision as well as questionnaire design and used of CAPI, as discussed above (Kasprzyk 2006).

The intra-enumerator correlation coefficient (IECC) is a measure that can be used to assess enumerator effects. This is defined as the ratio of the variance of an enumerator to that of all enumerators for the same variable. This ratio is typically around 0.02. An intuitive but important implication of the IECC is that fewer enumerators per survey increases the effect of an individual enumerator's IECC on the precision of the entire sample. The reduction in precision is non-linear, increasing more rapidly as enumerator interview counts increase (Kasprzyk, 2006). This implies a possible theoretical advantage for the local enumerator approach where enumerators are responsible for fewer clusters and potentially fewer respondents.

Respondents also affect measurement error. There are two ways that are especially relevant to this research. Longer recall periods may introduce error as memory fades over time affecting the accuracy of, for example, responses to questions about a previous year. Another respondent source of measurement error is if the respondent is not the person in the household who knows the most about the topic they are being asked about (SPO 2001). For example, if respondent is not the head of the household, they may be less informed on the details of farm management. This research controls for this potential contributor to measurement error.

Measurement error and the regression model

Measurement error in the right-hand side variable can be represented as follows for the ordinary least squared (OLS) model satisfying the standard assumptions.

$$y = \beta x^* + \mu \tag{1}$$

Where x^* represents x measured with error ε

$$x = x^* + \varepsilon \tag{2}$$

Where ε is not correlated with x or μ. Hausman (2001) shows that this measurement error in the right-hand side variable x usually results in a downward bias of the estimator β. The extent of the bias then depends on the ratio of the variance of the measurement error ε to the variance of the true indicator x. When this ratio is higher, the bias of estimator β is higher. Hausman (2001) cites empirical research showing downward bias most commonly in the range of 25 to 33 percent.

Hausman (2001) also shows that measurement error in the left-hand side variable y of an OLS regression does not introduce bias as the measurement error is accounted for by the error term μ. However, the variance of the error term μ does increase, resulting in larger standard errors. The implication is that a larger sample is needed to get the same precision when there is measurement error in the left-hand side variable. The effect of mismeasurement of both right and left hand variables is generally the same as their individual effects discussed above so long as the two errors are uncorrelated with each other (Hausman 2001).

In the case of binary left hand side variables for probit and logit models, measurement error or rather misclassification of binary variables can lead to biased and inconsistent estimators. However, maximum likelihood estimation provides consistent estimators so long as the combined probability of recording a 1 when the true value should be 0 plus the probability of recording a 0 when the true value should be 1 is less than 1 (Hausman 2001).

Measurement error and development research

The design proposed here is similar to that used by Caeyers et al. (2012) to compare results from interviews conducted by pen and paper with computer assisted personal interviewing (CAPI). They do this by running their study alongside an already-planned conventional survey and randomly selecting additional households from the same enumerator areas. To isolate the effects of consistency checks – which is believed to be a critical feature of CAPI – the researchers randomly assigned CAPI respondents to two groups: a) full CAPI that includes consistency checks; and b) restricted CAPI that excludes consistency checks.   The same enumerator team within an enumerator cluster conducted all three types of interviews. However, the interviews were scheduled to reduce time and interviewer clustering.

The authors first look at data errors that result in missing values and consequently sample size reduction. These data errors include routing errors and unlikely or impossible data entries. They regress enumerator characteristics – years of schooling and experience with both PAPI and CAPI – on number of data errors. As discussed above, the authors find that the effects of enumerator education and experience are significant with PAPI but with CAPI these effects disappear. The implication is that enumerator experience and competency are less relevant with CAPI because of the internal consistency checks and skips/routing features (Caeyers et al. 2012).

The authors used several models in their analysis. One was to regress a count variable defined as the number of problematic variables on dummy variables indicating assignment to the three groups. They expand this model to include household characteristics that the authors hypothesized would influence measurement error. Finally, the authors run the same model but replace household characteristics with enumerator characteristics. They confirm that their

analysis was robust to characteristics of the respondent, the interview, the interviewer and the

location – the latter two through interviewer and cluster fixed effects (Caeyers et al. 2012).

The authors look for classical measurement error in the explanatory variable (consumption) by

testing for attenuation bias. To detect attenuation bias, they regress the log of consumption, the

log of consumption interacted with a CAPI dummy, and a CAPI dummy alone on several

schooling related dependent variables. They find the coefficient for consumption alone is smaller

and statistically insignificant compared to consumption interacted with CAPI. The authors take

this as evidence of attenuation bias and therefore classical measurement error in the PAPI

version of the survey (Caeyers et al. 2012).

Carletto et al. (2011) look to determine the impact of measurement error on the inverse land size

hypothesis (the hypothesis is that smaller farms are more productive than larger ones). The

authors use national data from Uganda, including land measurements done by GPS and by

farmer estimate. They first provide means comparisons at the plot and household levels. They

then use econometric analysis to examine a) the predictors of discrepancy in measurement and b)

what impact that discrepancy has on estimating the inverse land size hypothesis. The authors

then test the former by regressing the difference between the two estimates on a vector of

variables they suspected influenced the farmers' ability to estimate their land size including

topography. For b) they run regressions using both land measurements and compare results using

a Wald test. One of their key findings is that significant bias results from respondent rounding

(approximating responses to a round number). They also find that the bias is inversely

proportionate to the size of the land holding. It is not clear if this can be generalized to mean that survey measurement error is more serious with smaller estimates.

In a subsequent study, Carletto et al. (2013) expand the analysis to four African countries. Through means tests they find that farmer estimates are over-estimated for small land parcels and under estimated for large land holdings. Their econometric specification to estimate the predictors of bias differs from their previous study in that they add an indicator for GPS-measured land area to control for bias of land area measurement. They also further expand the model to include dummies to represent rounding.

Statistical and practical significance

Statistical hypothesis testing such as student t tests (used here) predominates in sciences and social sciences. However, researchers caution against the overreliance on such statistical tests and perhaps more importantly, the conflation of statistical and practical significance. Statistical significance tests indicate whether or not a difference exists but say nothing about its magnitude. For both policy and science, whether or not a difference or causal relationship exists is less important than its magnitude (Ziliak and McCloskey 2008). For example, the difference between an agricultural technology adoption rates of 0.17 and 0.24 may be statistically significant but unlikely to be viewed as practically significant. That is to say, those two different adoption estimates should not elicit different policy responses. In such cases, it is not obvious how much more cost more precision is worth.

While using local enumerators is not new, the idea proposed here to have a permanent infrastructure of professional local enumerators appears to be novel. However, measurement

error resulting in practical and not only statistically significant differences may undermine this approach. This may originate from the questionnaire, the numerator or the interviewee and can introduce bias into regression estimations. Combining the local enumerator approach with tablet-based data collection can be expected to reduce the effect of enumerator based measurement error through logic checks and validations. This should thereby mitigate potential differences in enumerator quality between local and conventional enumerators and thereby reduce data quality differences between the two approaches.

3. APPROACHES EVALUATED

This section details the three enumeration approaches motivated based on the concept of the LEA approach, and one conventional approach, which is used as a comparison group. The conventional approach, as defined here, is that enumerators are hired from outside the survey area and sent around the survey area to conduct interviews during the survey period without returning home. By contrast, local enumerators are recruited from within or nearby the survey area and are able to return home every day.

The three variations of the local enumerator approach were developed independently by three implementers in response to a solicitation issued by researchers at Michigan State University (MSU) laying out the basic parameters of the local enumerator approach. The fourth model, which is used as the comparison group was developed in response to a solicitation by the researchers at MSU for a conventional survey. Table 1 below shows the geographic scope of the surveys conducted and the focus technologies by each survey firm. The surveys focused on five 2districts in India—two southern districts (Anantapur and Kurnool) where groundnut is an important crop, and three northern districts (Karnal, Ludhiana and Vaishali) with wheat-based cropping system.   In this chapter we describe the technologies included in this study for the wheat based and groundnut based farming systems. We then describe the four implementers selected for this study, their approaches, and sampling strategies.

Table 1: Implementers, districts and cropping system studied

District	Region (State)	LEA 1	LEA 2	LEA 3	Comparison
Anantapur	Southern (Andhra Pradesh)	Groundnuts			Groundnuts
Kurnool	Southern (Andhra Pradesh)	Groundnuts			Groundnuts
Karnal	Northern (Haryana)		Wheat based	Wheat based	Wheat based
Ludhiana	Northern (Punjab)		Wheat based		Wheat based
Vaishali	Northern (Bihar)			Wheat based	Wheat based

3.1 Agricultural technologies studied

Wheat based farming system: Technologies promoted through Climate-Smart Village Program

South Asia is particularly vulnerable to climate change and climate variability because of its

dense population. The Indian states of Haryana, Punjab and Bihar are located in Northern India

on the Indo-Gangetic Plains where 15% of the world's wheat is produced. Agriculture

predominates in these three states with about a 71% net sown area, compared to 43% throughout

India. However, water scarcity and soil fertility loss have led to declining yields. Increasingly

volatile and unpredictable weather also pose problems for agriculture. As temperatures rise, these

problems are expected to worsen (CCAFS 2014).

The Consultative Group on International Agricultural Research (CGIAR) Research Program on

Climate Change, Agriculture and Food Security and the International Maize and Wheat

Improvement Center (CIMMYT) has tried to address these challenges through the Climate-

Smart Village Program. This program customizes a package of technologies to the needs of a

village to achieve water conserving, soil conserving, energy conserving, weather risk

management and greenhouse gas reduction objectives. These packages are designed in

conjunction with researchers, farmer cooperatives, the private sector and local government

leaders. Technologies and practices promoted include zero tillage, direct seeding for rice, laser

land levelling, alternate wetting and drying for rice, residue management, index-based crop

insurance, ICT-based weather information and agronomic advice, and precision nutrient management. For this research, we investigated the adoption of three of these technologies: zero till, laser land levelling and direct seeded rice practices (CCAFS 2014). The goal was to estimate the adoption of these three technologies for the three districts (Karnal, Ludhiana and Vaishali) where they have been promoted by national and international research organizations.

Groundnut-based farming systems

Andhra Pradesh is a semi-arid region in southern India with a population that is heavily dependent on agriculture. The state was previously predominantly rice producing but the last several decades have seen a transition to cash crops including groundnuts. Water scarcity presents a significant constraint. The International Crops Research Center for Semi-Arid Tropics (ICRISAT) has worked in Andhra Pradesh since 1972. ICRISAT's work in groundnuts in Andhra Pradesh includes introducing a new drought tolerant variety of groundnut, integrated pest management, and sustainable natural resource management, especially water conservation.

The groundnut technology adoption survey in the two districts in Andhra Pradesh (Anantapur and Kurnool) measures the adoption of 12 groundnut related technologies and natural resource management practices promoted in the past by ICRISAT and other national partners. These are listed and described briefly below:
- **Soil Bunds** –Within the farm field to collect water runoff and prevent soil erosion.
- **Field/Boundary Bunds** - Border of the farm land to collect water runoff and prevent soil erosion.
- **Broad Bed and Furrow** – System to provide both drainage and standing water

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- **Land Leveling** – Reduces slope and conserves water

- **Contour Bunds** - Soil bunds used on sloped lands

- **Polythene Mulching** - Used polythene covers for water conservation

- **Nala Plugs/RFDs** - Dam constructed for save the soil during the rainy season

- **Sunken Pits** – Pits dug to retain water

- **Farm Ponds** – For harvesting rainwater

- **Masonry Check Dams** - Constructed control the water flow and erosion

- **Well Recharge Pits** - For rain water harvesting and saving

- **Penning Sheep/Goat/Cattle** – For compost

3.2 Survey implementers

The local enumerator approach was tested through local survey implementers in India. Implementers were identified through a request for proposal issued by MSU that invited responders to propose their own version of the local enumerator approach that was described in the RFP. The proposals received were evaluated on the criteria of innovativeness, rigor, cost effectiveness, and potential for continuation beyond this pilot. Three survey firms were selected based on these criteria, each with a slightly different version of the local enumerator approach. As per the RFP, each implementer proposed to conduct the surveys in two districts based on their experience in carrying out surveys in the past (Table 1). In addition to these three local enumerators, a fourth survey firm was selected to implement the conventional survey in all the five districts. Data from this survey is used for comparison. This fourth survey firm was selected based on a separate expression of interest solicited by MSU.

Table 2 summarizes the main differences between the approaches used by the three LEA

implementers as well as the one CEA implementer.

Table 2: Summary of differences between survey implementation models

	Firms selected for the pilot study			Firm selected for comparison survey
	LEA 1	LEA 2	LEA 3	CEA
Questionnaire	Designed by LEA Implementer 1 with input from ICRISAT and MSU	Designed by LEA Implementer 2 with input from CIMMYT and MSU	Designed by LEA Implementer 3 with input from CIMMYT and MSU	Designed by MSU with input from ICRISAT and CIMMYT
Enumeration software	Custom android-based app	Custom android-based app	Custom android-based app	SurveyBe
Enumeration hardware	Tablet	Tablet	Tablet and smartphone	Laptop
Sampling method	Three-stage cluster random sampling	Three-stage cluster random sampling	Two-stage cluster random sampling	Two-stage cluster random sampling
Sample size per district (number of households)	800	600	800	800
Sample selection:	Stage 1 (Blocks) and 2 (villages based on PPS): By LEA Implementer 1 Stage 3 (10 households/village): By enumerators	Stages 1 (all Blocks) and 2 (villages based on PPS): By LEA Implementer 2 Stage 3 (10 households/village): By enumerators	Stage 1 (100 villages): By LEA Implementer 3 Stage 2 (8 households/village): By enumerators	Stage 1 (80 villages based on PPS): By MSU Stage 2 (10 households/village): By enumerators
Enumerator recruitment	Local CSO employees	District level agricultural colleges	Local market researchers	Organization's contacts (previous survey participants)
Enumerator training	One per district; conducted by LEA Implementer 1; MSU student present as observer	One per district; conducted by LEA Implementer 2; MSU student present as observer	One per district; conducted by LEA Implementer 3; MSU student present as observer	One per district; conducted by the CEA Implementer; MSU student present for technical support
Survey management/ oversight	By CSO	Survey management at district level; data checked by supervisor	By phone	CEA Implementer staff, mostly by phone; 1-2 initial field visits with MSU student (only in northern districts)

LEA Implementer 1

LEA Implementer 1 is a subsidiary of an international economic consulting firm based in Washington DC. LEA Implementer 1 has offices in Delhi and Chennai and provides a range of services including survey design and implementation, data analysis and economic modelling. LEA Implementer 1 conducted the survey of adoption of groundnut-related technologies in Anantapur and Kurnool districts of Andhra Pradesh.

Their local enumerator model proposed was to use two local civil society organizations (CSOs) – one in each district – as the source of enumerators. These CSOs do not work directly in agriculture and enumerators mostly have backgrounds in health and the environment.[1] Unlike other implementers, LEA Implementer 1 enumerators were compensated through their regular salary received through their CSO employer. In the early stages of the survey, CSO management accompanied enumerators in conducting surveys. They also provided data quality control oversight. All the surveys were conducted in local languages and recorded for verification as part of the CAPI software developed by LEA Implementer 1.

LEA Implementer 2

LEA Implementer 2 is a consulting firm based in Delhi that specializes in agricultural development. They carryout qualitative and quantitative research, impact evaluation, project implementation, and extension education and training. Like LEA Implementer 3, their survey looked at farmer adoption of laser land levelling, zero-tillage practices and direct seeded rice

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[1] Note that because of their regular work in the communities in which they surveyed, Implementer 1 enumerators reported knowing nearly 27% percent of respondents.

technologies introduced through the CSVP program in two northern districts of Karnal and Ludhiana.

LEA Implementer 2's approach was to use students from the local agricultural universities, including those who they had worked with before. These enumerators were not from the communities they surveyed and only 0.5% knew the respondents they interviewed. But rather than send a team of enumerators to one village after another, the enumerators were based locally and responsible for interviewing respondents in their nearby area. Data collected by LEA Implementer 2's enumerators were submitted to a supervisor for approval before final submission to LEA Implementer 2 home office.

LEA Implementer 3

LEA Implementer 3 is a consulting firm based in Delhi that provides market research and business advisory services to a range of sectors including agri-business, food processing, infrastructure, logistics, green energy and rural management. LEA Implementer 3 conducted the adoption surveys for three technologies related to the CSVP program: laser land levelling, zero-tillage practices and direct seeded rice. Their survey took place in Karnal and Vaishali districts. LEA Implementer 3's proposed initial approach was to recruit enumerators who were hired from a pool of Community Service Center (CSC) providers. The CSC program is a new initiative of the Government of India (GoI) to make local government provision of services more efficient by outsourcing them to community based private service providers. However, most of the CSC enumerators recruited for this study dropped out because they did not view remuneration as matching the required level of effort by them. LEA Implementer 3 replaced these enumerators with local youth who had experience or education in agriculture. However, data quality was low

and the pace of work was slow on account of rice sowing season. Finally, these were replaced by

market research experts from the area. LEA Implementer 3 communicated directly with

enumerators during the survey to address implementation issues. The two failed attempts at

recruiting appropriate local enumerators point to one of the challenges of the approach.

Comparison

The CEA Implementer is a not-for-profit organization which undertakes surveys, analytical and

socio-economic impact evaluations. The CEA Implementer carried out surveys in each of the

five districts in which the three local enumerator approach implementers conducted their

surveys. The CEA Implementer responded to a solicitation for a conventional survey and

conducted the survey mostly following the same survey implementation model they usually

follow. Enumerators included some who were hired from the district in which the survey was

being carried out as well as from outside the district. Only in Bihar did the CEA Implementer use

some enumerators it had worked with previously. One person from the CEA Implementer was

assigned to provide management support to all the surveys.

CAPI tools

All three local enumerator survey implementers developed their own custom android survey

applications through different third party software developers. Implementers were aware of off

the shelf data collection applications but preferred to develop their own applications. Application

development costs in India are extremely low and implementers may have viewed having their

own survey application as market advantage. Additionally, one implementer reported having had

a bad experience with plot level data collection with an off the shelf data collection application.

These applications were developed for tablets which were purchased by each of the three

implementers through the project award funding. The surveys they conducted for this research were their first use of these applications and therefore implementers reported some issues during the implementation of the surveys (for e.g. skip logic and GPS location ID), which will likely be resolved in future surveys.

The CEA Implementer used laptops for data collection, and the off-the-shelf survey program *Surveybe.* The laptops were rented and only the rental cost were included in their budget. Unlike the three pilot study firms, they had prior experience in using the CAPI approach and were familiar with the *SurveyBe* program.

4. FRAMEWORK, METHODOLOGY AND DATA

4.1 Framework and Methodology

This research seeks to test the local enumerator (LE) approach by testing the three different versions of the approach described earlier. The hypothesis is that the LE approach will produce adoption estimates within the margin of error of a conventional survey, but at lower costs, and thus will be more cost effective. This research empirically tests this hypothesis. The empirical tests involve means comparison (balancing tests) of two main adoption outcome variables controlling for the village and enumerator fixed effects, and some covariates. These tests are based on three pairs of data points, each comparing the local enumerator approach with the conventional survey.

Note that while the research tests for statistically significant differences between adoption measurements, it also distinguishes between statistically and practically significant measurement differences. Therefore while using a p-value significance level of 0.05 allows for five percent of comparisons to be different by chance, a larger percentage are expected to be statistically different but practically comparable. That is, while the two approaches may yield statistically significant differences, some of these differences are likely to be close enough so as not to warrant different policy responses.

Because of this limited sample size in evaluating the LEA (n = 3), claims about the approach itself are made with caution. Note that this research is only able to make tentative claims about which approach generated better quality data. In this study, the CEA data is not viewed as the "gold standard"; rather it is the comparison group. In other words, the data collected through the

CEA is the counterfactual - the default approach conventionally used to conduct representative surveys for tracking technology adoption.

In a given district, the sample of farmers selected for data collection by the LEA implementers and the CEA implementer is randomly drawn from the same population. Thus, this research posits that any differences between the LEA and CEA implementer are likely to be due to four factors: sampling differences, enumerator quality differences, questionnaire and data collection application differences and survey management differences.

Sampling differences between the two survey approaches may result from the difference in cost structures and lead to differences in the precision (variance) of estimates. The LEA is based on one enumerator per cluster and therefore eliminates inter cluster costs. For the CEA, there are inter cluster costs if the number of clusters exceeds the number of enumerators. Inter-cluster costs comprise of labor for an enumerator and perhaps a driver, per diem and lodging for each, as well as vehicle rental and fuel. Inter-cluster costs imply increased interview costs as the ratio of respondents to clusters decreases. On the other hand, because enumerators are not as mobile in the LEA approach there may be more enumerators and therefore more enumerator fixed costs such as training or data collection technology costs. These differences in cost structures could create incentives for differences in sample designs between the two approaches. In our research, to some extent, sampling differences are controlled through sample weights, village fixed effects and farmer covariates.[2]

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[2] In the absence of household lists there also might be selection bias differences if local and conventional differ systematically in how rigorously they follow within village random walk sampling techniques. This cannot be controlled for during analysis.

In addition to sampling, data quality is likely to be affected by enumerator's ability, experience and skills set, which may differ between the LEA and CEA. It is likely that enumerators recruited from the urban areas (as would be the case for CEA) will be characteristically different from enumerators based in rural areas (as would be the case for LEA). This research tests the effects of enumerators on differences in adoption measurement through the inclusion of enumerator fixed effects. It also examines differences in the background between LEA and CEA enumerators, and whether or not these differences account for any differences in the observed adoption outcomes between the LEA and CEA. This allows the research to overcome the limitation of a small LEA and CEA implementer sample size and to determine theoretically whether or not the local enumerator approach should result in lower data quality if on average local enumerators are of lower caliber.

Local enumerator implementers had discretion in how they designed questionnaires so long as they collected the minimum required data. This means that the questionnaires used to collect data were not the same for local enumerator implementers and the comparison group. Differences include question wording, skip logic and question location within questionnaire. Because these differences are perfectly correlated with the implementer, we are not able to control for them in this research. Additionally, data collection applications and technologies differed between local enumerator and comparison groups which again could not be controlled for in this research. Questionnaires from each implementer can be found in the Annex.

This research also does not explicitly the effects of different survey management practices. These may have an effect on data quality control by incentivizing or enforcing better enumerator performance, or by detecting and effectively addressing potential problems in data collection. Likewise, it does not explicitly test differences in the data collection applications (i.e., the CAPI program and tool) though each enumerator used a different one. Because the sample size of implementers is small (n=3), attribution is difficult, especially given the multi-dimensionality of management practices. However, if, after accounting for sample and enumerator differences there remain statistically significant differences in adoption outcomes, they can implicitly be attributed to differences in implementation practices, including differences in the applications. See Table 2 for a summary of implementation differences across the four implementers.

4.2 Data

The surveys were conducted by the four implementers at the end of the rainy season from September to December, 2015. All the data, including technology adoption correspond to the same season and timeframe across the pairs of implementers that implemented the survey within a given district. Quantitative data were collected at both the household and plot level.

Table 3: Technologies and adoption outcome variables included in the comparative analysis by implementers

Technology	Adoption variables		Implementers			
	Percentage of adopter households	Acres of land under adoption per household	LEA 1	LEA 2	LEA 3	CEA
Wheat based farming system technologies						
Laser land leveler	X	X		X	X	X
Zero tillage	X	X		X	X	X
Direct seeded rice	X	X		X	X	X
Groundnut based farming system technologies \a						
Soil bunds	X	X	X			X
Field/boundary bunds	X	X	X			X
Broad bed and furrow	X	X	X			X
Land leveling	X	X	X			X
Contour bunds	X	X	X			X
Polythene mulching	X	X	X			X
Farm ponds	X	X	X			X
Masonry check dams	X	X	X			X
Well recharge pits	X	X	X			X
Penning livestock	X	X	X			X

\a Two technologies -- Nala plugs/RFDs and sunken pits are excluded because adoption rates were less than 1%.

Household level data are used to estimate two measures of adoption for the comparative analysis: 1) indicator of whether a household is an adopter or non-adopter of a given technology; and 2) total area per household under a given technology or a practice. For both these indicators, adoption refers to the previous or current season (depending on the type of technology and the season in which the focused crop was grown). The list of technologies for which these two adoption variables are calculated and used in the comparative analysis as the key outcome variables are listed in Table 3 by implementers.

Given the fact that each implementer designed their own questionnaire (with some feedback from MSU and the CGIAR centers), there is no one-to-one correspondence between the datasets across the four implementers. However, Table 4 lists the variables for which the data collected across implementers are comparable. These variables are used as covariates in the treatment effects estimation models to control for differences in the characteristics of sample across implementers included.

Table 4: List of variables common across the four implementer datasets

Respondent is head of household
Age of head of household
Gender of head of household (1= male)
Education of head of household
LEA Implementer 2/CEA Implementer – Years
LEA Implementer 3 – Categorical
LEA Implementer 1 – Literacy (y/n)
Annual income (1 = <200,000 Rs per hh)
Number of people in household
Distance to input dealer (km)
Household level land owned (acres)
Used credit for agriculture (past year)
Used crop insurance (past year)

4.3 Sample size

For the CEA Implementer surveys, MSU was responsible for determining the sample size and the sampling method. We used a confidence level of 95% and a precision of 5%, to determine the minimum sample size using a simple random sampling (SRS) method. The estimated sample size using SRS was 384 households.[3] However, SRS was not feasible logistically and so a cluster

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[3] This is based on the following standard formula for calculating sample size $N = t^2 * p(1-p) / m^2$, where t is confidence level at 95% (standard value of 1.96), p is estimated parameter value in the project area (50% assumed in this case, which is the most conservative value), and m is the level of precision (assumed 5%).

random sampling method was used. This required adjusting SRS for the cluster design effect.[4]

Using an estimated .12 intra cluster correlation coefficient for adoption and a cluster size of 10 households, the design effect was estimated to be 2.08 which when multiplied by 384 yields the sample size of 800 per district. This information was shared with the LEA implementers, which nudged them to increase their initially proposed sample size which was 400 households per district.

Table 5 shows for each district the sample size by implementers, which ranges from 600 households for LEA Implementer 2 conducted surveys to 800 households for all other surveys. The lower sample size for LEA Implementer 2 implies a higher confidence interval of the estimates derived from their sample survey relative to other sample surveys. The sampling method used by each survey firm is described below.

Table 5: Sample size by implementer and district

District	LEA Implementer 1	LEA Implementer 3	LEA Implementer 2	CEA (comparison)
Anantapur	Groundnuts (800)			Groundnuts (800)
Kurnool	Groundnuts (800)			Groundnuts (800)
Karnal		Wheat based (800)	Wheat based (600)	Wheat based (800)
Ludhiana			Wheat based (600)	Wheat based (800)
Vaishali		Wheat based (800)		Wheat based (800)

4.4 Sampling method

The sample selection for the three LEA implementers was done independently by each implementer. LEA Implementer 1 sampled eight hundred households from within Anantapur and

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[4] The main components of the design effect are the intra-cluster correlation, and the cluster sample sizes. The design effect (DEFF) is calculated as: DEFF = 1 + d (n – 1), where, d is the intra-cluster correlation for the statistic in question, and n is the average size of the cluster.

Kurnool districts. The plan was to select 80 villages from each district and sample 10 households per village. In Anantapur, 41 out of 63 mandals were purposively selected that accounted for 90% of groundnut area in the district. In Kurnool, 22 out of 53 mandals were selected which accounted for 95% of groundnut area sown. This implies that the adoption data are representative of only 90% and 95% of groundnut growing area in these two districts, respectively. For these purposively selected mandals, a two stage cluster sampling method was used. In stage one, the number of villages to be selected from each Mandal was determined based on the probability proportional to size (PPS) method, where size was defined as the area planted to groundnut in each village. To select the determined number of villages, Mandals were divided into quarters geographically and an equal number of villages were selected from each quadrant with villages spaced at least 5 kilometers apart. Within each village, enumerators were instructed to use a random walk technique to select farmer households. This involved identifying the village center and then proceeding to interview households at fixed intervals from the center in different directions.

LEA Implementer 2 followed a two-stage cluster random sampling method to select 60 villages across all the blocks in each district. In the first stage, the selection of villages was based on the probability proportionate to size (PPS) method, where the number of villages in each block were determined based on the share of wheat area in the total wheat area planted in the district. Urban areas and villages less than 50 households were excluded from the selection list. In the second stage, 10 households per selected village were identified randomly by the enumerators based on a list of households obtained from the village chief.

LEA Implementer 3 sampled 800 households within Karnal and Vaishali districts using a two-stage cluster random sampling method. In the first stage, one hundred villages were selected randomly from a list of all the wheat growing villages in the district. In the second stage, within each village, eight farming households were randomly selected from the village's electoral rolls.

For the comparison surveys, a two-stage cluster random sampling method was used in all 5 districts. In each district a list of all the villages was compiled by MSU based on the last census (2010). For sample selection purpose, the few villages where wheat (in Karnal, Ludhiana and Vaishali) or groundnut (in Anatapur and Kurnool) were not identified as one of the top three most important crops were excluded. In the case of Anantapur and Kurnool, only the villages from the mandals selected for the LEA Implementer 1 surveys were included to make the sampling frame comparable to LEA Implementer 1's. In stage 1, 80 villages were randomly selected by MSU from the list of villages using the PPS method where size was defined as the net sown area (to all the crops) in the village. Within each village, enumerators were responsible for sampling the households as randomly as possible. Enumerators were instructed to purposively visit households in different sections of the village and randomly select 10 households to represent a cross section of village demographics.

In order to make the sample estimates from these surveys representative of the population, it is necessary to multiply the data by a sampling weight, or an expansion factor. The sample weights for each household were calculated as the inverse of its probability of selection (calculated by multiplying the probability at each sampling stage). Note that due to problems of village names in the Vaishali data file not matching the list of village level information provided by LEA

Implementer 3 to calculate the sample weights, we were not able to calculate the sample weights for the LEA Implementer 3 data from Vaishali. This district is thus excluded from the analysis presented in this paper.

4.5 Costs

Total costs are the total contract amount awarded to each implementer. For the CEA Implementer, this includes the costs of MSU researchers who were involved in designing and managing the survey. On the other hand, the three local enumerator implementers received minimal assistance in survey design and management. Costs are broken down into five categories based on actual and not budgeted costs:

- Researchers cost – The costs of MSU researchers' time.
- Professional fees - Includes costs of management and supervision as well as overheads charged by each implementer.
- Training and survey implementation costs – The costs of training enumerators, payments made to enumerators as well as their travel costs.
- Technology – This includes the cost of application development and tablet purchase. For the CEA Implementer, this is rental of enumeration software and laptops.
- Other costs – Indirect costs and taxes

5. RESULTS

5.1 Comparison of descriptive statistics

This section begins with a comparison of descriptive statistics across the three pairs of LEA and CEA implementers across the districts. For LEA Implementer 1, the comparison is for the pooled data across two districts – Anantapur and Kurnool; for LEA Implementer 2, the comparison is for the pooled data across two districts – Karnal and Ludhiana; and for LEA Implementer 3, the comparison is for only one district – Karnal.

Household characteristics and adoption estimates

Table 6 below shows the weighted mean values for some of the household characteristics for which comparable data were collected across the four implementer surveys. Similarly, Table 7 presents the comparison between the LEA and CEA survey implementers of weighted mean values of the two adoption variables for the technologies focused in this study. Note that in all tables, standard errors are in parenthesis. The main purpose of this mean comparison is to see if the two samples - drawn from the same population but using different approaches - are similar or different based on key adoption variables and covariates. As these results indicate, the two approaches have yielded samples of household that are significantly different across all three implementer approaches. The mean estimates differ significantly at $p < 0.05$ for over half the covariates used for this stud. For LEA Implementer 2 the number of unbalanced covariates is the highest with seven out of ten not matching. Notably large differences include distance to inputs for LEA Implementer 1 and credit use for LEA Implementer 2.

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Table 6: Comparison of household characteristics between the three pairs of LEA and CEA approaches

	LEA 1	CEA	Difference	LEA 2	CEA	Difference	LEA 3	CEA	Difference
Demographics									
N	1,631	1,518	3,149	1,188	1,540	2,728	785	729	1,514
Age of HH Head	47.38	42.79	4.59*	47.84	49.37	-1.52*	48.98	45.65	3.31*
	(.68)	(.45)	(1.14)	(.49)	(.33)	(.72)	(.57)	(.46)	(1.11)
HHH Education	.59	.65	-.06	7.93	8.49	-.56*	2.36	2.43	-.08
	(.06)	(.02)	(.09)	(.17)	(.09)	(.27)	(.05)	(.03)	(.07)
Respondent is HHH	.86	.93	-.06	.80	.73	-0.07	.81	.90	-.10*
	(.05)	(.01)	(0.06)	(.02)	(.14)	(0.04)	(.02)	(.01)	(.02)
HH size	5.60	4.65	.95*	6.07	5.78	0.29	6.77	6.23	0.53*
	(.15)	(.07)	(.21)	(.10)	(.07)	(0.16)	(.15)	(.13)	(.22)
Low income (1=<200,000 R/year)	.86	.90	.04	.60	.23	.36*	.42	.27	.15*
	(.03)	(.01)	(.04)	(.02)	(.13)	(.04)	(.02)	(.02)	(.05)
Years of Farming experience	20.48	16.60	4.89*	23.10	20.99	2.10*	20.72	20.45	.15
	(1.04)	(.32)	(1.27)	(.53)	(.36)	(.90)	(.55)	(.45)	(.97)
Land holding									
N	1626	1513	3,139	1167	1515	2,682	756	764	1,520
Land owned (acres)	6.29	5.85	.44	6.96	7.21	-.25	6.54	7.13	-1.09
	(1.07)	(.14)	(.84)	(.20)	(.16)	(.35)	(.23)	(.22)	(.76)
Access to services and infrastructure									
N	1,591	1,538	3,129	1,148	1,542	2,690	721	777	1,498
Used crop Insurance	.77	.51	.26*	.07	.01	.06*	0.15	0.03	0.13*
	(.04)	(.03)	(.08)	(.01)	(0)	(.02)	(0.02)	(0.03)	(0.02)
Used credit	.98	.67	.30*	.76	.39	.38*	0.13	0.18	-0.04
	(.01)	(.02)	(.06)	(.02)	(.01)	(.06)	(0.01)	(0.02)	(0.03)
Distance to Inputs (km)	10.16	26.55	-16.39*	8.80	7.49	1.32*	9.46	8.39	1.12
	(1.24)	(1.53)	(4.57)	(0.21)	(0.15)	(.72)	(1.82)	(0.18)	(1.87)

* denotes p <.05

The means comparisons in Table 7 also show significant differences in adoption rates and adoption area across all three LEA implementers and their CEA comparison groups. For LEA Implementer 1 the adoption rate results are significantly different for the five groundnut technologies, and for the adoption area variable, results exhibit statistically significant differences between groups for three technologies. Note that nala plugs/RFD and sunken pits both have adoption rates and areas less than .01 and are therefore excluded in all the subsequent analysis.

For LEA Implementer 2, the means comparison of the adoption outcome shows two out of three wheat system technologies with statistically significant differences between groups for adoption rate estimates, and one for adoption area estimates. Differences are most pronounced for zero till technology, with area largely a function of the difference in rate. For LEA Implementer 3, five of six adoption indicators are statistically significantly different with the only exception being direct seeded rice area. Similar to LEA Implementer 2 estimates, differences between groups are most pronounced for zero till technology (Table 7).

However for several of the statistically significant difference, adoption rates and/or differences are so low that it is questionable whether or not these differences are in fact practically significant. This includes polyurethane mulching adoption rate and area for LEA Implementer 1 and direct seeded rice adoption rates for LEA Implementers 2 & 3.

Table 7: Adoption rate and adoption area for different types of technologies: Comparison between the two pairs of survey approaches by implementers

Implementer/Technology	Adoption Rate			Adoption Area (acres/HH)		
	LEA	CEA	Differences	LEA	CEA	Differences
LEA Implementer 1	*1,643*	*1,536*	*3,179*	*1,634*	*1,526*	*3,160*
Soil bunds	.24	.28	-.04	.26	.38	-.11
	(.04)	(.04)	(.15)	(.04)	(.07)	(.19)
Field bunds	.18	.02	.16*	.18	.04	.14*
	(.03)	(0)	(.04)	(.03)	(.01)	(.04)
Broad bed and furrow	.03	.33	-.30*	.04	1.08	-1.05*
	(.01)	(.03)	.04	(.01)	(.08)	(.13)
Land leveling	.26	.05	.21*	.33	.24	.09
	(.05)	(.01)	.05	(.12)	(.05)	(.16)
Contour bunds	.13	0	.12*	.18	0	.18
	(.05)	0	(.05)	(.12)	(0)	(.11)
Polythene mulching	0	.03	.03*	0	.09	-.08*
	(0)	(.02)	(.01)	(0)	(.03)	(.02)
Nala plugs/RFDs	*0*	*0*	*0*	*0*	*(.01)*	*.01*
	(0)	*(0)*	*(0)*	*(0)*	*(.01)*	*(0)*
Sunken pits	*0*	*0*	*0*	*0*	*0*	*0*
	(0)	*(0)*	*(0)*	*(0)*	*.*	*(0)*
Farm ponds	.07	.03	.04	.07	.07	0
	(.01)	(.02)	(.03)	(.02)	(.05)	(.05)
Masonry check dams	.01	.01	0	.01	.03	-.02
	(.01)	(0)	(0)	(.01)	(.01)	(.02)
Well recharge pits	0	.02	-.02	.01	.02	.02
	(0)	(.02)	(.01)	(0)	(.02)	(.01)
Penning	0.32	0.30	.02	.59	.89	.30
	(0.05)	(0.03)	(.06)	(.14)	(.06)	(.23)
LEA Implementer 2 (N)	*1,541*	*1,184*	*2,725*	*1,176*	*1,523*	*2,699*
Laser land leveling	.55	.54	.01	3.82	3.11	.72
	(.02)	(.01)	(.04)	(.18)	(.13)	(.38)
Zero Till	.13	.01	.12*	.75	.08	.68*
	(.02)	(0)	(.03)	(.11)	(.02)	(.13)
Direct seeded rice	0	.02	.02*	0	.08	.09
	(0)	(0)	(.01)	(0)	(.04)	(.06)
LEA Implementer 3 (N)	*797*	*776*	*1,573*	*777*	*768*	*1,545*
Laser land leveling	.73	.61	.12*	4.59	2.74	1.88*
	(.02)	(.02)	(.04)	(.22)	(.12)	(.34)
Zero Till	.22	.03	.18*	1.41	.18	1.22*
	(.02)	(.01)	(.03)	(.16)	(.05)	(.22)
Direct seeded rice	0	.04	-.04*	.02	.07	-.05
	(0)	(.01)	(.01)	(.02)	(.02)	(.03)

* denotes p <.05

Comparison of enumerators' characteristics

Table 8 below shows the comparison of enumerator characteristics for each implementer. This data were collected during enumerator training. The results show that there are significant differences between enumerators recruited to conduct surveys by the LEA implementers and enumerators recruited by the CEA Implementer. However, these differences are not consistent with the expectation that CEA enumerators might be more qualified than local enumerators.

In fact, on balance, it is not obvious which group of enumerators are more or less competent for the type of survey they conducted. For example, LEA implementers used smartphones and tablets for interviews and the enumerators recruited by them are slightly more likely to own a smartphone and thus more experienced in using that tool. On the other hand, CEA implementer used laptops and the enumerators reported spending significantly more time using a computer than enumerators from the LEA approach (Table 10). Conventional enumerators have more formal education. However local enumerators have more experience working as enumerators including carrying out agricultural and CAPI surveys. Hours spent per week in a job or other occupation is similar. This pattern holds at the individual implementer level with several exceptions. One is that LEA Implementer 3 enumerators are the only ones with significant CAPI experience. They also all own smartphones. LEA Implementer 2 enumerators have less agricultural experience than their counterparts, a fact that may be accounted for by their younger age. However, they do have more experience conducting agricultural surveys. Only one enumerator was female.

Table 8: Comparison of enumerator characteristics

	Age	Educa-tion[5]	Hours/ week in job	Ag. exper. (years)	Survey exper. (times)	Ag. survey (times)	CAPI (times)	Owns smart-phone	PC use (hours/ week)
LEA 1	34.4	7.9	32.4	9.6.	3.4	2.9	.3	.4	6.8
CEA	24.2	8.4	25	.3	.7	.2	.3	.4	32.1
Diff.	10.3*	.5	7.4	9.3*	2.7*	2.7*	0	.1	25.4*
SE	1.7	.3	10.7	2.8	s.9	.9	.3	.2	5.6
n (control)	16 (11)	16 (11)	15 (2)	16 (10)	16 (9)	13 (9)	11 (8)	16 (9)	16 (10)
LEA 2	25.4	6.8	20.2	3.2	2.1	.9	.1	.6	20
CEA	28.1	8.8	26.1	6.2	.4	.4	.1	.4	35.2
Diff.	2.7	1.9*	5.9	3.1	1.6	.5	0	.1	15.2*
SE	3.2	.4	5.2	2.3	.8	.5	.1	.2	6.8
n (control)	12 (8)	12 (9)	11 (9)	12 (9)	12 (9)	12 (9)	12 (9)	12 (9)	11 (9)
LEA 3	25.3	7.6	30.3	8.9	8.4	5.4	4.5	1	20.4
CEA	26	9	24.8	4.5	0	0	0	0	18
Diff.	.8	1.4*	5.5	4.4*	8.4*	5.4*	4.5	1*	2.4
SE	1.1	.3	3.2	1.7	1.5	1.5	2	0	
n (control)	8 (3)	8 (4)	8 (4)	8 (4)	8 (4)	8 (4)	8 (4)	8 (4)	8 (1)
All LE	29.4	7.5	27.9	7.3	4.1	2.8	1.3	.6	14
CEA	25.8	8.6	25.9	3.1	.6	.3	.2	.4	33.3
Diff.	3.5	1.1*	2	4.2*	3.5*	2.5*	1.1	.1	19.2*
SE	2.2	.3	4.3	1.8	.8	.7	.7	.1	4.1
N (control)	36 (19)	36 (20)	34 (11)	36 (19)	36 (18)	33 (18)	31 (17)	36 (18)	35 (16)

* denotes p <.05

5.2 Balancing tests for covariates

Because the means comparisons noted above revealed significant differences between group characteristics, balancing tests are conducted on the household and farm characteristic variables (i.e., covariates) by including village fixed effects in the regression model below. Village fixed effects account for village level differences in the two samples that may affect differences in household characteristics.

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[5] 1=Illiterate, 2=Read & Write (Non formal Education), 3=Primary (1st- 5th), 4=Upper Primary (6th-7th), 5=High School (8th - 10th), 6=Higher Secondary (11th-12th), 7=Diploma/ ITI, 8=UG, 9=PG & Above

$$c = \beta x_i + \gamma \mathbf{v} + \mu \qquad \text{for } i=1, 2, 3 \qquad (3)$$

Where c is the covariate variable, x_i is an indicator for implementer i, $\mathbf{v}$ *is* a vector of village-level indicator variables, and u is the error term. The balancing test in model 3 is conducted separately for each of the three LEA implementers. In each case, variable $x=0$ represents data collected by the CEA Implementer (i.e., the comparison data) in the same districts. The estimate of interest is β, which measures the difference in the estimated value of variable c in the sample data collected using the LEA approach compared to the estimated value of the same variable derived from the sample data collected using the CEA approach (the control group).

Model 3 is repeated for all ten covariates with all three pairs of LEA-CEA implementers and the results (i.e., β coefficients) are shown in Table 9. Note that in all the balancing tests conducted using the regression based approach, the model includes sample weights, and robust standard errors which are clustered at the village level. Village level clustering of standard errors accounts for hypothesized greater correlation within villages than between them.

For LEA Implementer 1, after accounting for the village fixed effects, four out of ten covariates are still unbalanced (Table 9). For LEA Implementer 2, three covariates remain unbalanced compared to seven without fixed effects. Finally, three out of 10 LEA Implementer 3 covariates are unbalanced compared with five using simple weighted means comparisons. While the sample is now more balanced than noted in Table 6, there are still significant number of covariates that are unbalanced between the two samples, indicating that controlling only for the differences in the villages included in the two samples is not adequate to account for the differences in the

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observed estimates of the adoption variables. This implies that any analysis of the treatment

effect to evaluate the effectiveness of the LEA approach in generating adoption estimates

comparable to the CEA approach (which is used as a control in this study), must control for

differences in the covariates that can influence the adoption outcome variables.

Table 9: *Balancing tests for covariates with village fixed effects*

	LEA 1	LEA 2	LEA 3
Demographics (n)	*3,119*	*2,722*	*1,530*
Age off HHH	6.66*	-1.40	3.74
	(1.28)	(2.17)	(2.50)
Literate HHH or	-0.26	-1.20[6]	-0.21[7]
HHH Education*	(0.17)	(0.69)	(0.12)
Respondent is	-0.35*	-0.06	-0.11*
HHH	(0.11)	(0.07)	(0.03)
Number in HH	0.22	-0.59	0.65
	(0.38)	(0.31)	(0.48)
Low income	0.02	0.43*	0.22*
(<200,000 R/year)	(0.04)	(0.05)	(0.07)
Years farming	2.84*	0.47	0.19
	(0.88)	(2.23)	(2.05)
Land (n)	*3,110*	*2,670*	*1,490*
Land owned	4.60*	-1.16	-1.09
(acres)	(1.75)	(0.61)	(0.76)
Access (n)	*3,095*	*2,677*	*1,474*
Used crop	0.21	0.03	0.14*
insurance	(0.15)	(0.02)	(0.04)
Used credit	0.16	0.41*	-0.07
	(0.12)	(0.17)	(0.04)
Distance to input	-4.95	5.45*	-1.55
Dealer (km)	(6.78)	(2.62)	(0.92)

* denotes p <.05

5.3 Identifying adoption differences

After determining that the sample characteristics are unbalanced even with village fixed effects,

the next step in the analysis is to identify whether or not there are statistically signficant

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[6] n = 2,636

[7] n = 1,489

differences in adoption estimates between LEA and CEA data. For this analysis we use two simple linear regression models. One includes the village fixed effects (**v**) and the covariates (**c**) listed in Table 8 (model 4), and the other replaces village fixed effects with enumerator fixed effects (**e**) (model 5).

$$y = \beta x + \gamma v + \delta c + \mu \tag{4}$$

$$y = \beta x + \gamma v + \theta e + \mu \tag{5}$$

Variable y represents the adoption outcome (i.e., adoption indicator and adoption area per household). Variable x is the indicator of whether the dataset was collected using the LEA approach ($x=1$) or using the CEA approach ($x=0$). The coefficient of this treatment variable, β, measures the difference in the value of the estimated adoption variable from the two approaches, after controlling for the confounding factors included in the models. The hypothesis we want to test is that $\beta=0$. In other words, we hypothesize that the estimates of adoption rate and level of adoption derived from the LEA approach are not statistically significantly different from the estimates derived from the CEA approach.

The results from models 4 and 5 are presented in Table 10. The first column simply replicates the weighted means comparisons from the descriptive statistics section (Table 7). The second column shows the results from equation 4 which includes village fixed effects and covariates. The third column 3 replaces village fixed effects with enumerator fixed effects (equation 5).

Table 10: Differences in the mean estimates of adoption variables derived from LEA and CEA datasets: Comparison of results across three methods

	Adoption Rate			Adoption Area		
	(A) Means comparison	(B) Village FE + Covariates	(C) Enum. FE + Covariates	(A) Means comparison	(B) Village FE + Covariates	(C) Enum. FE + Covariates
LEA 1 (n)	*3,179*	*3,000*	*2,973*	*3,160*	*3,000*	*2,971*
Soil bunds	-.04	-.58*	.85*	-.11	-.89*	.43*
	(.15)	(.26)	(.08)	(.19)	(.24)	(.14)
Field bunds	.16*	.06*	.60*	.14*	-.02	-.04
	(.04)	(.03)	(.10)	(.04)	(.05)	(.20)
Broad bed and furrow	-.30*	-.43*	-.27*	-1.05*	-1.20*	-1.13*
	.04	(.05)	(.07)	(.13)	(.33)	(.32)
Land Leveling	.21*	.21*	.23*	.09	.37*	-.11
	.05	(.04)	(.08)	(.16)	(.13)	(.23)
Contour Bunds	.12*	.20*	.09*	.18	.48*	.13*
	(.05)	(.04)	(.04)	(.11)	(.05)	(.06)
Polythene mulching	.03*	-.07*	0	-.08*	-.11*	.01
	(.01)	(.01)	(0)	(.02)	(.01)	(.04)
Farm ponds	.04	-.07*	.44*	0	-.26*	-.18
	(.03)	(.02)	(.12)	(.05)	(.05)	(.22)
Masonry check dams	0	-.01	-.12*	-.02	-.08	-.59
	(0)	(.01)	(.06)	(.02)	(.09)	(.32)
Well recharge pits	-.02	-.07*	0	.02	-.08*	.03
	(.01)	(.02)	(.01)	(.01)	(.01)	(.02)
Penning	.02	.03	-.42*	.30	-.05	-2.22*
	(.06)	(.12)	(.09)	(.23)	(.25)	(.51)
LEA 2 (n)	*2,725*	*2,533*	*2,517*	*2,699*	*2,512*	*2,507*
Laser land Leveling	.01	.03	.27*	.72	1.04	2.18*
	(.04)	(.11)	(.07)	(.38)	(1.21)	(.66)
Zero Till	.12*	.11*	.03	.68*	.53	.27
	(.03)	(.04)	(.03)	(.13)	(.31)	(.27)
DSR	.02*	-.03	0	.09	-.08	0
	(.01)	(.02)	(0)	(.06)	(.06)	(.01)
LEA 3 (n)	*1,573*	*1,352*	*1,352*	*1,545*	*1,330*	*1,330*
Laser land leveling	.12*	.12	.07	1.88*	2.31*	.99*
	(.04)	(.06)	(.07)	(.34)	(.76)	(.48)
Zero Till	.18*	.16*	.16*	1.22*	1.09*	1.37*
	(.03)	(.04)	(.05)	(.22)	(.30)	(.46)
DSR	-.04*	-.06*	0	-.05	-.10*	-.01
	(.01)	(.02)	(0)	(.03)	(.05)	(.01)

* denotes p <.05

The comparison of differences across the three methods shows that only for DSR area for LEA Implementer 2 are adoption results statistically indistinguishable across all three models. On the other hand, broad bed and furrow shows statistically significant difference in estimates for both adoption rate and adoption area across all three methods. The number of significant differences varies between these two extremes for the other technologies. In general, the inclusion of village fixed effects and covariates (column B) makes the effect size become statistically significant for more number of technologies compared to simple mean comparison (column A). Replacing village fixed effects with enumerator fixed effects (column C) has only a small effect on reducing the number of statistically significant coefficients compared with the preceding model (column B). Again it is important to keep in mind the distinction between statistical and practical significance. While polythene mulching and DSR both exhibit statistically significant differences across estimation models, these differences are minimal and not likely practically significant in terms of policy decision making.

The results indicate that adding village fixed effects and covariates does not generally decrease the number significant differences between adoption estimates. This suggests that while there are differences in sample composition, these differences do not explain the differences in adoption estimates. However, when enumerator fixed effects are included, the number of significant differences in adoption estimates is slightly reduced. The number of adoption rate differences declines from eleven to ten whereas the number of adoption area differences declines from 10 to seven across all three LEA implementers. This indicates that differences between enumerators may indeed explain some of the differences in adoption estimates. The proceeding section explores this relationship.

5.4 Comparison of missing values

One proxy for data quality are missing values which are themselves bad data but also potentially evidence of more bad data. This research examines the number of missing values for the ten covariates across the four implementers.[8] The mean of the total number of missing values per respondent across the ten covariates included in the previous models is compared at the implementer level, as well as at the approach level (Table 11). Households that were interviewed by the local enumerator approach had on average .06 total more missing values out of the ten covariate questions included in this analysis. This difference is highest for LEA Implementer 3 and lowest for LEA Implementer 2.

Table 11: Average number of missing values (out of ten covariates) per respondent

LEA 1 (1,643)	Control (1,540)	LEA 2 (1,195)	Control (1,542)	LEA 3 (801)	Control (777)	All (3,639)	Control (3,082)
.10 (.04)	.03 (.01)	.10 (.02)	.08 (0)	.27 (.03)	.11 (.02)	.12 (.02)	.05 (.01)

Additionally, village fixed effects are included as shown in equation 6 below, where *m* represents number of missing values. This analysis is also conducted at the implementer level using block level fixed effects.[9]

$$m = \beta x + \rho r + \gamma v + \mu \qquad (6)$$

Additionally, the model is estimated by including the enumerator FE (equation 7). Both models include an indicator variable for whether or not the respondent is the HH head (*r*).

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[8] Due to data issues missing values could not be computed for adoption.
[9] Stata variable limits were exceeded with village FE model. Thus, we used the next level of administrative boundaries (blocks, which are equivalent to counties).

$$m = \beta x + \rho r + \boldsymbol{\theta e} + \mu \qquad\qquad (7)$$

Table 12 shows group comparisons of means as well as regression coefficients estimated using

models 6 and 7. The regression results show significant changes in missing values with the

inclusion of enumerator fixed effects but not village fixed effects. In fact the model with

enumerator fixed effects shows no significant differences in missing values between all LEA and

CEA data implying that differences between enumerators account for differences in missing

values. Whether or not the respondent is the head of the household in all cases but one has a

negative coefficient, indicating the importance of interviewing the head of household,

Table 12: Missing value differences and coefficient comparison

	Mean difference	Village FE	Enumerator FE
LEA Implementer 1 *(n=3,115)*	.06	.04	-.07*
	(04)	(.04)	(.02)
HHH is respondent		.02	-.18
		(.02)	(.14)
LEA Implementer 2 *(n=2,718)*	.02	.01	.10
	(.03)	(.04)	(.06)
HHH is respondent		-.07	-.06*
		(.04)	(.03)
LEA Implementer 3 *(n=1,544)*	.16*	.18	.09
	(.07)	(.11)	(.09)
HHH is respondent		-.08*	-.11*
		(.04)	(.04)
All LEA *(n = 6,610)*	.07*	.06*	.02
	(.03)	(.02)	(.02)
HHH is respondent		-.08*	-.12
		(.03)	(.06)

* denotes p <.05

5.5 Exploring the factors contributing to differences in data quality

Given the differences in enumerator characteristics noted above, the next step is to see how these

characteristics affect the data quality as reflected in the estimated adoption variables and the

number of missing values. To do this, enumerator characteristics **k** are regressed on total

adoption area (z) across all 10 technologies for LEA Implementer 1 and all three technologies for

LEA Implementer 2 and LEA Implementer 3 (equation 8). Because of missing values, the

characteristics included in the model are restricted to enumerator education, experience in

agriculture, experience as an enumerator, ownership of a smartphone and ownership of a

computer. Additionally, the equation includes an indicator variable for whether or not the

respondent is the head of the HH (*r*). This attempts to control for the respondents' own

knowledge of their farm's adoption outcomes. As usual, the model include village FE and

standard errors are clustered at the village level.

$$z = \beta x + \rho r + \tau k + \gamma v + \mu \qquad\qquad (8)$$

The coefficients for vector **k** and their standard errors are reported in Table 13. The only

implementer for which enumerator characteristics are significant in affecting the estimated total

adoption area is LEA Implementer 1. The variables that are found to significantly impact the

estimated total adoption area are enumerator's education and whether he/she owns a computer.

However given that these are not significant for the other two implementers, it is difficult to

draw conclusions on the meaningfulness of enumerator characteristics for adoption area

measurement.

Table 13: Enumerator characteristics coefficients with total technology adoption area dependent variable

| | Enumerator characteristics | | | | |
	Education	Agricultural experience (years)	Enumeration experience (times)	Owns smartphone	Owns PC
LEA 1 n =2,356	1.27* (.50)	-.15 (.11)	.11 (.26)	2.11 (1.11)	4.42* (.72)
LEA 2 n = 2,718	.15 (.44)	-.08 .07	-.43 (.25)	1.04 (.92)	-.03 (.59)
LEA 3 n = 1,544	1.20 (1.52)	.05 (.36)	.50 (.34)	1.10 (3.97)	-1.32 (1.65)

* denotes p <.05

Next the same regression is repeated replacing total adoption area (*z*) as the dependent variable with *m* (number of missing values across 10 covariates). In total both enumeration experience and owning a smartphone are significant, with each having a counterintuitively positive affect on the number of missing values. Very speculatively, it could be that these practical skills – enumeration experience and technology familiarity make enumerators more likely to record the true unknown responses of a respondent rather than fabricate a response.

Table 14: Enumerator characteristics coefficients with missing values dependent variable

	Education	Agricultural experience (years)	Enumeration experience (times)	Owns smartphone	Owns PC
LEA Implementer 1 *n =2,356*	.02 (.02)	-.01* (0)	.03* (.01)	.08 (.07)	.01 (.01)
LEA Implementer 2 *n = 2,718*	.04 (.03)	0 (.01)	.01 (.02)	.17 (.12)	.04 (.04)
LEA Implementer 3 *n = 1,544*	-.47* (.19)	-.06* (.02)	.03 (.03)	Omitted	.29 (.13)
All *n = 5,851*	-.02 (-.02)	0 (0)	.02* (.01)	.04* (.02)	-.04 (.02)

* denotes p <.05

5.6 Cost

The following table shows survey costs and costs per respondent for all four implementers. The average cost per respondent for the three local enumerator survey implementers is $31 dollars, which exceeds the conventional survey (CEA) cost by nine dollars per respondent. However, several factors should be noted that can potentially change this comparison. One is that the cost of developing the Android based data collection application and purchasing tablets together account for about 20 percent of the total cost for the three local enumerator implementers. This is a one-time cost that will decrease as a share of per respondent costs with subsequent surveys. The CEA Implementer on the other hand used an off-the-shelf program, *Surveybe*, that requires annual subscription and rented laptops, making these costs reoccurring for them. The cost of these two items is substantially lower than the costs incurred by the LEA implementers for the CAPI survey. Taxes also account for some of the difference. Because of its non-profit status, the CEA Implementer did not pay the 14 percent tax paid by LEA Implementers 2 & 3. LEA Implementer 1 also did not pay this taxed based on its international subsidiary status.

Table 15: Actual costs for survey implementation (USD)

	LEA 1	LEA 2	LEA 3	All LEA	CEA
Researchers' cost (MSU personnel)	5,000 (9%)	5,000 (9%)	5,000 (20%)	(11%)	29,500 (33%)
Professional fees (survey management & oversight)	21,754 (40%)	22,226 (40%)	3,790 (15%)	(36%)	17,655 (20%)
Training and survey cost (enumerator payment, travel)	20,967 (39%)	12,129 (22%)	6,113 (25%)	(29%)	31,692 (36%)
Technology (application and hardware)	3,871 (7%)	8,065 (14%)	7.258 (30%)	(14%)	7,950 (9%)
Overhead and taxes	2,576 (5%)	8,252 (15%)	2,403 (10%)	(10%)	1,280 (1%)
Total cost	48,169	51,681	19,564		88,079
Total respondents	1,600	1,200	1,600		4,000
Costs per respondent	34	46	15	31	22

Accounting for multiple use of technology and controlling for tax differences brings the comparison closer. Specifically projecting over ten surveys (dividing technology costs by ten for LEA implementers) and adding 14 percent tax on the total survey cost less researchers cost makes the LEA average per-respondent cost 28 dollars compared to 24 dollars for the CEA Implementer.

Additionally, there are survey implementation economies of scale associated with the larger sample size such as developing the questionnaire and training materials. This gave the CEA Implementer, who implemented their surveys across 2.5 times more households than any local enumerator implementer. Finally there is reason to believe that the CEA may have under budgeted with a price much lower than the competition. This is supported by the fact that all three local enumerator implementers stated that the LEA they used in this study implied close to fifty-percent cost savings for them compared with their conventional, paper-based surveys.

6. DISCUSSION AND CONCLUSION

6.1 Summary of findings

This research sought to test whether or not the local enumerator approach – using locally-based enumerators and tablets - is a feasible alternative to the conventional enumerator approach. That is whether it would produce statistically indistinguishable adoption estimates at a lower cost. To do this, agricultural technology adoption data were collected by three survey firms in India utilizing different interpretations of the local enumerator approach. This was compared with similar data collected through a conventional enumerator model for the same representative geographies.

Through descriptive statistics, the research identified statistically significant differences in the adoption rate and area measurements and also found that covariates hypothesized to influence adoption – such as credit access and land size – were statistically significantly different. The research then attempted to more rigorously identify the difference in adoption measurement between approaches through two strategies. The first strategy was to control for village level differences in samples through village fixed effects and to control for covariates such as land size and access to credit to control for differences between them that might affect adoption estimates. This strategy did not reduce the measurement differences in adoption outcomes. The second empirical strategy was to include enumerator fixed effects in place of village fixed effects to control for differences in enumerators. This did slightly reduce the number of significant differences in adoption outcomes. Since there still remained statistically significant differences even after controlling for the sample composition and enumerator FE, it was not possible to

conclude that the local enumerator approach, as implemented through this research, yielded the same adoption measurement results as the local enumerator approach.

The fact that there are differences in measurement of adoption does not necessarily imply that the CEA produced the more accurate data. One proxy for data quality is the number of missing values. The CEA did in fact produce .07 fewer missing values on average for the ten responses tested per respondent. However, this was sensitive to model specification and in fact disappeared when controlling for enumerator fixed effects and whether or not the respondent was head of household. Finally, the research found differences in enumerator characteristics between CEA and LEA, though it is not intuitive which group of enumerators would favor the observed differences. Regression analysis was used to assess the effects of enumerator characteristics on adoption measurement and data quality. The results of these analyses were ambiguous and did not help clarify what factors were contributing to differences in adoption estimates and data quality.

Before undertaking this research, it was speculated that the local enumerator approach would be lower cost because of reduced transport and per diem costs. The results of the cost comparison are non-conclusive. On average, the LEA came out nine dollars more expensive per HH sample than the CEA. This gap is cut in half when controlling for the fixed cost of technology purchased by LEA Implementers as well as difference in taxes charged. There is also significant variation in costs between the three LEA implementers with the lowest cost 15 dollars per household and the highest 45 dollars per household.

A key finding of this research is the significance of the respondent being the head of the household in reducing missing values. This intuitive finding implies that the local enumerator approach has an advantage because of the comparative ease of revisiting households if the head of household is not initially available.

6.2 Sources of differences in adoption estimates

To guide future research, it is important to highlight and speculate about the sources of differences in adoption measurement that the analysis was unable to answer. One potential source of difference not studied in this paper is the difference in level of training given to enumerators on each technology focused by the survey, and how to communicate to the farmers what these technologies were. Because many of the technologies are not actual material technologies (i.e., inputs or products one can purchase regularly from the market) but in fact agronomic and resource management practices, proper description of these practices to farmers requires more knowledge and communication skills than for soliciting responses for simpler technologies. Differences in how implementers trained enumerators on these technologies, how well enumerators learned and understood these technologies or already knew about them, and how skilled they were at communicating them to farmers in local languages might have had an effect on adoption measurement. The technologies were not described on the questionnaire so this cannot be evaluated ex-post. Additionally, as is discussed below, the analysis does not control for differences in data collection applications that may be correlated with differences in seeking and recording responses.

Differences in questionnaires between implementers may also have affected differences in responses (Kasprzyk 2006). This includes differences in question phrasing, question sequencing, response options and skip logic and the overall length of the instrument. A closely related potential source of difference is differences between the data collection applications. Unlike what Caeyers et al. (2012) found, there were still a significant number of missing values in all of the datasets received, especially for the dataset received from the LEA implementers. This is somewhat to be expected as they each developed their own application, programed them with questionnaires and used it for the first time with these surveys. As the applications are improved and the implementers become more experienced in using them, this source of bad quality data is likely to decrease. On the other hand, the CEA Implementer used an off the shelf application that they had already had experience using and programing. This difference in technology maturity and familiarity with the technologies could possibly account for differences in results seen here.

Contrary to expectations, local enumerators were not clearly less qualified than conventional enumerators at least according to the characteristics collected from them. This was initially hypothesized to be the primary potential source in measurement differences for the local enumerator approach. However, caution should be used in extrapolating this finding to other developing country contexts as India's rural population is likely more educated than other developing countries'.

As discussed previously the costs of the CEA Implementer are likely lower per respondent due to the much larger scale of their surveys resulting in design and management efficiencies. Furthermore, there are reasons to expect the local enumerator cost per household to decrease

over time. One reason is that the initial cost of software development will decrease as a share of survey cost with each subsequent survey. It is also possible that with regular data collection, the comparative costs of LEA data collection will decrease because of less enumerator attrition.

Future research could focus on these sources of differences that this research was unable to address. Most useful would be identifying the characteristics associated with good enumerators through research that unlike this research controlled for approach, implementer, questionnaire, CAPI and other differences. This would have broad implications beyond the local enumerator approach and to date little research has been carried out on the topic.

6.3. Feasibility of the local enumerator approach

The local enumerator approach was envisioned to be a commercially sustainable model for collecting relatively simple agricultural data. The idea behind proposing this approach was that an infrastructure of local enumerators could be established and expanded that could be called upon to carryout surveys in their areas on an ongoing basis. Unfortunately, this research was not able test the LEA with longitudinal data collection where it should theoretically hold the most advantage on cost due to reduced travel to and from survey location. Ideally the local enumerator approach would be tested with longitudinal data collection. Deployment for a project's regular monitoring and evaluation is one example of how the approach could be tested longitudinally.

While this research did not directly test this commercial feasibility, the three implementers provided their feedback on the viability of the proposed model. The key lesson learned from this pilot study is that there must be frequent enough surveys with the same implementers for the

enumerators to maintain the survey implementer-local enumerator relationship. Speculatively, local enumerators should be engaged in data collection at least twice a year to maintain a relationship with their survey firm. This requires entrepreneurship from survey firms to secure sufficient clientele base in advance to meet this frequency requirement. Furthermore, number of interviews per enumerator is an important parameter for the long-term success of the local enumerator model. On one hand, tablets and training are fixed costs and so data collection costs increase with the number of enumerators per survey. On the other hand, some potential enumerators were discouraged from participating because of the extensive local travel while others complained of travel time after going through with the survey.

One possibility for commercialization of the local enumerator approach is in implementing regular project monitoring and evaluation activities that would guarantee bi-annual or quarterly data collection over a multiple year period. Another, which several implementers pointed out, is to sell data to commercial clients on a regular basis. One suggestion was to identify demand for tractor rental services and sell it to mechanized service providers. Another suggested idea for the application of the LEA was to track production of crops and sell that data to traders and processors so they could better plan their purchasing. Similarly, data could be sold to input suppliers. A key challenge here is to identify a sample and local enumerator-centered clusters that meet the sample needs of a broad number of clients. This is likely to be especially challenging during early stages of implementing the model when the enumerator infrastructure is smaller. Like most infrastructure, a certain scale is required to achieve commercial viability.

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APPENDICES

APPENDIX A: LEA Implementer 1 Questionnaire[10]

SECTION A: GENERAL INFORMATION – ENUMERATOR			
Date of Survey (DD/MM/YYYY)	**A1. Name of the Enumerator**	**A2. Name of the NGO** 1=MASS, 2=CHRD	**Start time of interview**

| **A3. Place of residence of the Enumerator** | **A4. Mode of transportation used by the enumerator to come to the place of this interview**
1=Bus, 2=Train, 3=Two Wheeler, 4=Bicycle, 5=Auto, 6=By walk, 99=Others (Specify) | **A5. Time required to travel from his/her location to this village/hamlet (HH-MM)** | |

GENERAL INFORMATION - LOCATION			
A6. State	**A7. District**	**A8. Mandal**	**A9. Gram Panchayat**

A10. Village/Hamlet		**GPS Coordinates**		**A11. Enumerator's acquaintance with farmer** 1=Yes-in the context of another survey, 2=Yes-in a social context, 3=Yes-we are personal acquaintances, 4=Not met before	

SECTION B: GENERAL HOUSEHOLD INFORMATION					
B1. Name of the main decision maker in the household	**B2. Are you the Head of the HH? (If yes go to B4;If no go next question)** (1=Yes, 2=No)	**B3. If the respondent is not the Head of the HH, Ask his/her relationship with the Head** 1=Spouse, 2=Son, 3=Daughter, 4=Grandson, 5=Granddaughter 6=Brother, 7=Son-in-law, 8=Daughter-in- law, 9=Father, 10=Mother, 99-Others (specify)	**B4. HH Sl. No**	**B5. Decision maker's age**

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[10] Introduction and consent removed for brevity

B6. Sex (1=Male, 2-Female)	B7. Religion of the household 1=Hindu, 2=Muslim, 3=Christian, 4=Sikh, 5=Buddhist, 98=Don't know, 99=Others (specify)	B8. Marital status of the main decision maker (1=Married, 2=Single, 99=Others)	B9. Main Occupation 1=Agriculture, 2=Livestock/poultry keeping (inc. sale), 3=Trading Livestock/poultry & its products, 4=Business, 5=Salaried, 6=Agri/Non-agri. labour, 7=Housewife, 8=Student, 9=Not applicable, 99=Others	
			B9a. Main decision maker	B9b. Spouse

B10. Literacy Status 1=Illiterate, 2=Read & Write (Non formal Education), 3=Primary (1st- 5th), 4=Upper Primary (6th-7th), 5=High School (8th -10th), 6=Higher Secondary (11th-12th), 7=Diploma/ ITI, 8=UG, 9=PG & Above, 10=Not applicable		B11. Mobile Number of the Main decision maker	B12. Total members in the family (in Numbers)
B10a. Main Decision maker	B10b. Spouse		

B13. Total working members in the family (in Numbers)		B14. Total Annual Income of the family (combined of all working members) (in Rupees)	B15. Total Income from groundnut farming? (in Rupees)
B13.a. Male	B13.b. Female		

B16. What type of Ration card do you have? 1=White Color, 2=Pink Color, 3= Yellow Color, 5=Do not have ration card, 99=Others (Specify)	B17. Do you have a bank account? (1=Yes, 2= No)	B18. Does anyone in your household belong to a farmer producer organization or a farm cooperative? (1=Yes, 2= No)

SECTION C: LAND HOLDINGS, USES AND GROUNDNUT CULTIVATION
DELETED
DELETED

C1. What is the total operational land (acres) holding of your household's in the past 12 months?	C2. In the past two years, how many times have you lost a more than 20% portion of your crop production due to unexpected weather (e.g., low rainfall, flooding, unexpected monsoon time, hail, etc)?	C3. Number of years you have been producing groundnuts

C4. Have you accessed credit for agricultural production in the past 12 months (1=Yes, 2= No)	C5. If YES, from where? 1=Trader, 2=Local money lender, 3=Bank, 4= Co-operative Bank, 5=Neighbor, 6=Family member, 7=Friends and Relatives, 8=Other financial institutions, 99= Others (Specify)	C6. If NO, why not? 1= Did not need, 2= Do not have access to credit, 3=Very high interest rate , 99= Others (Specify)

C7. Do you insure your crops (i.e., do you have crop insurance policy)? (1=Yes, 2= No)	C. 7a. If NO, why not? 1=Do not need, 2=Not available in my place, 3= Not available for groundnut, 4=Too expensive, 99= Others (Specify

C8. During the past year, where did you receive most of your information and advice about groundnut production and marketing from? (Tick all that apply) 1=Extension agent, 2=NGO staff, 3=Trader/input dealer, 4=Farmer group/leader farmer, 5=Service Provider, 6=I did not receive any information or advice, 99= Others (specify)

C8. a. If YES in previous question, In total, approximately how many times did you receive information last year from all these sources? 1=1-2 times, 2=3-4 times, 3=5-6 times, 4=7-10 times, 5=More than 10 times	C9. Do you use mobile phone to access information related to farming? 1=Yes, 2=No If NO, go to C10	C9. a. If YES, what type of information? (Tick all that apply) 1=Weather, 2=Price, 3=Inputs, 4=Production technology, 5=Pest control, 6=Government programs, 99= Others (Specify)	C9. b. From whom do you access information using mobile phone(Tick all that apply) 1=Relatives/friends, 2=Input dealers, 3=KVK, 4=Kisan Call Center, 5=Extension agents, 6=RML, 7=IFFCO Kisan Sanchar Limited (IKSL), 8=mKRISHI, 9=Other mobile based agro advisory services, 99=Others (Specify)

C10. How many plots/parcels of land does the Household own (including rented / borrowed/shared/leased in)	C11. On how many plots / parcels of land has the farmer cultivated groundnuts in Kharif 2015 season?

Particulars for each plot on which groundnut is cultivated in Kharif 2015 (total Number of columns should equal the response in C12)	Plot # 1	Plot # 2	Plot # 3	Plot # 4	Plot # 5
C12. Total Area (size of this plot) (in local units)					
C13. Area under Groundnut Cultivation					
C14. Distance from your home to this plot (in kms)					

C15. Land Tenure 1=Owned, 2=Crop sharing (yearly basis), 3=Leased for cash (yearly basis), 4=Pledged without interest, 99=Others (Specify)					
C16. Is groundnut inter/mixed/border crop cultivated with other crops on this plot? (1=Yes, 2=No) if **YES**, go to next question, if **NO** go to C18:					
C17. Name of the inter/mixed Crop with Groundnut 1=Red gram, 2=Green gram, 3=Horse gram, 4=Cow pea, 5= Black gram, 6= Bengal gram, 7= Finger millet, 8= Little millet, 9= Foxtail millet, 10= Pearl millet, 11= Barnyard millet, 12=Kodo millet, 13= Proso millet, 14=Sorghum,15=Maize, 16=Not cultivated any inter/mixed crop, 99=Others (Specify)					
C18. Border Crop 1=Red gram, 2=Green gram, 3=Horse gram, 4=Cow pea, 5= Black gram, 6= Bengal gram, 7= Finger millet, 8= Little millet, 9= Foxtail millet, 10= Pearl millet, 11= Barnyard millet, 12=Kodo millet, 13= Proso millet, 14=Sorghum,15=Maize, 99=Others (Specify)					
C19. Name of the Groundnut Variety 1=Anantha Jyothi (ICGV 91114),2=Bheema (TG 47), 3=Dharani,4=JL 24, 5=Kadiri 3, 6=Kadiri 5,7=Kadiri 6, 8=Kadiri 7,9=Kadiri 8, 10=Kadiri 9,11=Local (non-descriptive),12=Narayani, 13=Pollachi red (local land race),14=TGCS 1043, 15=TMV 2, 99=Others (Specify)					
C20. Source of groundnut seed planted 1=Saved from previous harvest, 2=Purchased from market as oilseed, 3=Purchased from other farmers or community based organization who produced seed, 4=Purchased from seed companies or input dealers, 5=Received subsidized seed from government or NGOs, 6=Purchased from Agriculture Office, 7=Borrowed / obtained from neighbors/relatives, 8=Do not remember, 99=Others (specify)					
C21. Can you recall when was the first year you adopted this variety? 9999=Do not remember					
C22. What was the source of seed for this variety when you first adopted it 1=Purchased from market as oilseed, 2=Purchased from other farmers or community based organization who produced seed, 3=Purchased from seed companies or input dealers, 4=Received subsidized seed from government or NGOs, , 5=Purchased from Agriculture Office, 6=Borrowed / obtained from neighbors/relatives,7=Do not remember, 99=Others (Specify)					
C23. What are the two characteristics of this variety you LIKE? 1=High yield, 2= Resistance to Insect and disease, 3=Drought resistance, 4=Early maturity, 5=Seed quality, 6=Color and taste, 7=Processing quality, 8=Good price / high demand, 99=Others (Specify)	C23.a. First				
	C23.b. Second				
C24. What are the two characteristics of this variety you DISLIKE? 1=Low yield, 2=Susceptible to insects and diseases, 3=Susceptible to drought, 4=Late maturity, 5=Seed quality, 6=Color and taste, 7=Processing quality, 8=Low price / Low demand, 99=Others (Specify)	C24. a. First				
	C24.b.Second				
C25. Source / type of Irrigation 1=Rainfed, 2=Bore well, 3=Well, 4=Canal, 5= River, 6=Stream, 7=Lake/ponds, 8=Pit,9=Drip irrigation, 10=Sprinkler, 99=Others (Specify)					
C26. Who in your house mainly	C26.a. Persons relationship to the main decision maker 1=Self, 2=Spouse, 3=Son/Daughter, 4=Brother/Sister, 5=Parent, 99=Others (Specify)				
	C26.b. Gender (1=Male, 2-Female)				

provides labour for this plot?							
C27. Who is the main decision maker regarding inputs and outputs of this plot	C27.a. Persons relationship to the main decision maker 1=Self, 2=Spouse, 3=Son/Daughter, 4=Brother/Sister, 5=Parent, 99=Others (Specify)						
	C27.b. Gender (1=Male, 2-Female)						
C28. Have you used or plan to use any of these inputs on this plot this Kharif season (Check all that apply)	C28.a. Organic fertilizer						
	C28.b. Chemical fertilizer						
	C28.c. Pesticides						
	C28.d. Herbicides						
	C28.e. Hired labour						
	C28.f. Other inputs (specify)						
C29. Expected groundnut production on this plot (in kgs)							
C30. In your assessment is your soil type fit for cultivating Groundnut? 1=Yes, 2= No							
C31. How would you rate the soil quality of this plot: 1=Low, 2=Medium, 3=High, 98=Don't know							

SECTION D: TECHNOLOGY ADOPTION

D1. Are you currently using the following technologies on this plot? (Check all that apply) 1=Soil bunds, 2=Field/boundary bunds, 3=Broad bed and furrow, 4=Land leveling, 5=Contour bunds, 6=Polythene mulching, 7=Nala plugs/RFDs, 8=Sunken pits, 9=Farm pond, 10=Masonry check dams, 11=Well recharge pits, 12=Penning Sheep/Goat/Cattle, 13=Others (Specify)……………………	
TX.1. In your estimate what is the total area on your farm covered by this technology? 1=Less than 20%, 2= 20-40%, 3=40-60%, 4=60-80%, 5=More than 80%	
TX.2. First year of adoption of _____ on your farm (9999=Do not remember)	
TX.3. What is the main source of information about the technology of _____? 1=Agricultural office, 2=Farmer Cooperative/Union, 3=Farmer group/association, 4=Learnt from Training programme, 5=Learnt from demonstration, 6=Traditionally known, 7=NGO/CBO, 8=Another farmer relatives and friends, 9=Another farmer neighbor, 10=Radio/newspaper/TV, 99= Others (Specify)	
TX.4. In your assessment what are the main benefits of using _____ on your farm 1=Saves water, 2=Soil management, 3=Improves crop yield, 4=More uniform moisture-environment for crops, 5=Reduces weeds problems, 6=Easy land preparation, 7=Improves uniformity of crop growth and maturity, 8=Reduces labour cost,9=Reduces cost of other inputs, 99= Others (Specify)	
TX.5. In your opinion does the _____ increase, decrease or has no effect on the labour time devoted to farming by the **MALE** members of your household? 1=Increase, 2=Decrease, 3=Neutral	
TX.6 If response is increase or decrease, ask: In what aspects is the labour input by male members increased or decreased? 1=Land preparation, 2=Sowing, 3=Weeding, 4= Irrigation, 5=Harvesting	

TX.7. In your opinion does the _____ increase, decrease or has no effect on the labour time devoted to farming by the **FEMALE** members of your household? 1=Increase, 2=Decrease, 3= Neutral	
TX.8. If response is increase or decrease, ask: In what aspects is the labour input by female members increased or decreased? 1=Land preparation, 2=Sowing, 3=Weeding, 4= Irrigation, 5=Harvesting	
D2. Have you ever used the following technologies in the past? (Check all that apply) 1=Soil bunds, 2=Field/boundary bunds, 3=Broad bed and furrow, 4=Land leveling, 5=Contour bunds, 6=Polythene mulching, 7=Nala plugs/RFDs, 8=Sunken pits, 9=Farm pond, 10=Masonry check dams, 11=Well recharge pits, 12=Penning Sheep/Goat/Cattle, 13=Others (Specify)……………………	
TX.9. When was the last year you used _____ (9999=Do not remember)	
TX.10. Reason for dis-adopting of _____ technology 1=Low yield, 2=High cost involved, 3=Insects affect, 4=More wastage of net area sown, 5=Not accessible to Machineries, 6=Not aware of this, 99=Others (Specify)	
D3. Other than the technologies mentioned above, has your household adopted any NEW practices, inputs, farming methods promoted by the agricultural extension service, KVKs, a research center, or a private input dealer? 1=Yes 2=No If **YES** go to next question; if **NO**, go to next section	
D3.1. If yes, what was this new technology?	
D3.2. When did you first adopt / use this technology on your farm? (year)	

SECTION E: CONNECTIONS

E1. How many farmers in this village/other villages you know personally?		
E1.a. How many days once you are interacting with them on farming related issues? 1=Regularly, 2=Twice in a week, 3=3 times in a week, 4= 4 times in a week, 5= 5 or more than 5 times in a week, 99=Do not interact		
E2. Totally how many farmers you know have used/currently using the following technologies on their farm? (read each, and note the Numbers)	E2.a. Soil bunds	
	E2.b. Field/boundary bunds	
	E2.c. Broad bed and furrow	
	E2.d. Land leveling	
	E2.e. Contour bunds	
	E2.f. Polythene mulching	
	E2.g. Nala plugs/RFDs	
	E2.h. Sunken pits	
	E2.i. Farm pond	
	E2.j. Masonry check dams	
	E2.k. Well recharge pits	
	E2.l. Penning Sheep/Goat/Cattle	
	E2.j.Others (Specify)……………………	

SECTION F: MIGRATION

F1. Has any member of your household migrated in the past 12 months? (1=Yes, 2=No) If **YES** go to (next question), if **NO** go to section G	

F2. What was the primary reason for migration? 1=To earn wages as food grain, 2=To earn higher wages, 3=To reduce burden on family, 4=Non-availability of work in village, 5=To work on relative's farm, 6=Other (specify)	

SECTION G: POVERTY SCORE CARD

G1. How many people aged 0-17 are present in your household? 0=Five or more, 4=Four, 8=Three, 13=Two, 20=One, 27=None	
G2. What is household's principal occupation? 0=Labourers (agricultural plantation, others farm), hunters, tobacco preparers and tobacco product makers and other labourers, 14=Professionals, technicians, clerks, administrators, managers, executives, directors, supervisors and teachers 8=Others	
G3. Is the residence all *pucca* (burnt bricks, Stone, Cement, Concrete, Jack board/Cement-plastered reeds, timber, tiles, gal vanished tin or asbestos cement sheets)? 4= Yes, 0=No	
G4. What is the household's primary source of energy for cooking? 0= Firewood and chips, Charcoal or none, 17=LPG, 5=Others	
G5. Does the household have own television? 6= Yes, 0=No	
G6. Does the household own a bicycle, scooter or motor cycle? 5= Yes, 0=No	
G7. Does the household own an almirah/dressing table? 3= Yes, 0=No	
G8. Does the household own a sewing (tailoring) machine? 6= Yes, 0=No	
G9. How many pressure cookers or pressure pans does the household own 0=None, 6=One, 9=Two or more	
G10. How many electric fans does the household own? 0=None, 5= One, 9= Two or more	

SECTION H: OTHER RELATED QUESTIONS

H1. During the past Kharif 2014 season what was the total groundnut produced by your household? (in Bags)		
H2. How much of this was sold? (in Bags)		
H3. What are the two most important constraints you face in groundnut farming? 1=Land, 2=Labour, 3=Cash constraint, 4=Seeds not available, 5=Insect and disease problem, 6=Cannot sell the crop, 7=Price is too low, 8=No information or technical advice on farming practices, 9=Low rainfall, 10=Not accessible to the machinery, 99=Others (Specify)		
H4. Have you stopped growing ANY groundnut varieties in the past 3 years that you used to grow before? 1= Yes, 2= No; if yes go to next question; if no go to H7		
H4.a. If **YES**, how many?		
H5. Give me the name of recent variety you have discontinued and the MAIN reason for not growing it anymore? 1=Anantha Jyothi (ICGV 91114),2=Bheema (TG 47), 3=Dharani,4=JL 24, 5=Kadiri 3, 6=Kadiri 5,7=Kadiri 6, 8=Kadiri 7,9=Kadiri 8, 10=Kadiri 9,11=Local (non-descriptive),12=Narayani, 13=Pollachi red (local land race),14=TGCS 1043, 15=TMV 2, 99=Others (Specify)	G5.a. Name	
H6. Reason codes: 1=Seed not available, 2=Had low yield, 3=Did not like the color, 4=Susceptible to diseases, 5=Not liked by processors, 6=Unpleasing cooking quality/taste, 7=Not adopting to climatic conditions, 99=Others (specify)	G6.a. Reason	
H7. What is the distance from your house to the nearest paved road? (if the house is next to the paved road, write zero) (in kms)		
H8. What is the distance from your house to the nearest market where you obtain agricultural inputs (e.g., fertilizer, pesticides, seeds, etc.)? (in kms)		
H9. What is the distance from your house to the nearest agricultural extension office? (in kms)		
H10. What means of transport do you mainly use to get to the nearest commercial town? 1=Walking, 2=Tractor, 3=Bicycle, 4=Motorcycle, 5=Car, 6=Bus, 7=Light transport Vehicle, 8=Animal Driven Cart, 99=Others (specify)		
H11. Distance from your home to this commercial town? (in kms)		

H12. Time it takes on average to travel to this commercial town using the main mode of transportation	H12.a. Hours	
	H12.b. Minutes	
H13. Indicate if this survey was completed in the first attempt or required a re-visit 1= First attempt, 2= Re-visit		
H14. Indicate if this HH was part of the first randomly selected farmer or a replacement 1= First random selection, 2= Replacement		
THANK YOU VERY MUCH FOR YOUR TIME		
End time of interview		

APPENDIX B: CEA Implementer – Groundnuts Questionnaire

To be filled by enumerator

Date of the interview (dd/mm/yyyy)		Time started	
Name of the enumerator			

To be filled by Supervisor

Date checked (dd/mm/yyyy)				Name of the supervisor	

Section 1: Current household composition and characteristics
1.1 Household identification

1a	District *CODE A*		1b. **Mandal / Block**		1c. **Gram Panchayat**	
2a	Village/hamlet name				2b. CODE	
3	Indicate random selection of Household	CODE B				
4	Elevation *(in meter)*					
4	GPS coordinate N *(Format xx.xxxxx)*			GPS coordinate E *(Format xx.xxxxx)*		
6	Household (HH) id	District Code	Mandal / Block Code		Village Code	HH Number

Code A: 1-Karnal, 2-Ludhiana, 3-Vaishali, 4-Kurnool, 5-Anantapur
Code B: 1-*Original, 2-Replacement*

1.2 General information about the Respondent
Note: Respondent here refers to the Lead Decision Maker for Agricultural Activities in the family.

1	**Name of the Respondent**	**a. First Name**		**b. Last Name**
2	**Gender of the Respondent** *(Code: 1 –Male, 2- Female)*			
3	**Age of the Respondent**			
4a	**Marital status** *(CODE A)*			
4b	**How many brothers and sisters do you have (including siblings that may**	a. brothers		b. sisters
4c	**What was your birth order? For example, were you first born, second born,**			
5	**Years of formal education of Respondent and spouse (if married)**	a. Respondent		b. Spouse (if married)
6	**Main occupation** *(CODE B)*	a. Respondent		b. Spouse (if married)
7a	**Can read a local Indian language (1-Yes, 2-No)**			
7b	**Can read English (1-Yes, 2-No)**			
8	**Years of Experience in farming**			
9a	**Years of experience in growing groundnut**			
9b	**Years of experience in growing wheat**			
9c	**Years of experience in growing rice**			
10	**Mobile number**			
11	**Relationship with Head of the household (HOH)** *(CODE B)* *If option 1, skip to section 17*			

12	**Name of the Head of Household**		
13	**Gender of the Head of the HH** *(Code: 1 –Male, 2- Female)*		
14	**Age of the Household Head**		
15	**Years of formal education**	a. Head	b. Spouse of Head (if
16a	**Can read a local Indian language (1-Yes, 2-No)**		
16b	**Can read English (1-Yes, 2-No)**		
17a	**Religion of the household** *(Code: 1- Hindu, 2- Muslim, 3-Christian, 4- Sikh, 5-Buddhist 98-Don't know, 99-Others (specify)*		
17b	**Caste** *(Code 1- General ,2- SC ,3- ST, 98-Don't Know,99 –Others)*		
18	**Highest level of formal education completed by any member of the household (Years of education), and the gender of that individual**	a. Education	b. Gender (1-Male 2-Female)
19	**Are you a member of any farmer organization or a farmer cooperative** *(1-Yes*		
20	**If Yes, what is your level of involvement in this group?** *1- very active, 2-somewhat active, 3-not active*		
21	**Are you a leader of any of these groups?** *(1-Yes 2-No)*		
22	**How many sons and daughters do you have**	a. Sons	b. Daughters
23	*If farmer has both sons and daughters ask:* **What is the birth order of your eldest son? Is he 1ˢᵗ**		

Code A: 1-Married living with spouse, 2-Married but spouse away, 3-Divorced, 4-Widow, 5-Not married, 99-other (specify),
Code B: 1- Farming on own farm, 2- Livestock rearing, 3- Salaried employment, 4- Self-employed off farm, 5- Casual labourer on-farm, 6- Casual labour off farm, 99-other (specify).
Code C: 1-Head himself/herself, 2- Wife, 3- Husband, 4- Son, 5-Daughter, 6- Grandchild, 7- Father, 8-Mother, 9- Sister, 10-Brother, 11- Niece, 12- Nephew, 13- Son in law,14- Daughter in law, 15-Brother in law, 16-Sister in Law, 17- Father in law, 18- Mother in law, 19- Other family relatives, 20- Servant, 21- Permanent labour, 22-Tenants, 99- Other person not related

1.3. Household Information

A 'household' is usually a group of (related or unrelated) persons who normally live together and take their meals from a common kitchen. If a group of unrelated persons live in a census house but do not take their meals from the common kitchen, then they are not constituent of a common household.

1.3.1 How many members belong to this household (first write total number, then by age and gender groups): ____ Total

By age and gender
FEMALE: a. <5 years ____ b. 5-17 _____ c. >18 _____ d. Total female members_____
MALE: e. <5 years ____ f. 5-17 _____ g. >18 _____ h. Total male members_____

1.3.2 Total working members in the family (in Numbers) a. Male_____ b. Female _____

1.3.3 In the past 12 months, did any member of your household obtain income from any of the following sources?
(Instruction: Read each item and note yes/no)

		1=Yes	0=No		1=Yes	0=No
a.	*Sale proceeds of Field Crops*			*g. Wages from off farm (govt. job, teacher, etc)*		
b.	*Horticulture crop sales*			*h. Non-farm business or self-employment*		
c.	*Dairy*			*i. Remittance*		
d.	*Livestock sales for meat*			*j. Pension Income*		
e.	*Renting/leasing land or farm equipment*			*k. Other (specify)*		
f.	*Wages from farm labor*					

1.3.4 Total annual household income across all the activities and working members (Rs)
a. **Cash**: (CODE A) b. **in kind (cash equivalent)** (CODE A)

Code A: 0 = < 25,000   1= 25,000-50,000, 2=50,000-1,00,000, 3= 1,00,000- 2,00,000, 4= 2,00,000-3,00,000, 5= 3,00,000-4,00,000, 6= 4,00,000-5,00,000, 7= 5,00,000 – 6,00,000, 8= 6,00,000 – 8,00,000 , 9= 8,00,000 – 10,00,000, 10= greater than 10,00,000

1.3.5. What source of income mentioned above contributes the largest share to your total household income? (write a code *a to k corresponding to the source mentioned*) _____

1.3.6 In your estimate, what percentage of your total HH income in the last 2 years came from?
 a. groundnut farming _____

1.3.6 What type of Ration card do you have? _____
 1-APL (white), 2-BPL (blue), 3-AYY (yellow), 4-AY (special), 5-Do not have ration card, 99-Others (Specify)

1.3.7 **Is anyone in your household (other than you) a member of a farmer producer organization or a farm cooperative?_____**   1-Yes, 2-No

1.4 Poverty Score Card
(The codes correspond to the poverty SCORE, PLEASE KEEP THESE SCORE CODES when programming the survey)

1	**How many people aged 0-17 are currently part of your household?** *0-Five or more, 4-Four, 8-Three, 13-Two, 20-One, 27-None*	
2	**What is household's principal occupation?** *0-Laborers (agricultural plantation, others farm), hunters, tobacco preparers and tobacco product makers and other labourers* *14-Professionals, technicians, clerks, administrators, managers, executives, directors, supervisors and teachers* *8-Others*	
3	**Is the residence all *pucca* (burnt bricks,Stone, Cement, Concrete, Jack board/Cement-plastered reeds, timber, tiles, gal vanished tin or asbestos cement sheets)?** *4-Yes, 0-No*	
4	**What is the household's primary source of energy for cooking?** *0-Firewood and chips, Charcoal or none, 17-LPG, 5-Others*	
5	**Does the household have own television?** *6-Yes, 0-No*	
6	**Does the household own a bicycle, scooter or motor cycle?** *5-Yes, 0-No*	
7	**Does the household own an almirah/dressing table?** *3-Yes, 0-No*	
8	**Does the household own a sewing (tailoring) machine?** *6-Yes, 0-No*	
9	**How many pressure cookers or pressure pans does the household own** *0-None, 6-One, 9-Two or more*	
10	**How many electric fans does the household own?** *0-None, 5-One, 9-Two or more*	

1.5. Information on Migrant Family Member
(Enumerator: A member is usually termed as migrated if she/he lives outside village for more than a year or left recently with that intention)   Only for related family members .Exclude spouses /children of migrant members)

1a	**Has any member of your household migrated in the past 5 years?** *(1-*	
1b	**Has any member of your household migrated in the past 12 months?**	
	If NO to both these questions, skip to next section (2.1)	
2	**Place of most recent migration** *CODE A*	
3	**Reasons for migration** *CODE B*	
4	**Does the member who has migrated take major decisions in matter relating to the agricultural activities?** *(1-Yes, 2-No)*	
5	**Does the member who has migrated contribute towards meeting household**	

Code A: 1-Within state (urban area), 2- Within state (rural area), 3-Within country, another state, 4-Middle East, 5-US/Canada/Australia, 6-European Countries, 99. Others (specify)

Code B: 1- Better prospect of employment, 2- Weather related uncertainties, 3- Higher education, 4- Marriage, 98- Don't know, 99-Others (sp)

Section II. Land Holding

2.1 Land ownership

2.1a	**Local land unit** *(LU)* CODE A	
2.1b	**LU conversion rate**	1 acre =...................LU
2.1c	**How many Plots of land does your household own?**	
2.1d	**How much area of land your household owns across all these**	
2.1e	**How much land that your household currently owns was:**	
	Acquired through purchase?	
2.1g	**Acquired through other means (specify)?**	
		Total across 2.1e to 2.1g should
2.1h	**Have you ever sold any land that you had inherited**? *If No, write 0, If Yes, indicate the total land area sold ; 999-did not*	
2.1i	**Have you ever sold any land that you had acquired through purchase?** *If No, write 0, If Yes, indicate the total land area sold; 999-have not purchased any*	
2.1j	**If YES to either 2.1h or 2.1i: What was the main reason for selling the land?**	

Code A: 1- Bigha, 2- Acre, 3- Killa, 4- Kanal, 5-Bissa, 99- Others (specify)
Code B: 1-to pay off debt; 2- to get cash for non-farm business or investment; 3-to meet household expenses; 4-to downsize my farming operation; 5-Other (specify)

III. Technology specific questions

3.4. Technology X[11]

S. N	*Questions*			
1	**Have you ever heard about TECHNOLOGY X?** *(1-Yes, 2-N0) If **NO**, skip to next*			
2	**When did you first come to know about it?** *(9999-Don't Know)*	*YYYY*		
3	**Source of information** *CODE A*			
4	**Have you ever used TECHNOLOGY X?** *(1-Yes, 0- No) If **YES**, skip to 7; if **NO**, ask 5 and skip to next technology*			
5	**If No, why?** *CODE B (main reason)*			
7	**When did you start using it?** *(9999-Don't Know)*	*YYYY*		
8a	**Who was involved in making the decision to use TECHNOLOGY X?** CODE C			
8b	**What was the motivation behind the decision to use TECHNOLOGY X?** CODE D			
9	**Did you stop using it once you adopted it**?(*1-yes, 0-No) if **NO**, skip to 11*			
10	**If yes**, **why? (main reason)** *CODE B*			
10	When was the last year you used **TECHNOLOGY X?** (9999=Do not remember)			
11	**Have you or anyone in your household received training in using TECHNOLOGY**			
12	**If Yes, From whom?** (*CODE A, 1 to 8*)			
12	Are you currently using **TECHNOLOGY X** on your farm? (*1=Yes, 2= No*) If **NO**, go to 27			
24	**In your estimate what is the total area on your farm covered by this technology?** *1=Less than 5%, 2= 5-10%, 3=10-15%, 4=15-20%, 5=20-40%, 6-40-60%, 7-60-90%, 8-*			
27	**In your opinion, what are the main benefits of using TECHNOLOGY X?** 1-Better Uniformity of crop growth / maturity	6-Increase nutrient efficiency 7-Reduces weed problem 8-Labor saving 9-Easy land preparation		

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[11] This question box was repeated for each of the 12 technologies in the original questionnaire

	2-Reduce water requirement / saves water and cost 3-Improves crop establishment 4-Increases water application efficiency 5-Higher Yields	10-reduces cost of other inputs 99-Others (Specify) 97-No more benefits	
28	**Do you face any inconveniences in using SOIL BUND technology?** *(Rank Top 3)* 1-Unavailable at the peak time 2-too expensive 3-Service provider does not provide credit 4-Lack of service provider/materials in the village 5-Unsatisfied with technology	6-Unsatisfied with service quality 7-Difficulty in getting subsidy 8-lack of repair and service facility nearby 9-Frequent technical problems 10-Labor intensive 99-Others (Specify) 97-No inconvenience	**Rank Top 3**
29	**Do you share your SOIL BUND technology experience with other farmers?** *(1- Yes, 0-No)*		
30	**In your opinion, does the SOIL BUND technology increase, decrease or has no effect on the time devoted to farming by the MALE members of your household relative to the conventional practice**? *(Code 1-Increase, 2-Decrease, 3-Neutral)**If Neutral, skip to 32*		
31	**If response is increase or decrease: In what aspects**	land	
31	**is the labor input by MALE members increased or**	Sowing	
31	**decreased?**	Weeding	
31	1-Yes, 0-No	Irrigating	
31		Harvesting	
31		**Other (specify)**	
32	**In your opinion, does the SOIL BUND technology increase, decrease or has no effect on the time devoted to farming by the FEMALE members of your household relative to the conventional practice?** *(Code: 1-Increase, 2-Decrease,3-Neutral)**If Neutral, skip to next section*		
33	**If response is increase or decrease: In what aspects**	land	
33	**is the labor input by FEMALE members increased or**	Sowing	
33	**decreased?**	Weeding	
33	1-Yes, 0-No	Irrigating	
33		Harvesting	
33		**Other (specify)**	

Code A: 1-Government Extension service, 2- Service Provider, 3- CIMMYT/ICRISAT, 4- Farmer Cooperative /group, 5-Research centres other than CIMMYT/ICRISAT, 6- Neighbour/Relative farmer, 7- Private Company/input dealer, 8- NGO/CBO, 9- Radio, 10- TV, 11- Mobile Phone , 12- Newspaper,, 13-traditionally known, 99- Others (Specify)

Code B: 1-Unwilling to try new technology, 2-lack training/information, 3- Expensive to hire/build, 4- Service/materials not available in the village, 5-Gives Less Yield, 6- Not satisfied with output, 7- Does not look good, 8- High weed, 9- Not suitable on small Land, 10- Not suitable for the crop, 11- Does not have irrigation facility, 12- Land is naturally level/ no need, 13-Difficulty in getting subsidy, 14- Lack of information 98-Cannot say, 99- Others (Specify)

Code C: 1-Only I myself made the decision, 2-Both me and my spouse were involved, 3-I and other male members of my family made the decision, 4-Whole family was involved, 99-Others (Specify)

Code D: 1-to increase crop yield/productivity, 2-to reduce irrigation cost or water wastage, 3-to control weed problem, 4-other farmers in the village were using it, 5-Other (specify)

IV. Plot characteristics and groundnut production in Kharif 2015 season

4.1 Land use

1a	**How many plots did you cultivate in Rabi 2014-15 season?**	
1b	**What was the total cultivated land area in Rabi 2014-15 season** *(LU)*	
2a	**How many plots did you cultivate in Kharif 2015 season?**	
2b	**What was the total cultivated land area in kharif 2015 season** *(LU)*	
3	**Did you leave any land fallow in Rabi 2014 and this Kharif 2015 season?** *1-Yes 2-No (If NO, go to 4.2)*	
4	**Reason for leaving land fallow (***1- Land not fertile, 2- Unavailability of water, 3-Dispute over land, 4-Unabvailability of labour, 99-Others (Specify)*	

What crops did your HH produce in the last 12 months in the following categories (only record number of crops mentioned):

5a. Cereal	5b. Pulses	5c. oil crops	5d. horticulture	5e. fibre crops	5f. Other

4.2. Plot characteristics

For each of the plot cultivated in Rabi 2014-15 and Kharif 2015 season, I would like to ask you some specific questions.

S.N	**Note to Enumerators:** *Start with biggest plot farmer cultivated*	**Plot 1**	**Plot 2**	**Plot 3**
1a	**Distance from your home to this plot** *km*			
1b	**Size /Area of plot** *(LU)*			
2	**Plot ownership** *CODE: 1- Owned, 2.-Leased in /Shared in, 3- Leased*			
3a	**If owned, Owned by** *CODE A*			
3b	**If owned, was this plot inherited or purchased?** *1-inherited 2-purchased 98-don't know*			
3c	**Your assessment of the market value of this plot if you were to sell it today? Rs**			
4	**Irrigation source** *CODE: 0- No irrigation, 1-Tube Well, 2-Open Well, 3-River canal water, 4-Pond 99- Others (specify)*			
5	**Irrigation type** *CODE: 1-Flood, 2-Pump, 3-Drip, 4-Sprinkler, 99-Other*			
6	**Soil type** *CODE: 1-Sandy, 2-Sandy Loam, 3-Loam Soils, 4-Clay Loam, 5-Clay, 99-Others (Specify)*			
7	**Soil quality** *CODE:1- Good, 2-Medium, 3-Poor*			
8	**Soil Salinity** *CODE:1- High, 2- Medium, 3- Low 98-don't know*			
9	**Land level** *CODE:1- High level, 2- Middle level, 3- Low level, 4-uneven/mixed, 5-uniform 98-don't know*			
10	**What is your observation about the soil quality, fertility on this plot compared to last 10 years? (**Code 1. Declining, 2. Remain same, 3. Improving)			
11	**How many times this plot has been leveled?** *If ZERO, ask 12 then go to 14a ; other than ZERO, skip to 13a*			
12	**Why this plot has never been leveled?** *CODE B (Multiple responses possible)*			
13a	**When was the plot leveled last?** *(mm/yyyy)*			
13b	**Method of leveling used** *CODE:(0 –Traditional, 1-Laser land levelling, 2-None)*			

S.N	Note to Enumerators: *Start with biggest plot farmer cultivated*		Plot 1	Plot 2	Plot 3
14a	**What did you do with the crop residues on this plot at the end of Kharif 2014?** *CODES: 0-No residue was produced, 1-Retained/incorporated in the field, 2-Mulched, 3-Burnt it, 4-Used it as fodder or cooking fuel on-farm, 5-Sold it, 99-Other (specify) (multiple responses are possible)*				
14b	**If retained, incorporated or mulched: Percentage retained/mulched/incorporated?**				
14c	**What did you do with the crop residues on this plot at the end of Rabi 2015?** *CODES: 0-No residue was produced, 1-Retained in the field, 2-Mulched, 3-Burnt it, 4-Used it as fodder or cooking fuel on-farm, 5-Sold it, 99-Other (specify)*				
14d	*If retained or mulched: Percentage retained/mulched?*				
15a	**Are you currently using following technologies on this plot or more generally on your farm with direct impact on this plot? (Check all that apply)** *1-Yes, 2-No*	Soil bunds,			
15b		Field/boundary bunds			
15c		Broad bed and furrow			
15e		Contour bunds			
15f		Polythene mulching			
15g		Nala plugs/RFDs			
15h		Sunken pits			
15i		Farm pond			
15j		Masonry check dams			
15k		Well recharge pits			
15l		Penning Sheep/Goat/Cattle			
15m		Others (Specify)……………………			
16a	**Do you have following types of planted trees on this plot?** *CODE: 1-Yes 2-No*	**Fruit trees**			
16b		**Trees for firewood/fuel**			
16c		**Trees for soil fertility**			
16d		**Trees for commercial purpose**			

Code A: 1-Head himself/herself, 2- Wife, 3- Husband, 4- Son, 5-Daughter, 6- Grandchild, 7- Father, 8-Mother, 9- Sister, 10-Brother, 11- Niece, 12- Nephew, 13- Son in law, 14- Daughter in law, 15-Brother in law, 16-Sister in Law, 17- Father in law, 18- Mother in law

Code B: 0-Don't know what is Laser levelling / this service is not available here; 1- Financial constraint, 2- Used on trial basis, 3-Land is naturally level, 4- Not required for particular crop, 5-Small land size, 6- Land not empty/vacant, 7-leased land , 99-Others(Specify)

Following questions are specific to groundnut farming in Kharif 2015(continue with the same plots)

S.N	Note to Enumerators: *Start with biggest plot farmer cultivated*	Plot 1	Plot 2	Plot 3
96	**Is this plot cultivated with groundnut in Kharif 2015?** *CODE: 1-Yes 2-No If No, skip to Next Plot or Section*			
97	**Is groundnut inter-cropped?** *CODE: 1-Yes 2-No If NO, skip to 99*			
98	**What percentage of this plot is planted to groundnut in the Kharif**			
99	**Name of the inter/mixed Crop** *CODE C 98=Not cultivated any*			
99	**Border crop** *CODE C 98=Not cultivated any border crop*			

S.N	Note to Enumerators: *Start with biggest plot farmer cultivated*		Plot I	Plot 2	Plot 3
100	Did you practice crop rotation on this plot by planting a legume crop before or after a cereal crop? *CODE: 1-Yes 2-No*				
101	Method of Plot Preparation in Kharif 2015 *CODE: 1-Planker 2- Tiller/Cultivator, 3- Rotavator, 4- Harrow, 5-Paddy Harrow, 6-ZT drill 7-LLL 8-conventional ploughing 9-ripping 10-ridging 99- others (Specify)*				
102	Method of seeding in Kharif 2015 *CODE:1-Broadcasting, 2-seed cum ferti drill,3-ZT drill, 4-Turbo happy seeder*				
10	Seeding rate (kg/LU)				
104	Who in your house mainly provided labour for this plot in Kahrif 2015?	a. Relationship (CODE A)			
105	*(write the relationship with the respondent and gender)*	b. Gender *(1-Male, 2-Female)*			
106	Who is the main decision maker regarding inputs and outputs of this	a. Relationship (CODE A)			
107	plot*? (write the relationship with the respondent and gender)*	b. Gender *(1-Male, 2-Female)*			
108	What groundnut variety of seed is planted in Kharif 2015? *CODE D*				
109	Source of groundnut seed planted *CODE: 1=Saved from previous harvest, 2=Purchased from grain vendors in the market, 3=Purchased from other farmers or community based organization who produced seed, 4=Purchased from seed companies or input dealers, 5=Received subsidized seed from government or NGOs, 6=Received seed from extension agents, 7=Borrowed / obtained from neighbors/relatives, 98=Do not remember, 99=Others (specify)*				
110	Can you recall when was the first year you adopted this variety on your farm? 9998= less than 15 years ago but do not remember; 9999= more than 15 years ago but do not remember;				
111	What was the source of groundnut seed for the first planting? *CODE: 1=Purchased from grain vendors in the market, 2=Purchased from other farmers or community based organization who produced seed, 3=Purchased from seed companies or input dealers, 4=Received subsidized seed from government or NGOs, 5=Received seed from extension agents, 6=Borrowed / obtained from neighbors/relatives, 98=Do not remember, 99=Others (specify)*				
112	What are the two characteristics of this variety you LIKE?	First			

S.N	Note to Enumerators: *Start with biggest plot farmer cultivated*		Plot I	Plot 2	Plot 3
11 3	*CODE: 1=High yielding, 2= Resistance to Insect and disease, 3=Drought resistance, 4=Early maturity, 5=Seed quality, 6=Colour and taste, 7=Processing quality, 8=Good price / high demand, 99=Others (Specify)*	**Second**			
11 4	**What are the two characteristics of this variety you DISLIKE?***CODE: 1=Low yielding, 2=Susceptible to insects and diseases, 3=Susceptible to drought, 4=Late maturity, 5=Seed quality, 6=Color and taste, 7=Processing quality, 8=Low price / Low demand, 99=Others (Specify)*	**First**			
11 5		**Second**			
11	**Did you use any of these inputs / practices on this plot in Kharif 2015** (read each input and note the response 0-No, if Yes, note the total Quantity of input used)	a=organic fertilizer (kg)			
11		b=Urea (Kg)			
11		*c=DAP (kg)*			
11		*d=Potash (Kg)*			
11		e=Phosphate (Kg)			
11		f= Zinc (kg)			
11		g=pesticides	(choose unit		
11					
11		h=herbicides	(choose unit		
11					
11		i=hired labor (yes/no)			
11		j=Nutrient Expert Decision Support software			
116		k=Leaf Colour Chart (yes/no)			
11		l=GreenSeeker sensors (yes/no)			
11		i=hired labor (yes/no)			
11	**What was the Total Man Days of Labor required in the following activities for groundnut farming in Kharif Season 2015?** **96-Not Applicable**	land preparation			
11		Sowing			
11		Weeding			
11		Irrigating			
11		Harvesting			
11		**Other (specify)**			
11	**How many times was this plot irrigated in Kharif Season 2015?**				
11	**What is the total quantity of groundnut you expect to harvest from this plot in this season?** *Qtl*				
11	*Specify if the weight is with or without shell: 1=with shell,*				
12 0	**If plot is inter-mixed crop, ask: What is the total value of other crops you expect to harvest from this plot in this season?** *Rs*				

Code A: 1-Head himself/herself, 2- Wife, 3- Husband, 4- Son, 5-Daughter, 6- Grandchild, 7- Father, 8-Mother, 9- Sister, 10-Brother, 11- Niece, 12- Nephew, 13- Son in law, 14- Daughter in law, 15-Brother in law, 16-Sister in Law, 17- Father in law, 18- Mother in law

Code C: 1=Red gram, 2=Green gram, 3=Horse gram, 4=Cow pea, 5= Black gram, 6= Bengal gram, 7= Lentils, 8=kidney beans / Rajma, 9=pigeon pea; 9= groundnut, 10=mustard, 11= Finger millet, 12= Little millet, 13= Foxtail millet, 14= Pearl millet, 15= Barnyard millet, 16=Kodo millet, 17= Proso millet, 18=Sorghum,19=Maize, 20-wheat, 21-rice, 22- soybean, 98=Not cultivated any inter/mixed/border crop, 99=Others (Specify)

Code D: 1=Anantha Jyothi (ICGV 91114),2=Bheema (TG 47), 3=Dharani,4=JL 24, 5=Kadiri 3, 6=Kadiri 5,7=Kadiri 6, 8=Kadiri 7,9=Kadiri 8, 10=Kadiri 9,11=Local (non-descriptive),12=Narayani, 13=Pollachi red (local land race),14=TGCS 1043, 15=TMV 2, 99=Others (Specify)

Section V: Perception on new technologies, constraints and access to information and credit

5.1. Perception of New Agriculture Practices

S.N	Questions			COD
1.	**When was the last time your Household adopted a NEW input or a farming practice on your farm for the first time?** (YYYY)			
2.	**What was this new input or farming practice you most recently adopted on your farm?** *CODE: 1-seed/Variety, 2-Agro-chemicals, 3-New animal breed, 4-agronomic practices, 5-soil or water conservation, 6-conservation agriculture, 7-Machinery/tools, 8-Storage method, 9-mono-cropping, 10-drying/processing, 99-Others (Specify)*			
3	**What is the depth of ground water level in this area?***(ft) 98 Don't know*			
4	**Over the past 10 years have you experienced fall in ground water level?***(2-No, 98-Don't Know, If YES, by how much **ft** water level has declined) If **NO**, skip to **6***			
5	**If** *YES,* **In your opinion, what are the reasons for the decline in ground water**			
6	**Are you aware of any water conservation practices?** (1- Yes, 0-No) *if NO,*			
7	**If yes, name the practices?** (Record up to three) (CODE	**A**	**B**	C
8	**Are you using any of these practices on your farm?** *CODE: 1-Yes 2-No*			
9a	**If YES, which one(s)?**			
9b	**If *NO*, why not?** *CODE C*			
10	**Have you ever used hybrid seeds of any crop on your farm?** *CODE: 1-Yes 2-*			

Code A: 1- Indiscriminate use of water, 2. Deforestation, 3- Increase in population, 4-Increased industrial activity, 5- Water Pollution, 6-Decline in rainfall, 7-Reason not related to human activity,8- Increase in submersible pump, 98-Don't Know, 99-Others (specify)

Code B: 1-Scheduling irrigation only when required, 2. Planting less water requiring crops/variety, 3. Keeping residue for water conservation, 4- Adopting water saving technology, 5- Farm pond, 99. Others (specify)

Code C: 1- Beyond my control, 2- Single effort will not help, 3- Water saving technology are costly, 4- My land uses surface water, 5- No water problem in my area, 99- Others (specify)

5.2 Use of technology by farmers in social network

1. How many farmers in this village/other villages you know personally?	
2. How often you are interacting with them on farming related issues? *(1=at most once a week, 2=Twice in a week, 3=3 times in a week, 4= 4 times in a week, 5= 5/more than 5 times in a week, 6=Do not interact)*	

3. Approximately how many farmers YOU KNOW have used/currently using the following technologies on their farm? *(read each, and note the numbers)*
Code: 997--I am not aware of this practice myself,
*   999—I am aware about this practice but don't know how many are using it*

a=Zero Tillage		**i Soil bunds**	
b1=Land levelling		**j. Field/boundary bunds**	
b2=Laser land levelling		**k. Broad bed and furrow**	
c=Direct seeding rice		**l. Contour bunds**	
d=Residue retention/mulching		**m. Polythene mulching**	
e=legume rotation		**n. Nala plugs/RFDs**	
f=drip irrigation		**o. Sunken pits**	
g=green seeker		**p. Farm pond**	
h=leaf color chart		**q. Masonry check dams**	
i=Nutrient expert decision support software		**r. Well recharge pits**	
j=agroforestry		**s. Penning Sheep/Goat/Cattle**	
h=hybrid seeds			

5.3c Constraints to Groundnut production

S.No	Questions		
1a	**What are the two main constraints you face in groundnut**	First	
1b	**farming?** CODE A	Second	
2	**Have you stopped planting any groundnut varieties in the past 3 years that you used to grow before?**(1-Yes,0-No) If NO, skip to 5.5		
3	**If yes**, How many?		
4	**Name the most recent variety you have discontinued**		
5	**What is the main reason for discontinuation?** CODE B		
6a	**What is the current price of groundnut (with shell) if you were to sell it? Rs/kg**		
6b	**What is the current price of groundnut (with shell) if you were to buy it? Rs/kg**		
6c	**What is the selling price of groundnut (with shell) you expect at the time of harvest this season? Rs/kg**		

Code A: 1-Land, 2-labour, 3-cash constraint, 4-seeds not available, 5-insect and disease problem, 6-cannot sell the crop, 7-price too low, 8-no information or technical advice on farming practices, 99-other(specify)
Code B: 1-Seed not available, 2-had low yield, 3-did not like the color, 4-susceptible to disease, 5- not liked by processors, 6-unpleasing cooking quality/taste, 99-other (specify)

5.3d Sources of risk in farming and coping strategies

1a		*Variability in the timing and level*	
1b	**Based on your experience, which of the following**	*Floods*	
1c	**events would you consider to be a major cause of**	*Drought*	
1d	**concern to you as a farmer or a major source of risk in**	*High temperatures*	
1e	**your farming operation?**	*Hail or cold temperatures*	
1f	***Read each event and ask the respondent to rank them***	*Insects and plant diseases*	
1g	***on a scale of 0 to 2***	*Infectious livestock diseases*	
1h	0 – *not a cause of concern for me*	*Price fluctuations in farm*	
1i	1- *Somewhat a concern for me*	*Non-availability of inputs in a*	
1j	2- *A major concern for me*	*Lack of market to sell the products*	
2a	**When you face an**	*Sell household goods, jewellery, etc.*	
2b	**economic shock due to**	*Sell animals/ livestock*	
2c	**any of these risk factors**	*Sell other farm assets*	
2d	**mentioned above,**	*Borrow money*	
2e	**what coping strategies do you most often use?**	*I change my farming practices by going back to doing things the*	
2f	*(indicate 1=Use most*	*I change my practices by using NEW and MODERN methods of*	
3	*If use 2e often or sometime, ask:* **Can you give an example of this strategy you have used in the**		
4	*If use 2f often or sometime, ask:* **Can you give an example of this strategy you have used in the**		

5.4 Loss Due to Unexpected Weather

1.	**In the past 5 years, have you ever lost a significant portion of your crop production due to unexpected weather (e.g., low rainfall, flooding, unexpected monsoon time, hail, etc)?** *1-Yes, only wheat, rice or groundnut, 2-Yes, Other crop, 3- Yes, multiple crops, including wheat, rice, groundnut, 4-No*	
2.	**If yes, how many times you have suffered such losses in past <u>five years</u>?** *98-Don't know/can't say/don't remember*	
3.	**How many times you have suffered such losses in the past <u>two years</u>?** *98-Don't know/can't say/don't remember*	

4	**Which crops were most impacted by these losses?** *1-wheat, 2-rice, 3-groundnut, 4-other, 5-all*		
5a.	**Have you heard about the phenomenon called 'climate change'? 1-Yes 2-No**		
5b	**If YES, can you tell me what will happen as a result of 'climate change' that has**		
5c	**implications for farmers like you? (select as many as mentioned):**		
5d	*1-extreme weather; 2-too much rain/flood; 3-too little rain/drought; 4-high*		
5e	*temperatures; 5-late start of rainy season; 6-cold winters; 7-too much pest/diseases; 8-unpredictable weather; 9-farming will become more risky; 10-Other (specify); 98-Don't know*		

5.5 Access to information, infrastructure and credit

1	**What is the distance from your house to the nearest paved road (if the house is next to the paved road, write zero)** *km*		
2	**What is the distance from your house to the nearest market where you obtain agricultural inputs (e.g., fertilizer, pesticides, seeds, etc.)** *km*		
3	**What is the distance from your house to the nearest agricultural extension office** *km*		
4	**What means of transport do you mainly use to get to the nearest commercial town?** *1- Walking, 2- Tractor, 3- Bicycle, 4-Motorcycle, 5-Car, 6- Bus, 7- Light transport Vehicle, 8-Animal Driven Cart, 99- others (specify)*		
5	**Distance from your home to this commercial town** *km*		
6a	**Time it takes on average to travel to this commercial town using the main mode of**	Hours	
6b	**transportation (Consider time of one way travel)**	minutes	
7	**Do you have a bank account?** *Code: 1-Yes 2-No*		
8	**Do you own kisan credit card?** *(1-Yes, 2-No)*		
9	**Do you currently have crop insurance policy (other than KCC)?** *Code: 1-Yes 2-No, If YES, skip to 12*		
10	**Did you have crop insurance in the past but have discontinued?** *Code: 1-Yes 2-No*		
11	**Reason for not having crop insurance or for discontinuing:** *1=Do not need, 2=Not available in my place, 3= No claim available at time of damage 4=Too expensive, 99= Others (Specify)*		
12	**Did you or anyone in the household access credit for agricultural production in the past 12 months** (1=Yes, 2= No) If NO, skip to 14		
13	**If yes, from where?** *1- Bank, 2- Cooperatives, 3- SHG, 4-Community member, 5-Relative/ Friend/ Neighbour, 6-Local money Lender, 7-Commission Agent, 8- Employer, 9-Agrovet, 10-Trader 99- Others (Specify)*		
14	**If no, why not?** *1= Did not need, 2= Do not have access to credit, 3=Very high interest rate , 4-Far From Residence, 5-Bank staff not cooperative, 6- was getting less amount 7-loan was not approved 8-no collateral 99= Others (Specify)*		
15a	**Do you currently have any debt (i.e., do you owe money to anyone)?** 1-Yes 2-No If NO, skip to 17a		
15b	**If yes, to whom do you owe money?** *1- Bank, 2- Cooperatives, 3- SHG, 4-Community member, 5-Relative/ Friend/ Neighbour, 6-Local money Lender, 7-Commission Agent, 8- Employer, 9-Agrovet, 10-Trader 96-multiple (specify) 99-Others (Specify)*		
15c	**What is the interest PER ANNUM you are paying on this debt?**		
15d	**In how many years do you expect to pay-off this debt?**		
16a	**If you need to borrow money for any purpose, how likely is it that you will be able to borrow money you need? (Read the possible responses and select one)** *1-Extremely likely (about 100% chance), 2-Quite likely (about 75% chance), 3-Neither likely nor unlikely (about 50%), 4-Quite unlikely (about 25% chance), 5-Extremely unlikely (about 0%) (skip to 17a)*		

16 b	**Who will be the main source of credit?** *1- Bank, 2- Cooperatives, 3- SHG, 4-Community member, 5-Relative/ Friend/ Neighbour, 6-Local money Lender, 7-Commission Agent, 8- Employer, 9-Agrovet, 10-Trader 99- Others (Specify)*		
17 a	**During the past year, where did you receive most of your information and advice about groundnut or general agricultural production and marketing from?** *CODE A (Multiple Response)*		
17 b	**In total, approximately how many times did you receive information about agricultural production and marketing last year from all these sources?**		
19	**Do you use mobile phone to access information related to farming?** *1=Yes 2=no* **If NO, go to 21**		
20	**If yes, what type of information?** *CODE C – Multiple Response*		
21	**From whom do you access information using mobile phone?** *CODE D— Multiple Response*		
22	**Have you heard about the following organizations / programs? (1-Yes 2-No)** a. CIMMYT b. ICRISAT c. IRRI d. CGIAR e. CCAFS f. Climate Smart Villages g. Krishi Vignan Kendra h. Internet		
23	**What is the farthest you have ever travelled?** 0-never left this village; 1-a village/town in this district; 2-a village/town in a neighboring district; 3-a neighbouring state; 4-another state within India; 5-another country in South Asia; 6-US/Canada/Australia/Europe; 7-Middle east; 9-Other (specify)		
24	**What is the farthest anyone who is currently a member of your household (other than you) has travelled so far and his/her relationship to you?** 0-never left this village; 1-a village/town in this district; 2-a village/town in a neighbouring district; 3-a neighbouring state; 4-another state within India; 5-another country in South Asia; 6-US/Canada/Australia/Europe; 7-Middle east; 9-Other (specify)	a.travel	b. relationship (CODE E)
25	**When it comes to adopting new technology, inputs or farming practices, which of the following best describes your behaviour:** 1 - I am one of the first ones to adopt NEW technologies 2 – I usually wait until a few farmers I know have used those inputs/technologies/practices, and then based on their experiences I make the decision 3 – I usually wait until most farmers in this village are already using those inputs/technologies/practices, and I am 100% sure that those technologies work 4 – I rarely change my farming practices as I am not comfortable doing new things		
26	**Do you have life insurance policy?** *1-Yes, 2-No*		

CODE A. *1-Extension agent, 2-NGO staff, 3-Trader / input dealer, 4-Farmer group/leader farmer, 5-Service Provider, 6-I did not receive any information or advice, 99-other (specify)*
CODE B. *1=1-2 times, 2=2-3 times, 3=3-5 times, 4=5-10 times, 5=More than 10 times*
CODE C. *1-Weather, 2-Price, 3-Inputs, 4-Production technology, 5-Pest control, 6-government programs, 99-other (Specify)*
CODE D. *1-Relatives/friends, 2-Input dealers, 3-KVK, 4-Kisan Call Center, 5-Extension agents, 6-RML, 7-IFFCO Kisan Sanchar Limited (IKSL), 8-mKRISHI, 9-other mobile based agro advisory services, 99-Other (specify)*

Code A: 2-wife, 3-Husband, 4- Son, 5-Daughter, 6- Grandchild, 7- Father, 8-Mother, 9- Sister, 10-Brother, 11- Niece, 12- Nephew, 13- Son in law, 14- Daughter in law, 15-Brother in law, 16- Sister in Law, 17- Father in law, 18- Mother in law

5.6 Assets owned

How many of the following does your household own and what is the total value (in Rs) if you were to sell it today? *(Instruction: For each item, write the number owned and its total value across all units owned. If none owned, write zero)*

	1	2	3	4	5	6	7	8	9	10	11	12
	Bicycle	Motor cycle / Scooter	Car / truck	Cart	Tractor	Plough	Metal silos	Water tank	Irrigation / water pump	Greenhouse / glass house	Dehusker	Fodder chopper
# owned												
value												

	13	14	15	16	17	18	19	20	21	22	23	24
	Combine harvester	Cultivator / tiller	Zero till drills	Biogas plant	Turbo/ Happy	Seed-cum-Ferti Drills	LLL	Ripper	Radio / cassette	TV	Fans	AC
# owned												
value												

	25	26	27	28	29	30	31	32	33	34	35	36
	Cooler	Washing machine	Water purifier	Camera	Pressure cooker	Almirah	Refrig-erator	Comp-uter	Sewing machine	Gas stove	Mobile phones	Non-Mobile
# owned												
value												

How many animals does your household currently own and its total value across all units owned *(if none owned, write zero)*

	36	38	39	40	41	42	43	44	45	46
	Horses	Cows	Buffaloes	Bulls	Goats	Sheep	Donkeys /	Pigs	Chickens	Other
# owned										
value										

To be filled by Enumerator after the completion of Survey

End Time	
Was the survey completed in first attempt or required a revisit? *1-First Attempt, 2-Re-Visit*	

THANK YOU FOR PARTICIPATING IN THIS SURVEY

APPENDIX C: LEA Implementer 2 Questionnaire

To be filled by enumerator

			dd	mm	yyyy
Date of the interview *(dd/mm/yyyy)*					
Name of the enumerator					
Time started					
Enumerator's acquaintance with farmer CODE A					

Code A: 1= not met before, 2=yes-in the context of another survey, 3=yes-in a social context, 4=yes-we are personal acquaintances

To be filled by Supervisor

Date checked *(dd/mm/yyyy)*			
Name of the supervisor			

Section 1: Current household composition and characteristics

1.1 Household identification

1	District	CODE A			
2	Block name			CODE	
3	Village name			CODE	
4	GPS coordinate N **(Format xx.xxxxx)**			GPS coordinate E **(Format xx.xxxxx)**	

5	Household (HH) id	District Code	Block Code	Village Code	HH Number

Code A: 1-Karnal, 2-Ludhiana

1.2 General information about the Head of the Household

Note: Respondent here refers to the Lead Decision Maker for Agricultural Activities in the family.

1	Name of the Respondent	First Name	Last Name
2	Gender of the Respondent *(Code: 1 –Male, 2- Female)*		
3	Age of the Respondent		
4	Marital status *(CODE A)*		
5	Years of formal education	a. Respondent	b. Spouse (if married)
6	Relationship with HOH *(CODE B)* *If option 1, skip to 11*		
7	Name of the Head of Household		
8	Gender of the Head of the HH *(Code: 1 –Male, 2- Female)*		
9	Age of the Household Head		
10	Years of formal education	a. Head	b. Spouse (if married)
11	Religion of the household *(Code: 1- Hindu, 2- Muslim, 3-Christian, 4- Sikh, 5- Buddhist 98-Don't know, 99- Others (specify)*		
12	Main occupation *(CODE C)*	a. Respondent	b. Spouse (if married)

13	**Years of Experience in farming**		
14	**Years of experience in growing wheat**		
15	**Years of experience in growing rice**		
16	**Mobile number**		

Code A: 1-Married living with spouse, 2-Married but spouse away, 3-Divorced, 4-Widow, 5-Not married, 99-other (specify),

Code B: 1-Head himself/herself, 2- Wife, 3- Husband, 4- Son, 5-Daughter, 6- Grandchild, 7- Father, 8-Mother, 9- Sister, 10- Brother, 11- Niece,   12- Nephew, 13- Son in law,14- Daughter in law, 15-Brother in law, 16-Sister in Law, 17- Father in law, 18- Mother in law, 19- Other family relatives, 20- Servant, 21- Permanent labour, 22-Tenants, 99- Other person not related

Code C:1- Farming on own farm, 2- Livestock rearing, 3- Salaried employment, 4- Self-employed off farm, 5- Casual labourer on-farm, 6- Casual labour off farm, 7- Involved in household chores, 99-other (specify).

General Remarks (anything that is noteworthy such as cropping pattern, no of plot and their respective size, if land is taken in lease if yes area of leased land, family size etc)

1.3. Household Information

A 'household' is usually a group of (related or unrelated) persons who normally live together and take their meals from a common kitchen. If a group of unrelated persons live a census house but do not take their meals from the common kitchen, then they are not constituent of a common household.

1.3.1 How many members belong to this household _____

1.3.2 Total working members in the family (in Numbers)

a.   Male_____   b. Female _____

1.3.3 Total annual household income across all the activities and working members (Rs)

a. **Cash**: (CODE A)   b. **in kind (cash equivalent)** (CODE A)

Code A: 1= 0, 2= 1-50,000, 3=50,000-1,00,000, 4= 1,00,000- 2,00,000, 5= 2,00,000-3,00,000, 6= 3,00,000-4,00,000, 7= 4,00,000-5,00,000, 8= greater than 5,00,000

1.3.4 In the past 12 months, did any member of your household obtain income from any of the following sources?

(Instruction: Read each item and note yes/no)

	1=Yes	0=No		1=Yes	0=No
a. Sale proceeds of Field Crops			**g. Wages from farm labor**		
b. Horticulture crop sales			**h. Wages from off farm (govt. job, teacher,etc)**		
c. Dairy			**i. Non-farm business or self-employment**		
d. Livestock sales for meat			**j. Remittance**		
e. Renting/leasing land			**k. Pension Income**		
f. Renting/leasing farm equipment			**l. Other (specify)**		

1.3.5 In your estimate, what percentage of your total HH income in the last 2 years came from?

   a. wheat farming _____

   b. rice farming   _____

1.3.6 What type of Ration card do you have? _____

      1-APL (GREEN), 2-BPL(YELLOW), 3-AYY(Pink), 4- AY (SPECIAL) 5- OPH(KHAKI), 6-Do not have Ration card, 99-OTHERS(SPECIFY)

1.3.7 **Does anyone in your household is a member of a farmer producer organization or a farm cooperative?_____**

      1-Yes, 0-No

1.4 Poverty Score Card

(I have changed the codes to correspond to the SCORE, PLEASE KEEP THESE SCORE CODES when programming the survey)

1	**How many people aged 0-17 are currently part of your household?** *0-Five or more, 4-Four, 8-Three, 13-Two, 20-One, 27-None*	
2	**What is household's principal occupation?** *0-Laborers (agricultural plantation, others farm), hunters, tobacco preparers and tobacco product makers and other labourers* *14-Professionals, technicians, clerks, administrators, managers, executives, directors, supervisors and teachers* *8-Others*	
3	**Is the residence all *pucca* (burnt bricks,Stone, Cement, Concrete, Jack board/Cement-plastered reeds, timber, tiles, gal vanished tin or asbestos cement sheets)?** *4-Yes, 0-No*	
4	**What is the household's primary source of energy for cooking?** *0-Firewood and chips, Charcoal or none, 17-LPG, 5-Others*	
5	**Does the household have own television?** *6-Yes, 0-No*	
6	**Does the household own a bicycle, scooter or motor cycle?** *5-Yes, 0-No*	
7	**Does the household own an almirah/dressing table?** *3-Yes, 0-No*	
8	**Does the household own a sewing (tailoring) machine?** *6-Yes, 0-No*	
9	**How many pressure cookers or pressure pans does the household own** *0-None, 6-One, 9-Two or more*	
10	**How many electric fans does the household own?** *0-None, 5-One, 9-Two or more*	

1.5. Information on Migrant Family Member

(Enumerator: A member is usually termed as migrated if she/he lives outside village for more than a year or left recently with that intention)   Only for related family members .Exclude spouses /children of migrant members)

1a	**Has any member of your household migrated in the past 5 years?** *(1-Yes, 0-No)*	
1b	**Has any member of your household migrated in the past 12 months?** *(1-Yes, 0-No)*	
	If NO to both these questions, skip to next section (2.1)	
2	**Place of most recent migration** *CODE A*	
3	**Reasons for migration** *CODE B*	
4	**Does the member take major decisions in matter relating to the agricultural activities?** *(1-Yes, 0-No)*	

Code A: 1-Within state (urban area), 2- Within state (rural area), 3-Within country, 4-Middle East, 5-US/Canada/Australia, 6-European Countries, 99. Others (specify)

Code B: 1- Better prospect of employment, 2- Weather related uncertainties, 3- Higher education, 4- Marriage, 98- Don't know, 99-Others (specify)

Section II. Land Holding

2.1 Land ownership

2.1a	**Local land unit** *(LU)* CODE A	
2.1b	**LU conversion rate**	1 acre =...................LU
2.1c	**How many Plots of land does your household own?**	
2.1d	**How much area of land your household owns across all these**	

Code A: 1- Bigha, 2- Acre, 3- Killa, 4- Kanal, 5-Bissa, 99- Others (specify)

III. Technology specific questions

3.1. Technology X[12]

S.N	*Questions*	
1	**Have you ever heard about TECHNOLOGY X?** *(1-Yes, 0-N0) If **NO**, skip to next*	
2	**When did you come to know about it?** *(9999-Don't Know)*	*YYYY*
3	**Source of information** *CODE A*	
4	**Have you ever used TECHNOLOGY X?** *(1-Yes, 0- No) If **YES**, skip to 7; if **NO**,*	
5	**If No, why?** *CODE B (main reason)*	
6	**Will you adopt it if there is access to a service provider?** *(1-Yes, 0- No, 98-Don't know/can't say)*	
7	**When did you start using it?** *(9999-Don't Know)*	*YYYY*
8	***Who was involved in making the decision to use TECHNOLOGY X?*** *CODE C*	
9	***Did you stop using it once you adopted it?***(1-yes, 0-No) if **NO**, skip to 11*	
10	***If yes, why? (main reason)*** *CODE B*	
11	**Have you or anyone in your household received training in using TECHNOLOGY X?** *(1-Yes, 0-No) If **NO**, skip to 13*	
12	**If Yes, From whom?** *(CODE A, 1 to 7,99-Others(Specify))*	
13	**When was the last time you used TECHNOLOGY X** *(indicate month and year)*	**a.Month**	**b. Year**
14	**Did you use your own leveler, borrowed or hire it? (code 1-own 2-Hired 3-Borrowed***) If **own**, skip to 17; If **hired**, ask 15 and then skip to 24; if Borrowed, ask 16 and then skip to 24*	
15a	**What was the per unit cost of hiring TECHNOLOGY X when you leveled last***?*	**Select the Unit** 1=hour 2=acre 99=other (specify)	
15b		**Rupees per unit**	
15c	**From whom did you hire the TECHNOLOGY X**? *CODE D*	
16	**From whom did you Borrow the TECHNOLOGY X**? *CODE D*	
17	**At what price did you purchase the TECHNOLOGY X Machine**? *(Rs)*	
18	**When did you purchase it?** *(YYYY)*	
19	**Did you receive any subsidy at the time of purchase?***(0-No, if **YES** amount of subsidy)*	
20	**Do you lease this machine to others on rental basis?** *1-Yes 0-No, If **NO**, skip to 24*	

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[12] This question box was repeated for each of the 3 technologies in the original questionnaire

21	When was the last time you rented the TECHNOLOGY X to others? (MM/YYYY)					
22a	What was is the per unit revenue you earn from renting out the TECHNOLOGY X when you rented to others last time?	**Select the Unit** 1=hour 2=acre 99=other (specify**)**				
22b		**Rupees per unit you charged**				
23	For how many units did you rent out your TECHNOLOGY X last time you rented to others?					
24a	Who mainly operates TECHNOLOGY X on your farm? *Capture age and gender*	Age				
24b		Gender 1=Male 2=Female				
25	On how many plots on your farm did you use this technology when last time you used it?					
26	What is the total area cultivated using this technology when last time you used it? LU					
27	The last time you used TECHNOLOGY X, which crop was planted? *CODE E*	**a**	**b**	**c**	**d**	

28	In your opinion, what are the main benefits of using laser land leveler? *(Rank Top 3)*	Suggested Benefits	Rank Top 3
		Uniformity of growth	
		Reduce water requirement	
		Higher Yields	
		Same or more output with lesser inputs	
		Reduce weed	
		Labor saving	
		Others (Specify)	
		No Response	
29	Do you face any inconveniences in using TECHNOLOGY X? *(0-No,* **If YES**, *Rank Top 3)*	Suggested Inconveniences	Rank Top 3
		Unavailable at the peak time	
		too expensive to hire	
		Service provider does not provide credit	
		Lack of service provider in the village	
		Unsatisfied with technology	
		More time than required taken	
		Service provider not levelling the field properly	
		Difficulty in getting subsidy	
		lack of repair and service facility nearby	
		Frequent technical problems with Machine	
		Others (Specify)	

		No Response		
30	**Do you share your TECHNOLOGY X experience with other farmers?** *(1- Yes, 0-No)*			
31	**In your opinion, does the laser land leveler increase, decrease or has no effect on the time devoted to farming by the MALE members of your household relative to the conventional practice?** *(Code 1-Increase, 2-Decrease, 3-Neutral)* **If Neutral, skip to 33**			
32a	**If response is increase or decrease: In what aspects is the labor input by MALE members increased or decreased?** 1-Yes, 0-No	land preparation		
32b		Sowing		
32c		Weeding		
32d		Irrigating		
32e		Harvesting		
32f		**Other (specify)**		
33	**In your opinion, does the laser land leveller increase, decrease or has no effect on the time devoted to farming by the FEMALE members of your household relative to the conventional practice?** *(Code: 1-Increase, 2-Decrease,3-Neutral)* **If Neutral, skip to Section 35**			
34a	**If response is increase or decrease: In what aspects is the labor input by FEMALE members increased or decreased?** 1-Yes, 0-No	land preparation		
34b		Sowing		
34c		Weeding		
34d		Irrigating		
34e		Harvesting		
34f		**Other (specify)**		
35	**In your opinion, what is the impact of this technology on labor?** *(Code: 1-Increase, 2-Decrease,3-Neutral)*			

Code A: 1-Government Extension service, 2- Service Provider, 3- CIMMYT, 4- Farmer Cooperative /group, 5-Research centres other than CIMMYT, 6- Neighbour/Relative farmer, 7- Private Company, 8- Radio, 9- TV, 10- Mobile Phone , 11- Newspaper, 99- Others (Specify)

Code B: 1-Unwilling to try new technology, 2- Expensive to hire, 3- Not available in the village, 4-Gives Less Yield, 5- Lack of service provider, 6- Not satisfied with output, 7- Does not look good, 8- High weed, 9- Not suitable on small Land, 10- Not suitable for the crop, 11- Does not have irrigation facility, 12- Land is naturally level, 13-Difficulty in getting subsidy, 14- Access to information 98-Cannot say, 99- Others (Specify)

Code C: 1-Only I myself made the decision, 2-Both me and my spouse were involved, 3-me and the Head of Household, 4-I and other male members of my family made the decision, 5-Whole family was involved, 99-Others (Specify)

Code D: 1-Service provider in village, 2- Service provider from other village, 3-Village cooperative, 4-Relatives/Neighbour farmer, 5-Farmers association, 6-Progressive farmer, 7-Farmer Cooperative, 8-Government Extension service, 99-Others (Specify)

Code E: 1-Rice, 2-Wheat, 3-Pulses, 4-Vegetables, 5-Fodder, 96-Not Applicable, 99-Others (Specify)

IV. Plot characteristics and wheat/rice production in Rabi 2014-15 and Kharif 2015 season

4.1 Land use

1a	How many plots did you cultivate in Rabi 2014-15 season?	
1b	What was the total cultivated land area in Rabi 2014-15 season *(LU)*	
2a	How many plots did you cultivate in Kharif 2015 season?	
2b	What was the total cultivated land area in kharif 2015 season *(LU)*	
3	What crops your HH produced and harvested in the last 12 months in the following categories (only record number of crops mentioned)	

Categories	No. of Crops	Categories	No. of Crops
a. Cereal crops		**d.** Horticulture crops (incl, veg, fruits, herbs)	
b. Pulse crops		**e.** Fibre crops	
c. Oil seed crops		**f.** Other	

4.2. Plot characteristics

For each of the plot cultivated in Rabi 2014-15 and Kharif 2015 season, I would like to ask you some specific questions.

S.N	**Note to Enumerators:** *Start with biggest plot farmer cultivated*	Plot 1	Plot 2	Plot 3
1	Size /Area of plot *(LU)*			
2	Plot ownership *CODE: 1- Owned, 2.-Leased in /Shared in, 3-*			
3	Owned/Leased by *CODE A*			
4	Soil type *CODE: 1-Sandy, 2-Sandy Loam, 3-Loam Soils, 4-Clay Loam, 5- Clay, 99-Others (Specify)*			
5	Soil quality *CODE:1- Good, 2-Medium, 3-Poor*			
6	Soil Salinity *CODE:1- High, 2- Medium, 3- Low, 4-No Soil Salanity*			
7	Land level *CODE:1- High level, 2- Middle level, 3- Low level 98-*			
8	What is your observation about the soil quality, fertility on this plot compared to last 10 years? (Code 1. Declining, 2. Remain same, 3. Improving)			
9	How many times this plot has been laser leveled? *If ZERO, ask 10 and skip to 12; other than ZERO, skip to 11*			
10	Why this plot has never been laser leveled? *CODE B (Multiple responses possible)*			
11	When was the plot leveled last? *(mm/yyyy)*			
12a	What did you do with the crop residues on this plot at the end of Kharif 2014? *CODES: 0-No residue was produced, 1-Retained in the field, 2-Incorporated 3-Mulched, 4-Burnt it, 5-Used it as fodder or cooking fuel on-farm, 6-Sold it, 7-Select All, 99-Other (specify) (multiple responses are possible)*			

S.N	Note to Enumerators: *Start with biggest plot farmer cultivated*		Plot I	Plot 2	Plot 3
12b	**If retained, mulched or incorporated: Percentage retained/mulched/incorporated?** *CODES: 1- 0-25%, 2- 25-50%, 3- 50-75%, 4- 75-100%*				
13a	**What did you do with the crop residues on this plot at the end of Rabi 2014-2015?** *CODES: 0-No residue was produced, 1-Retained in the field, 2-Incorporated 3-Mulched, 4-Burnt it, 5-Used it as fodder or cooking fuel on-farm, 6-Sold it, 7-Select All, 99-Other (specify) (multiple responses are possible)*				
13b	**If retained, mulched or incorporated: Percentage retained/mulched/incorporated?** *CODES: 1- 0-25%, 2- 25-50%, 3- 50-75%, 4- 75-100%*				
14	**Do you have following types of planted trees on this field?** *CODE: 1-Yes 0-No*				
14a		**Fruit trees**			
14b		**Trees for firewood/fuel**			
14c		**Trees for soil fertility**			
14d		**Trees for commercial purpose**			

Code A: 1-Head himself/herself, 2- Wife, 3- Husband, 4- Son, 5-Daughter, 6- Grandchild, 7- Father, 8-Mother, 9- Sister, 10- Brother, 11- Niece, 12- Nephew, 13- Son in law, 14- Daughter in law, 15-Brother in law, 16-Sister in Law, 17- Father in law, 18- Mother in law

Code B: 1- Financial constraint, 2- Used on trial basis, 3-Land is naturally level, 4- Not required for particular crop, 5-Small land size, 6- Land not empty/vacant, 7-leased land , 99-Others(Specify)

Following questions are specific to wheat farming in Rabi 2014-2015 (continue for the same plots)

S.N	Note to Enumerators: *Start with biggest plot farmer cultivated*	Plot I	Plot 2	Plot 3
15	**Was this plot cultivated with wheat in Rabi 2014-15?** *CODE: 1-Yes 0-No If No, Skip to 56*			
16	**If yes, what was the area under Wheat Cultivation? (LU)**			
17	**Was wheat inter-cropped?** *CODE: 1-Yes 0-No If NO,*			
18	*If YES,* **what was the total value of other crops harvested on this plot in Rabi 2014-2015?** *98-*			
19	**What percentage of this plot was planted to wheat in**			
20	**Did you practice crop rotation on this plot by planting a legume crop before or after wheat crop?** *CODE: 1-Yes 0-No*			
21	**Irrigation source** *CODE: 0- No irrigation, 1-Tube Well, 2-Open Well, 3- River canal water, 4-Pond 99- Others (specify)*			
22	**Irrigation type** *CODE: 1-Flood (with pump), 2-Flood (without pump), 3-Furrow, 4-Drip, 5-Sprinkler, 99-Other (specify)*			
23	**Method of Plot Preparation in Rabi 2014-2015**			

	CODE: 1-Planker 2- Tiller/Cultivator, 3- Rotavator, 4-Harrow, 5-Paddy Harrow, 6-ZT drill 7-LLL 8-TLL 9-conventional ploughing 10-Ripper 11-Bund Maker 99- others (Specify) ***Record multiple response up to 5 for each plot***				
24	**Method of seeding in Rabi 2014-2015** *CODE:1-Broadcasting,2-seed cum ferti drill,3-ZT drill, 4-Turbo happy seeder, 99-others*				
25	**Seeding rate (kg/LU)**				
26	**Who in your house mainly provided labour for this plot?** *(write the relationship Head of the Household)* **CODE A**				
27	**Who is the main decision maker regarding inputs and outputs of this plot***? (write the relationship Head of the Household)*				
28	**What wheat variety of seed was planted in Rabi 2014-2015?**				
29	**Source of wheat seed planted** *CODE: 1=Saved from previous harvest, 2=Purchased from market, 3=Purchased from other farmers or community based organization who produced seed, 4=Purchased from seed companies or input dealers, 5=Received subsidized seed from government or NGOs, 6=Received seed from extension agents, 7=Borrowed / obtained from neighbors/relatives, 98=Do not remember, 99=Others (specify)*				
30	**Can you recall when was the first year you adopted this variety on your farm?** 9999=Do not remember				
31	**What was the source of wheat seed for the first planting?** *CODE: 1=Purchased from market, 2=Purchased from other farmers or community based organization who produced seed, 3=Purchased from seed companies or input dealers, 4=Received subsidized seed from government or NGOs, 5=Received seed from extension agents, 6=Borrowed / obtained from neighbors/relatives, 98=Do not remember, 99=Others (specify)*				
32a	**What are the two characteristics of this variety you LIKE?** *CODE: 1=High yielding, 2= Resistance to Insect and disease, 3=Drought resistance, 4=Early maturity, 5=Seed quality, 6=Colour and taste, 7=Processing quality, 8=Good price / high demand, 100-No response, 99=Others (Specify)*	**First**			
32b		**Second**			
33a	**What are the two characteristics of this variety you DISLIKE?** *CODE: 1=Low yielding, 2=Susceptible to insects and diseases, 3=Susceptible to drought, 4=Late maturity, 5=Seed quality, 6=Color and taste, 7=Processing quality,*	**First**			
33b		**Second**			

S.No	Questions		Plot 1		Plot 2		Plot 3	
	8=Low price / Low demand, 100-No response, 99=Others (Specify)							
			Per LU	**Ttl Qty**	**Per LU**	**Ttl Qty**	**Per LU**	**Ttl Qty**
	For 34-41 record two responses for each plot. One response should be for Per LU and the Second response for							
34	**Did you use any of these inputs / practices on this plot in Rabi season**(read each input and note the response) 0-No, if Yes, note the per LU/total Quantity of input used)	a=organic fertilizer (kg)						
35		b=Urea (Kg)						
36		*c=DAP (kg)*						
37		*d=Potash (Kg)*						
38		e=Phosphate (Kg)						
39		f= Zinc (kg)						
40		g=pesticides(record the name and quantity of the top 3 pesticides used for the crop)	Name of Pesticide (choose unit 1-mg/2-gm / 3-ml / 4-lit/5-kg)					
			Name of Pesticide (choose unit 1-mg/2-gm / 3-ml / 4-lit/5-kg)					
			Name of Pesticide (choose unit 1-mg/2-gm / 3-ml / 4-lit/5-kg)					
41		h=herbicides(record the name and quantity of the top 3 herbicides used for the crop)	Name of Herbicide (choose unit 1-mg/2-gm / 3-ml / 4-lit/5-kg)					
			Name of Herbicide (choose unit 1-mg/2-gm / 3-ml / 4-lit/5-kg)					
			Name of Herbicide (choose unit 1-mg/2-gm / 3-ml / 4-lit/5-kg)					
42		i=Nutrient Expert Decision						
43		j=Leaf Colour Chart						
44		k=GreenSeeker sensors						
45		l=other inputs (specify)						
46	**What was the Total Man Days of Labor required in the following activities for wheat farming in Rabi Season 2014-15?**	land preparation						
47		Sowing						
48		Weeding						
49		Irrigating						

50		harvesting			
51		**Other (specify)**			
52	**How many times was this plot irrigated in Rabi Season 2014-15?**				
53	**What was the total quantity of wheat produced from this plot in Rabi 2014-15?** *Qtl*				
54	**Wheat quantity sold** *Qtl*				
55	**Price sold** *Rs/Qtl*				

Code A: 1-Head himself/herself, 2- Wife, 3- Husband, 4- Son, 5-Daughter, 6- Grandchild, 7- Father, 8-Mother, 9- Sister, 10-Brother, 11- Niece, 12- Nephew, 13- Son in law, 14- Daughter in law, 15-Brother in law, 16-Sister in Law, 17- Father in law, 18- Mother in law

Code B:1- Financial constraint, 2- Used on trial basis, 3-Land is naturally level, 4- Not required for particular crop, 5-Small land size, 6- Land not empty/Vacant, 99-Others(Specify)

Following questions are specific to rice farming in Kharif 2015(continue with the same plots)

S.N	**Note to Enumerators:** *Start with biggest plot farmer cultivated*	**Plot 1**	**Plot 2**	**Plot 3**
56	**Is this plot cultivated with rice in Kharif 2015?** *CODE: 1-Yes 0-No If No, skip to Next section (5.1)*			
57	**If yes, what was the area under Rice Cultivation? (LU)**			
58	**Is rice inter-cropped?** *CODE: 1-Yes 0-No If NO, skip to 60*			
59	**What percentage of this plot is planted to rice in the Kharif season?**			
60	**Did you practice crop rotation on this plot by planting a legume crop before or after the rice crop?** *CODE: 1-Yes 0-No*			
61	**Irrigation source** *CODE: 0- No irrigation, 1-Tube Well, 2-Open Well, 3-River canal water, 4-Pond 99- Others (specify)*			
62	**Irrigation type** *CODE: 1-Flood (with pump), 2-Flood (without pump), 3-Furrow, 4-Drip, 5-Sprinkler, 99-Other (specify)*			
63	**Method of Plot Preparation in Kharif 2015** *CODE: 1-Planker 2- Tiller/Cultivator, 3- Rotavator, 4- Harrow, 5-Paddy Harrow, 6-ZT drill 7-LLL 8-TLL 9-conventional ploughing 10-ripper 11-Bund Maker 99- others (Specify)* ***Record multiple response upto 5 for each plot***			
64	**Method of seeding in Kharif 2015** *CODE:1-Broadcasting,2-seed cum ferti drill,3-ZT drill, 4-Turbo happy seeder 99-Other (specify)*			
65	**Seeding rate (kg/LU)**			
66	**Who in your house mainly provided labour for this plot?** *(write the relationship with the Head of the Household)* CODE A			
67	**Who is the main decision maker regarding inputs and outputs of this plot***? (write the relationship with the name and relationship with the)* CODE A			
68	**What rice variety of seed is planted in Kharif 2015?**			
69	**Source of rice seed planted** *CODE: 1=Saved from previous harvest, 2=Purchased from market, 3=Purchased from other farmers or community based organization who produced seed, 4=Purchased from seed companies or input dealers, 5=Received subsidized seed from government or NGOs, 6=Received seed from extension agents,*			

S.N	Note to Enumerators: *Start with biggest plot farmer cultivated*		Plot 1	Plot 2	Plot 3
	7=Borrowed / obtained from neighbors/relatives, 98=Do not remember, 99=Others (specify)				
70	**Can you recall when was the first year you adopted this variety on your farm?** *9999=Do not remember*				
71	**What was the source of rice seed for the first planning?** *CODE: 1=Purchased from market, 2=Purchased from other farmers or community based organization who produced seed, 3=Purchased from seed companies or input dealers, 4=Received subsidized seed from government or NGOs, 5=Received seed from extension agents, 6=Borrowed / obtained from neighbors/relatives, 98=Do not remember, 99=Others (specify)*				
72a	**What are the two characteristics of this variety you LIKE?**	**First**			
72b	*CODE: 1=High yielding, 2= Resistance to Insect and disease, 3=Drought resistance, 4=Early maturity, 5=Seed quality, 6=Colour and taste, 7=Processing quality, 8=Good price / high demand, 100-No response, 99=Others (Specify)*	**Second**			
73a	**What are the two characteristics of this variety you DISLIKE?** *CODE: 1=Low yielding, 2=Susceptible to insects*	**First**			
73b	*and diseases, 3=Susceptible to drought, 4=Late maturity, 5=Seed quality, 6=Color and taste, 7=Processing quality, 8=Low price / Low demand, 100-No response, 99=Others (Specify)*	**Second**			

S.No		Questions	Plot 1		Plot 2		Plot 3	
	For 74-81 record two responses for each plot. One response should be for Per LU and the		Per LU	Ttl Qty	Per LU	Ttl Qty	Per LU	Ttl Qty
74	**Did you use any of these inputs / practices on this plot in Kharif 2015** (read each input and note the response 0-No, if Yes, note the total Quantity of input used)	a=organic fertilizer (kg)						
75		b=Urea (Kg)						
76		*c=DAP (kg)*						
77		*d=Potash (Kg)*						
78		e=Phosphate (Kg)						
79		f= Zinc (kg)						
80		g=pesticides (record the name and quantity of the top 3 pesticides used for the crop)	Name of Pesticide					
			(choose unit 1-mg/2-gm / 3-ml / 4-lit/5-					
			Name of Pesticide					
			(choose unit 1-mg/2-gm / 3-ml / 4-lit/5-					
			Name of Pesticide					
			(choose unit 1-mg/2-gm / 3-ml / 4-lit/5-					
81		h=herbicides(record the name and quantity of the top 3 herbicides used for the crop)	Name of Herbicide					
			(choose unit 1-mg/2-gm / 3-ml / 4-lit/5-					
			Name of Herbicide					

			(choose unit 1-mg/2-gm / 3-ml / 4-lit/5-		
			Name of Herbicide		
			(choose unit 1-mg/2-gm / 3-ml / 4-lit/5-		
82		i=Nutrient Expert Decision			
83		j=Leaf Colour Chart			
84		k=GreenSeeker sensors			
85		l=other inputs (specify)			
86	**What was the Total Man Days of Labor required in the following activities for wheat farming in Kharif Season 15?** **96-Not Applicable**	land preparation			
87		Sowing			
88		Weeding			
89		Irrigating			
90		Harvesting			
91		**Other (specify)**			
92	**How many times was this plot irrigated in Kharif Season 2015?**				
93	**What is the total quantity of rice you expect to harvest from this plot in this season?** Qtl				
94	*Specify if the weight is husked rice or dehusked: 1=husked 2=dehusked*				

Section V: Perception on new technologies, constraints and access to information and credit
5.1. Perception of New Agriculture Practices

S.N.	Questions	CODE
1.	**When was the last time your Household adopted a NEW input or a farming practice on your farm for the first time?** (YYYY)	
2.	**What was this new input or farming practice you most recently adopted on your farm?** *CODE: 1-seed/Variety, 2-Agro-chemicals, 3-New animal breed, 4-agronomic practices, 5-soil or water conservation, 6-conservation agriculture, 7-Machinery/tools, 8-Storage method, 9-mono0cropping, 10-drying/processing, 99-Others (Specify)*	
3	**What is the depth of ground water level in this area?***(ft) 98 Don't know*	
4	**Over the past 10 years have you experienced fall in ground water level?***(0- No, 98-Don't Know, If **YES**, by how much **ft** water level has declined) If **NO**, skip to **6***	
5	**If *YES,* In your opinion, what are the reasons for the decline in ground water level?** *CODE A*	
6	**Are you aware of any water conservation practices?** (1- Yes, 0-No) *if NO, skip to next section*	

7	**If yes, name the practices?** (Record up to three) (CODE B)	**A**	**B**		**C**
8	**Are you using any of these practices on your farm?** *CODE: 1-Yes 0-No*				
9	**If *NO*, why not?** *CODE C*				

Code A: 1- Indiscriminate use of water, 2. Deforestation, 3- Increase in population, 4-Increased industrial activity, 5- Water Pollution, 6-Decline in rainfall, 7-Reason not related to human activity, 8- Increase in submersible pump, 98-Don't Know, 99-Others (specify)

Code B: 1-Scheduling irrigation only when required, 2. Planting less water requiring crops/variety, 3. Keeping residue for water conservation, 4- Adopting water saving technology, 5- Farm pond, 99. Others (specify)

Code C: 1- Beyond my control, 2- Single effort will not help, 3- Water saving technology are costly, 4- My land uses surface water, 5- No water problem in my area, 99- Others (specify)

5.2 Use of technology by farmers in social network

1. How many farmers in this village/other villages you know personally? *1-more than 100 farmers 2. 75-100 farmers 3. 50-75 farmers 4. 30-50 farmers 5. 20-30 farmers 6. less than 20 farmers, 100-No Response*		
2. Approximately how many farmers YOU KNOW have used/currently using the following technologies on their farm? *(read each, and note the numbers)* *Code:* *997--I am not aware of this practice myself* *999--don't know how many are using it*	**a=Zero Tillage**	
	b=LLL	
	c=DSR	
	d=Residue retention/mulching	
	e=legume rotation	
	f=drip irrigation	
	g=green seeker	
	h=leaf color chart	
	i=Nutrient expert decision support software	
	j=agroforestry	

5.3 Constraints to Wheat production

S.No	Questions		
1a	**What are the two main constraints you face in wheat**	First	
1b	**farming?** CODE A	Second	
2	**Have you stopped planting any wheat varieties in the past 3 years that you used to grow before?** *(1-Yes,0-No) If NO, skip to 5.4*		
3	**If yes, How many?**		
4	**Name the most recent variety you have discontinued**		
5	**What is the main reason for discontinuation?** CODE B		

Code A: 1-Land, 2-labour, 3-cash constraint, 4-seeds not available, 5-insect and disease problem, 6-cannot sell the crop, 7-price too low, 8-no information or technical advice on farming practices, 9-introduction of new variety, 99-other(specify), 100-No Response

Code B: 1-Seed not available, 2-had low yield, 3-did not like the color, 4-susceptible to disease, 5- not liked by processors, 6-unpleasing cooking quality/taste, 99-other (specify)

5.4 Constraints to Rice production

S.No	Questions		
1a	**What are the two main constraints you face in rice**	First	
1b	**farming?** CODE A	Second	
2	**Have you stopped planting any rice varieties in the past 3 years that you used to grow before?** *(1-Yes,0-No) If NO, skip to 5.5*		
3	**If yes, How many?**		

4	Name the most recent variety you have discontinued	
5	What is the main reason for discontinuation? CODE B	

Code A: 1-Land, 2-labour, 3-cash constraint, 4-seeds not available, 5-insect and disease problem, 6-cannot sell the crop, 7-price too low, 8-no information or technical advice on farming practices, 9-introduction of new variety, 99-other(specify), 100-No Response

Code B: 1-Seed not available, 2-had low yield, 3-did not like the color, 4-susceptible to disease, 5- not liked by processors, 6-unpleasing cooking quality/taste, 99-other (specify)

5.5 Loss Due to Unexpected Weather

1.	In the past 2 years, have you ever lost a significant portion of your wheat or rice production due to unexpected weather (eg low rainfall, flooding, unexpected monsoon time, hail, etc)? *1-Yes, 0-No*	
2.	If yes, how many times you have suffered such losses in past two years? *98-Don't know/can't say/don't remember*	

5.6Access to information, infrastructure and credit

1	What is the distance from your house to the nearest paved road (if the house is next to the paved road, write zero) *km*	
2	What is the distance from your house to the nearest market where you obtain agricultural inputs (e.g., fertilizer, pesticides, seeds, etc.) *km*	
3	What is the distance from your house to the nearest agricultural extension office *km*	
4	What means of transport do you mainly use to get to the nearest commercial town? *1- Walking, 2- Tractor, 3- Bicycle, 4-Motorcycle, 5-Car, 6- Bus, 7- Light transport Vehicle, 8-Animal Driven Cart, 99- others (specify)*	
5	Distance from your home to this commercial town *km*	
6a	Time it takes on average to travel to this commercial town using the main mode of transportation (Consider time of one way travel)	a. Hours	
6b		b. minutes	
7	Do you have a bank account? *Code: 1-Yes 0-No*	
8	Do you own kisan credit card? *(1-Yes, 0-No)*	
9	Do you currently have crop insurance policy (other than KCC)?*Code: 1-Yes 0-No, If YES, skip to 12*	
10	Did you have crop insurance in the past but have discontinued? *Code: 1-Yes 0-No*	
11	Reason for not have crop insurance:*1=Do not need, 2=Not available in my place, 3= No claim available at time of damage 4=Too expensive, 99= Others (Specify)*	
12	Did you access credit for agricultural production in the past 12 months *(1=Yes, 0= No) If NO, skip to 14*	
13	If yes, from where? *1- Bank, 2- Cooperatives, 3- SHG, 4-Community member, 5-Relative/ Friend/ Neighbour, 6-Local money Lender, 7-Commission Agent, 8- Employer, 9-Agrovet, 10-Trader 99- Others (Specify)*	
14	If no, why not? *1= Did not need, 2= Do not have access to credit, 3=Very high interest rate , 4-Far From Residence, 5- Bank staff not cooperative, 6- was getting less amount 7-loan was not approved 8-no collateral 99= Others (Specify)*	
15a	During the past year, where did you receive most of your information and advice about wheat production and marketing from? *CODE A (Multiple Response)*	

15b	If yes in previous question, In total, approximately how many times did you receive information about wheat last year from all these sources?	
16a	During the past year, where did you receive most of your information and advice about Rice production and marketing from? *CODE A (Multiple Response)*	
16b	If yes in previous question, In total, approximately how many times did you receive information about Rice last year from all these sources?	
17	Do you use mobile phone to access information related to farming? *1=Yes 0=no* **If NO, End the Survey**	
18	If yes, what type of information? *CODE C – Multiple Response*	
19	From whom do you access information using mobile phone? *CODE D— Multiple Response*	

CODE A. *1-Extension agent, 2-NGO staff, 3-Trader / input dealer, 4-Farmer group/leader farmer, 5-Service Provider, 6-I did not receive any information or advice, 99-other (specify)*

CODE B. *1=1-2 times, 2=2-3 times, 3=3-5 times, 4=5-10 times, 5=More than 10 times*

CODE C. *1-Weather, 2-Price, 3-Inputs, 4-Production technology, 5-Pest control, 6-government programs, 99-other (Specify)*

CODE D. *1-Relatives/friends, 2-Input dealers, 3-KVK, 4-Kisan Call Center, 5-Extension agents, 6-RML, 7-IFFCO Kisan Sanchar Limited (IKSL), 8-mKRISHI, 9-other mobile based agro advisory services, 99-Other (specify)*

To be filled by Enumerator after the completion of Survey

End Time	
Was the survey completed in first attempt or required a revisit? *1-First Attempt, 2-Re-Visit*	

APPENDIX D: LEA Implementer 3 Questionnaire

Q.No.	Screen No.	Question	Options	Question Type	Looping
SECTION-A: LOCATION
1	1	State	Bihar	Drop Down	None
			Haryana		
2	1	District	Vaishali	Drop Down	None
			Karnal		
3	1	Block		Drop Down	None
4	1	Village		Alpha Numeric	None
SECTION-B: FARMER PROFILE
5	2	Name		Alpha Numeric	None
6	2	Age		Numeric	None
7	2	Gender	Male	Drop Down	None
			Female		
8	2	Education	Illiterate	Drop Down	None
			Literate but no formal schooling/ School Upto 4 years		
			School- 5 to 9 years		
			SSC/ HSC		
			Some College (a Diploma) but not Grad		
			Graduate/ Post Graduate: General		
			Graduate/ Post Graduate: Professional		
9	2	Which of these do you have?	UID	Multiple Check box	None
			BPL Card		
			Co-ooperative Society Membership		
10	2	Marital Status	Married	Drop Down	If "Married", go to 11, if Ünmarried", go to 13
			Unmarried		
11	2	Education (Spouse)	Illiterate	Drop Down	None
			Literate but no formal schooling/ School Upto 4 years		

			School- 5 to 9 years		
			SSC/ HSC		
			Some College (a Diploma) but not Grad		
			Graduate/ Post Graduate: General		
			Graduate/ Post Graduate: Professional		
12	2	Occupation (Spouse)	Farming	Drop Down	None
			Salaried Employment		
			Casual Labourer-on farm		
			Casual Labourer-off farm		
			Self-employed off farm		
			Housewife		
SECTION-C: HOUSEHOLD DETAILS					
13	3	Are you head of household	Yes	Drop Down	If "Yes", go to 18, if "No", go to 14
			No		
14	3	Name of Head of Household		Alpha Numeric	None
15	3	Age of Head		Numeric	None
16	3	Education of Head	Illiterate	Drop Down	None
			Literate but no formal schooling/ School Upto 4 years		
			School- 5 to 9 years		
			SSC/ HSC		
			Some College (a Diploma) but not Grad		
			Graduate/ Post Graduate: General		
			Graduate/ Post Graduate: Professional		
17	3	Relationship with the head	Spouse	Drop Down	None
			Son/Daughter		
			Parent		
			Brother/Sister		
			Son-in-law/Daughter-in-law		
			Grandchild		
18	4	Total family members in household		Numeric	None
19	4	Family Members Aged 0-17		Numeric	None
20	4	Male Members working in agri		Numeric	None

21	4	Male Members working in non-agri		Numeric	None
22	4	Female Members working in agri		Numeric	None
23	4	Female Members working in non-agri		Numeric	None
24	4	Migration in past 12 months	Yes No	Drop Down	If "Yes", go to 25, if "No", go to 27
25	4	Place of Migration		Alpha Numeric	None
26	4	Reason for migration	To earn higher wages from farm activity To earn higher wages from non-farm activity To reduce burden on family Non-availablity of work in village To work on relative's farm Other	Multiple Check box	None
27	5	Type of House	Pucca Kuchcha Semi-Pucca	Drop Down	None
28	5	Source of energy for cooking	Firewood and chips, charcoal or none LPG Other	Drop Down	None
29	5	Household Items owned	TV Two wheeler Pressure cooker Electric Fan Almirah/Dressing Table Sewing Machine	Multiple Check box	None
30	5	Total Annual Household Income (Rs.)		Numeric	None
31	5	Total Annual Income from Agriculture (Rs.)		Numeric	None
32	5	Percentage of Income from Wheat		Numeric	None
33	5	Percentage of Income from Rice		Numeric	None
34	5	Wheat growing experience (Years)		Numeric	None
35	5	Rice growing Experience (Years)		Numeric	None
SECTION-D: LAND PROFILE					

36	6	Distance to paved road		Numeric	None
37	6	Distance to agri-input market		Numeric	None
38	6	Distance to agri-extension centre		Numeric	None
39	6	Last Time you adopted a new technology (YYYY)		Numeric	None
40	6	Type of Technology Adopted	Seed/Variety	Multiple Check box	None
			Agrochemical		
			New animal breed		
			Agronomic Practice (Weeding/Planting/Harvesting)		
			Soil/water conservation		
			Machinery/Tools		
			Storage Method		
			Monocropping		
			Drying/Processing		
41	6	Total area owned (in local units)		Numeric	None
42	6	All crops cultivated in past 12 months	Wheat	Multiple Check box	None
			Rice		
			Cotton		
			Sugarcane		
			Maize		
			Vegetables		
			Other		
43	6	Technologies used in Rabi 2014-15	Laser Land Leveller	Multiple Check box	None
			Zero Tillage		
			Direct Seeded Rice		
44	6	Technologies used in Kharif 2015	Laser Land Leveller	Multiple Check box	None
			Zero Tillage		
			Direct Seeded Rice		
SECTION-E: TECHNOLOGY X[13]					
45	7	Ever used TECHNOLOGY X	Used it and still using it	Drop Down	Üsed it and still using it"will go to 49, üsed it but discontinued will go to 48 and skip to end of
			Used it but discontinued		
			Never used it		

[13] Repeated for each of the three technologies in the original questionnaire

					Section , never used it will go to 46, 47 and skip to end of Section
46	7	Reasons for not using	Unwilling to take risk	Multiple Check box	None
			Expensive to hire		
			Non-availablity in village		
			Less Yield		
			Not Satisfied		
			High Weed		
			Not suitable for small farmers		
			Not suitable for crop		
			Does not have irrigation facility		
			Land is naturally level		
			Cannot Say		
47	7	Will you use if there is access (thru service provider)	Yes	Drop Down	None
			No		
48	7	Reasons for discontinuing	Unwilling to take risk	Multiple Check box	None
			Expensive to hire		
			Non-availablity in village		
			Less Yield		
			Not Satisfied		
			High Weed		
			Not suitable for small farmers		
			Not suitable for crop		
			Does not have irrigation facility		
			Land is naturally level		
			Cannot Say		
49	8	When did you use for first time		Numeric	None
50	8	When did you use last time		Numeric	None
51	8	Who was involved in decisions?	Only self	Multiple Check box	None
			Self and spouse		
			Only male members of the family		
			Whole Family		
52	8	Area cultivated using TECHNOLOGY X		Numeric	None
53	8	Crops cultivated using TECHNOLOGY X	Wheat	Multiple Check box	None
			Rice		
			Maize		

			Cotton		
			Sugarcane		
			Vegetables		
			Other		
54	8	Source of information on TECHNOLOGY X	Local Government officials	Multiple Check box	None
			Private Input dealers		
			Local NGOs / Development Agency		
			Print Media (Newspaper / Magazines)		
			Electronic Media (TV /Radio)		
			Local Exhibition / Agricultural Fair		
			Fellow farmers / Relatives		
			Local research Institute / KVK / ARS		
55	8	Benefits derived from TECHNOLOGY X	Save Water	Multiple Check box	None
			Soil management		
			Improves crop yield		
			More uniform moisture-environment for crops		
			Less time and water required in irrigation		
			Reduce weeds problem		
			Easy land preparation		
			Improves uniformity of crop growth and maturity		
			Reduce consumption of seeds, fertilizers, chemicals, fuel, labor		
56	8	Effect on male Labour	Increase	Drop Down	None
			Decrease		
			Neutral		
57	8	Effect on female Labour	Increase	Drop Down	None
			Decrease		
			Neutral		
58	8	Training Received	Yes	Drop Down	If Yes, go to 59, if No, go to 60
			No		
59	8	Source of Training		Alpha Numeric	None
60	9	Owned/Leased	Owned	Alpha Numeric	If Leased, go to 61, if owned, go to 64
			Leased		
61	9	Cost of Hiring (Rs/Land Unit or Rs/hr)		Numeric	None

62	9	Source of Hiring	Service provider in village	Drop Down	None
			Service provider in other village		
			Village co-operative		
			Relatives/Neighbours		
			Farmers Association		
			Progressive farmer		
63	9	Age of Operator		Numeric	None
64	9	Gender of Operator	Male	Drop Down	None
			Female		
65	9	Purchase Price (Rs.)		Numeric	None
66	9	Year of Purchase		Numeric	None
67	9	Amount of subsidy received (Rs.)		Numeric	None
68	10	Do you lease out TECHNOLOGY X?	Yes	Drop Down	If "Yes", go to 69, if "No", go to 71
			No		
69	10	Last time leased out		Numeric	None
70	10	Revenue earned (per unit)		Numeric	None
71	10	Fellow Farmers known		Numeric	None
72	10	Farmers using TECHNOLOGY X on your advice		Numeric	None
73	10	Reason others not using	Lack of awareness	Multiple Check box	None
			Lack of availability of laser leveler		
			High cost of use		
			Farmers' are not perceiving benefit out of laser leveler		
			Lack of availability of Driils		
			High cost of use		
			Farmers' are not perceiving benefit out of DSR		

SECTION-H: AGRICULTURAL INFORMATION AND CREDIT

129	19	Source of infromation on seed variety/agri input	Fellow Farmers	Multiple Check box	None
			Local Input Dealers		
			Govt. Extension officers		
			KVK/ARS/SAUs		
			Local NGO		
			Radio/TV		
			Newspapers/Magazines		
			Exhibitions/Agri Fair		
			Mobile Agro Advisory Services		
			RML, IKSL, mKrishi		

			Fellow Farmers		
130	19	Source of infromation on agricultural technology	Local Input Dealers	Multiple Check box	None
			Govt. Extension officers		
			KVK/ARS/SAUs		
			Local NGO		
			Radio/TV		
			Newspapers/Magazines		
			Exhibitions/Agri Fair		
			Mobile Agro Advisory Services		
			RML, IKSL, mKrishi		
131	19	Source of infromation on agricultural markets and commodity prices	Fellow Farmers	Multiple Check box	None
			Local Input Dealers		
			Govt. Extension officers		
			KVK/ARS/SAUs		
			Local NGO		
			Radio/TV		
			Newspapers/Magazines		
			Exhibitions/Agri Fair		
			Mobile Agro Advisory Services		
			RML, IKSL, mKrishi		
132	19	Use mobile phone for agri information	Yes	Drop Down	If Yes, go to 133, if No, go to 135
			No		
133	19	Type of information accessed	Weather	Multiple Check box	None
			Price		
			Input use		
			Production Technology		
			Pest control		
			Govt. Programs		
134	19	Source of information access	Relatives/ Friends	Multiple Check box	None
			Input Dealers		
			KVK		
			Kissan Call Center		
			Extension Agents		
			RML		
			IFFCO Kisan Sanchar Limited (IKSL)		
			mKRISHI		
			Other mobile based agro advisory services		
135	20	Do you have Kisan Credit Card (KCC)	Yes	Drop Down	If Yes, go to 136, if No, go to 137
			No		
136	20	Credit Limit on KCC (Rs.)		Numeric	None
137	20		Yes		

		Have you taken any loan in past 12 months	No	Drop Down	If Yes, go to 138, if No, go to 141
138	20	Amount of loan (Rs.)		Numeric	None
139	20	Sources of loan	Bank	Multiple Check box	None
			Commission Agents / Aadati		
			Relatives / Friends		
140	20	Purpose of loan	To buy new tractor / machinery	Multiple Check box	None
			To procure agri-inputs (Fert. / chemicals)		
			Irrigation systems		
			Investment in field (Land levelling etc.)		
			Function at Home		
			Purchase of vehicle		
141	21	No. of crop losses due to weather since 2013		Numeric	None
142	21	Use crop Insurance	Yes	Drop Down	If No, go to 143, if Yes, go to 144
			No		
143	21	Reason for not using crop insurance	Not available in my area	Drop Down	None
			Too Expensive		
			Other		
SECTION-I: CONSTRAINTS					
144	22	Two important constraints faced in wheat farming	Land quality	Multiple Check box	None
			Labor constraint		
			Cash constraint		
			Seeds not available		
			Insect and Disease problem		
			Cannot sell the crop		
			Price too low		
			No information or technical advice on farming practices		
			None/no more		
145	22	Number of wheat varieties discontinued in past 3 years		Numeric	None
146	22	Name of one wheat variety discontinued		Alpha Numeric	None
147	22	Reason for discontinuing the variety	Seeds not available	Multiple Check box	None
			Had low yield		
			Did not like the shape/size/color		
			Susceptible to diseases		
			Not liked by processors		

148	22	Two important constraints faced in rice farming	Land quality	Multiple Check box	None
			Labor constraint		
			Cash constraint		
			Seeds not available		
			Insect and Disease problem		
			Cannot sell the crop		
			Price too low		
			No information or technical advice on farming practices		
			None/no more		
149	22	Number of rice varieties discontinued in past 3 years		Numeric	None
150	22	Name of one rice variety discontinued		Alpha Numeric	None
151	22	Reason for discontinuing the variety	Seeds not available	Multiple Check box	None
			Had low yield		
			Did not like the shape/size/color		
			Susceptible to diseases		
			Not liked by processors		
SECTION-J: PLOT INFORMATION[14]					
152	23	How many plots do you have	1	Multiple Check box	None
			2		
			3		
			4		
			5		
153	23	Total Area cultivated across all plots (Local Units)		Numeric	None
154	23	Plot Landmark		Alpha Numeric	None
155	23	Plot Area (Local Units)		Numeric	None
156	23	Plot-1 Ownership Status	Owned	Drop Down	None
			Leased		
			Shared		
157	23	Soil Type	Sandy	Drop Down	None
			Sandy Loam		
			Clayey Loam		
			Clay		
158	23	Irrigation Status	Rainfed	Drop Down	If Irrigated, go to 159, if rainfed, go to 16
			Irrigated		

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[14] This is repeated for up to five plots in the original questionnaire

159	23	Source of Irrigation	Canal		Drop Down	None
			Pond			
			Well/Tubewell			
160	23	Method of Irrigation	Flood		Drop Down	None
			Drip			
			Sprinkler			
			Pivot			
161	24	Wheat Intercropping	Yes		Drop Down	If Yes, go to 162, if No, go to 163
			No			
162	24	Percentage planted to wheat			Numeric	None
163	24	Total Wheat Production (Quintals)			Numeric	None
164	24	Total Quantity sold (Quintals)			Numeric	None
165	24	Selling Price (Rs./Qtl)			Numeric	None
166	25	Method of Plot Preparation	Planker		Drop Down	None
			Tiller/ Cultivator			
			Rotavator			
			Harrow			
			ZT drill			
			Laser leveller			
			Conventional ploughing			
167	25	Method of Levelling	None		Drop Down	None
			Traditional Land Levelling			
			Laser Land Levelling			
168	25	Method of seeding	Broadcasting		Drop Down	None
			Seed cum ferti drill			
			ZT drill			
			Turbo happy seeder			
169	25	Seed Rate (kg/Land Unit)			Numeric	None
170	25	Wheat Variety Planted			Alpha Numeric	None
171	25	Seed source	Own harvest		Multiple Check box	None
			Purchased			
			Received free or subsidized from govt/NGO			
			Borrowed from other farmer			
			Don't remember			
172	25	Labour Provided by	Self		Multiple Check box	None
			Spouse			
			Both			
			Son/Daughter			
			Other			
173	25	Gender of Labour	Male			None

			Female	Drop Down	
174	26	Rice Intercropping	Yes	Drop Down	If Yes, go to 175, if No, go to 176
			No		
175	26	Percentage planted to Rice		Numeric	None
176	26	Total Rice Production (Quintals)		Numeric	None
177	26	Total Quantity sold (Quintals)		Numeric	None
178	26	Selling PRice (Rs./Qtl)		Numeric	None
179	27	Method of Plot Preparation	Planker	Drop Down	None
			Tiller/ Cultivator		
			Rotavator		
			Harrow		
			ZT drill		
			Laser leveller		
			Conventional ploughing		
180	27	Method of Levelling	None	Drop Down	None
			Traditional Land Levelling		
			Laser Land Levelling		
181	27	Method of seeding	Broadcasting	Drop Down	None
			Transplanting		
			Seed cum ferti drill		
			ZT drill		
			Turbo happy seeder		
182	27	Seed Rate (kg/Land Unit)		Numeric	None
183	27	Rice Variety Planted		Alpha Numeric	None
184	27	Seed source	Own harvest	Multiple Check box	None
			Purchased		
			Received free or subsidized from govt/NGO		
			Borrowed from other farmer		
			Don't remember		
185	27	Labour Provided by	Self	Multiple Check box	None
			Spouse		
			Both		
			Son/Daughter		
			Other		
186	27	Gender of Labour	Male	Drop Down	None
			Female		
187	28	Do you have another plot?		Drop Down	If Yes, go to 188, If No, end of survey
			Yes		

APPENDIX E: CEA Implementer – Wheat and Rice Questionnaire

To be filled by enumerator

Date of the interview *(dd/mm/yyyy)*		Time started	
Name of the enumerator			

To be filled by Supervisor

Date checked *(dd/mm/yyyy)*				Name of the supervisor	

Section 1: Current household composition and characteristics

1.1 Household identification

1a	District *CODE A*		1b. **Mandal / Block**		1c. **Gram Panchayat**	
2a	Village/hamlet name				2b. CODE	
3	Indicate random selection of Household	CODE B				
4	Elevation *(in meter)*					
4	GPS coordinate N *(Format xx.xxxxx)*			GPS coordinate E *(Format xx.xxxxx)*		
6	Household (HH) id		District Code	Mandal / Block Code	Village Code	HH Number

Code A: 1-Karnal, 2-Ludhiana, 3-Vaishali, 4-Kurnool, 5-Anantapur
Code B: 1-*Original, 2-Replacement*

1.2 General information about the Respondent

Note: Respondent here refers to the Lead Decision Maker for Agricultural Activities in the family.

1	**Name of the Respondent**	a. First Name		b. Last Name	
2	**Gender of the Respondent** *(Code: 1 –Male, 2- Female)*				
3	**Age of the Respondent**				
4a	**Marital status** *(CODE A)*				
4b	**How many brothers and sisters do you have (including siblings that may**	a.		b. sisters	
4c	**What was your birth order? For example, were you first born, second**				
5	**Years of formal education of Respondent and spouse (if married)**	a. Respondent		b. Spouse (if married)	
6	**Main occupation** *(CODE B)*	a. Respondent		b. Spouse (if married)	
7a	**Can read a local Indian language (1-Yes, 2-No)**				
7b	**Can read English (1-Yes, 2-No)**				
8	**Years of Experience in farming**				
9a	**Years of experience in growing groundnut**				
9b	**Years of experience in growing wheat**				
9c	**Years of experience in growing rice**				
10	**Mobile number**				
11	**Relationship with Head of the household (HOH)** *(CODE B)* *If option 1, skip to question 17*				
12	**Name of the Head of Household**				

13	**Gender of the Head of the HH** *(Code: 1 –Male, 2- Female)*		
14	**Age of the Household Head**		
15	**Years of formal education**	a. Head	b. Spouse of Head (if
16a	**Can read a local Indian language (1-Yes, 2-No)**		
16b	**Can read English (1-Yes, 2-No)**		
17a	**Religion of the household** *(Code: 1- Hindu, 2- Muslim, 3-Christian, 4- Sikh, 5-Buddhist 98-Don't know, 99-Others (specify)*		
17b	**Caste** *(Code 1- General, 2- SC, 3- ST, 98-Don't Know, 99 –Others)*		
18	**Highest level of formal education completed by any member of the household (Years of education), and the gender of that individual**	a. Education	b. Gender (1-Male 2-Female)
19	**Are you a member of any farmer organization or a farmer cooperative** *(1-Yes*		
20	**If Yes, what is your level of involvement in this group?** *1- very active, 2-somewhat active, 3-not active*		
21	**Are you a leader of any of these groups?** *(1-Yes 2-No)*		
22	**How many sons and daughters do you have?**	a. Sons	b. Daughters
23	*If farmer has both sons and daughters ask:* **What is the birth order of your**		

Code A: 1-Married living with spouse, 2-Married but spouse away, 3-Divorced, 4-Widow, 5-Not married, 99-other (specify),

Code B: 1- Farming on own farm, 2- Livestock rearing, 3- Salaried employment, 4- Self-employed off farm, 5- Casual labourer on-farm, 6- Casual labour off farm, 99-other (specify).

Code C: 1-Head himself/herself, 2- Wife, 3- Husband, 4- Son, 5-Daughter, 6- Grandchild, 7- Father, 8-Mother, 9- Sister, 10-Brother, 11- Niece, 12- Nephew, 13- Son in law,14- Daughter in law, 15-Brother in law, 16-Sister in Law, 17- Father in law, 18- Mother in law, 19- Other family relatives, 20- Servant, 21- Permanent labour, 22-Tenants, 99- Other person not related

1.3. Household Information

A 'household' is usually a group of (related or unrelated) persons who normally live together and take their meals from a common kitchen. If a group of unrelated persons live in a census house but do not take their meals from the common kitchen, then they are not constituent of a common household.

1.3.1 How many members belong to this household: _____ ;

    By age and gender

    FEMALE: a. <5 years _____ b. 5-17 _____ c. >18 _____ d. Total female members_____

    MALE: e. <5 years _____ f. 5-17 _____ g. >18 _____ h. Total male members_____

1.3.2 Total working members in the family (in Numbers) a. Male_____ b. Female _____

1.3.3 In the past 12 months, did any member of your household obtain income from any of the following sources?

(Instruction: Read each item and note yes/no)

	1=Yes	0=No		1=Yes	0=No
g. **Sale proceeds of Field Crops**			g. *Wages from off farm (govt. job, teacher,etc)*		
h. **Horticulture crop sales**			h. *Non-farm business or self-employment*		
i. **Dairy**			i. *Remittance*		
j. **Livestock sales for meat**			j. *Pension Income*		
k. **Renting/leasing land or farm equipment**			k. *Other (specify)*		
l. **Wages from farm labor**					

1.3.4 Total annual household income across all the activities and working members (Rs)

a. **Cash**: (CODE A)   b. **in kind (cash equivalent)** (CODE A)

1.3.5. What source of income mentioned above contributes the largest share to your total household income? (write a code *a to k corresponding to the source mentioned*) _____

1.3.6 In your estimate, what percentage of your total HH income in the last 2 years came from?
 a. wheat farming _____ *b. rice farming* _____

1.3.6 What type of Ration card do you have? _____
 1-APL (white), 2-BPL (blue), 3-AYY (yellow), 4-AY (special), 5-Do not have ration card, 99-Others (Specify)

1.3.7 **Is anyone in your household (other than you) a member of a farmer producer organization or a farm cooperative?_____** 1-Yes, 2-No

1.4 Poverty Score Card

(The codes correspond to the poverty SCORE, PLEASE KEEP THESE SCORE CODES when programming the survey)

1	How many people aged 0-17 are currently part of your household? *0-Five or more, 4-Four, 8-Three, 13-Two, 20-One, 27-None*	
2	**What is household's principal occupation?** *0-Laborers (agricultural plantation, others farm), hunters, tobacco preparers and tobacco product makers and other labourers* *14-Professionals, technicians, clerks, administrators, managers, executives, directors, supervisors and teachers* *8-Others*	
3	**Is the residence all *pucca* (burnt bricks, Stone, Cement, Concrete, Jack board/Cement-plastered reeds, timber, tiles, gal vanished tin or asbestos cement sheets)?** *4-Yes, 0-No*	
4	**What is the household's primary source of energy for cooking?** *0-Firewood and chips, Charcoal or none, 17-LPG, 5-Others*	
5	**Does the household have own television?** *6-Yes, 0-No*	
6	**Does the household own a bicycle, scooter or motor cycle?** *5-Yes, 0-No*	
7	**Does the household own an almirah/dressing table?** *3-Yes, 0-No*	
8	**Does the household own a sewing (tailoring) machine?** *6-Yes, 0-No*	
9	**How many pressure cookers or pressure pans does the household own** *0-None, 6-One, 9-Two or more*	
10	**How many electric fans does the household own?** *0-None, 5-One, 9-Two or more*	

1.5. Information on Migrant Family Member

(Enumerator: A member is usually termed as migrated if she/he lives outside village for more than a year or left recently with that intention)   Only for related family members .Exclude spouses /children of migrant members)

1a	**Has any member of your household migrated in the past 5 years?** *(1-*	
1b	**Has any member of your household migrated in the past 12 months?**	
	If NO to both these questions, skip to next section (2.1)	
2	**Place of most recent migration** *CODE A*	
3	**Reasons for migration** *CODE B*	
4	**Does the member who has migrated take major decisions in matter relating to the agricultural activities?** *(1-Yes, 2-No)*	
5	**Does the member who has migrated contribute towards meeting household**	

Code A: 1-Within state (urban area), 2- Within state (rural area), 3-Within country, another state, 4-Middle East, 5-US/Canada/Australia, 6-European Countries, 99. Others (specify)
Code B: 1- Better prospect of employment, 2- Weather related uncertainties, 3- Higher education, 4- Marriage, 98- Don't know, 99-Others (sp)

Section II. Land Holding

2.1a	**Local land unit** *(LU)* CODE A	

2.1b	LU conversion rate	1 acre =...................LU
2.1c	How many Plots of land does your household own?	
2.1d	How much area of land your household owns across all these	
2.1e	How much land that your household currently owns was: Acquired through purchase?	
2.1g	Acquired through other means (specify)?	*Total across 2.1e to 2.1g should*
2.1h	Have you ever sold any land that you had inherited*? If No, write 0, If Yes, indicate the total land area sold ; 999-did not*	
2.1i	Have you ever sold any land that you had acquired through purchase? *If No, write 0, If Yes, indicate the total land area sold; 999-have not purchased any*	
2.1j	If YES to either 2.1h or 2.1i: What was the main reason for selling the land?	

Code A: 1- Bigha, 2- Acre, 3- Killa, 4- Kanal, 5-Bissa, 99- Others (specify)

Code B: 1-to pay off debt; 2- to get cash for non-farm business or investment; 3-to meet household expenses; 4-to downsize my farming operation; 5-Other (specify)

III. Technology specific questions

3.1. Laser Land Leveller

S.N	*Questions*	
1	**Have you ever heard about LLL or laser land leveller?** *(1-Yes, 2-N0) If **NO**, skip to*	
2	**When did you first come to know about it?** *(9999-Don't Know)*	*YYYY*
3	**Source of information** *CODE A*	
4	**Have you ever used LLL?** *(1-Yes, 0- No) If **YES**, skip to 7; if **NO,** ask 5 and 6 and*	
5	**If No, why?** *CODE B (main reason)*	
6	**Will you adopt it if there is access to a service provider?** *(1-Yes, 0- No, 98-Don't know/can't say)*	
7	**When did you start using it?** *(9999-Don't Know)*	*YYYY*
8a	**Who was involved in making the decision to use LLL?** CODE C	
8b	*What was the motivation behind the decision to use LLL? CODE D*	
9	*Did you stop using it once you adopted it?(1-yes, 0-No) if **NO**, skip to 11*	
10	*If yes, why? (main reason) CODE B*	
11	**Have you or anyone in your household received training in using LLL?** *(1-Yes, 0-*	
12	If Yes, From whom? (*CODE A, 1 to 8*)	
13	**When was the last time you used LLL** *(indicate*	**c. Season** (*1-Kharif 2-*	**d. Year**
14	**Did you use your own leveler or hire it? (code 1-own 2-Hired***) *If own, skip to 16; If **hired**, ask 15 and then skip to 23*	
15 a	**What was the per unit cost of hiring LLL when you leveled last***?*	**Select the Unit** 1=hour 2=acre 99=other (specify)	
15 b		**Rupees per unit**	
15 c	**From whom did you hire the LLL**? *CODE E*	
16	**At what price did you purchase the LLL Machine**? *(Rs)*	
17	**When did you purchase it?** *(YYYY)*	

18	Did you receive any subsidy at the time of purchase of *ANY?(0-No, if* **YES** *amount of subsidy)*				
19	Do you lease this machine to others on rental basis? *1-Yes 0-No, If **NO**, skip to 23*				
20	When was the last time you rented the LLL to others? YYYY				
21 a	What was the per unit revenue you earn from renting out the LLL when you rented to others last time*?*	**Select the Unit** 1=hour 2=acre 99=other (specify**)**			
21 b		**Rupees per unit you charged**			
22	For how many units did you rent out your LLL last time you rented to others?				
23 a	Who mainly operates LLL on your farm? *Capture age and gender*	**Age**			
23 b		**Gender 1=Male 2=Female**			
24	On how many plots on your farm did you use this technology in the last season				
25	What is the total area cultivated using this technology in the last season you used it?				

26	What crops were cultivated on the plot in which you used this technology in the last season you used it? *CODE F*	a	B	c	d
27	In your opinion, what are the main benefits of using laser land leveler? 1-Uniformity of crop growth / maturity 2-Reduce water requirement / saves irrigation water and cost 3-Improves crop establishment 4-Increases water application efficiency 5-Higher Yields	6-Increase nutrient efficiency 7-Reduces weed problem 8-Labor saving 99-Others (Specify) 97-No more benefits	**Rank Top 3**		
28	Do you face any inconveniences in using LLL? *(Rank Top 3)* 1-Unavailable at the peak time 2-too expensive to hire 3-Service provider does not provide credit 4-Lack of service provider in the village 5-Unsatisfied with technology 6-Unsatisfied with service quality	7-Difficulty in getting subsidy 8-lack of repair and service fertility nearby 9-Frequent technical problems with Machine 99-Others (Specify) 97-No inconvenience	**Rank Top 3**		

29	Do you share your LLL experience with other farmers? (1- Yes, 0-No)		
30	In your opinion, does the laser land leveller increase, decrease or has no effect on the time devoted to farming by the MALE members of your household relative to the conventional practice? *(Code 1-Increase, 2-Decrease, 3-Neutral)If Neutral, skip to 32*		
31	If response is increase or decrease: In what aspects	land	
31	is the labor input by MALE members increased or	Sowing	
31	decreased?	Weeding	
31	1-Yes, 0-No	Irrigating	
31		Harvesting	

31		Other (specify)	
32	**In your opinion, does the laser land leveller increase, decrease or has no effect on the time devoted to farming by the FEMALE members of your household relative to the conventional practice?** *(Code: 1-Increase, 2-Decrease,3-Neutral)***If Neutral, skip to Section 3.2**		
33	**If response is increase or decrease: In what aspects**	land	
33	**is the labor input by FEMALE members increased or**	Sowing	
33	**decreased?**	Weeding	
33	1-Yes, 0-No	Irrigating	
33		Harvesting	
33		Other (specify)	

Code A: 1-Government Extension service, 2- Service Provider, 3- CIMMYT/ICRISAT, 4- Farmer Cooperative /group, 5-Research centres other than CIMMYT/ICRISAT, 6- Neighbour/Relative farmer, 7- Private Company/input dealer, 8- NGO/CBO, 9- Radio, 10- TV, 11- Mobile Phone , 12- Newspaper,, 13-traditionally known, 99- Others (Specify)

Code B: 1-Unwilling to try new technology, 2-lack training/information, 3- Expensive to hire/build, 4- Service/materials not available in the village, 5-Gives Less Yield, 6- Not satisfied with output, 7- Does not look good, 8- High weed, 9- Not suitable on small Land, 10- Not suitable for the crop, 11- Does not have irrigation facility, 12- Land is naturally level/ no need, 13-Difficulty in getting subsidy, 14- Lack of information 98-Cannot say, 99- Others **(**Specify)

Code C: 1-Only I myself made the decision, 2-Both me and my spouse were involved, 3-I and other male members of my family made the decision, 4-Whole family was involved, 99-Others (Specify)

Code D: 1-to increase crop yield/productivity, 2-to reduce irrigation cost or water wastage, 3-to control weed problem, 4-other farmers in the village were using it, 5-Other (specify)

Code E: 1-Service provider in village, 2- Service provider from other village, 3-Village cooperative, 4-Relatives/Neighbour farmer, 5-Farmers association, 6-Progressive farmer, 7-Farmer Cooperative, 99-Others (Specify)

Code F: 1-Rice, 2-Wheat, 3-Pulses, 4-Vegetables, 5-Fodder, 99-Others (Specify)

a

IV. Plot characteristics and wheat/rice production in Rabi 2014-15 and Kharif 2015 season

4.1 Land use

1a	**How many plots did you cultivate in Rabi 2014-15 season?**	
1b	**What was the total cultivated land area in Rabi 2014-15 season** *(LU)*	
2a	**How many plots did you cultivate in Kharif 2015 season?**	
2b	**What was the total cultivated land area in kharif 2015 season** *(LU)*	
3	**Did you leave any land fallow in Rabi 2014 and this Kharif 2015 season?** *1-Yes 2-No (If NO, go to 4.2)*	
4	**Reason for leaving land fallow (***1- Land not fertile, 2- Unavailability of water, 3- Dispute over land, 4-Unabvailability of labour, 99-Others (Specify)*	

What crops did your HH produce in the last 12 months in the following categories (only record number of crops mentioned):

5a. Cereal	5b. Pulses	5c. oil crops	5d. horticulture	5e. fibre crops	5f. Other

4.2. Plot characteristics

For each of the plot cultivated in Rabi 2014-15 and Kharif 2015 season, I would like to ask you some specific questions.

S.N	Note to Enumerators: *Start with biggest plot farmer cultivated*		Plot I	Plot 2	Plot 3
1a	**Distance from your house to this plot** *km*				
1b	**Size /Area of plot** *(LU)*				
2	**Plot ownership** *CODE: 1- Owned, 2.-Leased in /Shared in, 3-*				
3a	**If owned, Owned by** *CODE A*				
3b	**If owned, was this plot inherited or purchased?** *1-inherited 2-purchased 98-don't know*				
3c	**Your assessment of the market value of this plot if you were to sell it today? Rs**				
4	**Irrigation source** *CODE: 0- No irrigation, 1-Tube Well, 2-Open Well, 3- River canal water, 4-Pond 99- Others (specify)*				
5	**Irrigation type** *CODE: 1-Flood (with pump), 2- Flood (without Pump), 3-Furrow, 4-Drip, 5-Sprinkler, 99-Other (specify)*				
6	**Soil type** *CODE: 1-Sandy, 2-Sandy Loam, 3-Loam Soils, 4-Clay Loam, 5- Clay, 99-Others (Specify)*				
7	**Soil quality** *CODE:1- Good, 2-Medium, 3-Poor*				
8	**Soil Salinity** *CODE:1- High, 2- Medium, 3- Low 98-don't know*				
9	**Land level** *CODE:1- High level, 2- Middle level, 3- Low level, 4-uneven/mixed, 5-uniform 98-don't know*				
10	**What is your observation about the soil quality, fertility on this plot compared to last 10 years? (**Code 1. Declining, 2. Remain same, 3. Improving)				
11	**How many times this plot has been leveled?** *If ZERO, ask 12 then go to 14a ; other than ZERO, skip to 13a*				
12	**Why this plot has never been leveled?** *CODE B (Multiple responses possible)*				
13a	**When was the plot leveled last?** *(mm/yyyy)*				
13b	**Method of leveling used** *CODE:(0 –Traditional, 1-Laser land levelling)*				
14a	**What did you do with the crop residues on this plot at the end of Kharif 2014?** *CODES: 0-No residue was produced, 1-Retained in the field, 2-Mulched, 3-Burnt it, 4-Used it as fodder or cooking fuel on-farm, 5-Sold it, 99-Other (specify)*				
14b	**If retained or mulched: Percentage retained/mulched?**				
14c	**What did you do with the crop residues on this plot at the end of Rabi 2015?** *CODES: 0-No residue was produced, 1-Retained/incorporated in the field, 2-Mulched, 3-Burnt it, 4-Used it as fodder or cooking fuel on-farm, 5-Sold it, 99-Other (specify) (multiple responses are possible)*				
14d	*If retained or mulched*: **Percentage retained/mulched/incorporated?**				
15a	**Are you currently using the following technologies on this plot or more generally on your farm with direct impact on this**	Soil bunds,			
15b		Field/boundary bunds			
15c		Broad bed and furrow			
15e		Contour bunds			
15f		Polythene mulching			

S.N	Note to Enumerators: *Start with biggest plot farmer cultivated*		Plot I	Plot 2	Plot 3
15g	plot? (Check all that apply) *1-Yes, 2-No*	Nala plugs/RFDs			
15h		Sunken pits			
15i		Farm pond			
15j		Masonry check dams			
15k		Well recharge pits			
15l		Penning Sheep/Goat/Cattle			
15m		Others (Specify)……………………			
16a	**Do you have following types of planted trees on this plot?**	**Fruit trees**			
16b		**Trees for firewood/fuel**			
16c		**Trees for soil fertility**			
16d	*CODE: 1-Yes 2-No*	**Trees for commercial**			

Code A: 1-Head himself/herself, 2- Wife, 3- Husband, 4- Son, 5-Daughter, 6- Grandchild, 7- Father, 8-Mother, 9- Sister, 10-Brother, 11- Niece, 12- Nephew, 13- Son in law, 14- Daughter in law, 15-Brother in law, 16-Sister in Law, 17- Father in law, 18- Mother in law

Code B: 0-Don't know what is Laser levelling / this service is not available here; 1- Financial constraint, 2- Used on trial basis, 3-Land is naturally level, 4- Not required for particular crop, 5-Small land size, 6- Land not empty/vacant, 7-leased land , 99-Others(Specify)

Following questions are specific to wheat farming in Rabi 2014 (continue for the same plots)

S.N	Note to Enumerators: *Start with biggest plot farmer cultivated*		Plot I	Plot 2	Plot 3
17	**Was this plot cultivated with wheat in Rabi 2014-15?** *CODE: 1-Yes 2-No If No, Skip to next plot or next season*				
18	**Was wheat inter-cropped?** *CODE: 1-Yes 2-No If NO, skip to 21*				
19	*If YES,* **what was the total value of other crops harvested on this plot in Rabi 2014?** *98- don't remember*				
20	**What percentage of this plot was planted to wheat in the Rabi**				
21	**Name of the inter/mixed Crop** *CODE C 98=Not cultivated any*				
22	**Did you practice crop rotation on this plot by planting a legume crop before or after wheat crop?** *CODE: 1-Yes 0-No*				
23	**Method of Plot Preparation in Rabi 2014** *CODE: 1-Planker 2- Tiller/Cultivator, 3- Rotavator, 4- Harrow, 5-Paddy Harrow, 6-ZT drill 7-LLL 8-conventional ploughing 9-ripping 10-ridging 99- others (Specify)*				
24	**Method of seeding in Rabi 2014** *CODE:1-Broadcasting,2-seed cum ferti drill,3-ZT drill, 4-Turbo happy seeder*				
25	**Seeding rate (kg/LU)**				
26	**Who in your house mainly provided labour for this plot in Kahrif 2015?** *(write the relationship with the respondent and gender)*	a. **a. Relationship** (CODE A)			
27		b. **b. Gender** *(1-Male, 2-Female)*			
28a	**Who is the main decision maker regarding inputs and outputs of this**	a. **a. Relationship** (CODE A)			

28b	**plot***? (write the relationship with the respondent and gender)*	**b. b. Gender** *(1-Male, 2-Female)*			
29	**What wheat variety of seed was planted in Rabi 2014?** <for programming, we can ask Surabhi to provide a list of popular wheat varieties for coding>				
30	**Source of wheat seed planted** *CODE: 1=Saved from previous harvest, 2=Purchased from grain vendors in the market, 3=Purchased from other farmers or community based organization who produced seed, 4=Purchased from seed companies or input dealers, 5=Received subsidized seed from government or NGOs, 6=Received seed from extension agents, 7=Borrowed / obtained from neighbors/relatives, 98=Do not remember, 99=Others (specify)*				
31	**Can you recall when was the first year you adopted this variety on your farm?** 9999=Do not remember				
32	**What was the source of wheat seed for the first planting?** *CODE: 1=Purchased from market, 2=Purchased from other farmers or community based organization who produced seed, 3=Purchased from seed companies or input dealers, 4=Received subsidized seed from government or NGOs, 5=Received seed from extension agents, 6=Borrowed / obtained from neighbors/relatives, 98=Do not remember, 99=Others (specify)*				
33a	**What are the two characteristics of this variety you LIKE?**	**First**			
33b	*CODE: 1=High yielding, 2= Resistance to Insect and disease, 3=Drought resistance, 4=Early maturity, 5=Seed quality, 6=Colour and taste, 7=Processing quality, 8=Good price / high demand, 99=Others (Specify)*	**Second**			
34a	**What are the two characteristics of this variety you DISLIKE?***CODE: 1=Low yielding, 2=Susceptible to insects and diseases, 3=Susceptible to drought,*	**First**			
34b	*4=Late maturity, 5=Seed quality, 6=Color and taste, 7=Processing quality, 8=Low price / Low demand, 99=Others (Specify); 97-No more*	**Second**			
35	**Did you use any of these inputs / practices on this plot in Rabi season**(read each input and note the response) 0-No, if Yes, note the total Quantity of input used)	a=organic fertilizer (kg)			
36		b=Urea (Kg)			
37		*c=DAP (kg)*			
38		*d=Potash (Kg)*			
39		e=Phosphate (Kg)			
40		f= Zinc (kg)			
41a		g=pesticides	(choose unit		
41b					
42a		h=herbicides	(choose unit		
42b					
43		i=hired labor (yes/no)			
44		j=Nutrient Expert Decision Support software (yes/no)			
45		k=Leaf Colour Chart (yes/no)			
46		l=GreenSeeker sensors (yes/no)			
47		m=other inputs (specify)			

			Plot I	Plot 2	Plot 3
48	What was the Total Man Days of Labor	land preparation			
49	required in the following activities for wheat	Sowing			
50	farming in Rabi Season 2014-15?	Weeding			
51		Irrigating			
52		Harvesting			
53		Other (specify)			
54	How many times was this plot irrigated in Rabi Season 2014-15?				
55	What was the total quantity of wheat produced from this plot in				
56a	Wheat quantity sold *Qtl*				
56b	Price sold *Rs/Qtl*				
57	If plot is inter-mixed crop, ask: What is the total value of other crops you expect to harvest from this plot in this season?				

Code A: 1-Head himself/herself, 2- Wife, 3- Husband, 4- Son, 5-Daughter, 6- Grandchild, 7- Father, 8-Mother, 9- Sister, 10-Brother, 11- Niece, 12- Nephew, 13- Son in law, 14- Daughter in law, 15-Brother in law, 16-Sister in Law, 17- Father in law, 18- Mother in law

Code B:1- Financial constraint, 2- Used on trial basis, 3-Land is naturally level, 4- Not required for particular crop, 5-Small land size, 6- Land not empty/Vacant, 99-Others(Specify)

Code C: 1=Red gram, 2=Green gram, 3=Horse gram, 4=Cow pea, 5= Black gram, 6= Bengal gram, 7= Lentils, 8=kidney beans / Rajma, 9=pigeon pea; 9= groundnut, 10=mustard, 11= Finger millet, 12= Little millet, 13= Foxtail millet, 14= Pearl millet, 15= Barnyard millet, 16=Kodo millet, 17= Proso millet, 18=Sorghum,19=Maize, 20-wheat, 21-rice, 22- soybean, 98=Not cultivated any inter/mixed/border crop, 99=Others (Specify)

Following questions are specific to rice farming in Kharif 2015(continue with the same plots)

S.N	Note to Enumerators: *Start with biggest plot farmer cultivated*		Plot I	Plot 2	Plot 3
58	Is this plot cultivated with rice in Kharif 2015? *CODE: 1-Yes 2-No If No, skip to Next plot or next section*				
59	Is rice inter-cropped? *CODE: 1-Yes 2-No If NO, skip to 61*				
60	What percentage of this plot is planted to rice in the Kharif				
61	Name of the inter/mixed Crop *CODE C 98=Not cultivated any*				
62	Did you practice crop rotation on this plot by planting a legume crop before or after the rice crop? *CODE: 1-Yes 2-No*				
63	Method of Plot Preparation in Kharif 2015 *CODE: 1-Planker 2- Tiller/Cultivator, 3- Rotavator, 4- Harrow, 5-Paddy Harrow, 6-ZT drill 7-LLL 8-conventional ploughing 9-ripping 10-ridging 99- others (Specify)*				
64	Method of seeding in Kharif 2015 *CODE:1-Broadcasting, 2-seed cum ferti drill,3-ZT drill, 4-Turbo happy seeder*				
65	Seeding rate (kg/LU)				
66a	Who in your house mainly provided labour for this plot in Kahrif 2015? *(write the relationship with the respondent and gender)*	c. a. Relationship (CODE A)			
66b		d. b. Gender *(1-Male, 2-Female)*			
67a	Who is the main decision maker regarding inputs and outputs of this plot? *(write the relationship with the respondent and gender)*	c. a. Relationship (CODE A)			
67b		d. b. Gender *(1-Male, 2-Female)*			

S.N	Note to Enumerators: *Start with biggest plot farmer cultivated*		Plot I	Plot 2	Plot 3
68	**What rice variety of seed is planted in Kharif 2015?** <for programming, we can as IRRI to provide a list of popular rice varieties for coding>				
69	**Source of rice seed planted** *CODE: 1=Saved from previous harvest, 2=Purchased from market from grain vendors, 3=Purchased from other farmers or community based organization who produced seed, 4=Purchased from seed companies or input dealers, 5=Received subsidized seed from government or NGOs, 6=Received seed from extension agents, 7=Borrowed / obtained from neighbors/relatives, 98=Do not remember, 99=Others (specify)*				
70	**Can you recall when was the first year you adopted this variety on your farm?** 9998= less than 15 years ago but do not remember; 9999= more than 15 years ago but do not remember;				
71	**What was the source of rice seed for the first planting?** *CODE: 1=Purchased from market, 2=Purchased from other farmers or community based organization who produced seed, 3=Purchased from seed companies or input dealers, 4=Received subsidized seed from government or NGOs, 5=Received seed from extension agents, 6=Borrowed / obtained from neighbors/relatives, 98=Do not remember, 99=Others (specify)*				
72a	**What are the two characteristics of this variety you LIKE?**	**First**			
72b	*CODE: 1=High yielding, 2= Resistance to Insect and disease, 3=Drought resistance, 4=Early maturity, 5=Seed quality, 6=Colour and taste, 7=Processing quality, 8=Good price / high demand, 99=Others (Specify)*	**Second**			
73a	**What are the two characteristics of this variety you DISLIKE?** *CODE: 1=Low yielding, 2=Susceptible to*	**First**			
73b	*insects and diseases, 3=Susceptible to drought, 4=Late maturity, 5=Seed quality, 6=Color and taste, 7=Processing quality, 8=Low price / Low demand, 99=Others (Specify)*	**Second**			
74	**Did you use any of**	a=organic fertilizer (kg)			
75	**these inputs /**	b=Urea (Kg)			
76	**practices on this**	*c=DAP (kg)*			
77	**plot in Kharif 2015**	*d=Potash (Kg)*			
78	(read each input and note the response	e=Phosphate (Kg)			
79	0-No, if Yes, note the total Quantity of input used)	f= Zinc (kg)			
80a		g=pesticides	(choose unit		
80b					
81a		h=herbicides	(choose unit		
81b					
82		i=hired labor (yes/no)			
83		j=Nutrient Expert Decision Support			
84		k=Leaf Colour Chart (yes/no)			
85		l=GreenSeeker sensors (yes/no)			
86		i=hired labor (yes/no)			

S.N	Note to Enumerators: *Start with biggest plot farmer cultivated*	Plot I	Plot 2	Plot 3
87	**What was the Total Man Days**	land preparation			
88	**of Labor required in the**	Sowing			
89	**following activities for rice**	Weeding			
90	**farming in Kharif Season 2015?**	Irrigating			
91		Harvesting			
92	**96-Not Applicable**	**Other (specify)**			
93	**How many times was this plot irrigated in Kharif Season 2015?**			
94a	**What is the total quantity of rice you expect to harvest from**			
94b	*Specify if the weight is husked rice or dehusked: 1=husked*			
95	**If plot is inter-mixed crop, ask: What is the total value of other crops you expect to harvest from this plot in this season?**			

Section V: Perception on new technologies, constraints and access to information and credit
5.1. Perception of New Agriculture Practices

S.N.	Questions	CODE	
1.	**When was the last time your Household adopted a NEW input or a farming practice on your farm for the first time?** (YYYY)		
2.	**What was this new input or farming practice you most recently adopted on your farm?** *CODE: 1-seed/Variety, 2-Agro-chemicals, 3-New animal breed, 4-agronomic practices, 5-soil or water conservation, 6-conservation agriculture, 7-Machinery/tools, 8-Storage method, 9-mono-cropping, 10-drying/processing, 99-Others (Specify)*		
3	**What is the depth of ground water level in this area?***(ft) 98 Don't know*		
4	**Over the past 10 years have you experienced fall in ground water level?***(2- No, 98-Don't Know, If* **YES**, *by how much* **ft** *water level has declined) If* **NO**, *skip to* **6**		
5	**If** *YES,* **In your opinion, what are the reasons for the decline in ground water**		
6	**Are you aware of any water conservation practices?** (1- Yes, 0-No) *if NO, skip to*		
7	**If yes, name the practices?** (Record up to three) **A** **B** C		
8	**Are you using any of these practices on your farm?** *CODE: 1-Yes 2-No*		
9a	**If YES, which one(s)?**		
9b	**If** *NO*, why not? *CODE C*		
10	**Have you ever used hybrid seeds of any crop on your farm?** *CODE: 1-Yes 2-No*		

Code A: 1- Indiscriminate use of water, 2. Deforestation, 3- Increase in population, 4-Increased industrial activity, 5- Water Pollution, 6-Decline in rainfall, 7-Reason not related to human activity,8- Increase in submersible pump, 98-Don't Know, 99-Others (specify)

Code B: 1-Scheduling irrigation only when required, 2. Planting less water requiring crops/variety, 3. Keeping residue for water conservation, 4- Adopting water saving technology, 5- Farm pond, 99. Others (specify)

Code C: 1- Beyond my control, 2- Single effort will not help, 3- Water saving technology are costly, 4- My land uses surface water, 5- No water problem in my area, 99- Others (specify)

5.2 Use of technology by farmers in social network

1. How many farmers in this village/other villages you know personally and regularly interact with them on farming related issues? Would you say you personally know: 1-more than 100 farmers? 2-75-100 farmers? 3-50-75 farmers? 4-30-50 farmers? 5-20-30 farmers? 6-less than 20 farmers?	

2. Approximately how many farmers YOU KNOW have used/currently using the following technologies on their farm? *(read each, and note the numbers)* Code: 997--I am not aware of this practice myself 999—I am aware about this practice but don't know how many are using it			
a=Zero Tillage		i Soil bunds	
b1=Land levelling		j. Field/boundary bunds	
b2=Laser land levelling		k. Broad bed and furrow	
c=DSR		l. Contour bunds	
d=Residue retention/mulching		m. Polythene mulching	
e=legume rotation		n. Nala plugs/RFDs	
f=drip irrigation		o. Sunken pits	
g=green seeker		p. Farm pond	
h=leaf color chart		q. Masonry check dams	
i=Nutrient expert decision support software		r. Well recharge pits	
j=agroforestry		s. Penning Sheep/Goat/Cattle	
h=hybrid seeds			

5.3a Constraints to Wheat production

S.No	Questions		
1a	**What are the two main constraints you face in wheat**	First	
1b	**farming?** CODE A	Second	
2	**Have you stopped planting any wheat varieties in the past 3 years that you used to grow before?***(1-Yes,0-No) If NO, skip to 5.4*		
3	**If yes**, How many?		
4	**Name the most recent variety you have discontinued**		
5	**What is the main reason for discontinuation?** CODE B		
6a	**What is the current price of wheat if you were to sell it? Rs/kg**		
6b	**What is the current price of wheat if you were to buy it? Rs/kg**		

5.3b Constraints to Rice production

S.No	Questions		
1a	**What are the two main constraints you face in rice**	First	
1b	**farming?** CODE A	Second	
2	**Have you stopped planting any rice varieties in the past 3 years that you used to grow before?***(1-Yes,0-No) If NO, skip to 5.5*		
3	**If yes**, How many?		
4	**Name the most recent variety you have discontinued**		
5	**What is the main reason for discontinuation?** CODE B		
6a	**What is the current price of rice/paddy if you were to sell it? Rs/kg**		
6b	**What is the current price of rice/paddy if you were to buy it? Rs/kg**		
6c	**What is the selling price of rice you expect after harvest this season? Rs/kg**		

Code A: 1-Land, 2-labour, 3-cash constraint, 4-seeds not available, 5-insect and disease problem, 6-cannot sell the crop, 7-price too low, 8-no information or technical advice on farming practices, 99-other(specify)
Code B: 1-Seed not available, 2-had low yield, 3-did not like the color, 4-susceptible to disease, 5- not liked by processors, 6-unpleasing cooking quality/taste, 99-other (specify)

5.3d Sources of risk in farming and coping strategies

1a	**Based on your experience, which of the following events**	*Variability in the timing and level of*	
1b	**would you consider to be a major cause of concern to**	*Floods*	
1c	**you as a farmer or a major source of risk in your farming**	*Drought*	
1d	**operation?**	*High temperatures*	

1e	***Read each event and ask the respondent to rank them on***	*Hail or cold temperatures*	
1f	***a scale of 0 to 2***	*Insects and plant diseases*	
1g	*0 – not a cause of concern for me*	*Infectious livestock diseases*	
1h	*3- Somewhat a concern for me*	*Price fluctuations in farm*	
1i	***4-*** *A major concern for me*	*Non-availability of inputs in a*	
1j		*Lack of market to sell the products*	
2a	**When you face an economic shock due to any of these risk factors mentioned above, what coping strategies do you most often use?** *(indicate 1=Use most*	*Sell household goods, jewelry, etc.*	
2b		*Sell animals/ livestock*	
2c		*Sell other farm assets*	
2d		*Borrow money*	
2e		*I change my farming practices by going back to doing things the*	
2f		*I change my practices by using NEW and MODERN methods of farming*	
3	*If use 2e often or sometime, ask:* **Can you give an example of this strategy you have used in the**		
4	*If use 2f often or sometime, ask:* **Can you give an example of this strategy you have used in the**		

5.4 Loss Due to Unexpected Weather

1.	**In the past 5 years, have you ever lost a significant portion of your crop production due to unexpected weather (e.g., low rainfall, flooding, unexpected monsoon time, hail, etc)?** *1-Yes, 2-No*	
2.	**If yes, how many times you have suffered such losses in past <u>five years</u>?** *98-Don't know/can't say/don't remember*	
3.	**How many times you have suffered such losses in the past <u>two years</u>?** *98-Don't know/can't say/don't remember*	
4	**Which crops were most impacted by these losses?** *1-wheat, 2-rice, 3-groundnut, 4-other, 5-all*	
5a.	**Have you heard about the phenomenon called 'climate change'?** **1-Yes 2-No**	
5b	**If YES, can you tell me what will happen as a result of 'climate change' that has implications for farmers like you? (select as many as mentioned):** *1-extreme weather; 2-too much rain/flood; 3-too little rain/drought; 4-high temperatures; 5-late start of rainy season; 6-cold winters; 7-too much pest/diseases; 8-unpredictable weather; 9-farming will become more risky; 10-Other (specify); 98-Don't know*	
5c		
5d		
5e		

5.5 Access to information, infrastructure and credit

1	**What is the distance from your house to the nearest paved road (if the house is next to the paved road, write zero)** *km*		
2	**What is the distance from your house to the nearest market where you obtain agricultural inputs (e.g., fertilizer, pesticides, seeds, etc.)** *km*		
3	**What is the distance from your house to the nearest agricultural extension office** *km*		
4	**What means of transport do you mainly use to get to the nearest commercial town?** *1- Walking, 2- Tractor, 3- Bicycle, 4-Motorcycle, 5-Car, 6- Bus, 7- Light transport Vehicle, 8-Animal Driven Cart, 99- others (specify)*		
5	**Distance from your home to this commercial town** *km*		
6a	**Time it takes on average to travel to this commercial town using the main mode of transportation (Consider time of one way travel)**	Hours	
6b		minutes	
7	**Do you have a bank account?** *Code: 1-Yes 2-No*		
8	**Do you own kisan credit card?** *(1-Yes, 2-No)*		
9	**Do you currently have crop insurance policy (other than KCC)?** *Code: 1-Yes 2-No, If YES, skip to 12*		
10	**Did you have crop insurance in the past but have discontinued?** *Code: 1-Yes 2-No*		

11	**Reason for not having crop insurance or for discontinuing:** *1=Do not need, 2=Not available in my place, 3= No claim available at time of damage 4=Too expensive, 99= Others (Specify)*	
12	**Did you or anyone in the household access credit for agricultural production in the past 12 months** (1=Yes, 2= No) If NO, skip to 14	
13	**If yes, from where?** *1- Bank, 2- Cooperatives, 3- SHG, 4-Community member, 5-Relative/ Friend/ Neighbour, 6-Local money Lender, 7-Commission Agent, 8- Employer, 9-Agrovet, 10-Trader 99- Others (Specify)*	
14	**If no, why not?** *1= Did not need, 2= Do not have access to credit, 3=Very high interest rate , 4-Far From Residence, 5- Bank staff not cooperative, 6- was getting less amount 7-loan was not approved 8-no collateral 99= Others (Specify)*	
15a	**Do you currently have any debt (i.e., do you owe money to anyone)?** 1-Yes 2-No If NO, skip to 17a	
15b	**If yes, to whom do you owe money?** *1- Bank, 2- Cooperatives, 3- SHG, 4-Community member, 5-Relative/ Friend/ Neighbour, 6-Local money Lender, 7-Commission Agent, 8- Employer, 9-Agrovet, 10-Trader 96-multiple (specify) 99- Others (Specify)*	
15c	**What is the interest PER ANNUM you are paying on this debt?**	
15d	**In how many years do you expect to pay-off this debt?**	
16a	**Suppose you need to borrow money for any purpose, how likely is it that you will be able to borrow money you need? (Read the possible responses and select one)** *1-Extremely likely (about 100% chance), 2-Quite likely (about 75% chance), 3-Neither likely nor unlikely (about 50%), 4-Quite unlikely (about 25% chance), 5-Extremely unlikely (about 0%) (skip to 17a)*	
16b	**Who will be the main source of credit?** *1- Bank, 2- Cooperatives, 3- SHG, 4-Community member, 5-Relative/ Friend/ Neighbour, 6-Local money Lender, 7-Commission Agent, 8- Employer, 9-Agrovet, 10-Trader 99- Others (Specify)*	
17a	**During the past year, where did you receive most of your information and advice about wheat production and marketing from?** *CODE A (Multiple Response)*	
17b	**In total, approximately how many times did you receive information about wheat production and marketing last year from all these sources?**	
18a	**During the past year, where did you receive most of your information and advice about Rice production and marketing from?** *CODE A (Multiple Response)*	
18b	**In total, approximately how many times did you receive information about Rice last year from all these sources?**	
19	**Do you use mobile phone to access information related to farming?** *1=Yes 2=no* If NO, go to 21	
20	**If yes, what type of information?** *CODE C – Multiple Response*	
21	**From whom do you access information using mobile phone?** *CODE D— Multiple Response*	
22	**Have you heard about the following organizations / programs? (1-Yes 2-No)** a. CIMMYT b. ICRISAT c. IRRI d. CGIAR e. CCAFS f. Climate Smart Villages g. Krishi Vignan Kendra h. Internet	
23	**What is the farthest you have ever travelled?** 0-never left this village; 1-a village/town in this district; 2-a village/town in a neighboring district; 3-a neighbouring state; 4-another state within India; 5-another country in South Asia; 6-US/Canada/Australia/Europe; 7-Middle east; 9-Other (specify)	

24	**What is the farthest anyone who is currently a member of your household (other than you) has travelled so far and his/her relationship to you?** 0-never left this village; 1-a village/town in this district; 2-a village/town in a neighbouring district; 3-a neighbouring state; 4-another state within India; 5-another country in South Asia; 6-US/Canada/Australia/Europe; 7-Middle east; 9-Other (specify)	a.travel	b. relationship (CODE E)
25	**When it comes to adopting new technology, inputs or farming practices, which of the following best describes your behaviour:** 1 - I am one of the first ones to adopt NEW technologies 2 – I usually wait until a few farmers I know have used those inputs/technologies/practices, and then based on their experiences I make the decision 3 – I usually wait until most farmers in this village are already using those inputs/technologies/practices, and I am 100% sure that those technologies work 4 – I rarely change my farming practices as I am not comfortable doing new things		
26	**Do you have life insurance policy?** *1-Yes, 2-No*		

CODE A. *1-Extension agent, 2-NGO staff, 3-Trader / input dealer, 4-Farmer group/leader farmer, 5-Service Provider, 6-I did not receive any information or advice, 99-other (specify)*

CODE B. *1=1-2 times, 2=2-3 times, 3=3-5 times, 4=5-10 times, 5=More than 10 times*

CODE C. *1-Weather, 2-Price, 3-Inputs, 4-Production technology, 5-Pest control, 6-government programs, 99-other (Specify)*

CODE D. *1-Relatives/friends, 2-Input dealers, 3-KVK, 4-Kisan Call Center, 5-Extension agents, 6-RML, 7-IFFCO Kisan Sanchar Limited (IKSL), 8-mKRISHI, 9-other mobile based agro advisory services, 99-Other (specify)*

Code A: 2-wife, 3-Husband, 4- Son, 5-Daughter, 6- Grandchild, 7- Father, 8-Mother, 9- Sister, 10-Brother, 11- Niece, 12-Nephew, 13- Son in law, 14- Daughter in law, 15-Brother in law, 16-Sister in Law, 17- Father in law, 18- Mother in law

5.6 Assets owned

How many of the following does your household own and what is the total value (in Rs) if you were to sell it today? *(Instruction: For each item, write the number owned and its total value across all units owned. If none owned, write zero)*

	1 Bicycle	2 Motor cycle / Scooter	3 Car / truck	4 Cart	5 Tractor	6 Plough	7 Metal silos	8 Water tank	9 Irrigation / water pump	10 Greenhouse / glass house	11 Dehusker	12 Fodder chopper
# owned												
value												
	13 Combine harvester	14 Cultivator / tiller	15 Zero till drills	16 Biogas plant	17 Turbo/ Happy	18 Seed-cum-Ferti Drills	19 LLL	20 Ripper	21 Radio / cassette	22 TV	23 Fans	24 AC
# owned												
value												
	25 Cooler	26 Washing machine	27 Water purifier	28 Camera	29 Pressure cooker	30 Almirah	31 Refrig-erator	32 Comp-uter	33 Sewing machine	34 Gas stove	35 Mobile phones	36 Non-Mobile
# owned												
value												

How many animals does your household currently own and its total value across all units owned *(if none owned, write zero)*

	36 Horses	38 Cows	39 Buffaloes	40 Bulls	41 Goats	42 Sheep	43 Donkeys / Mules	44 Pigs	45 Chickens	46 Other (describe)
value										

To be filled by Enumerator after the completion of Survey

End Time	
Was the survey completed in first attempt or required a revisit? *1-First Attempt, 2-Re-Visit*	