Innovation for Rural Prosperity

Ghana

Evaluation Report – October 2017

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INTRODUCTION

Purpose

International Development Enterprises (iDE) implemented a food security project in Ghana, Ethiopia and Cambodia called the "Innovation for Rural Prosperity (IRP) Project" with funding from Global Affairs Canada. The Ghana IRP Project sought to achieve its intended outcomes through targeted investments in training and developing private sector product and service providers, who will continue to provide products and services to smallholders after the end of the program. To achieve the program's objectives, iDE is invested in three key areas:

1. Supply Chain Strategies that result in the delivery of smallholder-oriented products and services through local commercial supply chains. iDE works with local manufacturers (in some cases importers), distributors and retailers, to create a network of providers that are profitably serving customers with affordable products (Micro-irrigation technologies [MIT] and quality agricultural inputs) and services (agronomic advice, market information and technical support);
2. Value Chain Strategies enhancing local production and open up high-value market channels to smallholder farmers; and
3. An Innovation Strategy improving the effectiveness of IDE's work, sharing best practices across the organization and between iDE and other organizations.

Background

During the start of the project iDE field staff, referred to as Marketing Development Officers (MDOs), were responsible for disseminating information to farmer groups in their respective districts. MDOs coordinated with farmer groups to schedule times to deliver horticultural trainings and facilitate access to credit via partnering micro-finance institutions (MFIs). As part of this process, the MDO trained the farmer group on ways they can access agricultural credit and assisted farmer groups in opening bank accounts. In addition, MDOs served as liaisons between the lending organization and farmer groups by following up with farmer groups to encourage timely payback of loans.

However, challenges were identified with the MDO model. Access to trainings, credit, and loans without sufficient access to markets did not enable farmers to sell their produce in a profitable manner. Instances were identified where agricultural credit was used for personal needs instead of farming needs. Additionally, the credit limit set by the lending organizations coupled with a high rate of interest restricted the farmers to invest in farming essentials only (inputs & crop protection products). Moreover, it became apparent that the MFIs were abusing the relationship with iDE's MDOs by requesting them to collect repayments without the presence of an MFI-employed staff—this was beyond the scope of the original partnerships between iDE and the lending organizations.

To solve the identified blocks and ensure the process was focused and remained sustainable, in July 2016 iDE introduced a new intensive program model called Korsung, 'Good Farming' in several languages in Northern Ghana. Korsung employs Farm Business Advisor (FBAs) as opposed to MDOs to connect farmers to high-value vegetable markets by improving their access to finance, irrigation, and technical support. In order to demonstrate the effectiveness of the new model, iDE started on a small scale with a group of 30 farmers by connecting them to market vendors and by encouraging them to invest in input and production packages (irrigation technologies, improved seed varieties, fertilizers, and mulching). iDE tested the model during the 2016/17 dry season, reducing staff hired to perform as MDOs and concentrating a smaller team on the intensive Korsung approach.

STUDY DESIGN

This evaluation is a mixed-method study with a quantitative household survey, qualitative research, program staff reflections, and data analysis of real-time data from our management information system on a subset of farmers. The quantitative survey estimates pre-post comparisons of key program indicators while the qualitative findings provide context for results. Given the program shift to the intensive Korsung model, which captures real-time crop cycle data, we use callout boxes throughout the report to highlight early findings.

Quantitative

Sampling

At baseline, a multi-stage cluster design was used to collect a representative sample from the program target region. Probability proportional to size was used to select 16 Farmer Based Organizations (FBO) from each region. The selection of FBOs was stratified by the length of time the FBO has been in existence and by the Marketing Development Officer (MDO) responsible for coordinating between iDE and the FBO. In the second stage of sampling, 10 Individual farmers were stratified by gender[1] and randomly selected from the FBO member lists. Summary statistics for relevant baseline indicators were presented in a 2013 baseline report.

In addition, a midline evaluation was conducted to provide mid-term impact estimates and inform management decision-making. The August 2015 midline evaluation report provided updated indicator figures and impact estimates based on 115 farmer surveys.

Finally, for endline sampling we attempted follow-up with the 115 farmers from the midline sample, in order to create a panel data set for rigorous evaluation. Of the 115 midline farmers, we were able to successfully locate 83 of the farmers for a baseline and endline panel data set, and supplemented 39 farmers previously un-sampled. Program staff reviewed the baseline sampling frame and eliminated areas in which the IRP project was no longer active due to the Korsung model shift. From there, farmers were randomly sampled for replacement, stratified by community. As such, the sample is not fully representative of the intended treatment region of IRP, but rather the actual treatment region. All endline survey respondents are IRP participants.

Data sets

For the purposes of rigorous evaluation and consistency with prior reports, we calculated endline comparisons using two different data sets. For topline impact indicators[2] from the PMF we restrict our data to the 82 observations for which we had repeat panel data available.[3] By restricting our data set to farmers with panel observations, we eliminate the threat of selection bias due to unobservable differences between baseline and endline groups. Future reference to this data set will use the term "panel sample." Table 1 presents the sample for impact indicator figures.

Table 1: Impact indicator sample sizes – panel sample

		Baseline	Endline
Upper East	Garu	25	25
	Lawra	22	22
Upper West	Jirapa	11	11
	Lambussie	24	24
TOTAL		82	82

However, though the panel data set reduces our threat of selection bias, it could suffer from sampling bias meaning the farmers we were able to locate again are not a random or representative sample of the intended project participants. It is likely there are systematic differences between the farmers that remain in our sample and those we were unable to locate from baseline. For this reason, for all other summary statistics reported in the evaluation report we used the full 314 baseline and 121 endline farmer responses. Future reference to this data set will use the term "inclusive sample."

Our rationale is that the baseline was sampled specifically to be representative of the intended target IRP population and all baseline values previously reported were drawn from this sample. We want to maintain

[1] In some cases, there were less than 5 females in the FBO, and the number of men and women were not sampled equally.
[2] Topline impact indicators = (1) Change in average productivity per square meter of target crops. (2) Change in average number of square meters under target season crop cultivation (3) Change in net income obtained by smallholder farmers (4) Change in Progress Out of Poverty Index
[3] One observation was omitted as an outlier.

consistency in our reporting. Further, the additional 39 farmers were added to the endline responses to include greater representation of the Upper East region. Finally, in some cases where midline indicator estimates were calculated we include those values in this final report. Thus the sampling for all three data collection periods is presented in Table 2.

TABLE 2: SUMMARY STATISTICS SAMPLE SIZES – INCLUSIVE SAMPLE

		Baseline	Midline	Endline
Upper East	Kassena Nankana	20	10	10
	Bongo	10	-	-
	Nabdam	10	-	-
	Sissala West	-	15	-
	Bawku West	35	15	28
	Binduri	10	-	-
	Garu	70	15	25
Upper West	Lawra	57	15	24
	Nandom	21	15	-
	Jirapa	42	15	23
	Lambussie	39	15	39
TOTAL		314	115	121

Table 3 presents the proportion of female respondents and female-headed households for our inclusive sample. To note, only 33% of endline respondents (44 people) had their gender recorded for respondent gender, the rest are missing data. Thus, the female respondent endline proportions may be unrepresentative which would explain the abnormally high figure of 94% of survey respondents in the Upper West region were reported as female.

Further, 30% of our matched panel (25 of 83 farmer pairs) reported a different head-of-household gender at endline than at baseline, resulting in an overall increase from 11% female-headed households at baseline to 34% at endline. While a few changes in head of household are possible, it seems unlikely that 30% of our sample would experience a shift in the head of household in the four-year gap between data collection efforts.

TABLE 3: FEMALE RESPONDENTS AND FEMALE HEADED HOUSEHOLDS – INCLUSIVE SAMPLE

	Female Respondents		Female Headed Households	
	Baseline	Endline	Baseline	Endline
Upper East	52%	43%	12%	28%
Upper West	33%	94%	9%	40%
Total	42%	65%	11%	34%

Given the disparities in gender identification for head of household and the under-reporting of survey respondent, we believe any sex-disaggregated indicator estimation would be unreliable.

IMPLEMENTATION

Baseline: The survey implementation took place March 15-23, 2013 and used face-to-face paper-based data collection. The survey team was made up of eight enumerators. After four days of training, the enumerators were split into four teams and assigned a supervisor for guidance relating to the questionnaire, validity checks and logistical clarification. Each team completed the surveys for one farmer-group per day (five interviews per person, per day). Household respondents were interviewed at pre-determined meeting locations based on the household's location and accessibility. The survey took approximately 35 minutes to complete.

Endline: Survey implementation took place May 8 – May 18, 2017 and used face-to-face mobile data collection. The survey team was comprised of eight enumerators.

The field staff were assigned communities based on their language proficiency and charged to administer the surveys to the assigned households.

To ensure the quality of the data remained uncompromised, the monitoring team – Performance Manager and Project Coordinator/Director- performed the following quality control checks:

- Spot checking: This involved the monitoring team visiting selected field surveyors at the time of surveying without their prior notice. This approach was used to ensure that field staff were following all the due protocol and administering surveys to the right people at the scheduled time and place, which should strictly be at respondents' homes. Administering the survey at the respondent's home was a strict requirement to ensure that surveyors collect the right information with respect to questions that required surveyors to observe features.
- Accompaniment: During the data collection period, the monitoring team periodically accompanied surveyors to listen to the information given by the accompanied surveyor for a full questionnaire. This was useful in assessing whether they understood all the different modules of the questionnaire and were prompting or probing appropriately were required.
- Back Checking: The Performance Manager during the period of data collection contacted about 10% of the respondents via phone call to re-administer a few of the questions in the questionnaire to the respondents. The random questions selected for re-administrating were objective questions with definite responses, which should not change with time. This was done to verify that the right household and individuals were visited and that the questions were asked the right way.
- Follow-up Calls: The team also made follow up calls to some of the respondents in instances when the responses given by respondents appeared to be an outlier or logically inconsistent with other responses they had given.

After all the data verification and data cleaning, a data file and a draft do file were created for further analysis.

LIMITATIONS

As the quantitative study is only a pre / post comparison, we lack a control group for counterfactual comparison. Findings should not be interpreted as causal impact but rather suggestive correlation. Without a control group comparison, we cannot be sure how much of the observed change between baseline and endline is due to program intervention and how much is due to external factors beyond the scope of the project.

As previously mentioned, given the restructuring of the IRP program, the sampling of final participants is non-representative of the original program design and reach. Thus findings are not generalizable to all farmers who initially were working with IRP under the MDO model but were then dropped during the shift to the Korsung model. Findings should be interpreted as results for farmers actually receiving treatment (i.e. working with iDE) as opposed to the larger intended to treat farmers.

In addition, because the intervention uses a market-based approach and does not randomly assign "treatment," if farmers self-selected into the IRP program based on systematic factor the results could be biased. For example, if factors like location (distance from roads or other infrastructure) or personal traits (more willing to risk trying new technology) predicted farmers' likelihood of participating in IRP program, the internal validity of our study is threatened.

The data collection also relies on farmer recall for figures around input costs, harvest yields, and sales earnings. The evaluation attempted to reduce recall bias by limiting the time period of farmer recall to the most recent harvest cycle. However, as many farmers do not have written record of their agriculture activities their estimations are prone to recall bias. Notably, under the Korsung model, farmer record keeping is greatly improved. Korsung field technicians visit farmers before and after every crop cycle to record accurate measures of plant date and crop type; harvest weights, grade, purpose, soil type; agriculture practices applied; and inputs used.

Qualitative

Sampling

The qualitative study primarily interviewed farmers while a market vendor and an input dealer were also interviewed for additional insight. The study was conducted in 11 different communities from 4 districts in the Upper East and the Upper West regions where IRP was active to include responsive farmers. Clustering within each location, farmers were purposively selected to ensure a diverse representation of experiences. Within each location, the local FBA acted as the contact, arranging meetings with farmers. Farmers were informed that the purpose of the interview was to collect information and understand their farming practice.

Interviewees were farmers, retailers, vendors, and farm group leaders. Farmers were chosen from pre-Korsung and Korsung farmers, which included a mix of those who were growing vegetables, staples, and a mix of vegetables and staples in the dry season and the rainy season respectively.

The Farmers were chosen by the FBAs. The FBAs were instructed to identify different profiles of farmers to gain a broad understanding of their motivations, needs and barriers. A mix of farmers were identified based on their access to water for irrigation, farm equipment, farm practice, and storage.

For the qualitative data collection, a total of 28 respondents were interviewed, across the Upper East and Upper West regions.

Table 4: Farmer interviews by region – qualitative sample

		Respondents
Upper East	Garu	11
Upper West	Lawra	17
TOTAL		28

In-depth individual interviews were conducted with 28 farmers, as well as 1 female market vendor and 1 female input dealer. The interviews with farmers consisted of 28 IRP participants, including 14 Korsung participants, and 14 IRP non-Korsung participants. Table 6 presents the distribution of farmer interviews for the qualitative study.

Table 5: Farmer interviews by gender – qualitative sample

	IRP	Korsung	Non-iDE Participant	Total
Male	9	13	0	22
Female	5	1	0	6
Total	14	14	0	28

Implementation

Qualitative data collection occurred distinctly from, but simultaneously with, the endline household survey, May 8 to May 18, 2017. The primary method for qualitative data collection was semi-structured individual interviews. Interview protocols were designed for farmers, input retailors, and food vendors. Each interview included the participant, the primary investigator, a note-taker, and a translator. Interviews lasted between two to three hours and were not recorded. Most interviews took place on the respondent's farm or in a common and convenient location for the community. Two of the authors for this report led the interviews and provided the analysis. Two agriculture officers facilitated the interview logistics in coordination with the local FBAs.

Additional Sources of Information

In addition to the quantitative and qualitative studies, this report draws on insights from program and field staff as well as data from our management information system, Salesforce. Salesforce was adapted to capture detailed records for Korsung farmers. These data include input purchase, crop cycle information, agriculture techniques practiced, and training received. Insights gleaned from these data are highlighted in the red Korsung callout boxes throughout this report.

AGRICULTURAL PRODUCTION

To account for production differences due to land size we standardize our results to kilograms per square meter. Farmers were asked to estimate their harvest in terms of area planted, seed costs, harvest yields, and sales totals at the crop level. Crop totals were aggregated to calculate farm level productivity and income productivity. Crop-level analysis of the primary crops grown by most households can be found in Appendix A.

Productivity per square meter

Table 7 presents the average productivity at a household level per square meter of irrigated land.[4] We see a statistically significant increase of 69% in the harvest productivity per square meter at the household level. When stratified by region, we find statistically significant differences between farmers in the Upper East and Upper West. Regional differences can be explained in part by iDE operational differences. The Korsung program worked with farmers in the Upper West region, which correlates with the statistically significant gains made in that region. In addition, iDE Ghana staff report seeing more NGO activity and greater NGO density in the Upper East region. They theorize that these agriculture-focused NGOs do not use market system approaches and their charity-based aid undercuts the impact of iDE's entrepreneurship program.

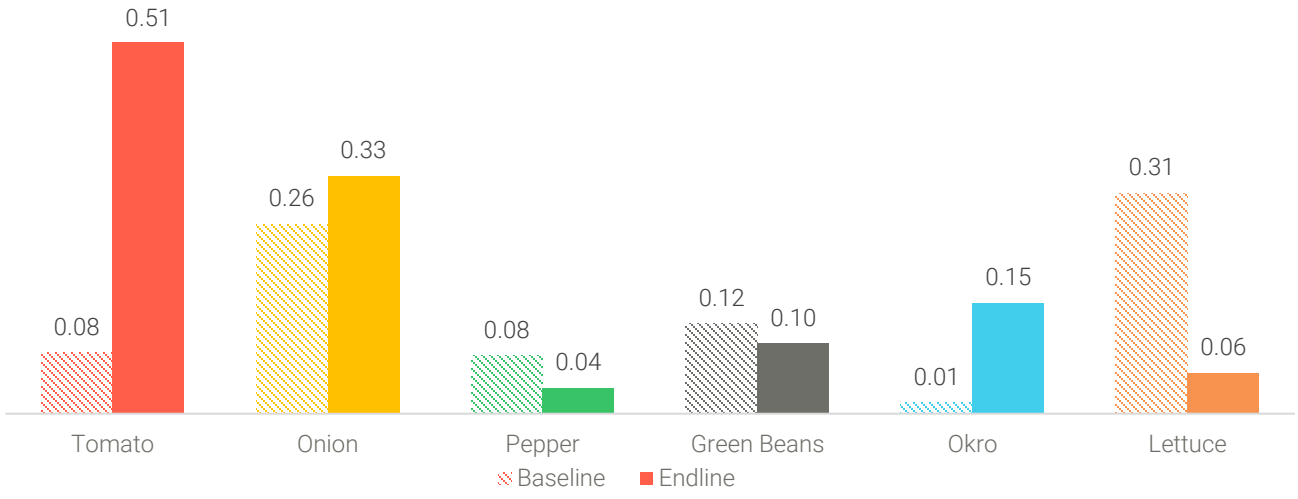
TABLE 6: KILOGRAMS HARVESTED PER SQUARE METER OF IRRIGATED LAND – PANEL SAMPLE

	Baseline	Endline	Percent Change	Significant
Upper East	.34	.14	-58%	***
Upper West	.09	.33	267%	***
TOTAL	.16	.27	69%	*

** p < 0.05; ** p < 0.01; *** p < 0.001*

Figure 1 compares crop level productivity after harvest at baseline and endline. While farmers grew more than the crops presented below, these six were grown by the majority of farmers and provided us with a sufficient sample for comparison. We see that tomato, onion, and okra productivity increased while pepper, green bean, and lettuce declined. Interestingly, when we later on present income findings we see that despite the gains in productivity in tomato production, the dollar return on the crop declines. Onions appear to be the crop that gained in both harvest and income productivity.

FIGURE 1: CROP LEVEL HARVEST (KG/M^2) – PANEL SAMPLE



[4] Almost all farmers reported irrigating their crops at endline and one of the baseline samples. We omitted non-irrigated crops from a baseline sub-sample as those farmers reported unirrigated maize yields which had large land sizes and skewed the data.

Farmers in the northern regions of Ghana have two seasons of farming. The rainy or major season lasts from about June/July through November. The rest of the year is referred to as the dry season. The major crops in the rainy season are the staple crops, such as maize and millet. Dry season production focuses on income generating vegetable crops dependent on irrigation.

In the qualitative individual interviews, farmers primarily reported production yields to be related to the amount of money they have at the beginning of the season in order to purchase inputs (primarily fertilizer), as well as chemicals (pesticides and herbicides). Farmers also reported that access to water was essential to grow certain crops, especially during the dry season. Rains also affected farmers' growing seasons, as early or late starts to the rains affect dry season vegetable farming. Farmers also discussed hiring labor during specific times of the growing cycle – land preparation (including building fences) and harvesting.

Timing was also an important factor for farmers. This includes receiving inputs, loans, labor, or pumps in a timely way that is most effective. Women in particular report having to wait until family members or other farmers have either used pumps first before borrowing them, or have finished with labor on their farm before they go to women's farms.

Farmers reported that the amount of money earned by selling tomatoes varies according to the timing of the sale, and other market factors such as an influx. For onions, farmers have reported making good amount of money by selling them at the right time (particularly in the Upper West). This is due to more favorable climate conditions and a more stable shelf life than highly perishable tomatoes.

Square meters under target crop cultivation

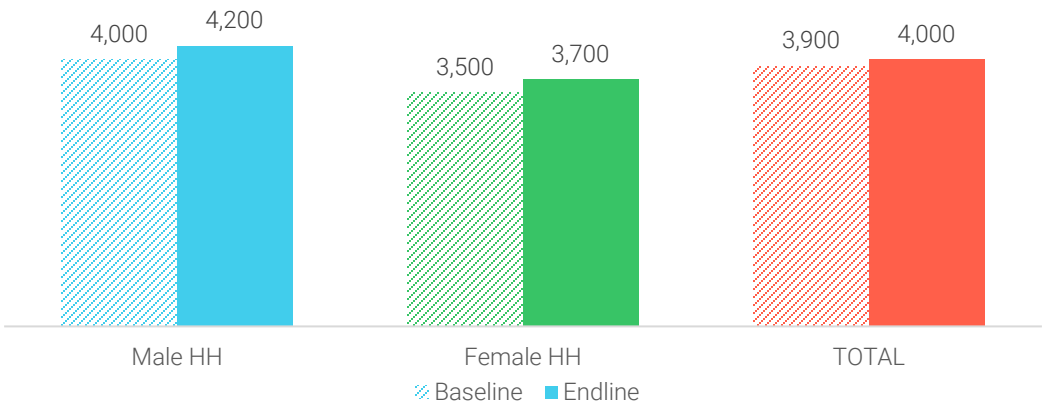
Farmers were asked to report the total land area they planted for each crop. The crop level results were aggregated, standardized and are presented in Table 8. We see that total area under irrigated cultivation increased by 48% and is statistically significant. We also asked farmers at the beginning of the survey to report their total land holdings in terms of irrigated land and other. Figure 2 shows the overall change in irrigated land holdings in which we see no statistically significant increase. These findings could suggest that the increase in land area under cultivation is due to increased crop cycles, intermixing of crops or other agricultural practices as opposed to expanding farm size.

TABLE 7: TOTAL CULTIVATED LAND (M^2) UNDER IRRIGATION – PANEL SAMPLE

	Baseline	Endline	Percent Change	Significant
Upper East	4,871	5,292	63%	
Upper West	3,450	6,035	77%	***
TOTAL	**3,895**	**5,802**	**48%**	****

** p < 0.05; ** p < 0.01; *** p < 0.001*

FIGURE 2: TOTAL LAND SIZE (M^2) UNDER IRRIGATION – PANEL SAMPLE



Farmers reported learning about improved farm practices from iDE: planting in rows; intercropping; preparing the soil before cultivation; and use of improved seeds and mulching. These practices allow farmers to grow multiple cycles as opposed to limited growing cycles per year. Increased availability of inputs and ability to purchase inputs also encouraged farmers to explore previously unused lands to cultivate. Increase in land area under cultivation may be due to farmers accessing lands that might not belong to them (explained in detail under land and water use).

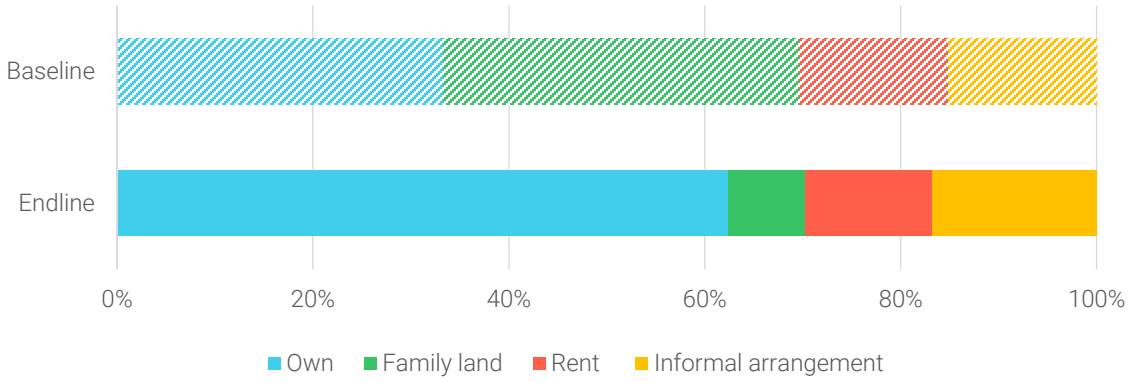
LAND AND WATER USE

In addition to productivity figures, we are interested in better understanding how farmers are accessing their land, water sources, and applying water to their fields.

LAND

Figure 3 suggests that compared to baseline, more farmers report owning their land while accessing family land has decreased. This could be due to change in ownership status, or personal interpretation of family land vs owned land where those two terms are indistinguishable for farmers.

FIGURE 3: METHOD OF ACCESS TO LAND – INCLUSIVE SAMPLE



Family land differs from male to female respondents. We observed male respondents refer to family lands when they work on their parent's/brother's land where as female respondents refer to their husband's lands as family lands. When a male member moves out of the house, the land he farms will be referred to as his own land and if a female farmer has her own separate plot (not a part of her husband's), she will refer to it as her own land.

The majority of lands are owned by the chief or in certain cases landowners in which people work on those lands. Hiring laborers to work the land is more common during the dry season as there are more lands available than the farmers can farm. During the dry season, some farmers identify an area close to a water source and ask for permission to farm on the land. Another important aspect of access to land in the dry season is the ability to fence. Farmers report that a lot of lands are available in the dry season but are unused as they are unable to fence it to protect it from foraging animals. iDE facilitated farmers in exploring available lands for cultivation.

Table 9 presents a regional breakdown of land access. We see a higher percentage of farmers sampled in the Upper West region owning land (72%) as opposed to the Upper East (55%).

TABLE 8: METHOD OF ACCESS TO LAND – INCLUSIVE SAMPLE

	UPPER EAST		UPPER WEST		TOTAL	
	Baseline	Endline	Baseline	Endline	Baseline	Endline
Own	22%	55%	43%	72%	33%	63%
Family land	37%	5%	35%	11%	36%	8%
Rent	29%	20%	2%	4%	15%	13%
Informal arrangement	11%	20%	19%	13%	15%	17%

Water source

We see a change in primary water source as more farmers are drawing upon a well or borehole (69%) as their primary source in comparison to baseline (37%). Further, we see a dramatic shift where 35% of the baseline sample reported using a reservoir or tank as their primary water source and now no farmers are using this source. This change holds true across both regions as presented in Table 10.

Well or borehole (dugouts) are a primary source of water for farmers who are not close to a water body (river or dam). Farmers close to a water body tend to use water from the river or dam. Reservoirs or tanks are typically community owned or from another organization or project. Project staff and qualitative researchers did not observe many farmers who own tanks.

Figure 4: Primary water source – inclusive sample

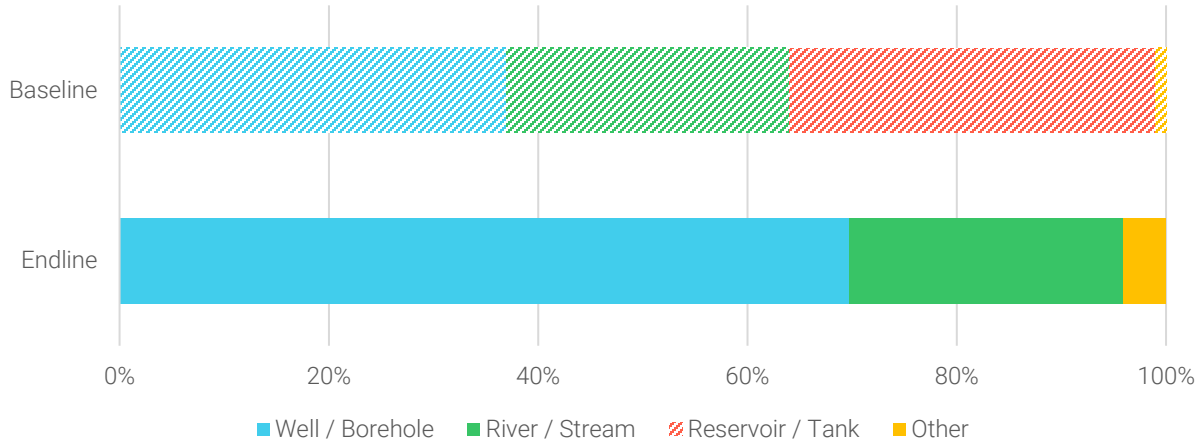


Table 9: Primary water source – inclusive sample

	UPPER EAST		UPPER WEST		TOTAL	
	Baseline	Endline	Baseline	Endline	Baseline	Endline
Well / Borehole	52%	52%	21%	82%	37%	69%
River / Stream	22%	36%	32%	18%	27%	26%
Reservoir / Tank	24%	0%	46%	0%	35%	0%
Other	1%	11%	1%	0%	1%	4%

Irrigation

Though water sources have shifted at endline, we see that method of water lifting used by farmers has held relatively steady as show in Table 8. We see that roughly three-fourths of famers primarily draw water from its source by bucket hauling. At endline only 17% of farmers were using some form of pump (motorized or solar) in comparison to 12% at baseline. Finally, canal diversion is the other primary method of water lifting used by farmers in our sample.

TABLE 10: METHOD OF LIFTING WATER FROM SOURCE – INCLUSIVE SAMPLE[5]

	Baseline	Endline
Bucket hauling	78%	73%
Canals	18%	14%
Motorized pump	10%	13%
Solar pump	1%	4%
Treadle pump	1%	0%
Other	2%	2%

Similar to water lifting methods, we see that farmers are primarily using labor-intensive practices to apply water to their fields, with over 88% using a bucket or watering can application at endline. Table 12 shows there has been little change in water application between baseline and endline as the two primary methods remain bucket application and flood/furrows. These findings align with program activities as during the first 3.5 years of IRP, iDE focused on facilitating access to credit and providing integrated pest management training. Improving use of better irrigation technologies became a focus once iDE stopped collecting loans for MFIs in the beginning of 2016. There may not have been time to observe significant changes due to this recent change.

TABLE 11: METHOD OF WATER APPLICATION TO FIELDS – INCLUSIVE SAMPLE[6]

	Baseline	Endline
Bucket / watering can	83%	88%
Flood / furrow	18%	12%
Hosepipe	4%	2%
Other	2%	0%

The majority of farmers who source their water manually from a dugout use a bucket or a watering can to apply to their fields. In instances when they have access (through owning or borrowing) to a fuel pump, they may flood their fields for water application. The final step in flooding fields often involves using a bucket or a small locally sourced container. Drip irrigation technology was primarily promoted through the Korsung program approach, though staff observed some of the Korsung farmers resort to flooding and bucket application.

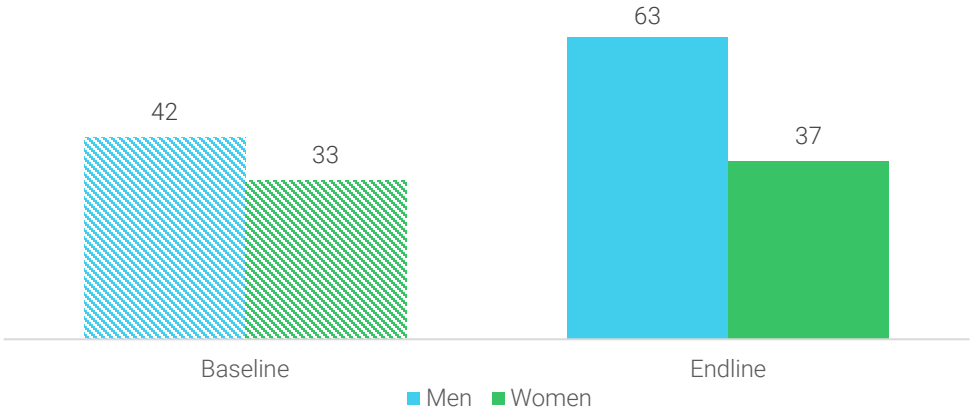
Additional factors that were observed to have an influence on type of water lifting mechanism were proximity to the water source, number of farmers sharing a water source, and timing dependent on seasons. Farmers trying to extend seasons by starting to farm early and having a common water source reported using buckets instead of pumps in order to not deplete the source before rains and share the amount of water available by judicious use.

Farmers were also asked to report how many hours per week men and women spend irrigating their fields. We see in Figure 5 that while hours reported irrigating for women remain relatively steady (differences are statistically insignificant), men reported a statistically significant increase in hours per week spent irrigating their fields. We were not able to identify any difference in the patterns between men and women. Increase in land area under cultivation is directly linked to increase in time spent irrigating the fields. Farmers explained that rains began late and ended early, resulting in additional need to irrigate to complete crop cycles.

[5] Total percentages add up to more than 100% as farmers can use more than one method to lift water.

[6] Total percentages add up to more than 100% as farmers can use more than one method to apply water.

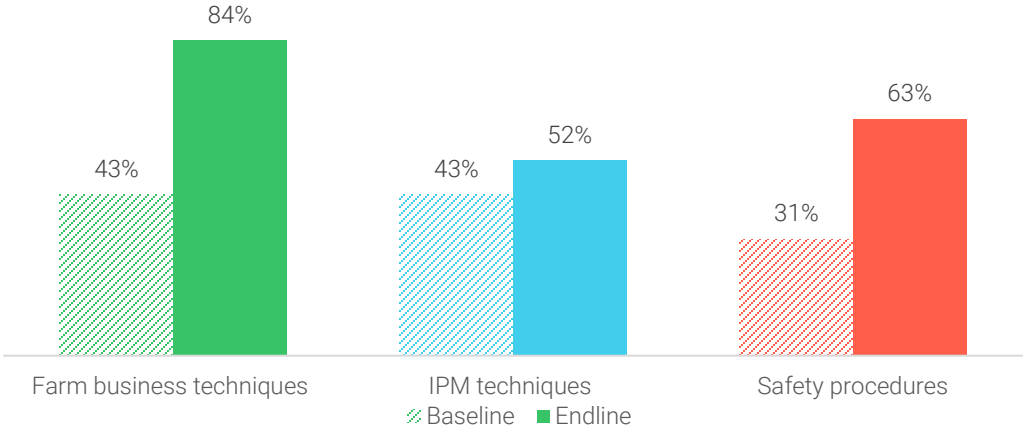
FIGURE 5: HOURS PER WEEK HOUSEHOLD GENDERS SPEND IRRIGATING FIELDS – INCLUSIVE SAMPLE



KNOWLEDGE

In addition to measurable impact, we are interested in knowing how well farmers retained knowledge they would have received in training on farm business techniques, integrated pest management, and safe application of pesticides. Figure 6 presents the percentage of farmers who could correctly identify at least two of appropriate techniques for each category of training. Each training module and its respective retention is described later in detail.

FIGURE 6: FARMERS IDENTIFYING AT LEAST TWO OF THE FOLLOWING TECHNIQUES – INCLUSIVE SAMPLE



Agricultural awareness

KNOWLEDGE

Of the farmers interviewed at endline, 84% indicated they had received farm-business or irrigation training from iDE. An additional 2% indicated they received training from a farmer group member, while 14% said they never received any training. We then asked questions on the timing of irrigation events and factors to be considered when planning the size of one's plot to test whether the respondent has retained the information presented in the farm-business and agronomic training sessions.

Though not assessed at baseline, at endline we asked knowledge-questions to farmers who had received the training and those that had not. Table 13 shows that while there was a significant increase in farmers retaining farm business knowledge (84%), farmers who did not receive a specific iDE training also had high levels of retention (94%). This could be due to a general high level of farm business knowledge among the general population, or training provided by other NGO organizations, and not specifically attributable to iDE training.

TABLE 12: FARM BUSINESS KNOWLEDGE RETENTION – INCLUSIVE SAMPLE

	Baseline	Midline	Endline
Farmers receiving training	43%	62%	84%
Farmers without training			94%

Table 14 similarly presents knowledge retention for integrated pest management practices. Here we see both an increase in retention from baseline to endline as well as higher levels of knowledge from farmers having received iDE training.

TABLE 13: IPM KEY PRINCIPLES KNOWLEDGE RETENTION – INCLUSIVE SAMPLE

	Baseline	Midline	Endline
Farmers receiving training	43%	62%	52%
Farmers without training			21%

APPLICATION

Knowledge application was not assessed at endline for application of key IPM principles, however, a mid-term evaluation found that, among farmers recalling appropriate IPM techniques, the technique is being applied roughly 79% - 92% of the time, depending on technique.

Environmental Awareness

KNOWLEDGE

Of the farmers interviewed at endline, 82% of farmers said they received an agricultural environmental awareness training, and an additional 2% said they received one from a fellow farmer group member. Table 15 shows that knowledge retention doubled between baseline and endline to 63%, while 42% of farmers who never received an iDE training had adequate knowledge.

TABLE 14: SAFE APPLICATION OF PESTICIDES KNOWLEDGE RETENTION – INCLUSIVE SAMPLE

	Baseline	Midline	Endline
Farmers receiving training	31%	68%	63%
Farmers without training			42%

ADDITIONAL CROPS GROWN

The average number of vegetable varieties grown by farmers at baseline was 3.2 crop types and at endline was only 1.7 crop types. The average number of crops grown depends on the size of land and varies from season to season. Farmers tend to differentiate between the crops grown to sell vs. those for self-consumption. Farmers expressed interest to move towards crops with shorter maturity period in order to complete a growing cycle before they run out of water or rainy season begins. Additionally, farmers opt to reduce risks by cultivating multiple varieties; however, farmers lose selling power if they are marketing small quantities of vegetables—they are price takers. If individual farmers/groups have greater amounts of produce, they gain leverage in being able to negotiate higher prices for their crops with vendors/aggregators.

Through the qualitative data collections, farmers discussed the existing crops that they were growing, as well as new and different crops to grow in the future. In terms of existing crops, many farmers were growing crops that they learned to grow as children.

Crops varied in how they were introduced to farmers. The main pathways for introduction were seeing other farmers grow the crop successfully, or learning about the crop through an external agent training. After seeing others growing, many said they would go to neighbor farmers directly to seek knowledge about growing the new crop.

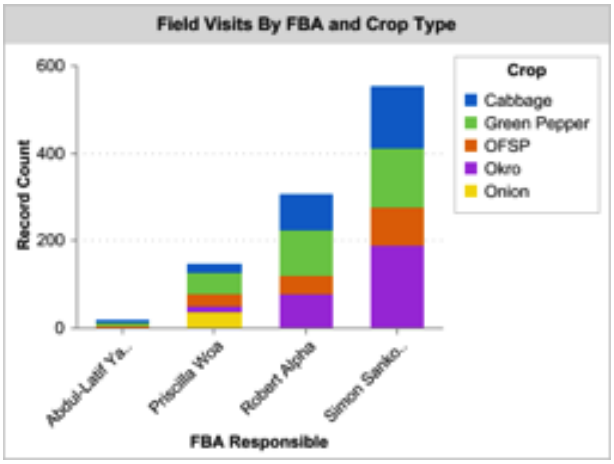
Additional training on how to market or consume the crops was useful in this. For example, farmers who were growing orange-fleshed sweet potato referred to both the nutritional benefits of eating it in soup and the financial benefits of growing it for sale to processors. Some farmers had tried new crops, but did not continue growing them. Not being able to access the necessary inputs was one of the primary reasons farmers stopped growing new crops. In some cases, external agents or programs introduced new crops, but farmers did not have ongoing access to seed beyond the initial introduction. Also, if pests or drought caused the crop to fail the first time, farmers were reluctant to try the crop again.

Korsung Highlight #1

By using salesforce to monitor FBA performance and farm productivity, iDE was able to identify which crops are unproductive by comparing the labor intensity (number of farm visits per crop) against revenue per square meter.

The below graphic illustrates four FBAs' number of visits to their respective farmers by crop. Okra, cabbage and green pepper required the most visits for all but one of the FBAs. However, green pepper and onions generated the most revenue per square meter. Based on this knowledge, Korsung will not work with farmers to produce okra for the next production cycle—and instead will allocate more production area to onion cultivation.

The data from the MIS provides clear guidance on how to improve effectiveness on the farm.



Farmers mentioned wanting to grow more vegetables to diversify income in terms of timing and source, as well as to be productive during the dry season ("not idle"). They recognized the demand or saw an example of someone else growing and being successful.

INCOME

In addition to measuring agricultural productivity, we estimate income productivity in terms of both net gain and a standardized measure per square meter. Table 16 presents average net income per farmer in the local currency, Ghana cedis (GHS). This measure was calculated by taking the total value of produce sold and subtracting seed and input costs, as self-reported by the farmer. This is highly sensitive to both farm size, as we expect larger farms to have greater income gains, and inflation rates. Between baseline and endline, we saw a 59% increase in the Consumer Price Index, overstating gains measured in unadjusted Ghana cedis.[7]

Net income from target crops

TABLE 15: TOTAL NET INCOME, GH CEDIS – PANEL SAMPLE

	Baseline	Endline	Difference	Significant
Upper East	-GHS 132	GHS 322	GHS 454	**
Upper West	GHS 393	GHS 954	GHS 561	*
TOTAL	**GHS 234**	**GHS 761**	**GHS 527**	****

** p < 0.05; ** p < 0.01; *** p < 0.001*

[7] Based on World Bank data – average consumer price index for 2013 (111.621) and 2016 (177.378)

To account for the Ghana Cedi devaluation, we convert all local currency to $USD using a purchasing power parity based exchange rate based on the year of data collection (as opposed to market exchange rate).[8] This ensures us that we are eliminating the differences in price levels between countries for the same basket of goods. The PPP adjusted results are presented in Table 17.

TABLE 16: TOTAL NET INCOME, USD PPP ADJUSTED – PANEL SAMPLE

	Baseline	Endline	Difference	Significant
Upper East	-$142	$225	$367	**
Upper West	$425	$667	$242	
TOTAL	**$252**	**$532**	**$280**	*

** p < 0.05; ** p < 0.01; *** p < 0.001*

Finally, to account for differences in farm size we standardize the results to income per square meter and present the results in Table 18.

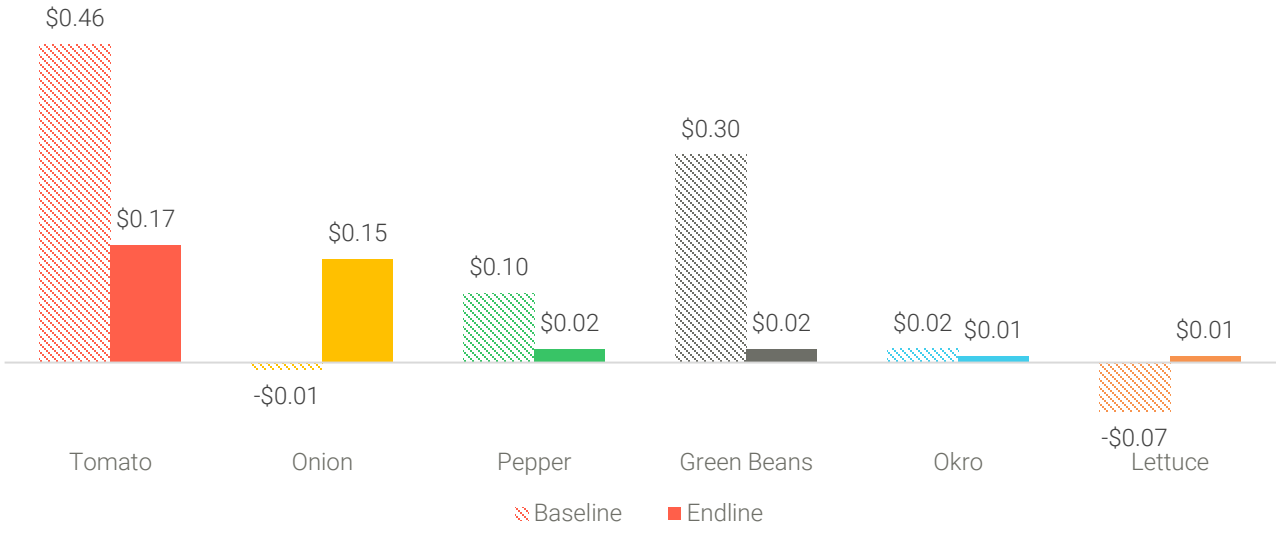
TABLE 17: NET INCOME PER M^2, USD PPP ADJUSTED – PANEL SAMPLE

	Baseline	Endline	Difference	Significant
Upper East	-$0.04	$0.05	$.09	***
Upper West	$0.17	$0.19	$.02	
TOTAL	**$0.10**	**$0.15**	**$.05**	

** p < 0.05; ** p < 0.01; *** p < 0.001*

As agriculture profit is sensitive to crop type, we present the crop level profitability per square meter in Figure 7. Here we see in comparison to the baseline, onions are the only crop that gained in profitability (100%) while other crops saw a decline.

FIGURE 7: CROP LEVEL PROFIT PER M^2, USD PPP ADJUSTED – PANEL SAMPLE



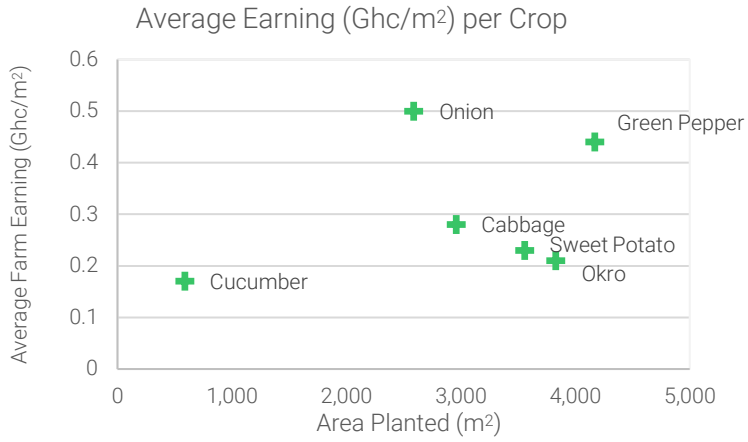
iDE heard from farmers that the ability to store crops affects individual crop profitability, post-harvest. Onions are not a highly perishable crop and can be stored, under the right conditions, for months. The timing of the sale (time of the year) has been identified as a major influencer on the income per crop. Onions can be stored until the market price rises, encouraging farmers to move from other crops to producing Onions. Other crops are highly

[8] The most recent PPP conversion factor we have available is 2016. We used World Bank PPP conversion factors for private consumption from http://data.worldbank.org/indicator/PA.NUS.PRVT.PP?locations=GH

perishable, particularly okra and tomatoes. Although farmers may indicate producing more of each crop in Figure 1, the reality is they are losing profitability to spoilage. It is for this reason iDE began focusing on onion storage and production techniques in the last 1.5 years of the project.

In order to calculate the net profit figures reported, we ask farmers to report their input costs in terms of seeds, chemicals (fertilizers and pesticides), labor, rentals, and other production costs. Seed costs are reported at the crop level and all other costs are reported at the farm level. Table 19 presents the average crop costs incurred per square meter of land. Overall we see no statistically significant change in crop costs for our farmer population, though there does appear to be a large significant change in crop costs within the two regions where costs declined in the Upper East region but increase in the upper west region.

Korsung Highlight #2



Under the Korsung approach during the 2016-17 dry season, iDE was able to closely monitor participating farmers' revenue per square meter. Onion crops generated the most revenue—0.50 GHS per square meter. For the 2016/17 dry season, Korsung farmers cultivated 2,590 square meters of onions—less area than green peppers, orange-fleshed sweet potato, okra, and cabbage—even though the other four crops generated less revenue per square meter than did onions.

iDE used these data to show farmers their earnings against the area cultivated of each crop per farmer—empowering farmers to make better decisions for the following growing cycle on which crops they plant, and how much they plant (area).

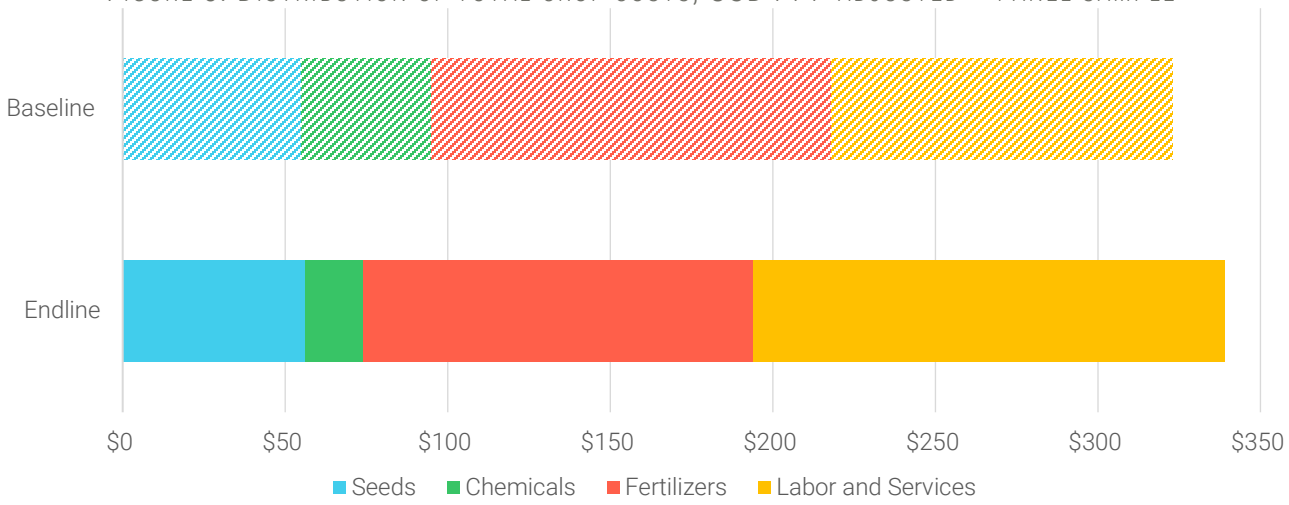
TABLE 18: CROP COSTS (SEEDS, INPUTS, & OTHER) PER M^2, USD PPP ADJUSTED – PANEL SAMPLE

	Baseline	Endline	Difference	Significant
Upper East	$0.17	$0.05	-$.12	***
Upper West	$0.01	$0.07	$.06	***
TOTAL	**$0.06**	**$0.07**	**$.01**	

** p < 0.05; ** p < 0.01; *** p < 0.001*

Figure 8 presents the distribution of total crop costs incurred by farmers at baseline and at endline. Overall, we see that farmers at endline spent, on average, $339 PPP on crops costs compared to $323 at baseline. The difference is insignificant. Further, the data suggests a shift to greater investment in labor and services with a decrease in pesticides and herbicides compared to baseline. To arrive at crop profitability we deduct an estimate of the total input costs proportional to area planted per crop and total area cultivated.

FIGURE 8: DISTRIBUTION OF TOTAL CROP COSTS, USD PPP ADJUSTED – PANEL SAMPLE



PPI

The Progress Out of Poverty Index (PPI) was developed by the Grameen Foundation and is a valuable tool that iDE uses in as many of its country programs as possible to measure the incidence of poverty among iDE customers.[9] The PPI score is obtained by adding together the scores from ten simple and verifiable questions pertaining to household size, building materials, education, energy use, etc. [10] Each set of questions has been specifically chosen and weighted for the country in which it is to be implemented. The resulting PPI score is then used to estimate the probability that the household is in poverty using a PPI Scorecard. The PPI scorecard provides probabilities for each possible PPI score, and may be used to estimate the household's likelihood of falling below a number of poverty thresholds.

Tables 20 and 21 present the average poverty rates for farmers in our sample based on the $1.25 and $2.50 PPP per day thresholds, respectively. On average 57% of farmers at baseline fell above the $1.25 PPP poverty line, based on their score from the PPI. In comparison, we see that 71% of farmers at endline fall above the $1.25 PPP poverty line, a gain of 14 percentage points. We see a similar statistically significant gain of 12 percentage points for farmers falling above the $2.50 PPP poverty line, though at endline only 29% of the population falls above the $2.50 PPP poverty threshold.

TABLE 19: PERCENT OF HOUSEHOLDS ABOVE $1.25 PPP POVERTY LINE, PANEL SAMPLE

	Baseline	Endline	Difference	Significant
Upper East	41%	74%	33%	***
Upper West	63%	70%	7%	
TOTAL	**57%**	**71%**	**14%**	*******

** p < 0.05; ** p < 0.01; *** p < 0.001*

[9] Recently rebranded as Poverty Probability Index, now managed by Innovations for Action

[10] The ten questions are extracted from the respective country's income/expenditure survey and must match the translation and content exactly. Between baseline and endline there was a change in the PPI survey. We used the current survey version at endline but calculated legacy scores to be able to compare to baseline with accuracy.

Further, one of the questions that is part of the PPI module was omitted from the baseline survey instrument. The baseline report calculated low and high scores based on the two response options from that omitted question. For the purposes of endline comparison we took the most conservative estimate, that is one that showed lowest levels of poverty so that gains at endline would at under-estimated as opposed to over-estimated.

TABLE 20: PERCENT OF HOUSEHOLD ABOVE $2.50 PPP POVERTY LINE, PANEL SAMPLE

	Baseline	Endline	Difference	Significant
Upper East	12%	35%	23%	***
Upper West	20%	27%	7%	*
TOTAL	17%	29%	12%	***

** p < 0.05; ** p < 0.01; *** p < 0.001*

SUPPLY CHAIN

We asked farmers a series of questions about their access to inputs, markets, buyers, extension agents, and credit to better understand the strength of the agriculture supply chain for rural farmers.

Access to inputs

Table 22 shows that the overwhelming majority of farmers use local retailers for agriculture inputs. At endline 88% of famers were using local retailers, a 5-percentage point increase from baseline. While use of local retailers has risen, we see that satisfaction has declined from 90% satisfaction at baseline to 78% at endline. The lowest rates of satisfaction are with government suppliers (25% baseline, 0% endline) and informal suppliers (50% baseline, 80% endline). Reliance on NGOs and government reduced by 10 percentage points by the endline. This is supportive of the development of more sustainable supply channels as there is less dependence on NGOs and government for supplies and more dependence on informal and local retailers (entrepreneurs).

TABLE 21: INPUT SUPPLIER AND CUSTOMER SATISFACTION, PANEL SAMPLE

	BASELINE		ENDLINE	
	Supplier	Satisfied	Supplier	Satisfied
Local retailer	83%	90%	88%	78%
NGO	7%	100%	1%	100%
Government	5%	25%	1%	0%
Informal	3%	50%	6%	80%
Other	2%	100%	4%	100%

** Satisfied respondents = "Very Satisfied" or "Somewhat Satisfied" rating for input supplier.*

We found that that overall satisfaction with input supplier has declined from 87% to 80% at endline. This difference appears to be driven by the decline in satisfaction for female-headed households. Farmers from male-headed households had no significant change in satisfaction levels, while female-headed households' satisfaction declined by 18 percentage points. This could also be due to NGO activity and subsidized inputs. If farmers are dependent on subsidized inputs, these tend to go to male farmers in the community first.

Korsung Highlight #3

One of the reasons for taking a new approach under IRP via the Korsung model was to ensure farmers have access to crop-specific inputs while also having guaranteed market linkages to sell the product. One of the primary factors influencing farmers' investment in production technologies is the knowledge of what their potential revenue will be, so they can determine potential margins. Korsung coordinated with vendors and aggregators before the production cycle to set a range of potential prices for each crop, providing farmers with a confirmed market linkage in advance of planting their farms. This advanced knowledge enabled farmers to take risks with testing new irrigation technologies facilitated through Korsung's FBAs to the farm gate. An additional improvement in the supply channel of irrigation technologies for farmers is the on-farm technical services Korsung FBAs provided for installing and maintaining irrigation equipment—farmers will not purchase irrigation technologies if they do not understand them and cannot manage them on their farms.

The graphic illustrates the role the Korsung hub played in the supply of outputs to farms and the uptake of harvests to vendors from farms.

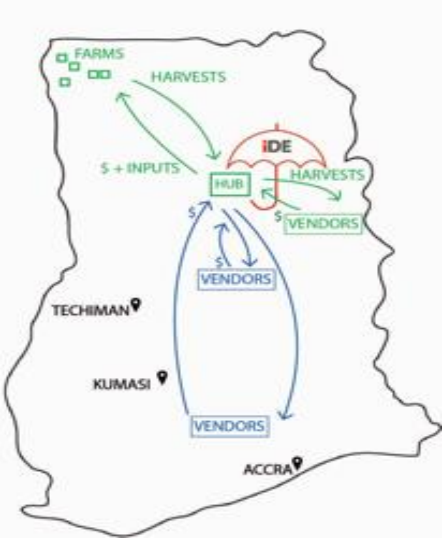


TABLE 22: OVERALL SATISFACTION WITH INPUT SUPPLIER, PANEL SAMPLE

	Baseline	Endline
Male HH	86%	85%
Female HH	88%	70%
TOTAL	87%	80%

Access to markets

Overall satisfaction with produce buyers remains unchanged with just over half of farmers reporting being satisfied, 58% at baseline and 55% at endline. However, Table 24 shows an interesting shift in satisfaction levels depending on the source. At baseline, 50% of farmers were satisfied with selling their own produce, whereas at endline 76% were satisfied. Conversely, 80% of farmers at baseline were happy selling through their local establishment (such as a lodge, school, etc.), while no farmers even reported selling through that buyer at endline. This could reflect a shift in market access and greater reliance on entrepreneurship.

Our findings show that we need to differentiate sale through a local establishment from selling to a vendor/wholesaler at the market, as farmers may use both interchangeably. The majority of farmers interviewed qualitatively either sold their own produce or asked a family member to sell. They differentiate between 'sit and sell' and 'sell all at once' in the market. A 'sit and sell' is when they take the produce to the market, understand the market price, and sell it to customers themselves. A 'sell all at once' is when farmers take their produce to the market and sell it to other traders in one go. Under Korsung, iDE buys the produce directly from farmers.

BUYERS

TABLE 23: PRODUCE BUYER AND CUSTOMER SATISFACTION, INCLUSIVE SAMPLE

	BASELINE		ENDLINE	
	Buyer	Satisfied	Buyer	Satisfied
Local trader	69%	62%	85%	52%
Self sold	1%	50%	15%	7%
Commercial buyer	23%	44%		
Local establishment	4%	80%		
Marketing group	1%	0%		

** Satisfied respondents = "Very Satisfied" or "Somewhat Satisfied" rating for buyer.*

MARKET INFORMATION

To better understand farmers' access to market information, we asked about the primary source of information, and how long it takes to receive price information from the nearest market.

At baseline, 98% of farmers said they received their market information informally via word-of-mouth and only 83% had more than one market they could access. At endline we see a greater diversification of information sources where 68% of farmers said they received their market information via word-of-mouth, 25% from media, TV, or radio, and 6% from an NGO. Further, we see an increase in market opportunities where 98% of farmers had more than one market they could access. Finally, Table 25 shows that the lag time for price information to reach the farmer improved with 89% of farmers reporting price information arrived on the same day at endline in comparison to 47% at baseline.

TABLE 24: TIME FOR MARKET PRICE INFORMATION TO REACH FARMER, INCLUSIVE SAMPLE

	Baseline	Endline
Same day	47%	89%
Next day	13%	9%
Two days or more	39%	1%
Never	0%	2%

These results suggest an improvement in satisfaction with market access, which we see reflected in Table 26. Satisfaction rates increased by 10 percentage points to an overall level of 78%. The gain is statistically significant while differences between female and male-headed households are not.

TABLE 25: OVERALL SATISFACTION WITH MARKET INFORMATION, INCLUSIVE SAMPLE

	Baseline	Endline
Male HH	69%	83% **
Female HH	61%	68%
TOTAL	**68%**	**78% ***

** p < 0.05; ** p < 0.01; *** p < 0.001*

Extension agent service

The primary sources of extension agent advice used by farmers are the Ministry of Food and Agriculture (MoFA) and NGOs, ranging between 30%-45% for each source at both baseline and endline. Interestingly, we see that 21% of farmers reported no source of agriculture advice at baseline whereas only 6% reported none at endline. The decline in no source of advice seems to be captured with 12% of endline farmers reporting relying on media for advice. In Table 27, we see that satisfaction with these sources declined at endline to 75% and 77%, respectively while both had 90% or higher satisfaction rates at baseline. This decline in satisfaction with agriculture advice occurred despite no significant change in the average number of visits farmers received from extension agents in year (3.6 and 3.4 for baseline and endline, respectively).

Despite this decline in satisfaction for the two primary sources of advice, changes in overall satisfaction as presented in Table 28 are statistically insignificant.

TABLE 26: SOURCE OF AGRICULTURAL ADVICE AND CUSTOMER SATISFACTION, INCLUSIVE SAMPLE

	BASELINE		ENDLINE	
	Source	Satisfied	Source	Satisfied
MoFA	35%	90%	30%	75%
NGO	32%	98%	44%	77%
None	21%	1%	3%	
Friends or family	9%	96%	11%	
Local business	2%	71%	1%	100%
Media, radio, TV	0%		12%	100%

** Satisfied respondents = "Very Satisfied" or "Somewhat Satisfied" rating for buyer.*

TABLE 27: OVERALL SATISFACTION WITH SOURCE OF AGRICULTURAL ADVICE, INCLUSIVE SAMPLE

	Baseline	Endline
Male HH	73%	78%
Female HH	76%	66%
TOTAL	**73%**	**74%**

Credit

The survey collected information on whether the household borrowed money or received some other form of credit for inputs of other production costs. Table 29 shows an increase in borrow rates between baseline and endline, which is statistically significant. Interestingly, we see this increase in access to credit is driven by a statistically significant increase for male-headed households while female-headed households remained constant.

TABLE 28: PERCENTAGE OF FARMERS BORROWING MONEY FOR AGRICULTURE COSTS, INCLUSIVE SAMPLE

	Baseline	Endline
Male HH	35%	52%**
Female HH	39%	40%
TOTAL	36%	48%*

*$p < 0.05$; ** $p < 0.01$; *** $p < 0.001$*

Table 30 shows us that between baseline and endline farmers shifted from relying on their friends or family for borrowing money to higher rates of borrowing from savings and loans groups, microfinance institutions, banks, and local money lenders.

TABLE 29: SOURCE OF CREDIT FOR BORROWING FARMERS, INCLUSIVE SAMPLE

	Baseline	Endline
Family / friends	69%	51%
Savings and loan groups	12%	24%
Microfinance institution	7%	11%
Bank	6%	9%
Local money lender	2%	5%
Other	3%	0%

CONCLUSION AND KEY FINDINGS

It is important to recall that the sampling of final participants is non-representative of the original program design and thus findings are not generalizable to all farmers initially working under the MDO model who were subsequently dropped during the shift to the Korsung model. With this in mind, a few key findings emerge.

We see that the average productivity per square meter of irrigated land increased by 69% from baseline to endline (significant at the 5% level). We find a significant 50% increase in land under irrigated cultivation, while total land holdings under irrigation did not change significantly. This suggests that the increase in land area under cultivation is due to increased crop cycles, intermixing of crops or other agricultural practices as opposed to expanding farm size. Further, we found qualitatively that the increase in land area under cultivation was directly linked to increase in time spent irrigating the fields. Farmers explained that rains began late and ended early, resulting in additional need to irrigate to complete crop cycles. Given the decreased rainfall, farmers expressed interest to move towards crops with shorter maturity period in order to complete a growing cycle before they run out of water or rainy season begins.

At the crop level, we find the largest gains in productivity for tomato and okra crops. However, our multi-method research approach reveals that though onions had only marginal positive increase in productivity, they are emerging as the primary target crop for future agriculture activities. First, in terms of FBA intensity under the Korsung model okra, cabbage, and green pepper required the most visits for all but one of the FBAs. However, onions generated the most revenue per square meter. Based on this knowledge, Korsung encourages farmers to dedicate more production area to onion cultivation in future crop cycles.

Finally, as we apply the lessons learned from IRP to the new Korsung model it is important to consider the balance between risk diversification and market power. Our qualitative evidence found that while some farmers opt to reduce risks by cultivating multiple varieties, they become price takers and face the risk of losing selling power if they are marketing small quantities of vegetables. Korsung should explore aggregating individual farmers and groups to gain leverage in price negotiation with vendors and market buyers.

APPENDIX A: CROP LEVEL ANALYSIS

	Total Harvest (kg)		Total Sales (kg)		Harvest / m2		Sales / m2		Total Crop Profit ($PPP)		Crop Profit / m2 ($PPP)	
	Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline
Tomato	117	2080	100	1954	0.08	0.51	0.07	0.48	$ 192	$ 673	$ 0.46	$ 0.17
Onion	744	1331	646	1297	0.26	0.33	0.24	0.32	-$ 152	$ 593	-$ 0.01	$ 0.15
Pepper	166	146	171	143	0.08	0.04	0.09	0.04	$ 201	$ 74	$ 0.10	$ 0.02
Green Beans	197	393	126	387	0.12	0.10	0.08	0.10	$ 199	$ 64	$ 0.30	$ 0.02
Okra	14	619	14	561	0.01	0.15	0.01	0.14	$ 4	$ 23	$ 0.02	$ 0.01
Lettuce	348	229	326	184	0.31	0.06	0.29	0.05	-$ 144	$ 28	-$ 0.07	$ 0.01

APPENDIX B: PMF INDICATOR REPORTING

	Indicator	Target	Endline	Source
	FAO: Prevalence of Food inadequacy (% of population without adequate food to cover normal physical activity)			Secondary data
	WHO – prevalence of underweight children in rural areas			Secondary data
1100	Increase in average productivity per square meter of target crops (M/F)	30% increase in KG for all vegetable crops (M/F scores to be within 20 % of aggregate)	69%	Household survey
1100	Increase in average number of square meters under target season crop cultivation for poor rural households (M/F)	25% increase in area under vegetable production. (M/F scores to be within 20 percent of aggregate)	48%	Household survey
1110	% of farmers able to cite 2 key production/ business mgmt principles (knowledge transfer)	70% of iDE clients	84%	Household survey
1110	% of clients applying at least 2 key principles of Integrated pest mgmt (knowledge application)	70% of iDE clients	52%	Household survey
1111	# farmers (M/F) attending info sessions	18,000 (40% women)	10,885	Project data
1111	# of farmer information meetings	100	308	Project data
1112	# of demonstration plots established	150	81	Project data
1112	# of trainings held on farming as a business and agronomic & production management	320 (average 31 per trg)	327	Project data
1112	Number of individuals trained	6,000 (2,400 women) (average 1.5 trgs/farmer)	7,812	Project data
1120	% of farmers who can cite 2 product appropriate safety procedures re use of pesticides (knowledge retention)	70% of iDE clients	63%	Household survey
1120	Average number of additional crops grown by a farmer (knowledge application)	2	2	Household survey
1121	# of trainings held on these identified environmental topics	160 (average 31 per trg)	340	Project data
1121	Number of individuals trained (the same individuals as are trained in Result 1112)	6,000 (2,400 women) (average 1 training/farmer)	5,086	Project data
1124	# of iDE clients exposed to environmental materials	6000	6,333	Project data
1130	# of farmers (M/F) accessing credit to purchase iDE technologies and/or associated services	3,000 farmers, 1200 women	3,140	Project data
1130	# of suitable credit instruments available to farmers	1 additional	2	Project data
1131	# of independent retailers (M/F) offering inputs and irrigation equipment to farmers	15 new dealers (3 women)	23	Project data
1133	# of gender sensitive training programs designed	1 in each country	1	Project data

1133	Participants' (M/F) satisfaction with trainings	75% of participants 'very' or 'somewhat' satisfied (M/F scores to be within 20 % points of each other)		
1200	% of supply chain supported by iDE as measured by $ value of iDE spending on supply chain divided by the total value of farmer purchases of inputs and technologies	20% of supply chain supported by iDE	23%	Project data
1200	Retailer satisfaction with supply chain	90% 'somewhat' or 'very' satisfied	80%	Household survey
1212	# of local manufacturers established	2	5	Project data
1212	# of local wholesalers established	0	1	Project data
1213	# of local entrepreneurs trained in irrigation tech supply chain		36	Project data
1213	# of trainings held		34	Project data
1220	# of farmers (M/F) purchasing non-irrigation income generating solutions	6000 (40% women)	6,305	Project data
1220	% of farmers (M/F) expressing satisfaction with the quality of their input supply	100% increase in satisfaction (M/F score within 10 % points of each other)	-	-
1221	# of supply chain business partners	10	38	Project data
1221	# of product lines supplied	4	7	Project data
1222	# of CMAs/FBAs/ other agents (M/F)	10 agriculture agents (2 women)	19	Project data
1222	# of clients (M/F) accessing agents	6000, 2400 women	6397	Project data
1300	Increase in Net Income obtained by smallholder farmers (M/F) from crops using iDE-promoted technologies.	$250 increase in raw annual net income (M/F scores to be within 20% of each other)	$384	Household survey
1300	Progress Out of Poverty Indicator	50% increase in households above poverty line (M/F scores to be within 20% of each other)	14%	Household survey
1310	# of wholesaler/national buyers		2	Project data
1310	Level of farmer's (M/F) satisfaction with wholesale/national buyer		n/a	n/a
1311	GE sensitive analysis of market chain gaps completed, with gender differences noted	1 in each country	1	Project data
1311	GE sensitive plan for addressing gaps completed	1 in each country	1	Project data
1312	Average number of markets identified for each farmer	1	3	Project data
1312	Level of satisfaction with market outlets	70% 'somewhat' or 'very' satisfied	55%	Household survey
1313	# of women members of collection centres	200	62	Project data

1320	# of farmer clients (M/F) with information from more than one market	6000 (40% women)	6,109	Project data
1320	Level of satisfaction with market information	90% 'somewhat' or 'very' satisfied	78%	Household survey
1321	# of market information channels established	1	4	Project data
1321	Average # of days/hours before market information reaches farmers	1 day	1 day – 89%	Household survey
1322	# of farmers (M/F) linked to a marketing group	600 (240 women)	0	Project data
1322	Satisfaction with marketing groups	70% 'somewhat' or 'very' satisfied	n/a	n/a

QUESTIONNAIRE NUMBER | | | | | |

1. INTERVIEW DATA

1.1	INTERVIEWER NAME	

1.2	INTERVIEW DATE											
		Y	Y	Y	Y		M	M		D	D	

1.3	SUPERVISOR NAME	
1.4	SUPERVISOR SIGNATURE (QUESTIONNAIRE OK)	

LOCATION

1.5	REGION													
1.6	DISTRICT													
1.8	VILLAGE													
1.9	LATITUDE	S				°			'			.			"
1.10	LONGITUDE	E				°			'			.			"

2. BASIC HOUSEHOLD DATA

RESPONDENT DETAILS

2.1	RESPONDENT'S LAST NAME	
2.2	RESPONDENT'S FIRST NAME	

2.3	FARMER GROUP			

2.4	RESPONDENT'S SEX	MALE		1
		FEMALE		2

2.5	PHONE NUMBER *[Any phone number on which we can reach the respondent. If no phone number, enter "N/A"]*	

2.6	Is the respondent the household head? *[IF YES, SKIP TO 2.11]*	NO		0
		YES		1

HEAD OF HOUSEHOLD DETAILS (IF NOT RESPONDENT)

2.7	Head of Household Full Name	

2.9	Head of Household SEX	MALE		1
		FEMALE		2

2.10	What is the household head's relation to the respondent?	HUSBAND/WIFE		1
		BROTHER/SISTER		2
		MOTHER/FATHER		3
		OTHER (SPECIFY)		4

HOUSEHOLD COMPOSITION

2.11	Please complete the table, showing number of male and female household members in each category.	AGE RANGE	NUMBER OF HOUSEHOLD MEMBERS		
			MALE	FEMALE	TOTAL
		>50 YEARS			
		18-49 YEARS			
		5-17 YEARS			
		<5 YEARS			
		TOTAL			

3. LAND AND WATER USE

3.1	Did you have a land area under irrigation in the past dry season? [*IF NO, SKIP TO 4.0*]		NO		0
			YES		1
3.2	What is the total land area that you had under irrigation in the past dry season?		HECTARES		1
		AREA UNIT (TICK ONE) -->	ACRES		2
			m^2		4
			OTHER (SPECIFY)		5

3.3	How do you have access to this land?	It is my own land		1
		It is family land		2
		I rent the land		3
		Informal (non-cash) arrangement		4
		OTHER (SPECIFY)		5

3.4	What was your primary source of water for irrigation in the past dry season?	RIVER / STREAM		1
		WELL / BOREHOLE		2
		RESERVOIR / TANK		3
		OTHER (SPECIFY)		4

3.5	How did you get water from the source to your irrigation field in the past dry season?	BUCKET / WATERING CAN		1
		TREADLE PUMP		2
		DIESEL / PETROL PUMP		3
		SOLAR PUMP		4
		CANALS		5
		OTHER (SPECIFY)		6

3.6	How did you access this technology?	OWNED		1
		RENTED		2
		SHARED/BORROWED		3
		OTHER (SPECIFY)		4

3.7	How did you apply water to your crops in the past dry season?	BUCKET / WATERING CAN		1
		FLOOD / FURROW		2
		SPRINKLER		3
		HOSEPIPE		4
		DRIP IRRIGATION		5
		OTHER (SPECIFY)		6

3.8	How did you access this technology?	OWNED		1
		RENTED		2
		SHARED/BORROWED		3
		OTHER (SPECIFY)		4

3.9	What irrigation technologies do you plan to purchase **in the next 12 months**? *[TICK ALL THAT APPLY]*	NONE		0
		TREADLE PUMP		1
		MOTOR PUMP		2
		ROPE AND WASHER PUMP		3
		DRIP IRRIGATION		4
		SPRINKLER		5
		MANUAL-DRILLED WELL		6
		OTHER (SPECIFY)		7

3.10	Approximately how many hours per week did WOMEN in your household spend on irrigation in the past dry season?	Hrs

3.11	Approximately how many hours per week did MEN in your household spend on irrigation in the past dry season?	Hrs

QUESTIONNAIRE NUMBER | | | | | |

4. KEY CROP PRODUCTION

Please provide details for the crops you harvested in the past year.

4.1 CROP	4.2 MONTH PLANTED	4.3 AREA PLANTED	4.4 AREA UNITS	4.5 SEED QUANTITY	4.6 SEED UNITS	SEED PRICE		4.9 IRRIGATED		4.10 HARVEST QUANTITY	4.11 HARVEST UNITS	4.12 SOLD QUANTITY	4.13 SOLD UNITS	SOLD PRICE		CROP CODE
						UNIT PRICE	4.8 TOTAL PRICE							UNIT PRICE	4.15 TOTAL PRICE	
1								Y	N							1. *Cabbage* 2. *Carrot* 3. *Cucumber* 4. *Green beans* 5. *Green pepper* 6. *Lettuce* 7. *OFSP* 8. *Okfra* 9. *Onion* 10. *Peppers* 11. *Tomato* 12. *Other*
2								Y	N							
3								Y	N							
4								Y	N							
5								Y	N							
6								Y	N							
7								Y	N							
8								Y	N							
9								Y	N							
10								Y	N							
11								Y	N							
12								Y	N							

UNIT CODES

AREA	CODE
HECTARE	1
ACRE	2
LIMA	3
m^2	4

SEED	CODE		
GRAMS	1	200g SACHET	4
KG	2	500g TIN/PACKET	5
100g SACHET	3	10KG SACK	6

HARVEST/SOLD	CODE		
KG	1	90KG BAG	5
10KG BAG	2	100KG BAG	6
20KG BAG/CRATE	3	PIECE/NUMBER	7
50KG BAG	4	HEADS	8

5. OTHER INPUT AND PRODUCTION COSTS

CHEMICALS AND FERTILIZERS

Please provide the quantities and cost of chemicals and fertilizers **used in the past year** per the table below:

HERBICIDES		LITERS	TOTAL COST
PESTICIDES		**LITERS**	**TOTAL COST**
	1. Bomec 2. Moncozeb 3. Super Dean 4. Other		
FERTILIZERS		**KG**	**TOTAL COST**

OTHER PRODUCTION COSTS

5.2	How much did you spend on TILLAGE in the past year?	GHC
5.3	How much did you spend on HIRED LABOUR in the past year?	GHC
5.4	How much did you spend on LAND RENTAL in the past year?	GHC
5.5	How much did you spend on FARM EQUIPMENT RENTAL in the past year?	GHC
5.6	How much did you spend to TRANSPORT YOUR PRODUCE TO MARKET in the past year?	GHC
5.7	How much did you spend on OTHER PRODUCTION COSTS in the past year?	GHC

5.8	Did you borrow money or receive some other form of credit for inputs or other production costs? *[IF 'NO', SKIP TO 6.1]*	NO		0
		YES		1

5.9	From whom did you borrow money or receive inputs/equipment on credit?	FAMILY / FRIENDS		1
		SAVINGS AND LOAN GROUP		2
		MICRO-FINANCE INSTITUTION		3
		BANK		4
		LOCAL MONEY-LENDER		5
		BUSINESS (INPUT DEALER, COMPANY, ETC.)		6
		OTHER (SPECIFY)		7

6. Exposure, Retention, and Application of Training Content

THIS SECTION IS TO BE COMPLETED BY ALL TYPES OF FARMER GROUPS, REGARDLESS OF WHETHER THEY ARE CONTROL, SPILLOVER, OR TREATMENT.

6.1 Did a member of the household receive farm-business or irrigation training from iDE?	1. Yes, directly from iDE organized training 2. Yes, from same group member 3. No

6.2 Retention Question #1		**6.3 Retention Question #2**	
When is the best time to apply water onto your vegetables during the day? (CHECK ALL THAT APPLY)		What factors did you consider in determining your plot size for this year's dry season farming? (CHECK ALL THAT APPLY)	
Early Morning		Water availability	
Morning		The amount of money you have in savings	
Mid-Day		Cost of fertilizers/herbicides/pesticides	
Afternoon		Cost of seeds	
Late Afternoon		Cost of labor	
Night		Home consumption	
Other Response		Other Response	

6.4 Did a member of the household receive Agronomic practices and Environmental Awareness training from iDE?	1. Yes, directly from iDE organized training 2. Yes, from same group member 3. No

6.5 Retention Question #1		**6.6 Retention Question #2**	
Apart from using chemicals to control pest and diseases, mention one other method which can be used in pest and disease control? (CHECK ALL THAT APPLY)		Please list the basic safety procedures that should be used when applying pesticides. (CHECK ALL THAT APPLY)	
Using Neem leaves		Wearing protective clothing	
Spreading ashes on the ground		Safe disposal of chemical containers	
Burning the field prior to planting		Do not spray into the wind	
Other Response		Do not spray more than what is directed	
		Other response	

7. CUSTOMER SATISFACTION

INPUT SUPPLIERS

7.1	What was your main source of agricultural inputs in the past year?	LOCAL RETAILER		1
		NATIONAL SUPPLIER		2
		NGO		3
		GOVERNMENT		4
		INFORMAL (NEIGHBOURS, FAMILY, ETC.)		5
		OTHER (SPECIFY)		6

7.2	How satisfied are you with the service you received from this supplier? *[Read options; select one]*	Very satisfied		1
		Somewhat satisfied		2
		Neither satisfied nor dissatisfied		3
		Somewhat dissatisfied		4
		Very dissatisfied		5
		Don't know		9

7.3	Have you recommended this supplier to anyone else?	NO		0
		YES		1

EXTENSION AGENT SERVICE

7.4	Who was your main provider of agricultural advice in the past year? *[Read options; select one]* *[IF 'NO SERVICE', skip to 6.7]*	NONE		0
		MoFA		1
		Local business (Shop / trader)		2
		Private company agent		3
		Media (radio, TV, newspaper)		4
		NGO		5
		Friends or family		6
		OTHER (SPECIFY)		7
7.5	How satisfied are you with your access to agricultural advice? *[Read options; select one]*	Very satisfied		1
		Somewhat satisfied		2
		Neither satisfied nor dissatisfied		3
		Somewhat dissatisfied		4
		Very dissatisfied		5
		Don't know		9

7.6	How many visits did you receive from an extension agent in the past year?	

MARKET INFORMATION

7.7	What is your main source of market information? *[Read options; select one]*	Media (television, radio, newspaper)		1
		Government service		2
		NGO		3
		Informal (word-of-mouth)		4
		Other (specify)		5
7.8	Where is your closest market?			

7.9	When do you typically get price information from this market? *[Read options; select one]*	Same day		1
		Next day		2
		After two days or more		3
		Never		4

7.10	Where is your next closest market? (if any)			
7.11	When do you typically get price information from this market? *[Read options; select one]*	Same day		1
		Next day		2
		After two days or more		3
		Never		4
		Not Applicable (no market identified)		9

7.13	How satisfied are you with your access to market information? *[Read options; select one]*	Very satisfied		1
		Somewhat satisfied		2
		Neither satisfied nor dissatisfied		3
		Somewhat dissatisfied		4
		Very dissatisfied		5
		Don't know		9

STORAGE

7.15	What is your main method of storage for vegetable crops? *[Read options; select one]*	Inside the house		1
		Other structure in my compound		2
		Communal storage facility		3
		No Storage Facility		4
		Other (specify)		5

7.16	How satisfied are you with your current storage options? *[Read options; select one]*	Very satisfied		1
		Somewhat satisfied		2
		Neither satisfied nor dissatisfied		3
		Somewhat dissatisfied		4
		Very dissatisfied		5
		Don't know		9

PRODUCE BUYERS

7.17	To whom did you sell the most agricultural produce in the past year? *[Read options; select one]* *[IF 'NO SALES', skip to 7.1]*	NO SALES		0
		Local trader		1
		Local establishment (lodge, school, etc.)		2
		Commercial buyer (supermarket, company, etc.)		3
		Marketing group or collection centre		4
		OTHER (SPECIFY)		5

7.18	How satisfied are you with this buyer? *[Read options; select one]*	Very satisfied		1
		Somewhat satisfied		2
		Neither satisfied nor dissatisfied		3
		Somewhat dissatisfied		4
		Very dissatisfied		5
		Don't know		9

8. PROGRESS OUT OF POVERTY INDEX

8.1	What is the highest grade completed by the female head/spouse? *[Read options; select one]*	No female head/spouse		1
		None or pre-school		2
		Primary or middle school		3
		Any JSS, SSS or higher		4
8.2	Is the main job of the male head/spouse in agriculture? *[Read options; select one]*	Male head/spouse has no job		1
		Yes, main job is in agriculture		2
		No, main job is not in agriculture		3
		No male head/spouse		4
8.3	What is the main construction material used for the roof? *[Read options; select one]*	Palm leaves/raffia/thatch, wood, mud bricks/earth, bamboo, or other		1
		Corrugated iron sheets, cement/concrete, asbestos slate, or roofing tiles		2
8.4	What is the main source of lighting for the dwelling? *[Read options; select one]*	Not electricity (mains)		1
		Electricity (mains)		2
8.5	What is the main source of drinking water for the household? *[Read options; select one]*	Borehole, well (with pump or not, protected or not), or other		1
		River/stream, rainwater/spring, or dugout/pond/lake/dam		2
		Indoor plumbing, inside standpipe, sachet/bottled water, standpipe/tap (public or private outside), pipe in neighbours, water truck/tanker, or water vendor		3
8.6	Does any household member own a working stove (kerosene, electric or gas)?	NO		0
		YES		1
8.7	Does any household member own a working iron (box or electric)?	NO		0
		YES		1
8.8	Does any household member own a working radio, radio cassette, record player or 3-in-1 radio system? *[Read options; select one]*	None		1
		Only radio		2
		Radio cassette but no record player or 3-in-1 (regardless of radio)		3
		Record player but no 3-in-1 (regardless of radio or cassette)		4
		3-in-1 radio system (regardless of any others)		5

[Ask the respondent if he/she has anything to add or any questions]

THANK the respondent

END INTERVIEW.