Achieving Impact at Scale Through ICT-enabled extension services in Ghana (CIFSRF Phase 2)

108129-001

Final Evaluation Report

01 November 2016 to 28 February 2018

Executive Summary

Background

- 'Achieving Impact at Scale' (AIS) provides a package of integrated agriculture extension services to farmers in six regions in Ghana; Volta, Ashanti, Brong Ahafo, Northern, Upper East and Upper West Regions.
- The overall objective of the project is to improve the efficiency and economic viability of agricultural extension services by scaling up enhanced ICT-enabled extension service models for reaching and benefiting smallholder farmers in Ghana.
- The project is implemented by Grameen Foundation (GFUSA) and Farm Radio international in partnership with Wageningen University (WU) and builds on the gains of a a private-sector led ICT-enabled extension service project,
- The project contributes to addressing challenges of low agricultural production and rising food insecurity in Ghana. There is an urgent need for increased access to agricultural extension services by small holder farmers to help them learn and apply improved and efficient agronomic practices that contribute to increased farm productivity. This is the gap the project sort to fill.
- Having tested the use of a combination of ICT and radio in providing agriculture extension services to small holder farmers under the ICT Challenge fund, the Achieving Impact at Scale sort scale up the successes of the previous project to reach more farmers. The project targeted reaching 300,000 small holder farmers using these tested approaches.
- The project uses two different, yet innovative methods. GFUSA uses an 'Intermediated method' which uses trained 'Field Agents' supported by an ICT platform work directly with farmers to provide them extension and support services. FRI on the other hand, uses 'Direct to Farmer' method using interactive radio programming to provide extension services.

Purpose of Evaluation

- The purpose of the evaluation is to provide a holistic view of project results to support recommendations for the development of smallholder-inclusive agribusiness extension systems and underpinning policies. The evaluation also assessed the impact of AgroTech on SHF productivity, as well as evidence to support sustainable deployment of AgroTech on a commercial scale.

Approach

- A mixed method was used to undertake the evaluation. A combinations of desk reviews, sample surveys, focus group discussions and key informant interviews provided data for the analysis of progress against set objectives and targets.

Sampling

- 1200 small holder farmers were sampled for the SHF surveys using multiple sampling techniques. The project population was treated as two separate subpopulations or strata, one for radio and another for the intermediated approach. This is because the two components targeted farmers differently and so the degree to which selection of respondents can be randomized will not be the same for all.
- The first stage of sampling was the stratification of the universe into 2 according to the project own strategy implementation; AgroTech Radio and Intermediated Extension.
- The population for the AgroTech Radio survey was all communities in project districts that receive radio broadcasts from partner FM stations. The sampling frame for this population is citizens in all 110 communities who listen to radio broadcasts from FRI partner radio stations. Using an appropriate sample size determining formula, 700 small holder farmers were sampled and interviewed.
- The population for the AgroTech Radio survey was all communities in project districts that receive radio broadcasts from partner FM stations. The sampling frame for this population is citizens in all 110 communities who listen to radio broadcasts from FRI partner radio stations. Using appropriate sample determination formula, 500 small holder farmers were sampled and interviewed

Focus Group and Key Informant Interviews

- A total of 112 participants were involved in 8 focus group discussion across 8 districts in Ashanti, Brong Ahafo and Volta regions of Ghana. Ashanti, Brong Ahafo and Volta regions recorded 1, 4 and 3 focus group discussions respectively. For all the focus groups discussions, there was equal representation of both men and women.
- A total of 19 Out-grower business owners (OB) were interviewed in Brong Ahafo and Volta Regions. These OBs were made up 19 males and 2 females.
- Representatives of all six radio stations were interviewed, two in the Volta (Volta Star Radio and Lorlornyo FM) and four in Brong Ahafo (Atoobu FM, Akyeaa FM, Asta FM and Adars FM) regions.

- A total of 13 agents were interviewed across three regions (Volta, Brong Ahafo and Ashanti). These agents were made up 12 males and a female.

Key Findings

- A total of 1174 farmers from 40 districts in all 5 operational regions. Majority of respondents to the survey, 35 percent, are from Brong Ahafo Region while Ashanti had the lowest representation of 6 percent
- Fifty-eight percent of the 1174 farmers interviewed are males and 42 percent females
- Thirty-two percent of farmers interviewed by the study are above 50 years old, less than 2 percent of respondents are below 19 years of age and another 2 percent said they do not know their age
- Twenty-five percent of all respondents to the study fall between the ages of 20 – 34, the youth age group, making them a critical group in the agriculture workforce.
- Majority of small holder farmers interviewed, 83 percent, reported they were married while less than 1 percent of all interviewed reported they were living together.
- More than half of all small holder farmers interviewed, 59 percent, have been to school, 41 percent have never attended school.
- Majority of those who responded to the survey, 87 percent, have completed some level of education; 46 percent have completed middle/JSS, 20 percent have completed Secondary and 16 percent Primary.
- Only 44 percent of females interviewed have attended school compared to 69 percent of males interviewed who said they have attended school.

Participation in Farmer Community

- More than half of all small holder farmers the study interviewed, 52 percent, indicated that they have been registered by an AGROTECH Agent working for an Out-grower Business
- More than half of the 488 women interviewed, about 53 percent, said they have been registered by an AGROTECH agent.
- A large majority of the farmers interviewed, 64 percent of farmers indicated they are members of a farmer based group while 36 percent said they were not. About 59 percent of all respondents also said they participate in meetings of the group often.
- Sixty percent of 762 respondents from 3 regions with FRI radio presence said they listen frequently to FRI partner radio station broadcasts on agriculture issues.

- About 60 percent of all women interviewed listened to FRI partner stations

Access to Financial Services

- Majority of farmers have some of savings, this is either home, or kept with non-bank financial institution.
- Thirty percent of respondents said they did not have any savings, while 70 percent said they have. 18 percent have savings with rural banks, 14 percent with Village Savings and Loans, 10 percent with universal banks and 5 percent with micro-finance institutions. Another 8 percent said they have savings with local susu collectors.
- Majority of farmers interviewed did not own a bank account. Only 44 percent of those interviewed said they have a bank account.
- Twenty percent said they had accounts in rural banks, 13 percent with universal banks, 7 with credit unions and 3 percent said they had accounts with micro finance institutions.
- Fifty one percent of respondents however said they do not have mobile money accounts, 49 percent, said they own mobile money accounts.
- The study however found access to financial services for women in the study area is relatively low. Majority of women interviewed did not have a bank account, 67 percent, only a third, 33 percent, had a mobile money account.

Farming Practices of Respondents

- An overwhelming majority of farmers who were interviewed by the study cultivated multiple farms. 33 percent indicated they cultivated 3 farms, 26 percent cultivated 2 farms, 20 percent cultivated 4 farms and seven percent said they cultivated more than 4 farms. Only 13 percent of respondents cultivated 1 farm.
- An overall majority of women the study spoke to, 90 percent, indicated they have multiple farms. About 34 percent had 3 farms and another 14 percent had 4 farms.
- Majority of farmers, 86 percent, in the areas of operation of the project cultivate cereals as their main crop
- Fifty-three percent of all who respondent to the survey said they cultivated maize as their main crop, 23 percent mentioned rice and 14 percent mentioned yam as their main crop of cultivation. Only 7 percent mentioned soya beans and 3 percent mentioned cowpea as the main crops cultivated.
- About 51 percent of all females interviewed mentioned maize as their major crop.

- Fifty-one percent of farmers farmed in both the minor and major seasons, 35 percent said the farmed only one season and 11 percent said they farmed only in the main season. Further analysis of responses indicates those who answered as farming only one season are mostly from the northern part of the country.

Access to Radio and Listening Habits

- More than 75 percent of respondents to the study said that they have easy access to radio sets if they wanted to.
- Only 25 percent of farmers the study spoke to said they did not have easy access to a radio set
- More than half of all respondents, 52 percent, said they own the radio sets, 10 percent said the set was owned by the husband, and 7.2 percent said by the whole household.
- A small minority, 0.3 percent also indicated the radio was owned by their wives and another 0.7 percent said by both husband and wife.
- More than 66 percent of all women interviewed have easy access to radio, with about 24 percent actually saying the own the radio set.
- More than half of all respondents, 55 percent, said they listen to radio daily, 10 percent said they listened twice a week and 8 percent said they did so once a week.
- An overwhelming majority of respondents indicated they have listened to radio programs on the cultivation of their major crop in the past 12 months
- Sixty percent of all respondents said they listen frequently to FRI partner radio station broadcasts on agriculture issues. Again, about one third of the 459 respondents who listened to FRI partner stations are females.

Acquisition of knowledge

- Majority of respondents to the study said they have had contact session with an agent in the last 12 months
- More than 75 percent of those interviewed said they have been in contact with an agricultural field agent. Only 24 percent said they have not been in contact with an agent in the last 12 months.
- Forty-one percent mentioned government extension agents, 24 percent, mentioned buyer/aggregator/OB while 8 percent mentioned agents from other NGO interventions.

- More than 71 percent of those who said they listened to radio also said that they listened to broadcasts on the cultivation of their major crop in the past 12 months.
- FRI partner radio stations broadcast 11 improvements to farmers on improved planting, improved seeds, weed control, fertilizer application, improved harvesting techniques, pesticide application, post-harvest management, marketing, input credit, land preparation and farm planning.
- An overwhelming majority of respondents, more than 90 percent said they listened to radio broadcasts on 7 out of 11 improvements broadcast in the last 12 months
- AGROTECH Agents have also reached over 60 percent of all farmers interviewed on the improvements with planning

Adoption of Promoted Practices

- An overwhelming majority of farmers indicated that they applied all improvement with land preparation, weed control and right spacing of crops being applied by 93, 87, and 81 percent of farmers respectively
- Knowledge on the use of pesticides and improved seeds were the least applied by farmers, accounting for 54 percent each of those who the study spoke to.
- Generally, there is an equally high application of knowledge on farms by women farmers as well as their male counterparts. Three out of 4 women interviewed, 75 percent of women, said they applied the improvement on their farm to cultivate their major crop.

Land Size Under Improvement for Maize

- The average land size under cultivation for maize farmers who listen to FRI partner radio whose major crop is maize is 4.3 hectors
- The average land area under cultivation for a maize male farmer is 5.5 hectors compared to 2.2 hectors for females.
- The average land size the past major season for maize farmers is 1.7 (this is 2.0 hectors for males and 1.1 for females)
- The average area under cultivation for farmers who are registered by an Agent whose major crop is maize is 4.0 hectors (5.3 for males and 2.2 for females) while the average land size under cultivation of maize for the last major season is 1.6 hector (1.9 for males and 1.1 for females).

Land Size Under Improvement for rice

- The average land size under cultivation for farmers who listen to FRI partner radio whose major crop is rice is 2.5 hectors.
- The average land area under cultivation for a male rice farmer is 3.0 hectors compared to 1.7 hectors for females.
- The average land size the past major season for rice farmers is 0.9 (this is 1.0 hectors for males and 0.7 for females).
- The average area under cultivation for farmers whose major crop is rice and have AgroTech support is 2.5 hectors (3.1 for males and 1.7 for females) while the average land size under cultivation of rice for the last major season is 0.9 hector (0.7 for males and 0.5 for females).

Land Size Under Improvement for Soybean

- The average land size under cultivation for farmers who have AgroTech support whose major crop is soybean is 2.3 hectors.
- The average land area under cultivation for a male soybean farmer is 4.7 hectors compared to 1.4 hectors for females.
- The average land size the past major season for cowpea farmers is 1.2 (this is 2.2 hectors for males and 0.8 for females).

Land Size Under Improvement for Cowpea

- The average land size under cultivation for farmers who listen to FRI partner radio station whose major crop is cowpea is 4.0 hectors.
- The average land area under cultivation for a male cowpea farmer is 4.4 hectors compared to 3.1 hectors for females.
- The average land size the past major season for cowpea farmers is 1.8 (this is 1.9 hectors for males and 1.6 for females).
- The average land size under cultivation for farmers who have AgroTech support whose major crop is cowpea is 3.6 hectors.
- The average land area under cultivation for a male cowpea farmer is 4.4 hectors compared to 2.6 hectors for females.
- The average land size the past major season for cowpea farmers is 1.6 (this is 1.9 hectors for males and 1.3 for females).
- The average adoption area for improved seeds in the major season for cowpea is 0.4, for land preparation is 0.7 hectors

Land Size Under Improvement for Yam

- The average land size under cultivation for farmers who have AgroTech support whose major crop is yam is 4.2 hectors.
- The average land area under cultivation for a male yam farmer is 5.1 hectors compared to 2.3 hectors for females.
- The average land size the past major season for yam farmers is 1.3 (this is 1.4 hectors for males and 0.9 for females).
- The average adoption area for improved seeds in the major season is 0.5

Average Yield

- The average yield for SHF in the project locations shows significant difference between those who has AgroTech support and those who did not have AgroTech support.
- The yield for maize and rice (2.1 and 0.76) is higher for AgroTech beneficiaries than for those who did not benefit from the project of (1.0 and 2.18)
- level of yield for FRI partner radio listeners compared to yield for other farmers in the community who did no benefit from the project. Average yield for maize and rice for female FRI listeners is (2.25 compared to 0.99) for maize and (2.39 compared to 1.95) for non-FRI community members

Satisfaction with Outcomes

- Majority of small holder farmers expressed satisfaction with the yield they got in the main season.
- As many as 54 percent of all small holder farmers interviewed said they were satisfied with the yield they got in the main harvest (42 percent satisfied and 12 percent very satisfied)
- Consistently however the satisfaction levels for males is higher than that of females. this could be as a result of the fact that the males are better able to cultivate large farms
- Farmers were also satisfied with the price of the produce for the main season
- Only 48 percent of small holder farmers expressed satisfaction with the level of revenue, this include 39 percent who said they were satisfied and 9 percent who said they were very satisfied with the revenue from their harvest.
- As many as 52 percent of small holder farmers said they were not satisfied with the revenue from the harvest.

Key Results Achieved

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List of Abbreviations

AGRA	Alliance for a Green Revolution in Africa
AIS	Achieving Impact at Scale
CLGs	Community Listener Groups
DG	Digital Green
D2F	Direct-to-farmer
FBO	Farmer-Based Organizations
FRI	Farm Radio International
ICT	Information and Communications Technology
IVR	Interactive Voice Response
MOFA	Ministry of Food and Agriculture
OBs	Outgrower Business-owners
PRC	Participatory Radio Campaign
RMP	Radio Market Place
RFP	Regular Farmer Program
NA	New Alliance for Food Security and Nutrition
SHF	Smallholder farmer
SSTP	Scaling Seed and Technology Program

1.0 Background and Purpose of Study

1.1 Project Background

Grameen Foundation (GFUSA) and Farm Radio international in partnership with Wageningen University (WU) implemented a private-sector led ICT-enabled extension service project, 'Achieving Impact at Scale' (AIS), in Ghana. The project provided a package of integrated agricultural extension services to farmers in five regions, contributing to addressing challenges of rising food insecurity in Ghana.

The overall objective of the project is to improve the efficiency and economic viability of agricultural extension services by scaling up enhanced ICT-enabled extension service models for reaching and benefiting smallholder farmers in Ghana.

The specific objectives of the project are to:

- Scale up enhanced ICT-enabled extension services to smallholder households, resulting in adoption of productivity-enhancing technologies, specifically targeting women
- Test the economic viability of enhanced ICT-enabled extension scaling approaches through different buyer-agent models
- Engage policymakers and the private sector in the promotion of proven new models to scale food security and market growth in Ghana

On the ground, the project is working to extend information on smart agricultural practices, improve the reach and efficiency of local agriculture extension services by training and facilitating private extension agents to provide customised services to small holder farmers in five regions in Ghana.

In spite of the fact that significant numbers of the working population in Ghana are directly engaged in agriculture, productivity in the sector is relatively low. Indeed, low agricultural productivity in Ghana is cited as one of the key reasons for the decline in agriculture in Ghana. A number of reasons account for this decline, key among which are climate change, declining land fertility, low of application of technology and innovation and a lack of required level of extension services to the farmers. In Ghana, agriculture extension services are primarily provided by the state through Ministry of Food and Agriculture (MoFA). Lack of adequate budgetary allocation and resources in the last two decades have severely constrained provision of extension services to small

holder farmers in country. Evidence have it that with a farmer to extension agent ratio of 1:3000 many small holder farmers will not have access to extension services. A rapid scoping assessment found very positive aspects of extension and services delivery, as well as some significant weaknesses and deficiencies, Manfre et al (2013). Extension assets identified included some examples of good extension practice in a number of public sectors and NGO's run extension programs that employ key approaches like market-oriented extension and use of innovative ICT approaches. The assessment also identified some gaps including weak coordination at the national level, inefficient performance from the public-sector extension services and the over-focus on production increases, without sufficient concern for farm-level profitability, which was necessary to induce further agricultural innovations and thereby boost productivity.

Extension and advisory services delivery in Ghana has evolved from the traditional methods of Farmer Field Schools (FFSs) and on-farm demonstrations which are associated with high cost and limited scale of outreach to the use of community based extension services delivery and e-extension systems. The still evolving e-extension approaches use Information and Communication Technology (ICT) to improve outreach and performance.

Ghana suffers seasonal food insecurity, which is severe in low income farming communities in the Northern parts of the country. The World Food Program classifies Ghana as a food-deficit country and 51 percent of children under five suffer from malnutrition. Research has also found that smallholder farmers chronically under-invest in their farms, which exacerbates their low productivity, increases their vulnerability to risks, and contributes to food insecurity.

In 2012, the G-8 Summit launched the New Alliance for Food Security and Nutrition to partner African Union's Comprehensive Africa Agriculture Development Programme (CAADP). A key objective of this initiative was to address constraints that prevent smallholder farmers, especially women, from increasing their output. The New Alliance ICT Extension Challenge Fund contributed to this goal by supporting financially sustainable ICT-enabled extension services to help reach more farmers so they adopt new techniques that can increase their productivity. In Ghana, CAADP has set a goal of increasing yields of cassava, maize, rice, soybean, and yam by 50 percent and cowpea by 25 percent by 2015.

With funding from the New Alliance ICT Extension Challenge Fund Grameen Foundation, Farm Radio International and Digital Green worked with local institutions to develop content on

agricultural best practices and other relevant topics for distribution to 200,000 farming households in the Ashanti, Brong-Ahafo and Volta regions.

Against this background, the Canadian International Food Security Research Fund (CIFSRF) provided funding to Grameen Foundation and Farm Radio International to scale up the project to reach 300,000 farmers with extension information and to support 60,000 of them to adopt the use of improved inputs and agronomic practices through the "Achieving Impact at Scale Through ICT-enabled Extension Services in Ghana (AIS)" project. The project implementation period is twenty-four months starting November 2015.

1.2 Purpose of the Evaluation

The main purpose of the evaluation is to provide adequate details of project final results to IDRC, GF, Farm Radio International and other stakeholders. The primary objective is to provide a holistic view of project results to support recommendations for the development of smallholder-inclusive agribusiness extension systems and underpinning policies. Specifically, the evaluation will assess the impact of AgroTech on SHF productivity, as well as evidence to support sustainable deployment of AgroTech on a commercial scale.

2.0 Project Description and Implementation Strategy

2.1 AIS ICT Enabled Extension Service

GFUSA and Farm Radio International (FRI), provide extension services to small holder farmers in five regions in Ghana through two different, yet innovative methods. GFUSA uses an 'Intermediated method' which uses trained 'Field Agents' supported by an ICT platform work directly with farmers to provide them extension and support services. FRI on the other hand, uses 'Direct to Farmer' method using interactive radio programming to provide extension services.

Evidence from the field have indicated that these two different are complementary, and builds synergies that reinforces learning among the farmers resulting in behavior change. The two methods integrated into one have the potential to contribute to improving the technical knowledge of farmers and also in helping them with the much-needed farm inputs.

2.2 ICT based farmer extension services model of GFUSA

GFUSA developed and deployed on android tablets, an ICT-based agricultural extension service platform, the 'SmartEx'. The project trained field agents[1] to provide customized extension service to farmers on their farms.

The Field Agent is the representative of the Farm Business (Nucleus farm, Out-grower Business, Processor, Aggregator etc.) in the communities. Among other things, field agents are responsible for managing information between farmers and the project, ensure inputs are distributed to farmers in a timely manner, provide information required for efficient utilization of the input resources provided as well as farmers to manage their natural resource base in a sustainable manner.

Field Agent also conduct coaching sessions for farmers on site and also collect data for the project. The coaching sessions may include the use of multi-media, voice messages, videos on tablets, videos projected using Pico projectors. The sessions are designed for pre-sowing season, in-season and post-harvest season.

The key features of the software application, AgroTech SmartEx are:

- Farmer discovery and enrolment: This enables the Agent to register a farmer, and document previous farm practices and credit activities prior to farmer joining the AgroTech SmartEx Coaching Scheme.

[1] Most of the agents are be staff of Out-grower Businesses or Nucleus Farmer

- Farmer Management: provides a protocol of programed visits or Agent routine tied to key crop growth stages or farm operations, to deliver appropriately timed support (advice and/or demonstration) to the farmer. Agent records input and output information of all activities and aggregates are provided to relevant value chain actors through a dashboard.
- Value Chain Linkages: This feature provides the agent access to a range of agribusiness service providers value chain service providers (nucleus farmers, aggregators, buyers, processors, input dealers, tractor ploughing, post-harvest threshing and warehousing) and financial service providers).
- Access to information and Knowledge Content depository: This is a collection of information and knowledge on crop production, processing and marketing. Currently five (5) food crops are covered, namely Maize, rice, soya bean, cassava and yam. Content of other food crops such as groundnut and cowpea, as well as tree crops and vegetables will be deployed soon.
- Monitoring, Evaluation and Learning: Data collected by the mobile application through agent interactions are stored and analyzed by remote servers. The analyzed data, accessed by the mobile application, helps the agent to understand the background of the farmer, his/her learning needs and requirements and track performance. The activities of the agent are also tracked and the data is available to supervisors via a dashboard.

The ICT platform provides customized advisory information to farmers and allows farmers to have direct interaction and personalized discussions around their farm issues with the Field Agent. The SmartEx application helps in tracking farm performance objectively and to compare farm performance before and after the support. This helps in tracking productivity, price realizations, effectiveness of advisory and change in economic status of farmers.

The ICT platform has great potential gathering and building a database on farming practices, yields, yield trends, sales figures, fertilizer usage, seed usage, chemical usage etc. This data can be disaggregated for Farmer Groups, Villages and regions. This could be utilized in multiple large-scale operations.

2.3 Direct to farmer model of Farm Radio International

The Direct-to-farmer approach utilizes a combination of radio and SMS/IVR to deliver content on agronomic practices to a much wider audience than human networks could cost-effectively reach. The radio broadcasts utilize multi-format educational programming approaches to create extremely interactive experiences by inviting listeners to engage with tools like beep-to-vote, call-in segments,

and the formation of listening groups that include demos, video screenings, or farmer knowledge exchange

FRI's radio programming broadcasts expand access to extension content into the homes of listeners and into communities via the creation of listening groups, which have the added benefit of bringing radio to farmers who do not have radio access in their homes. Broadcasts are reach SHFs with entertaining, educational radio programs. Embedded in that context, radio hosts raise awareness of the benefits of technologies for the targeted value chains and provide information on their use. Radio hosts are joined by agronomists from MOFA or research institutions, to complement educational content with live Q&A call-in segments, where experts emphasize the value and ease of technology adoption or provide troubleshooting. This interactive, farmer-centered programming reinforce intermediated extension services and the short, technical messages delivered via SMS/IVR campaigns to service rural, hard-to-reach farmers unable to access information through other channels. Content increase listeners' knowledge, change their attitudes, and encourage educated decision-making on adoption of improved farming practices.

2.4 AgroTech: Integrated model

GFUSA and FRI combined the two models into an integrated AgroTech extension services model. The integrated model has the potential to improve the efficacy of extension services and promote lasting behavior change among Ghanaian SHFs to increase yields and improve food security. Agent working as Leader of the Community Listener Group serving its members,

The Agents supported and promoted the radio program to all farmers while the radio program promoted the Agent. The Agents also provided information as a resource person to the radio station. Radio Program designed to complement the content on the agents Smartex tablet.

2.5 Project Scope and Targets

The project had presence in 5 administrative regions in Ghana and covered 70 Districts. The radio component of the project covered only 3 of the 5 regions which had the project. The table XXX provides information on key project targets.

Table 1.

Project milestones	Target	Scale up
Geographical coverage		5 Regions 70 Districts
Small holder farmers		13000 registered farmers

OB/ Nucleus farmers		
Radio stations		6 Radio Stations
crops		6 crops
Cultivated Land Size		

2.6 Key Stakeholders and responsibilities

Table 2.

Stakeholder	Key Responsibilities
Grameen	Project lead. Development of overall strategy and responsible for implementation
FRI	Project Partner. Development and management of radio component and community listener groups
WEGNEGEN	Research partner
ACDI ADVANCE	Implementation partner. Worked with agents to sign on and support farmers
MOFA	Implementation partner
Outgrower business/Nucleaus Farmers	Focal point for enrolling and engaging with small holder farmers
Agents	Enroll farmers. Provide on-site technical support to farmers
Radio Stations	Develop and broadcast radio campaigns to communities
Communities	Participate and engage with project

3.0 The Evaluation Approach

The research design is informed by the unique nature of the project and its implementation strategies. The project developed and implemented two different and innovative but complementary solutions – Direct to Farmer (D2F) radio and Intermediated Extension Service (IES) solution – ICT enhanced agricultural extension on agronomic information to farmers with a view to increase their access to agricultural extension services and to promote lasting behaviour change among Ghanaian SHFs to increase yields and improve food security in target crops.

The project promoted the production of a number of crops in the different ecological zones it operated in. The table below show the crop type by promoted at different project locations.

Table 3 Type of Crop Promoted at Different Locations

Region	Crop
Volta	Maize and Rice
Brong Ahafo	Maize, Cowpea, Yam
Norther, Upper East, and Upper West	Maize, Soya and Rice

Support to farmers was tailored to the needs of farmers in each location and also according to project design. The categories of support offered by the project are classified into three below:

The AgroTech Only Support: This involved the provision of ONLY technical support by AgroTech Agents through the use of the AgroTech mobile solution. Farmers therefore had to raise their own resources to implement the technologies they learnt from the AgroTech Agent.

AgroTech ADVANCE Support: The beneficiaries were provided technical support in addition to input on credit. Farmers were registered by Out - grower Business (OB) owners who provided inputs to some of their respective farmers on credit. Inputs provided on credit are mainly fertilizer, agro chemicals and improved seeds. Services such as plowing are also provided as inputs. Beneficiary farmers are expected to pay back the credit to the OB upon harvesting their crop.

AgroTech Radio Support: The project implemented a series of radio campaigns on modern agronomic technologies through AgroTech Radio. This campaign was aired in the Volta and Brong Ahafo Regions and parts of the Ashanti Region. The Radio campaign also established Community

Listening Groups (CLG) who were pre - informed of the radio broadcast times to enable them meet and listen to the agronomic messages together as a group and further discuss the messages after the broadcast and the use of the IVR system.

3.1 Sampling for Small Holder Farmer Surveys

The evaluation applied multiple sampling techniques to select respondents to survey. The project population was treated as two separate subpopulations or strata, one for radio and another for the intermediated approach. This is because the two components targeted farmers differently and so the degree to which selection of respondents can be randomized will not be the same for all. Each subpopulation has common attributes that allows for the same sampling technique to be applied effectively within the sub group. This method guarantees better representation of samples to the subgroups. The first stage of sampling was the stratification of the universe into 2 according to the project own strategy implementation; AgroTech Radio and Intermediated Extension. A total sample size of 1200 respondents were targeted for the SHF survey.

3.1.1 AgroTech Radio Listener Survey

The population for the AgroTech Radio survey was all communities in project districts that receive radio broadcasts from partner FM stations. The sampling frame for this population is citizens in all 110 communities who listen to radio broadcasts from FRI partner radio stations. The study was conducted in the same geographical areas that the baseline study was conducted with the same category of farmers.

To enable the evaluation report findings at a 95% confidence level with a margin of error of +/- 5%, the sample size was estimated using the following formulae;

$$SS = \frac{Z^2 p\,(1-p)}{C^2}$$

Where,

SS = Sample Size Z = Z-value

P = Percentage of population C = Confidence interval

Using this formula, the minimum acceptable sample size for this population is 385. To ensure high chance of representation in the sample of different subgroups and also to ensure that disaggregation yields sufficient responses for analysis, the evaluation sampled 700 respondents from 110 communities that receive the radio broadcast.

Assuming homogeneity within each listening community, citizens are exposed to the same socioeconomic and agronomic conditions, the survey systematically selected of 8 respondents per community to be interviewed. Using a sampling interval of 1.48, 75 out of the 110 communities were sampled to be included in interviews. The spread of the interviews will be beneficial to the analysis as generalizations can be made for the entire radio population. This number enable the survey cover more of the communities, more than 70 of the 110 communities receiving radio broadcasts was included in the survey.

The fieldwork guidelines directed the data collection team to ensure balance between male and females in the selection of respondents and also to ensure that two persons out of eight interviewed in the communities do not listen to AgroTech programs on partner radio stations and are not members of the CLGs.

3.1.2 Intermediated Extension Group

The sampling frame for intermediated extension component of the project is a listing of all agent registered small holder farmers in identified project communities, who are either with or without support from ADVANCE. The project has more than 13000 registered farmers in over 70 districts in 5 regions.

Using the same formula as expressed below,

$$\text{Necessary Sample Size} = (Z - score)^2 * \text{StdDev} * (1 - \text{StdDev}) \,/\, (\text{margin of error})^2$$

The minimum acceptable sample size determined for this population was estimated to be 385. To enable the evaluation report findings at a 95% confidence level and a margin of error of +/-5%, the evaluation increased the sample size for this subgroup to 500 respondents. This size will ensure high chance of representation in the sample of different subgroups.

Using a sampling interval of 3, a total of 84 agents were shortlisted for their registered role of farmers to be used in selecting respondents for the survey. A total of five hundred SHF were identified to be interviewed. Assuming homogenous agronomic conditions for farmers under each agent, the survey select 8 SHF under each agent to be interviewed in the survey.

Similar considerations for gender was applied to ensure high representation of men women in the sampled respondents.

3.2 Focus Group Discussions

A total of 112 participants were involved in 8 focus group discussion across 8 districts in Ashanti, Brong Ahafo and Volta regions of Ghana. Ashanti, Brong Ahafo and Volta regions recorded 1, 4 and 3 focus group discussions respectively. For all the focus groups discussions, there was equal representation of both men and women. Participants' age ranged between 22 and 67 years old. All the participants who were involved in the discussion had ever listened to the radio program on their designated radio station. All the participants were farmers with a few of the women being traders as well. In all the groups, there were about 4 youth. Table 4 presents list of focus group discussions

Table 4 Focus Groups

REGION	DISTRICT	COMMUNITY	TOTAL PARTICIPANTS
Ashanti	Ejura-Sekyedumase	Dejau	10
	Atebubu- Amantin	New Konkrompe	12
Brong Ahafo	Nkoranza South	Nkwabeng	12
	Techiman	Fiaso	12
	Kintampo	Kobeda No.1	22
	Hohoe	Dodi Akum	12
Volta	Biakoye	Bowiri Kyrahin	12
	Kedjebi	Gbi-Godenu	12

Focus groups sessions discussed project implementation strategies, community participation, knowledge gained through the project as well as the impact of the project on groups within the communities such as women as well as persons with disability.

3.3 Key Informant Interviews

Key informant interviews targeted out grower business owners, radio station operators, AGROTECH agents and financial intermediary. The table 5 below presents a group of stakeholders who were interviewed in focus groups.

Table 5. Stakeholder List for Key Informant Interviews

Stakeholder Group	**Number interviewed**
Out-grower business owner	19
Radio stations	6
Agents	13
Financial Intermediaries	2

A total of 19 Out-grower business owners (OB) were interviewed in Brong Ahafo and Volta Regions. These OBs were made up 19 males and 2 females. The minimum and maximum age was 32and 60 respectively. Brong Ahafo region recorded the 13 interviews whiles the Volta region recoded 6 interviews. The reason for the low number of interviews in Volta region was a result of less OB presence in the region.

All six radio stations were interviewed, two in the Volta (Volta Star Radio and Lorlornyo FM) and four in Brong Ahafo (Atoobu FM, Akyeaa FM, Asta FM and Adars FM) regions. These radio station staff were all male and served on the project as either host or producer. All the 6 radio stations were on board since the inception of the project.

A total of 13 agents were interviewed across three regions (Volta, Brong Ahafo and Ashanti). These agents were made up 12 males and a female. The minimum and maximum age was 16 and 54 respectively. Ashanti region recorded the least number of agents' interviews (1), with Volta recording 4 and Brong Ahafo region recording the highest of 8. The reason for the low number was a result of the Christmas festivities. Most agents had traveled to their families to celebrate Christmas with them.

Key informant interviews sort to ask more detailed about what worked, what didn't work and challenges stakeholder faced in delivering the SmartEx application services for the AIS project. The interviews inquired about the integration, effectiveness of the SmartEx agent' services and the

stakeholders they were able to make informed or positive decision and actions based on the delivery of the service.

3.4 Data Analysis

The data was analysed to respond to the research questions as outlined in the results matrix of the project. Data was sorted and cleaned to minimise errors from data entry and capture. Descriptive statistics was used extensively to describe respondents, classifications into groups, adoption rates and statistic of interest.

Multivariate analysis has been utilized extensively to analyse the interaction between variables such as gender, education, income levels, geographical location and adoption rate etc. Data has been represented with charts and graphs. Data analysis responded to the research questions in the project evaluation framework such as the number of households reached by the project through the various strategies, benefits to households, businesses and radio stations, impact on yield and outputs etc.

4.0 Key Findings, Small Holder Farmer Interviews

4.1 Characteristics of Respondents

The study interviewed a total of 1174 farmers from 40 districts in all 5 operational regions. The number of respondents from each region reflects the number of communities the project is working in as well as the number of agents operational in the area. Figure 1 shows that majority of respondents to the survey, 35 percent, are from Brong Ahafo Region. Only six percent of farmers the study spoke to came from the Ashanti region. This corresponds to the fact that the project operates in only 1 district in Ashanti region.

This number almost doubles the number of farmers interviewed in the baseline survey[2], which interviewed about 620 farmers from three regions, Volta, Brong Ahafo and Ashanti regions.

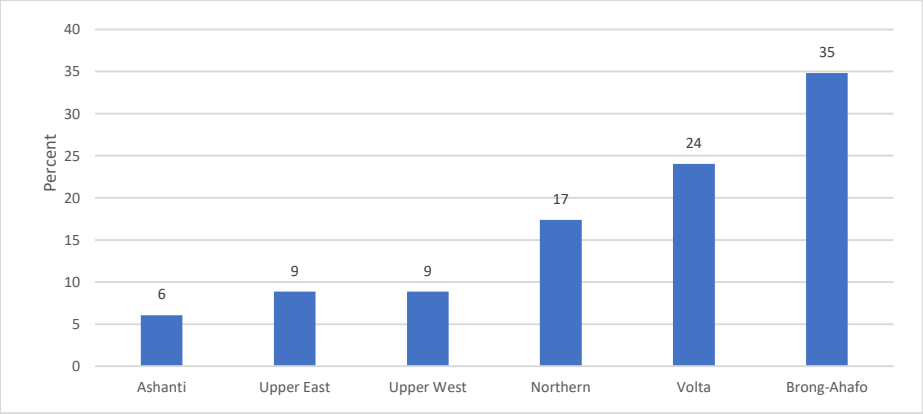


Figure 1. Distribution of respondents according to administrative regions in Ghana

Figure 3 and 4 shows the gender and age range of respondents respectively. Fifty-eight percent of the 1174 farmers interviewed are males and 42 percent females. The study interviewed more male small holder farmers than females. Thirty-two percent of farmers interviewed by the study are above 50 years old, less than 2 percent of respondents are below 19 years of age and another 2 percent said they do not know their age. Twenty-five percent of all respondents to the study fall

[2] See Endline Evaluation, ICT Extension Fund, 2016

between the ages of 20 – 34, the youth age group, making them a critical group in the agriculture workforce.

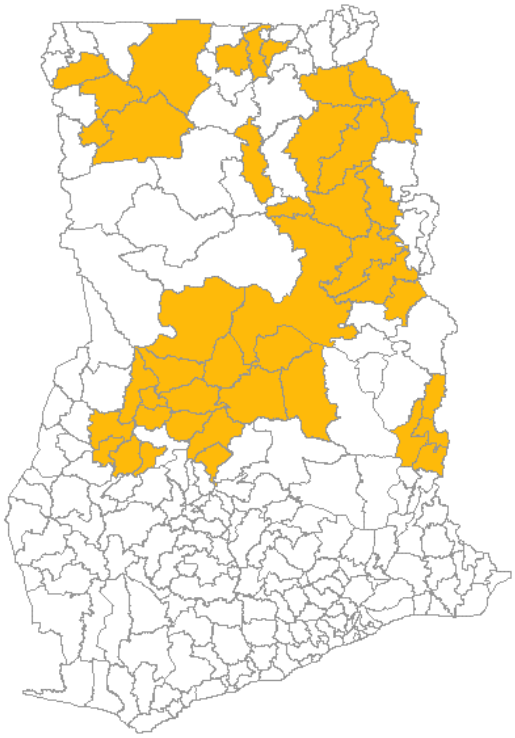


Figure 2. Administrative districts sampled for survey respondents.

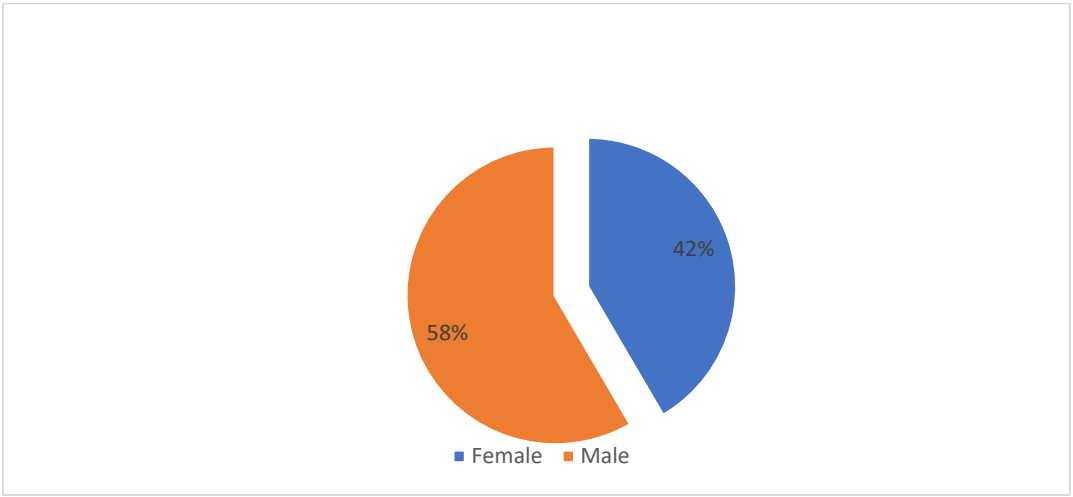


Figure 3. Proportion of female and male respondents surveyed.

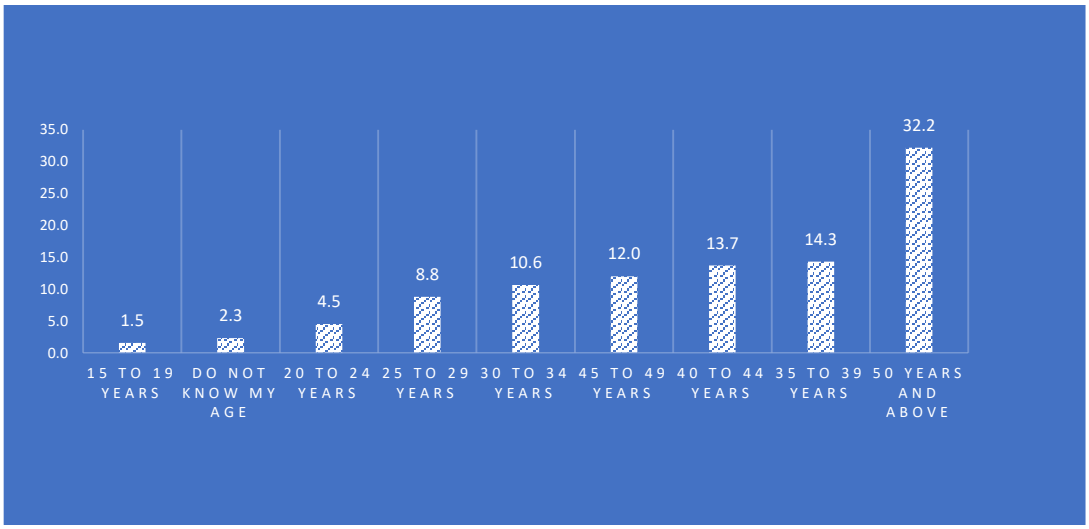


Figure 4. Number of respondents in nine age categories used in survey.

Figure 5 shows the distribution of respondent by marital status. Majority of small holder farmers interviewed, 83 percent, reported they were married while less than 1 percent of all interviewed reported they were living together.

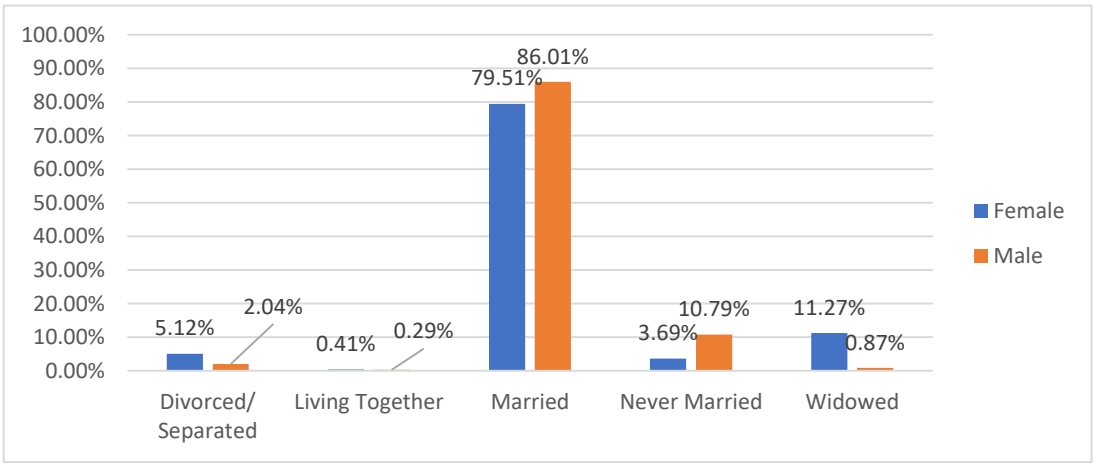


Figure 2. Marital status (Percent) of male and female respondents.

Over 92 percent of those interviewed reported they have children. Again, sixty percent of all respondents indicated they have other family members depending on them for a living.

More than half of all small holder farmers interviewed, 59 percent, shown in figure 6, responded in the affirmative when asked if they have ever been to school, 41 percent have never attended school.

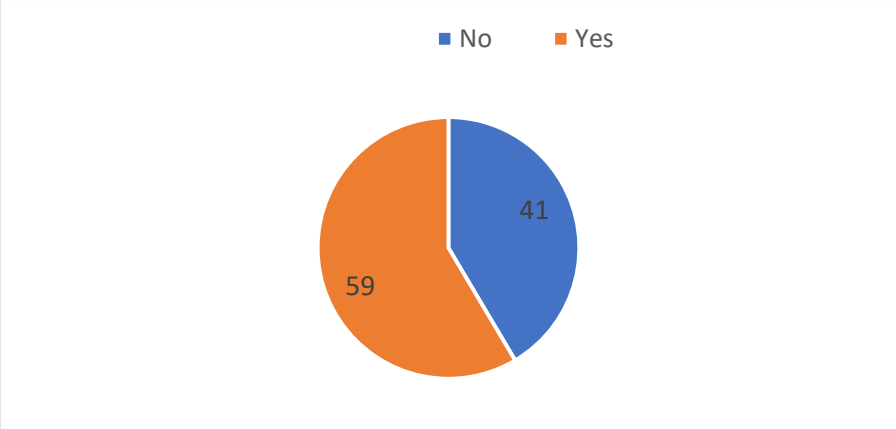


Figure 3. Percent of respondents who have ever attended school

Figure 7 shows the level of schooling completed by respondents. A large majority of those who responded to the survey, more than 87 percent have completed some level of education; 46 percent have completed middle/JSS, 20 percent have completed Secondary and 16 percent Primary. Five percent have however completed post-secondary or tertiary education. Only 12 percent of those who said they attended school indicated they did not complete primary education. Only 44 percent of females interviewed have attended school compared to 69 percent of males interviewed who said they have attended school.

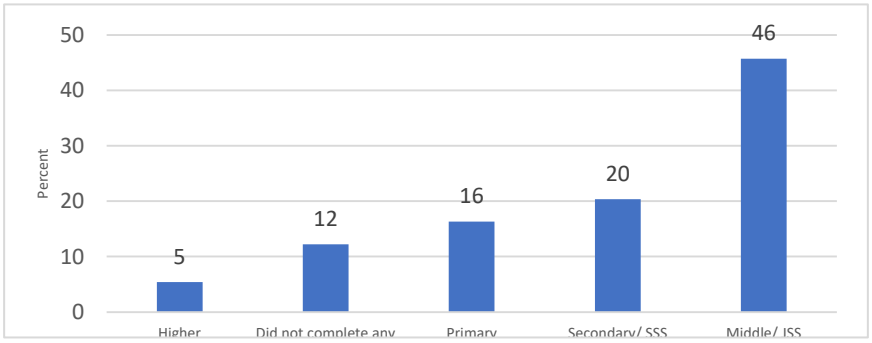


Figure 4. Level of education completed by survey respondents.

4.1 Active Participation in Farmer Community

The study assessed how active the respondents to the survey are in the farming community in terms of their participation in farmer based group activities. Overall, majority of small holder farmers interviewed participate actively in the communities of practice by belonging to farmer based

organisation, subscribing to farmer based programs like AGROTECH as well as patronized local radio station programs.

More than half of all small holder farmers the study interviewed, 52 percent, indicated that they have been registered by an AGROTECH Agent working for an Out-grower Business as indicated in figure 8.

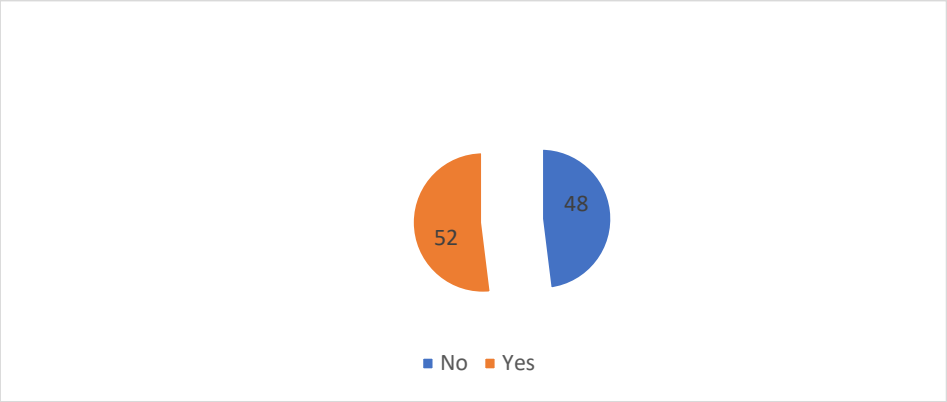


Figure 5. Proportion of survey respondents registered by AgroTech agents.

The study found that women are quite active in these communities where the live and work. More than half of the 488 women interviewed, about 53 percent, said they have been registered by an AGROTECH agent.

A significant majority of the farmers interviewed for the study also indicated they are registered as members for various farmer based organizations in the communities where they live. Figure 9 shows 64 percent of farmers indicated they are members of a farmer based group while 36 percent said they were not. About 59 percent of all respondents also said they participate in meetings of the group often.

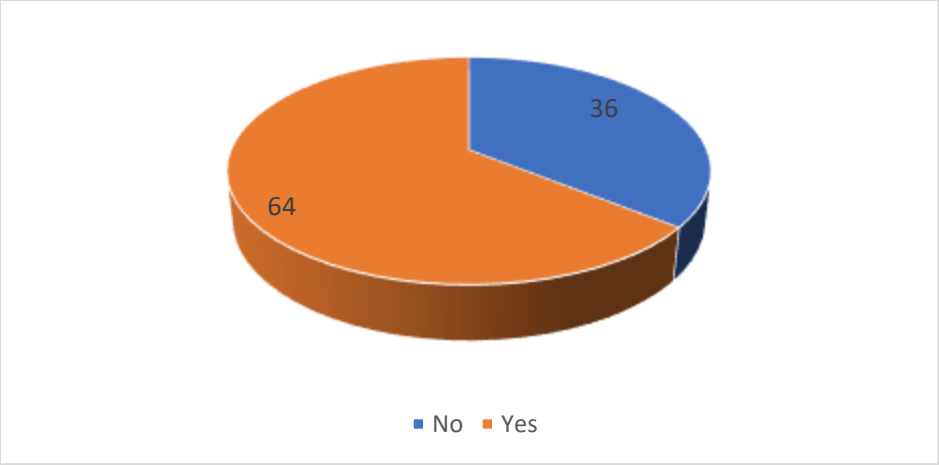


Figure 6. Membership of Farmer-Based organizations of respondents.

The study also aimed to establish whether respondents to the survey were also receiving support from similar interventions that is helping to improve farming practices and increase farm output. Fig 10 shows the number of respondents benefitting from other projects. Only 18 percent of respondents said they were not benefitting from any other project while another 37 percent said they were beneficiaries of the government extension service. This finding confirms existing information about the very low access by most farmers to agricultural extension services. This level of access is interesting especially when one considers the fact that the interviews were done in typical farming communities.

Again, majority of women interviewed were benefitting from other projects, with 47 percent saying they were beneficiaries of ADVANCE.

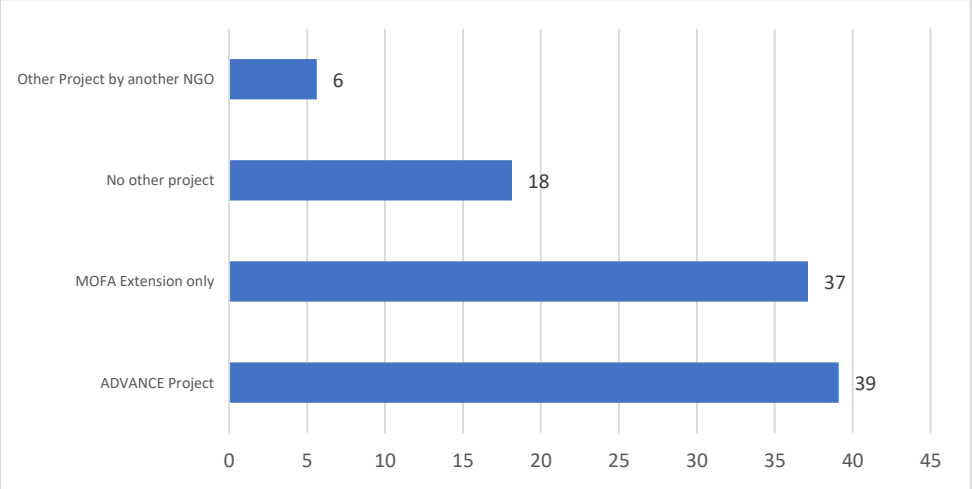


Figure 7. Source of other agricultural extension support received by survey respondents.

4.2 Access to Financial Services

The study assessed small holder farmers access to financial services. The project promoted a model that was supposed to improve small holder farmer's access to credit, input and cash, to support farming activities.

Majority of farmers interviewed did not own a bank account. Only 44 percent of those interviewed said they have a bank account. Figure 11 provides a breakdown of the types of bank accounts owned by respondents. 20 percent said they had accounts in rural banks, 13 percent with universal banks, 7 with credit unions and 3 percent said they had accounts with micro finance institutions.

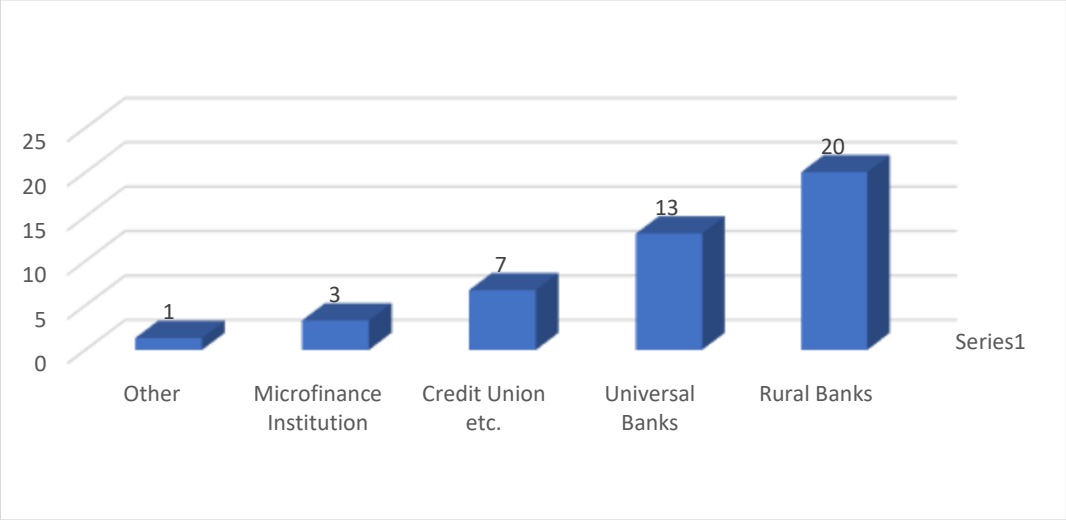


Figure 11. Type of financial institution where respondents own account.

Mobile money transaction has become increasingly important in increasing financial inclusion for many poor small holder farmers. Mobile money transactions act as an intermediary that facilitates exchange of cash in business transactions. It has become popular in the last 5 years because of its flexibility of use and ease of access. According to Central Bank reports, Ghana has more than ten million-active mobile money subscribers. The Bank of Ghana reported that mobile money transactions reached 109 billion Ghana cedi at the end September 2017, representing a 112 percent growth from 2016. Figure 12 shows that almost half of all those interviewed, 49 percent, have mobile money accounts. Fifty one percent of respondents however said they do not have mobile money accounts

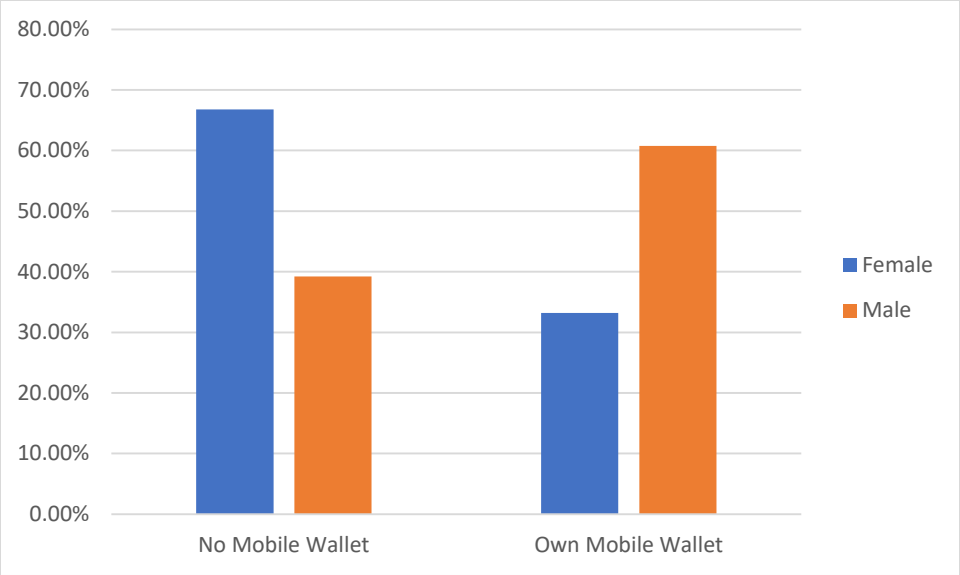


Figure 12. Ownership of mobile money account among survey respondents

Majority of farmers have some of savings, this is either home, or kept with non-bank financial institution. Figure 13 shows the distribution of responses when asked if they had savings. Thirty percent of respondents said they did not have any savings, while 70 percent said they have. 18 percent have savings with rural banks, 14 percent with Village Savings and Loans, 10 percent with universal banks and 5 percent with micro-finance institutions. Another 8 percent said they have savings with local susu collectors.

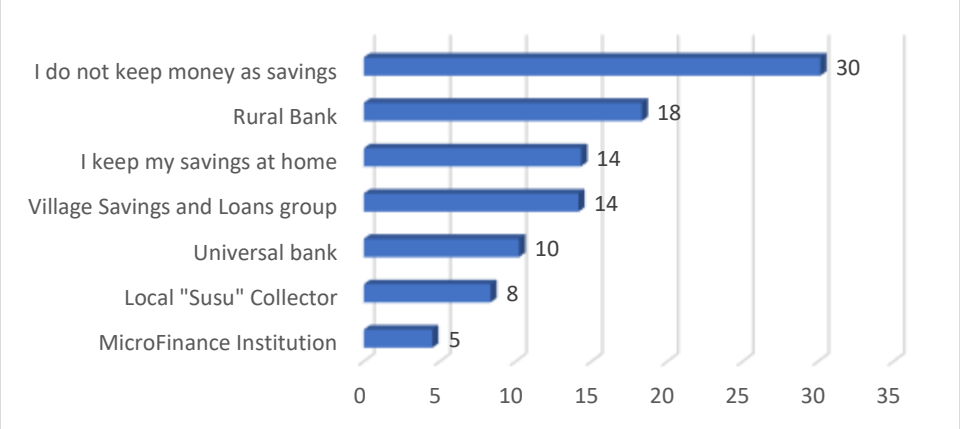


Figure 13. Ownership of savings account among survey respondents.

The study however found access to financial services for women in the study area is relatively low. Majority of women interviewed did not have a bank account, 67 percent, only a third, 33 percent, had a mobile money account. Close to half of all women interviewed said they did not have savings with any group or kept their savings at home.

4.3 Farming Practices of Respondents

The study assessed the farming practices of respondents. Literature on farmer adoption of new approaches and methods cites a number of factors including, education level, gender, cost of the implementing the new methods, as well as the agronomic practices of the farmer as some of the key factors that determine the extent to which farmers will adopt new methods.

An overwhelming majority of farmers who were interviewed by the study cultivated multiple farms. Figure 14 shows that while only 13 percent of respondents cultivated 1 farm, 33 percent indicated they cultivated 3 farms, 26 percent cultivated 2 farms, 20 percent cultivated 4 farms and seven percent said they cultivated more than 4 farms. This is mainly the result of a cumbersome land tenure system in parts of the country that makes its difficult for farmers to own large fields in one piece. This finding could mean that farmers are trying to farm bigger fields and will have to aggregate smaller fields to get the size of land they require.

Women farmers also cultivated multiple farms like their male counterparts. An overall majority of women the study spoke to indicated they have multiple farms. More than ninety percent of the 488 women interviewed said they had more than a single farm. About 34 percent had 3 farms and another 14 percent had 4 farms.

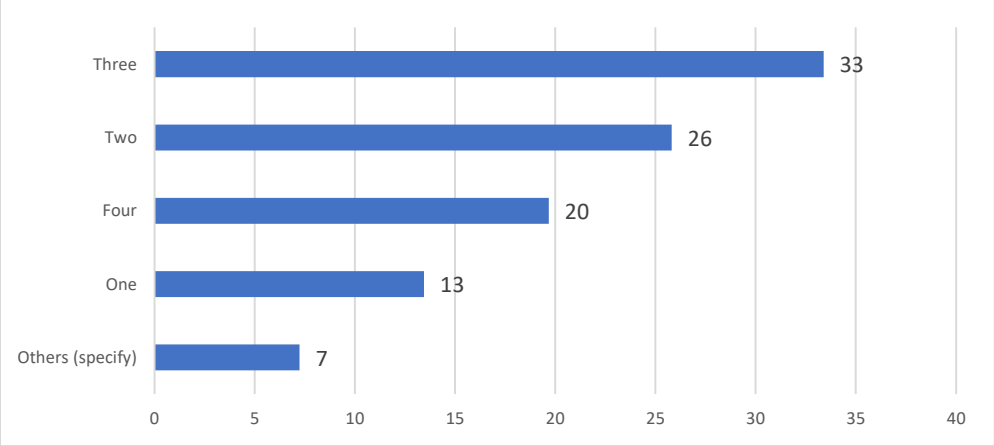


Figure 14 Number of Farms under Cultivation

The study also found that majority of farmers in the areas of operation of the project cultivate cereals as their main crop. Only a small minority produce tubers as their main crop. Figure 15 shows the responses of small holder farmers to the survey when asked the main crop cultivated. Fifty-three percent of all who respondent to the survey said they cultivated maize as their main crop, 23 percent mentioned rice and 14 percent mentioned yam as their main crop of cultivation.

Only 7 percent mentioned soya beans and 3 percent mentioned cowpea as the main crops cultivated.

Maize was mentioned by majority of women as the major crop they cultivate. About 51 percent of all females interviewed mentioned maize as their major crop.

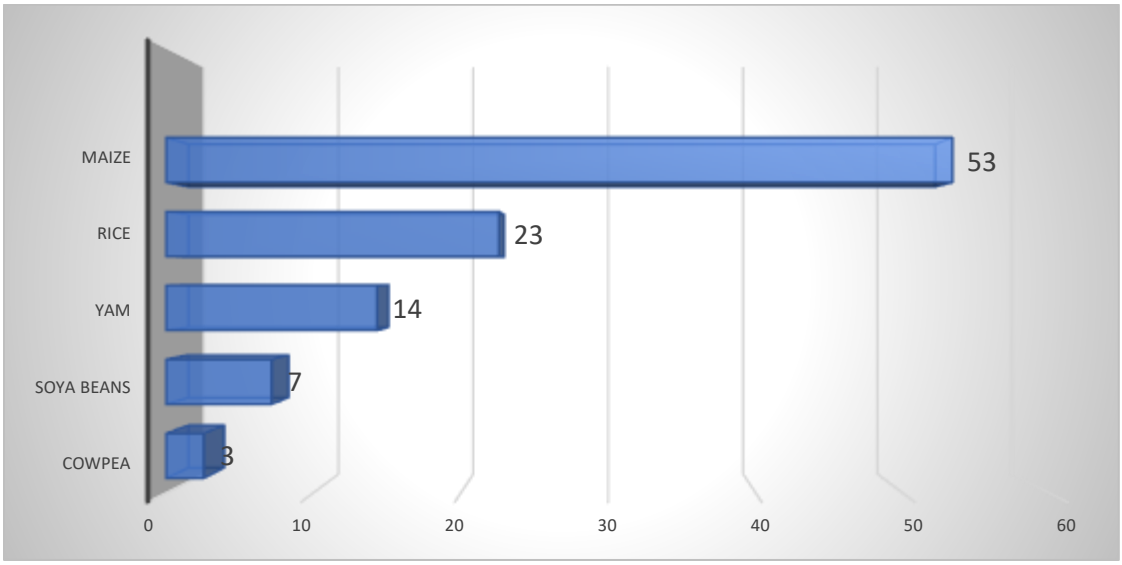


Figure 8. Major crops cultivated by survey respondents

The ecological zones of the country places several limitations on the number of months available for active farming activities can be undertaken by farmers. The northern ecological zone has limited annual rainfall that only allows one farming season. In the southern ecological zone, the number of months of rainfall annually permits more than 6 months of farming. Farmers are therefore farm 2 seasons annually.

Majority of farmers who responded to the study farmed in both minor and major seasons. The results indicate that the more than 51 percent of farmers farmed in both the minor and major seasons. Thirty five percent said the farmed only one season and 11 percent said they farmed only in the main season. Further analysis of responses indicates those who answered as farming only one season are mostly from the northern part of the country.

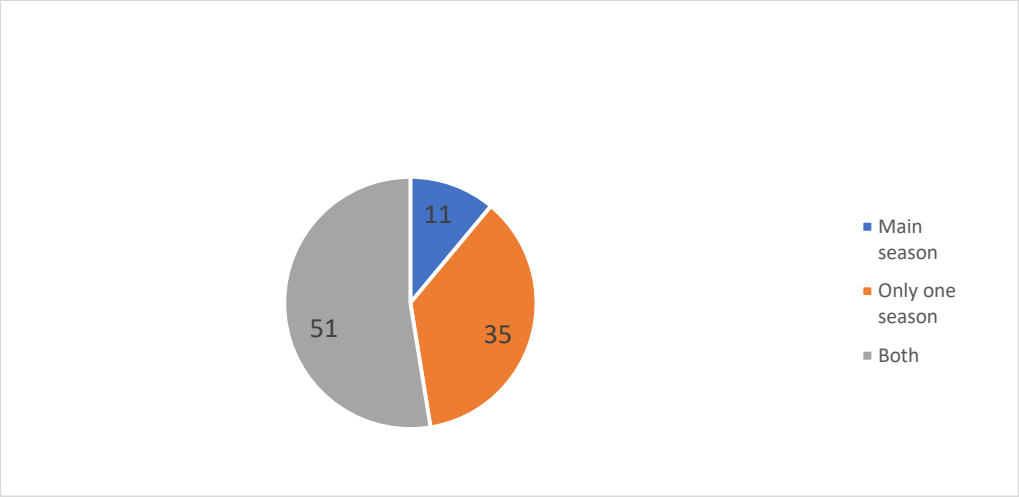


Figure 16 Farming Seasons.

4.4 Access to Radio and Listening Habits

The evaluation study assessed respondent's access to radio and listening habits. This is important as it has a direct correlation with the extent to which communities participate and take up knowledge on farming practices broadcast by radio stations. Literature on major sources of news and entertainment for most Ghanaians mentions radio as the number one source of news and entertainment.

Figure 17 presents distribution of respondent's access to radio. More than 75 percent of respondents to the study said that they have easy access to radio sets if they wanted to. Only 25 percent of farmers the study spoke to said they did not have easy access to a radio set.

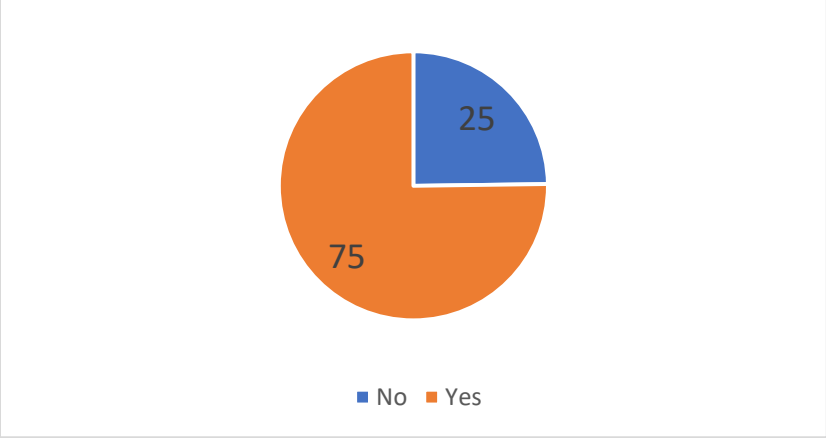


Figure 9 Easy Access to Radio

Figure 18 presents responses on ownership of radio. The same percentage of those who said they have no access to radio also indicated they do not own a radio set, 25 percent. More than half of

all respondents, 52 percent, said they own the radio sets, 10 percent said the set was owned by the husband, and 7.2 percent said by the whole household. A small minority, 0.3 percent also indicated the radio was owned by their wives and another 0.7 percent said by both husband and wife.

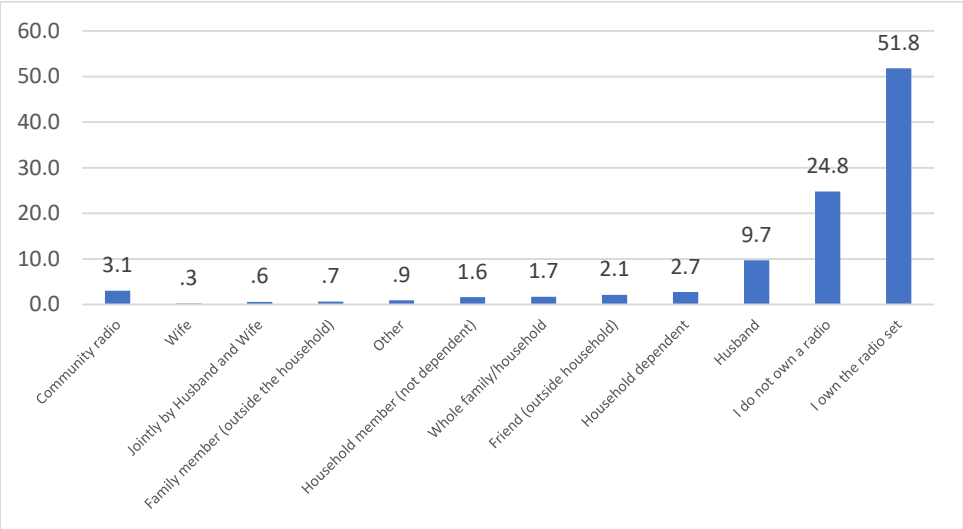


Figure 10 Ownership of Radio

Access to radio by gender indicates that majority of women farmers in the project districts have access to radio. More than 66 percent of all women interviewed have easy access to radio, with about 24 percent actually saying the own the radio set.

More than 3 out of 4 respondents to the study said they listened to radio broadcasts often and have done so frequently in the past 12 months. In figure 20, more than 76 percent of all respondents to the survey said they have listened to radio in the past 12 months. Only 24 percent of respondents have not listened to radio in the past 12 months.

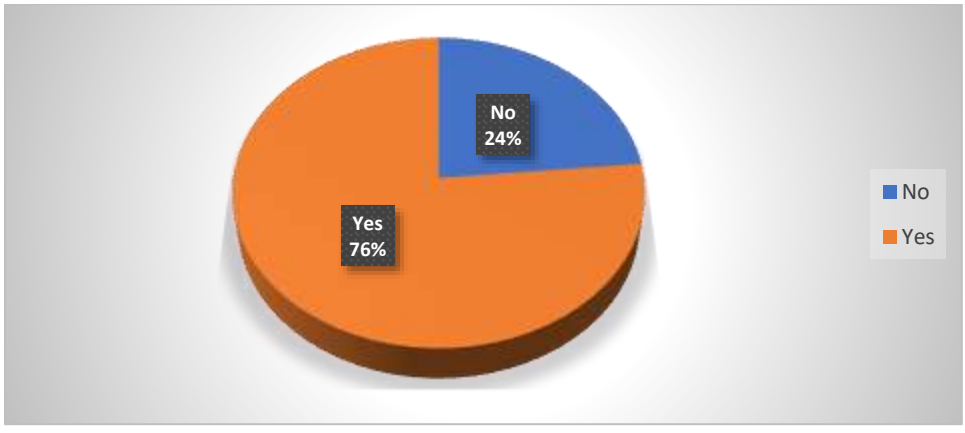


Figure 11 Listened to Radio in 12 Months

Overall, majority of farmers frequently listened to radio, with more than half of all respondents saying they listen daily. More than half of all respondents, 55 percent, said they listen to radio daily as shown in figure 21. Ten percent said they listened twice a week and 8 percent said they did so once a week.

An overwhelming majority of respondents indicated they have listened to radio programs on the cultivation of their major crop in the past 12 months.

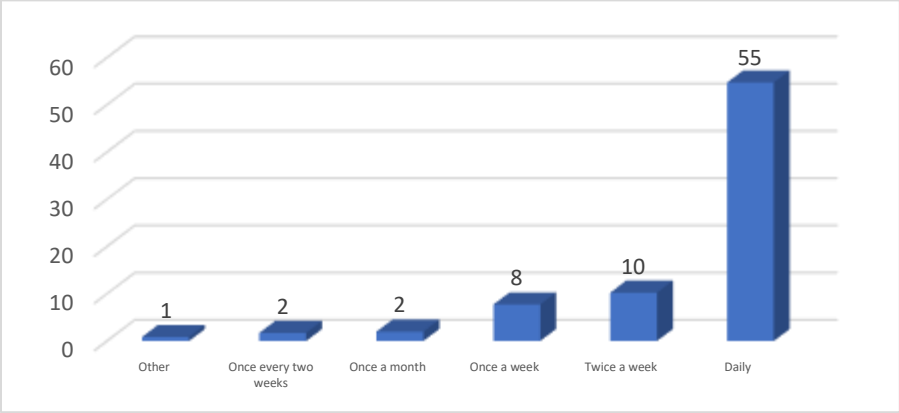


Figure 12 Listening Frequency

Majority of farmers interviewed in the three regions that had FRI radio presence said they listened frequently to FRI/AGROTECH partner radio station. Figure 22 presents a breakdown of distribution of respondents who listen to FRI partner station. Sixty percent of 766 respondents in FRI areas said they listen frequently to FRI partner radio station broadcasts on agriculture issues. Again, about one third of the 459 respondents who listened to FRI partner stations are females.

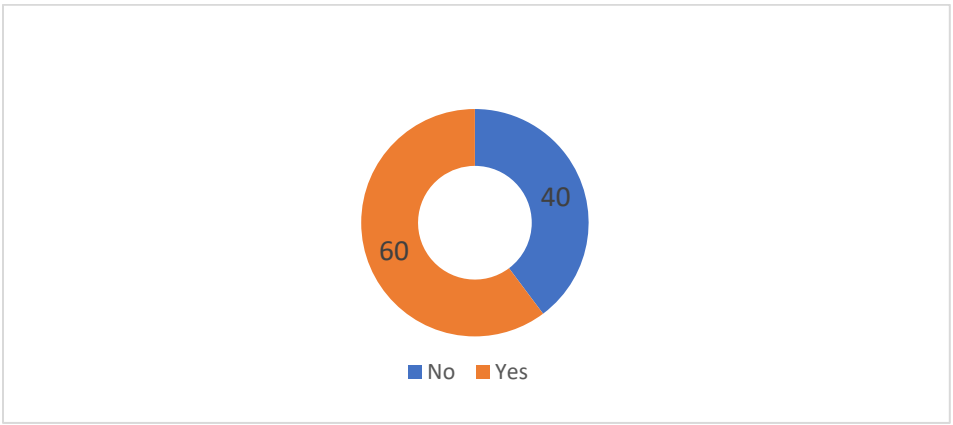


Figure 22 Listen to FRI Partner/Radio

There is a high awareness of the project among farmers in the project communities. Most of the participants in focus group discussions affirmed that they got to know about the AgroTech project, Farm Radio International and Grameen foundation through the formative research about 3 years ago because their communities were selected for the research. Others also got to know about the project through the radio broadcast across the six radio stations being used. The program so far brings them extension information on maize, rice, yam and cowpea farming and how they can maximise yield, use and select the right seedlings for planting and make profit from their farming. Most of the participants have featured in the radio program before in many ways. They featured in the radio programme through feedback, beep-to-vote, Interactive Voice Response polls (IVR) and phone ins. In focus group sessions, women participants complained of the low participation of women in the Interactive voice response polls; phoned-ins and beep-to-vote. All 8 focus group sessions agreed that the participation of women in the interactive sessions of the radio broadcasts was low because some don't have phones and those who own phones don't have airtime to enable them to participate. The few women who were able to call the IVR listened to the weather and price information.

Of the eight communities that participated in the focus group discussions, only one (Dejau) never participated in any of the phone-ins, beep-to-vote and the IVR. This is because they do not have electricity in the community.

Participants of the focus groups assessed the radio programs over the period and concluded that in all the radio programs, the resource persons explained all the difficult words and phrases to make it more practical and simple for them to understand. The topics on weekly basis were very easy and simple to understand too.

Communities in the Biakoye district of the Volta region however explained they had some challenges with some ewe jargons used during the radio programs. These communities speak a different dialect of the ewe language. They however overcame these difficulties by bringing up these terminologies in CLG group meetings for discussion and explanations.

Other challenges related to listening and learning in a group, relating to dynamics in group engagement. Some of the challenges included scheduling time for group meetings, limited opportunities for group meetings, usually once a week.

4.5 Access to AgroTech Knowledge and Other Support Services

Using a combination of radio and the agents mediated approach, the project provided capacity support to farmers in the catchment area of the project in a number of key agronomic areas aimed at improving productivity and revenues to farmers. Majority of farmers interviewed by the study indicated they were registered by AGROTECH agents or listened to FRI radio station broadcasts on agricultural practices on their major crop.

To affirm that the farmers are close enough to the activities of the project, the study asked if they have been in contact with any of the mediums through which the project reached farmers.

4.5.1 Access to AgroTech Radio

The study found that more than 62 percent of respondents in the three regions where AgroTech radio is present said they listened regularly to FRI partner FM stations. An overwhelming majority of respondents, 97 percent, who said they listen to AgroTech radio broadcast also said they listened to a radio program on the cultivation of their major crop in the last 12 months. The study found similar percentages of males (61 percent) and females (60 percent0 said they listened regularly to AgroTech radio stations. Again. More than 87 percent of female respondents whoo said they listened regularly to AgroTech radio also said they have listened to a broadcast on the cultivation of their major crop in the last 12 months.

4.5.2 Access to AgroTech Agent

Figure 22 shows that more than 75 percent of those interviewed said they have been in contact with an agricultural field agent. Only 24 percent said they have not been in contact with an agent in the last 12 months. Majority of respondents to the study said they have had contact session with an agent in the last 12 months.

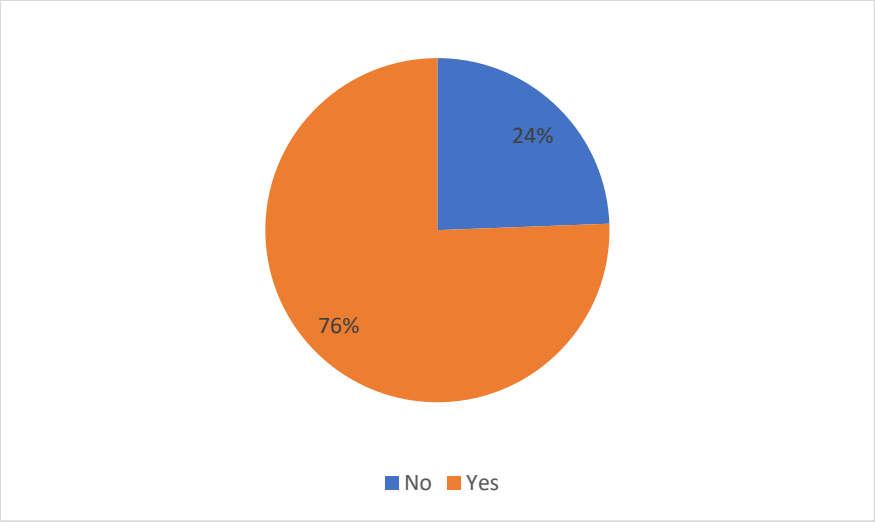


Figure 13. Percentage of respondents engaged in a Session with agricultural field agent in previous 12 months.

Asked what type of agent they have been in touch with, majority of farmers interviewed they have been mentioned government extension agents, 41 percent, buyer/aggregator/OB agent was mentioned by 24 percent of respondents while 8 percent mentioned agents from other NGO interventions.

An analysis of those who have listened to radio in the last 12 months and those who have listened to a radio broadcast on the cultivation of their major crop indicated that more than 71 percent of those who said they listened to radio also said that they listened to broadcasts on the cultivation of their major crop in the past 12 months.

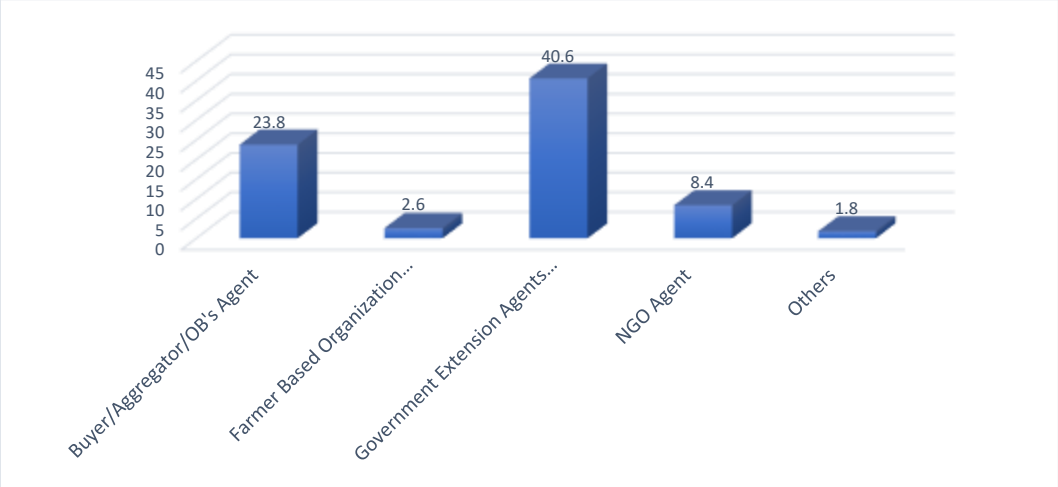


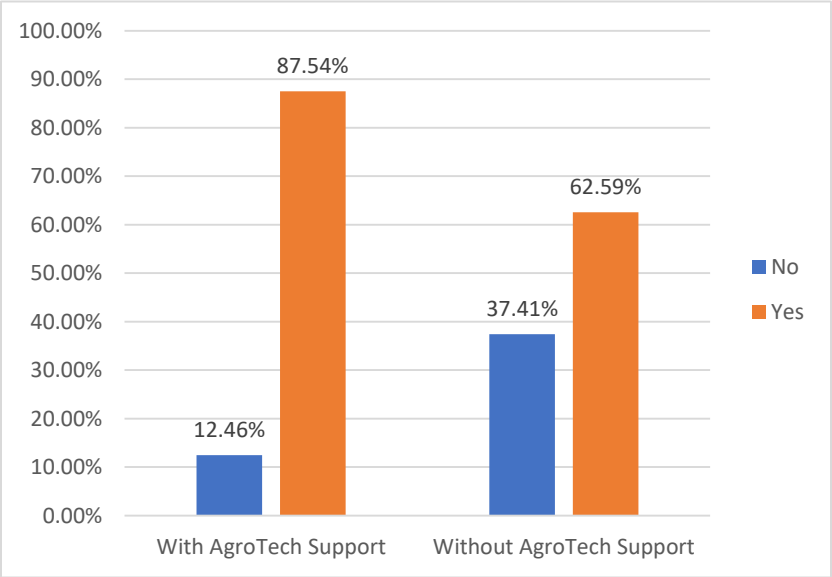
Figure 14. Type of field agent engaging survey respondents in previous 12 months.

Overall, there is a relatively strong engagement between farmers and extension agents, especially

the government sponsored agents from MOFA. AGROTECH agents were mentioned as the second largest group that engaged farmers in the project areas.

The study assessed the knowledge acquired by the small holder farmers as they interacted with agents of the projects and listened to radio broadcasts on selected improvements. Both radio and agent approach have reached significant numbers of farmers in the project areas.

In the study 52% of respondents had been previously registered by an AgroTech agent whilst 48% had not been. Among those who had been registered, 88% indicated they have been seen by an agent in the last 12 months, whilst only 63% of respondents not registered by an AgroTech Agent had seen a field agent (Figure 23). This suggests that the likelihood for a smallholder to be in contact with an agent was higher if he/she is registered by an AgroTech Agent.



Comparison of access to field agents between AgroTech registered and unregistered farmers

4.5.3 Access to Agribusiness Services

Access to agribusiness credit services was generally very low among respondents. The highest was in the provision of market outlets, although this was to be expected as farmers will normally find a way to sell their produce. About 30% did not have a reliable market, and majority (44.5%) depended on local market traders (table XXX). The reported figures for those with AgroTech

support and those without are similar for these two groups. Those without AgroTech support were more among those who obtained their primary market from private institutions (1.2%) and Processors (2.4%) The next big group, (Known Produce Buyer/OB, 15%) however shows higher number of respondents are those who were provided with AgroTech support.

Table 6. Percentage of respondents with access to service providers providing market for produce.

Type of service provider	With AgroTech Support	Without AgroTech Support	All
No one has provided a reliable market	15.6%	14.8%	30.4%
Local market retailers	22.8%	21.7%	44.5%
Government agency/Institution	0.4%	0.3%	0.8%
Government Education Institution	0.2%	0.1%	0.3%
Known Produce Buyer/OB	9.4%	5.5%	14.9%
Other	2.6%	3.0%	5.5%
Private Institution	0.3%	0.9%	1.2%
Processor	0.8%	1.6%	2.4%
Grand Total	**52.0%**	**48.0%**	**100.0%**

Table 7. Percentage of respondents to access ti various input credit service providers

Type of service provider	With AgroTech Support	Without AgroTech Support	All
Did not receive input credit	33.1%	40.6%	73.8%
Family member	1.0%	0.3%	1.4%
Financial institution	0.6%	0.3%	0.9%
Friend	1.4%	1.0%	2.4%
Input dealer shop	1.4%	0.3%	1.6%
Known Produce Buyer/OB	10.2%	2.2%	12.4%
Other	1.4%	1.9%	3.2%
Other Produce buyers	0.5%	0.3%	0.9%
Savings Group	2.4%	1.1%	3.5%
Grand Total	**52.0%**	**48.0%**	**100.0%**

For access to input credit, the data (table XXX) suggests that those with AgroTech support were also better off that those without, although for some other sources of input credit the difference appears marginal. Similar trend can be found in the provision of other services like ploughing, cash credit, and post-harvest threshing services. For ploughing services the demand is mainly in Northern Ghana.

Table 8. Percentage of respondents with access to various machine ploughing service providers

Count of ploughing_service	Column Labels		
Row Labels	With AgroTech Support	Without AgroTech Support	Grand Total
Did not receive credit on ploughing service	36.9%	42.3%	79.2%
Family member	0.6%	0.2%	0.8%
Input dealer shop	0.5%	0.1%	0.6%
Known Produce Buyer/OB	6.6%	1.9%	8.5%
Ministry of Food and Agriculture	0.2%	0.0%	0.2%
NGO	0.5%	0.0%	0.5%
Other	0.9%	0.2%	1.1%
Other Produce buyers	0.1%	0.2%	0.3%
Private tractor owner	3.8%	2.0%	5.9%
Savings Group	1.8%	1.2%	3.0%
Grand Total	**52.0%**	**48.0%**	**100.0%**

Table 9. Percentage of respondents with access to various cash credit service providers.

Count of cash_credit_service	Column Labels		
Row Labels	With AgroTech Support	Without AgroTech Support	Grand Total
Did not receive cash credit	32.9%	36.5%	69.3%
Family member	1.8%	1.4%	3.2%
Financial institution	2.5%	1.3%	3.7%
Friend	1.4%	1.0%	2.4%
Input dealer shop	0.5%	0.0%	0.5%
Known Produce Buyer/OB	4.9%	2.7%	7.6%
Other	0.9%	0.5%	1.4%
Other Produce buyers	1.4%	0.8%	2.2%
Savings Group	5.7%	3.8%	9.5%
Grand Total	**52.0%**	**48.0%**	**100.0%**

Table 10. Percentage of respondents with access to various providers of post-harvest machine threshing services.

Count of postharvest_processing Row Labels	Column Labels With AgroTech Support	Without AgroTech Support	Grand Total
Did not receive any post-harvest credit service	38.6%	44.1%	82.7%
Family member/Friend	1.3%	0.6%	1.9%
Known Produce Buyer/OB	5.5%	1.2%	6.7%
Ministry of Food and Agriculture	3.0%	0.5%	3.5%
NGO	0.8%	0.0%	0.8%
Other	0.4%	0.2%	0.6%
Other Produce buyers	0.2%	0.1%	0.3%
Private operator	0.5%	0.3%	0.9%
Savings Group	1.7%	1.0%	2.7%
Grand Total	**52.0%**	**48.0%**	**100.0%**

4.6 Acquisition of Knowledge

4.6.1 AgroTech Radio

FRI partner radio stations broadcasted 11 improvements to farmers over the period of 24 months. More than 90 percent of respondents said they listened to 7 out of 11 radio broadcasts on crop improvements in the last 12 months. Figure 24 shows that the exceptions are marketing, input credit, land preparation and farm planning, which reached 84, 82, 72, and 64 percent of respondents.

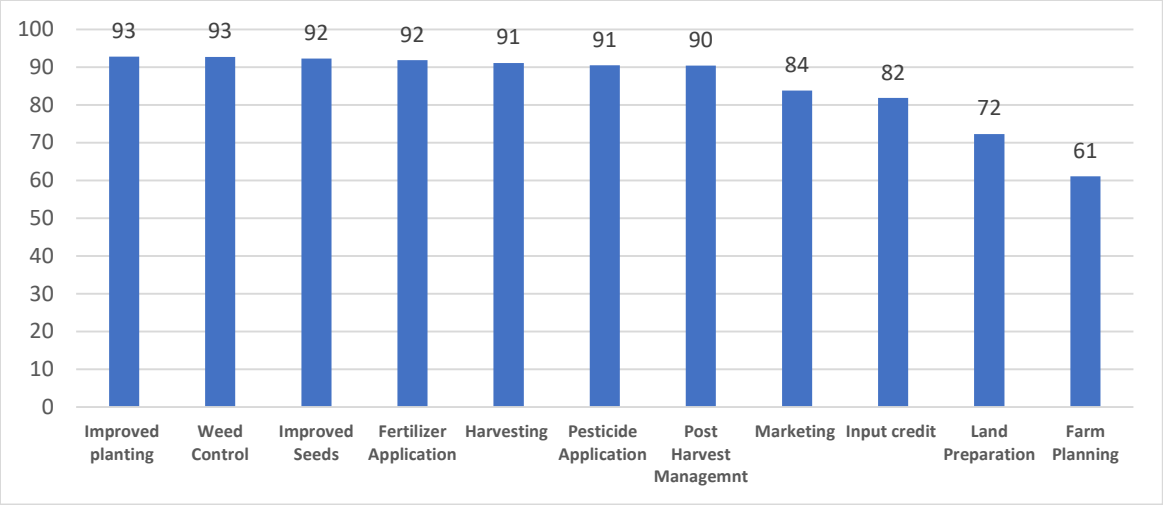


Figure 24. Percentage of respondents with access to AgroTech Radio who listened to various broadcast topics.

Overall, there was a strong participation of listeners to the FRI radio broadcast through the use of ICT enhancements, especially by members of the CLGs. This is in line with the finding from FDGs which confirmed that CLG members said they listened to the radio program broadcast weekly and they participated in the programs by calling in to the program to give their knowledge on the topic for discussion. They usually had the opportunity to call in to the program to express their views and concerns. These views were recorded by the radio station and featured on the live radio programs.

The members of the CLG also said they shared whatever they listened to on the radio program with their colleague farmers and applied it on their farms. All the 8 groups interviewed mentioned that they do not meet every week to listen to the live program as a group. They sometimes listen individually. However, they met weekly to listen and discuss the recorded program. This helped to give proper feedback to the radio station staff when they visited them in their various communities.

AGROTECH Agents have also reached over 60 percent of all farmers interviewed on the improvement areas they worked on. The improvement areas where they reached the highest number of farmers were improved planning techniques and weed control with farm planning reaching the lowest amount of people, 61 percent.

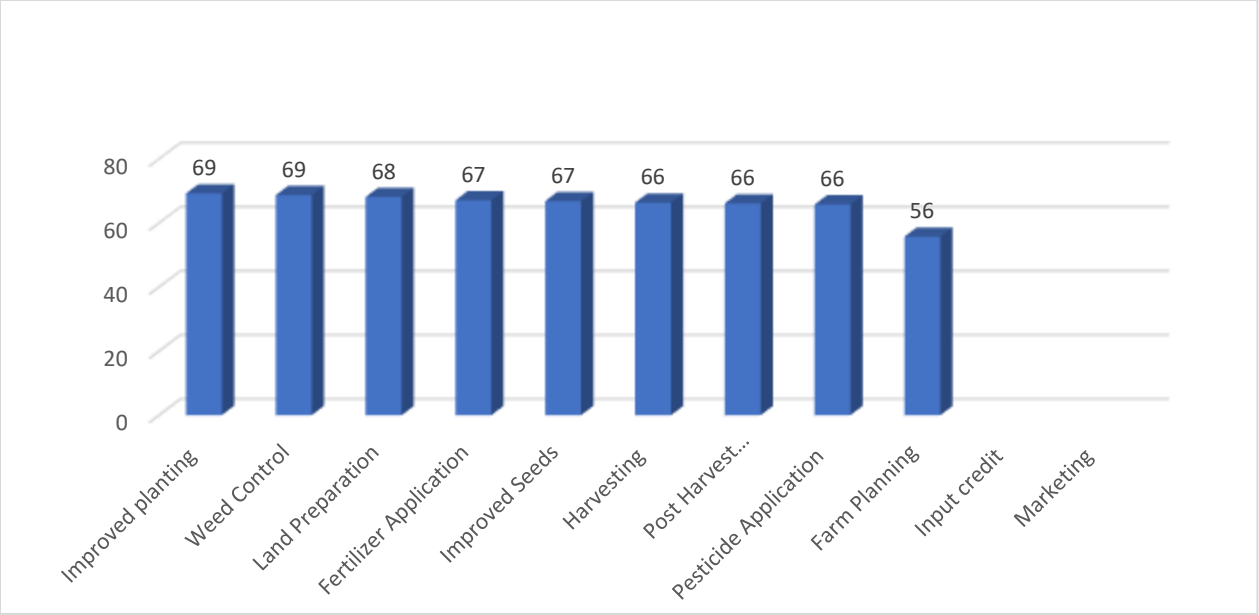


Figure 15. Percentage of respondents with access to AgroTech field agents and various support services

Figure 26 compares the performance of FRI radio broadcast and agent model in reaching small holder farmers. The figure tells 2 stories, the complementarity of the 2 approaches is demonstrated by the way the number move together at peaks and troughs. That one reinforced the other. In areas where radio did well, the agent approach also performed well. Farm planning reached the least number of farmer while improved planting and weed control reached the largest number of farmers.

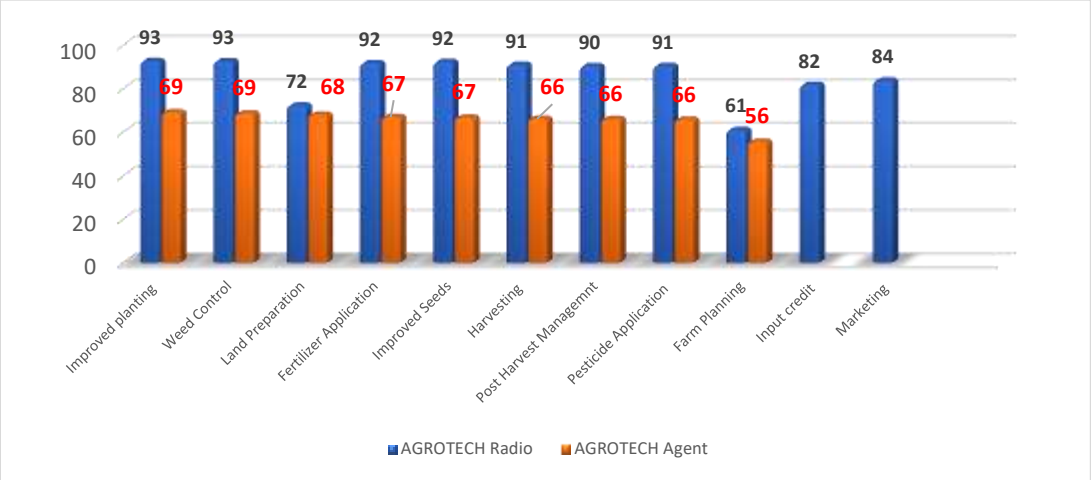


Figure 16. Knowledge gained on knowledge on Improvement by respondents with access to AgroTech Radio and Agent.

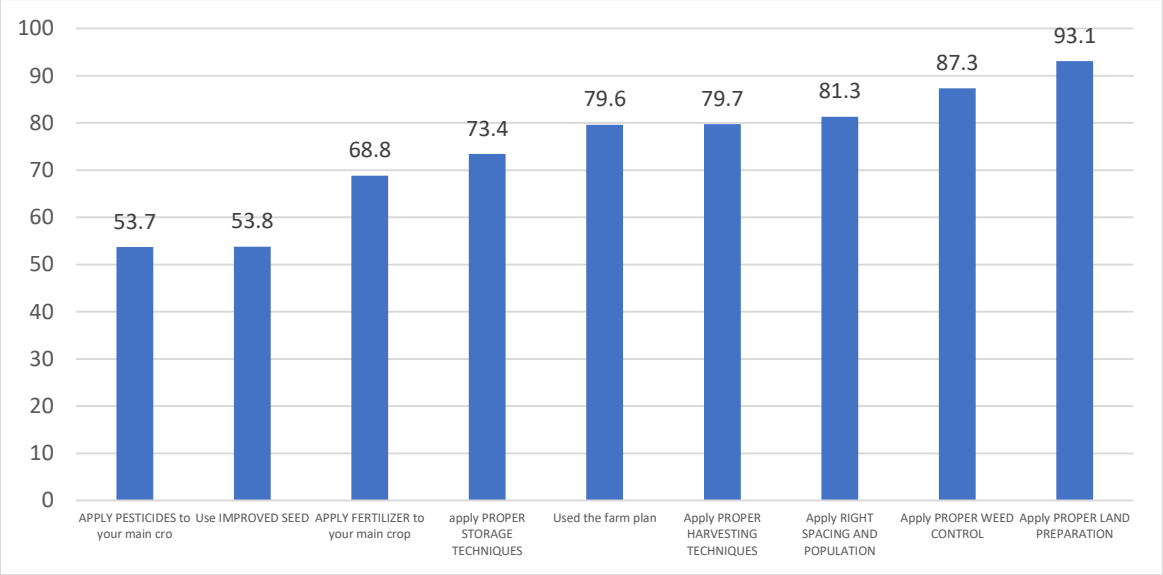
4.7 Adoption of Promoted Practices

The extent to which project beneficiaries will take on board promoted improvements could be demonstrated by their application of the new knowledge. The study assessed the applications of improvements by farmers in the project communities.

Figure 27 shows the number of farmers who adopted the promoted agronomic practices for their major crops. The first level of analysis shows those who say they have applied.

An overwhelming majority of farmers indicated that they applied all improvement with land preparation, weed control and right spacing of crops being applied by 93, 87, and 81 percent of farmers respectively.

Knowledge on the use of pesticides and improved seeds were the least applied by farmers, accounting for 54 percent each of those who the study spoke to.



Percentage of respondents who applied knowledge gained on various practices.

Generally, there is an equally high application of knowledge on farms by women farmers as well as their male counterparts. Three out of 4 women interviewed, 75 percent of women, said they applied the improvement on their farm to cultivate their major crop. However, only 53 percent applied pesticides to their crops. The cost of pesticides could be a reason why women farmers are no applying it on their farms.

Adoption and application of improvements was the same for all farmers and crops. Finding from focus groups provided more details on the types of improvements farmers have adopted in each of the three regions where FRI partner radio stations operated.

In all the focus group sessions, a discussion on which of the improvement that was difficult to implement mentioned the use of farm plans and the application of fertiliser. The groups mentioned low level of literacy rate among farmers as the major reason why they are not able to apply the concepts of farm planning. The focus groups said that most farmers planned in their heads but found it difficult to document these plans and refer to them periodically. The challenge with fertilizer application was the fact that burying the fertilizer was laborious, time consuming and costly especially when using hired labour.

This finding confirms the finding from the survey findings on knowledge acquired from the project. In both radio and AGROTECH engagements, farm planning is ranked lowest by most farmers in the levels of knowledge acquired by farmers.

4.8 Size of Land under Improvement

Respondents cultivated an average area of 1.3 ha to their main crop in the main season, out of an average holding of 3.5 ha (representing 36% of the land holding). Males cultivated 1.5 ha (out of a holding of 4.7 ha) and females cultivated 0.9 ha (out of a holding of 2.0 ha). Thus, women devoted a higher proportion (47.6%) of their holdings to their main crop than males (33.1%). The crop with the highest average land cultivated was cowpea (1.26 ha.) and this is probably because it is the only crop that women cultivated more than 1.0 hectares.

Table 11. Mean land area(ha) of respondents on which improved practices have been applied, by gender.

gender	RP	SEED	WC	FERT	PESTC	HARV	LP	MSEASON	HOLDING	AVGIMP	PCIMP	PCHOLD
Female	0.76	0.45	0.80	0.70	0.60	0.72	0.84	0.94	2.0	0.69	73.9	47.6
Male	1.37	0.87	1.64	1.31	1.20	1.49	1.52	1.54	4.7	1.34	86.9	33.1
Total	1.12	0.70	1.29	1.05	0.95	1.16	1.22	1.29	3.5	1.07	82.8	36.5[3]

The mean land area for which new practices (or "adopted practices") were applied was 1.1 hectares representing 82.8% of the cultivated area. Land preparation (1.2 ha) and weed control (1.3 ha) were the largest areas in which new knowledge was applied, although only two practices, seed

[3] RP= Row Planting; SEED = Seed Variety; WC=Weed Control; FA=Fertilizer; PEST=Pest Control[; HARV=Harvesting practices; HOLD=Total land holdings; AVGIMP=Avearge land area planted to improved practices; PCIMP=Percentage of land cultivated that improved practices are applied in major season; PCHOLD=Percentage of holdings that is cultivated in major season.

variety and pest control were applied on less than a hectare; 0.7 and 0.9 ha., representing 54.3% and 73.6% respectively.

Males applied new practices to an average of 1.3 hectares (86.9% of cultivated area) whilst females applied to 0.7 hectares (73.9% of cultivated area). Females applied new knowledge in land preparation and weed control to larger land areas (0.84 ha and 0.80 ha respectively) and the lowest area to seed variety (0.45 ha). Males applied new knowledge in weed control to the largest area 1.64 ha) and the lowest to seed variety (0.87 ha.)

In terms of the main crops cultivated (Annex X), new knowledge (or "adopted practices") was applied to lager area for maize cultivation (1.4 ha, representing 92.1% of the area cultivated to the crop), followed by rice (0.7 ha; 77.9%), soybean (0.7 ha; 62.7%), yam (0.8 ha; 61.8%) and cowpea (0.8 ha; 47.0%). This order is similar for both males and females. Maize was the only crop in which the area for "adopted practices" exceeded 1.0 hectare.

The most common adopted practice applied to larger areas for all the cultivated crops was weed control. This is followed by land preparation methods and harvest and post-harvest practices. As expected fertilizer application on the legumes (soybean and cowpea) was applied on relatively smaller cultivated areas since their nitrogen fixing ability is well-known to farmers. Again, very few farmers consider fertilizer application on yam as beneficial, as they often associate post-harvest losses with application of inorganic fertilizer. Thus fertilizer application was applied to larger areas (1.5 ha.) in maize, it was not so for all other crops.

For maize, male respondents indicated that they applied all "adopted practices" to more than 1.5 hectares (With the exception of seed variety), whilst females applied all the practices to less than 1.0 hectares (Annex XX). Females applied adopted practices to 79.3% of cultivated area (1.1 ha) for maize (97.2% for males), the highest for all the main crops, in spite of cultivating a higher average area to cowpea (1.3 ha). The least proportion of area for adopted practices for females was 53% for cowpea cultivation.

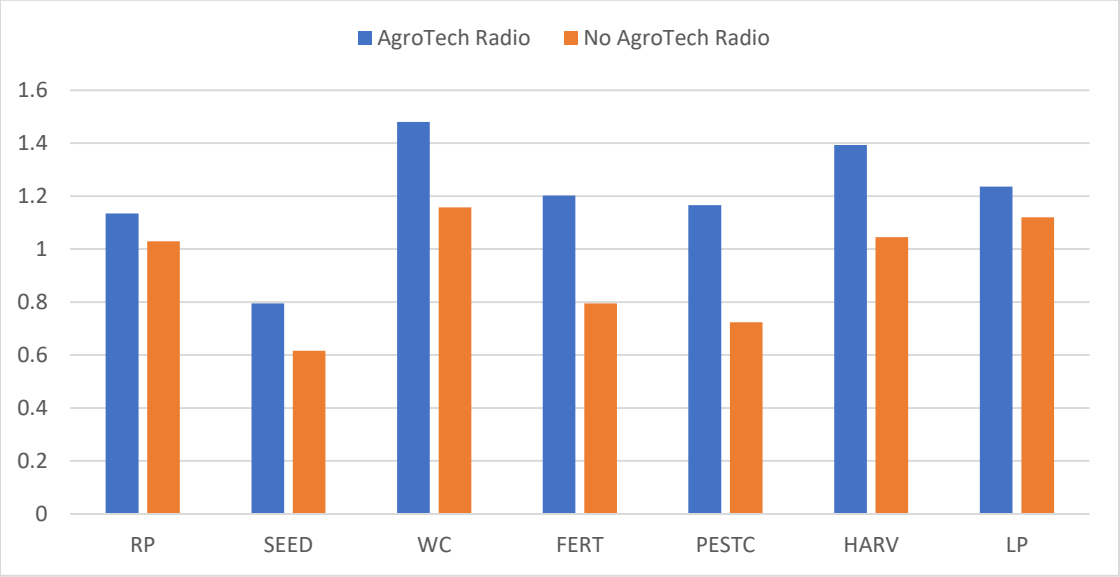
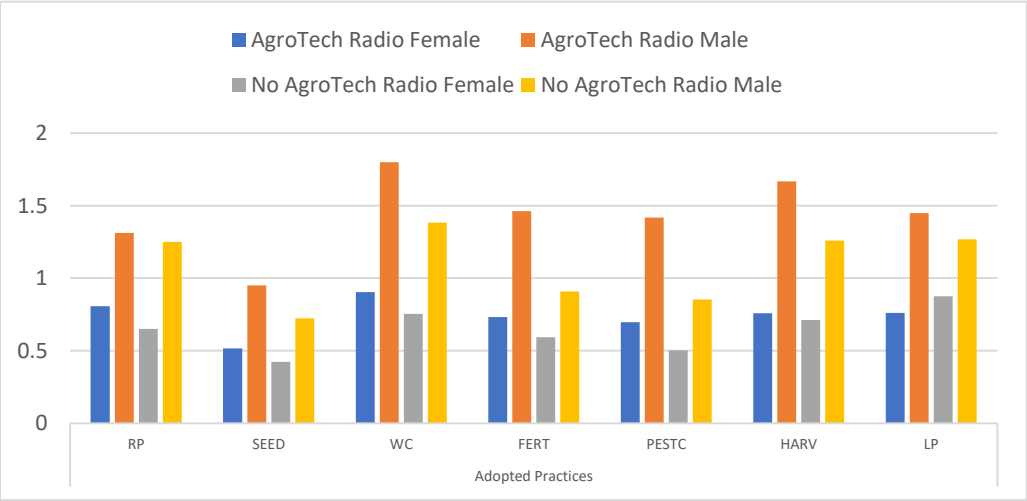


Figure 17. Mean land area on which improved practices are applied according to access to AgroTech Radio.

4.8.1 AgroTech radio

The results indicate that those respondents with access to AgroTech radio applied "adopted practices" to larger areas of land than those without access. The difference in land area range from 10.9% (row planting/plant arrangement) to 61.1% (pest control) more than those without access, with an average of 31.9%. In general, those with access applied "adopted practices" to 93.1% of the cultivated land area whilst those without access applied to 74.1% of the cultivated area.



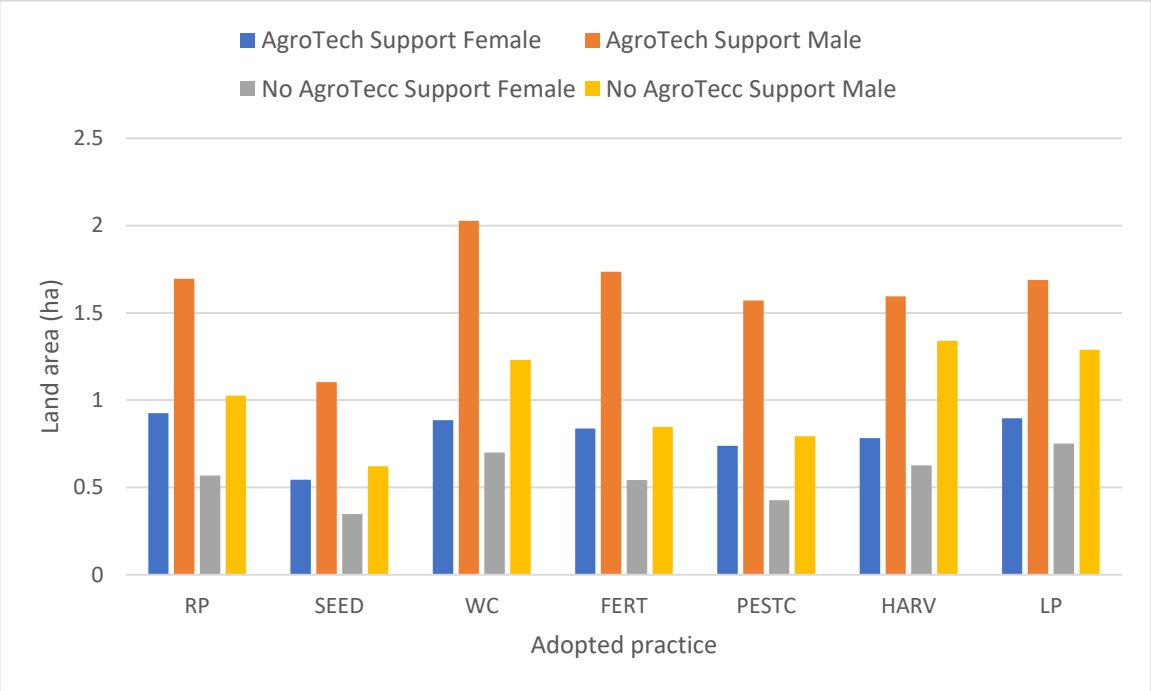


Figure 18. Mean land area (ha) on which improved practiced are applied by gender and access to AgroTech Radio.

The survey results also show that those registered with AgroTech agents generally cultivated larger areas and applied "adopted practices" to larger areas. The mean area cultivated was 1.3 hectares for those with AgroTech support and 0.8 for those without, and the proportion applied to "adopted practices" were 87.7% and 74.7% respectively. The difference between the two groups was larger in terms of pest control, fertilizer application, plant arrangements and weed control. The increase between registered and unregistered smallholders range from 20.7% (harvesting techniques) to 89.7% (pest control).

The survey results also show that both male and female applied "adopted" practices to larger land areas than their counterparts not registered by an agent.

MAIZE RADIO

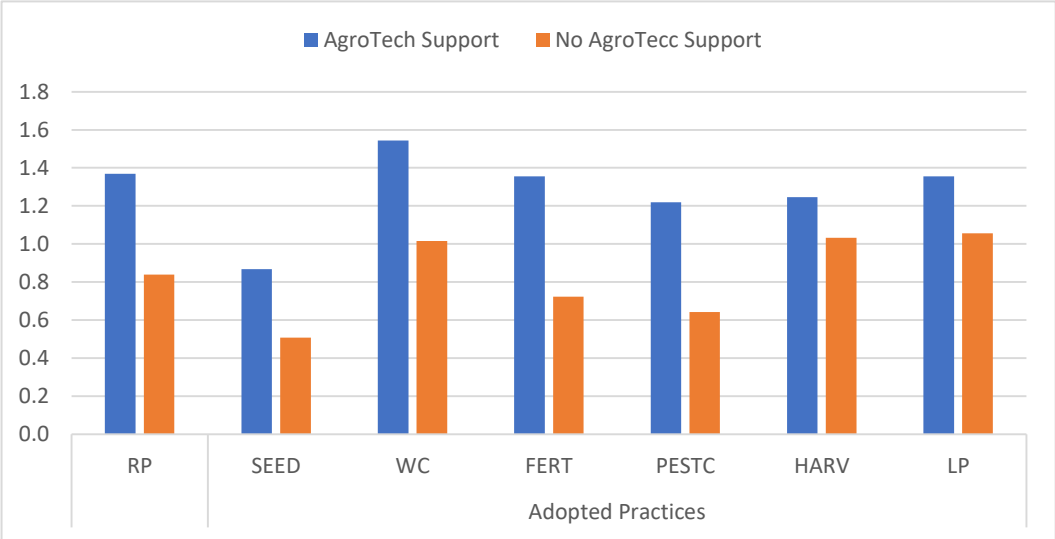
The average land size under cultivation for maize farmers who listen to FRI partner radio whose major crop is maize is 1.5 hectares. The average land area under cultivation for a maize male farmer is 5.5 hectares compared to 2.2 hectares for females. The average land size the past major season for maize farmers is 1.7 (this is 2.0 hectares for males and 1.1 for females). The average adoption area for improved seeds in the major season is 1.0, for land preparation is 1.7 hectares, and an average of 2.0 hectare went under weed control for each of the farmers under review. Furthermore, the average adoption for fertilizer application was 1.9 hectares, 1.8 hectares for pesticide application of areas under cultivation, and 1.8 hectares adopted for improved harvesting techniques. An average of 48.3 bags of harvest was stored using improved storage techniques

Figure 20. Mean land area on which improved practices are applied by gender and access to AgroTech Agent.

Figure 19. Mean land area on which improved practices are applied by access to AgroTech field agent.

acquired from the project

Table 12. Mean land area planted to maize on which improved practices were applied by respondents with access to AgroTech Radio.



Listener Category	Sex	Row planting	Seed Variety	Weed Control	Fertilizer application	Pest Control	Harvest	Land preparation	Land area (major season	Total land holding	Mean improved	% Improved area	% LHC

AgroTech Radio	Females	1.12	0.61	1.11	1.05	1.09	0.88	0.91	1.16	2.33	0.96	83.5	49.6
	Males	2.12	1.36	2.70	2.67	2.66	2.34	1.78	1.78	6.16	2.23	125.3	28.9
	Mean	1.73	1.07	2.10	2.05	2.05	1.88	1.51	1.54	4.72	1.77	114.6	32.7
No AgroTech Radio	Females	0.80	0.49	0.78	0.78	0.67	0.68	0.88	0.90	1.97	0.73	81.1	45.5
	Males	1.48	0.80	1.57	1.29	1.25	1.57	1.37	1.62	4.19	1.33	82.4	38.6
	Mean	1.25	0.70	1.31	1.11	1.05	1.26	1.20	1.36	3.42	1.12	82.4	39.9
Grand Mean		1.52	0.90	1.74	1.63	1.61	1.64	1.38	1.46	4.13	1.49	101.7	35.4

MAIZE AGENT

The average area under cultivation for farmers whose major crop is maize is 4.0 hectares (5.3 for males and 2.2 for females) while the average land size under cultivation of maize for the last major season is 1.6 hectare (1.9 for males and 1.1 for females). The average adoption area for improved seeds was less than a hectare, 0.9, while the average area adopted for improved land preparation was 1.5 hectares. Adoption area for row planting in the major season was 1.5. Average area adopted for weed control is 1.7 hectares, 1.6 hectares for fertilizer application, 1.4 hectares for pest control and 1.5 hectares was adopted for improved harvesting techniques. An average of 37.8 bags of maize adopted improved storage techniques.

Table 13. Mean land area planted to maize on which improved practices were applied by respondents with access to AgroTech Agent

Category of respondent	Sex	RowPplanting	Seed Variety	Weed Control	Fertilizer application	Pest Control	Harvest	Land preparationP	Land area (major season	Total land holding	Mean improed practices (ha)	% Improved area	% LHC
AgroTech Agent	Female	0.70	0.56	0.81	0.69	0.64	0.72	0.78	0.85	1.92	0.70	82.4	44.3
	Male	0.86	0.87	1.42	1.28	0.84	1.26	1.20	1.45	3.67	1.10	76.2	39.4
	Mean	0.79	0.74	1.15	1.02	0.75	1.01	1.01	1.18	2.90	0.92	78.1	40.8

No AgroTech Agent	Female	0.33	0.43	0.68	0.51	0.20	0.71	0.72	0.69	1.58	0.51	74.1	43.6
	Male	0.40	0.61	0.82	0.59	0.20	1.07	1.05	0.86	2.83	0.68	78.9	30.3
	Mean	0.37	0.54	0.76	0.55	0.20	0.90	0.90	0.79	2.31	0.60	76.7	34.2

RICE RADIO

The average land size under cultivation for farmers who listen to FRI partner radio whose major crop is rice is 2.5 hectares. The average land area under cultivation for a male rice farmer is 3.0 hectares compared to 1.7 hectares for females. The average land size the past major season for rice farmers is 0.9 (this is 1.0 hectares for males and 0.7 for females). The average adoption area for improved seeds in the major season is 0.6, for land preparation is 1.0 hectares, an average land area of 0.5 hectares for row planting and an average of 0.9 hectare went under weed control for each of the farmers under review. Furthermore, the average adoption for fertilizer application was 0.7 hectares, 0.3 hectares for pesticide application of areas under cultivation, and 1.0 hectares adopted for improved harvesting techniques. An average of 206 bags of harvest was stored using improved storage techniques acquired from the project

Table 14. Mean land area planted to rice on which improved practices were applied by respondents with access to AgroTech Radio

Listener Category	Sex	RowPplanting	Seed Variety	Weed Control	Fertilizer application	Pest Control	Harvest	Land preparationP	Land area (major season	Total land holding	Mean improed practices (ha)	% Improved area	% LHC
AgroTech Radio	Females	0.41	0.44	0.65	0.48	0.17	0.77	0.64	0.64	1.50	0.51	78.9	42.8
	Males	0.52	0.69	1.01	0.78	0.35	1.23	1.19	1.01	2.97	0.82	81.4	34.1
	Mean	0.48	0.60	0.88	0.67	0.28	1.09	1.00	0.88	2.43	0.71	81.5	36.0
No AgroTech Radio	Females	0.47	0.48	0.92	0.63	0.38	0.73	0.93	0.92	2.06	0.65	70.8	44.4
	Males	0.52	0.65	0.87	0.70	0.26	0.93	0.85	0.94	3.01	0.68	72.4	31.3
	Mean	0.50	0.58	0.89	0.67	0.31	0.84	0.88	0.93	2.62	0.67	71.7	35.6
Grand mean		0.49	0.59	0.88	0.67	0.29	0.99	0.96	0.89	2.49	0.70	78.0	35.9

RICE AGENT

The average area under cultivation for farmers whose major crop is rice and have AgroTech support is 2.5 hectares (3.1 for males and 1.7 for females) while the average land size under

cultivation of rice for the last major season is 0.9 hectare (0.7 for males and 0.5 for females). The average adoption area for improved seeds was less than a hectare, 0.6, while the average area adopted for improved land preparation was 0.9 hectares. Adoption area for row planting in the major season was 0.5 hectares while the average area adopted for weed control is 0.9 hectares, 0.7 hectares for fertilizer application, 0.4 hectares for pest control and 0.9 hectares was adopted for improved harvesting techniques. An average of 172.5 bags of rice adopted improved storage techniques.

Table 15. Mean land area planted to rice on which improved practices were applied by respondents with access to AgroTech Agent

Category of responde	Sex	RowPplanting	Seed Variety	Weed Control	Fertilizer application	Pest Control	Harvest	Land preparationP	Land area (major season	Total land holding	Mean improed practices (ha)	% Improved area	% LHC
Yes	Female	0.70	0.22	0.59	0.39	0.38	0.48	0.70	0.78	1.43	0.49	63.1	54.7
0	Male	2.19	0.38	2.21	0.96	1.67	1.63	2.32	2.52	5.29	1.62	64.5	47.6
0	Total	1.08	0.26	1.00	0.54	0.70	0.76	1.10	1.22	2.41	0.78	63.5	50.7
No	Female	0.50	0.10	0.50	0.33	0.27	0.40	0.70	0.73	1.30	0.40	54.5	56.4
0	Male	1.36	0.40	1.12	0.00	0.72	0.80	1.28	1.28	2.88	0.81	63.4	44.4
0	Total	0.75	0.19	0.68	0.24	0.40	0.52	0.87	0.89	1.76	0.52	58.3	50.7
Total	Female	0.66	0.19	0.57	0.38	0.35	0.46	0.70	0.77	1.41	0.48	61.4	55.0
0	Male	2.00	0.38	1.96	0.75	1.45	1.43	2.08	2.24	4.75	1.44	64.2	47.1
0	Total	1.01	0.24	0.94	0.48	0.64	0.71	1.05	1.16	2.28	0.73	62.7	50.7

SOYBEAN AGENT

The average land size under cultivation for farmers who have AgroTech support whose major crop is soybean is 2.3 hectares. The average land area under cultivation for a male soybean farmer is 4.7 hectares compared to 1.4 hectares for females. The average land size the past major season for cowpea farmers is 1.2 (this is 2.2 hectares for males and 0.8 for females). The average adoption area for improved seeds in the major season for cowpea is 0.2, for land preparation is 1.1 hectares, an average land area of 1.0 hectares for row planting and an average of 0.9 hectare went under weed control for each of the farmers under review. Furthermore, the average adoption for fertilizer application was 0.5 hectares, 0.6 hectares for pesticide application of areas under cultivation, and 0.7 hectares adopted for improved harvesting techniques. An average of 21.8 bags of harvest was stored using improved storage techniques acquired from the project

Table 16. Mean land area (ha) planted to soybean on which improved practices were applied by respondents with access to AgroTech Agent

Category of responde	Sex	RowPplanting	Seed Variety	Weed Control	Fertilizer application	Pest Control	Harvest	Land preparationP	Land area (major season	Total land holding	Mean improed practices (ha)	% Improved area	% LHC
Yes	Female	0.57	0.17	0.34	0.34	0.34	0.40	0.53	0.69	1.51	0.39	56.3	45.3
0	Male	2.40	2.40	2.40	0.80	2.40	1.20	1.20	2.40	5.20	1.83	76.2	46.2
0	Total	1.12	0.84	0.96	0.48	0.96	0.60	0.70	1.20	2.62	0.81	67.4	45.8
No	Female	0.53	0.00	1.33	0.00	1.53	0.00	0.00	2.00	3.77	0.68	34.0	53.1
0	Male	0.71	0.23	1.40	0.29	1.40	0.80	0.80	1.80	4.26	0.80	44.7	42.3
0	Total	0.66	0.16	1.38	0.20	1.44	0.80	0.80	1.86	4.11	0.78	41.8	45.3

COWPEA RADIO

The average land size under cultivation for farmers who listen to FRI partner radio station whose major crop is cowpea is 4.0 hectares. The average land area under cultivation for a male cowpea farmer is 4.4 hectares compared to 3.1 hectares for females. The average land size the past major season for cowpea farmers is 1.8 (this is 1.9 hectares for males and 1.6 for females). The average adoption area for improved seeds in the major season for cowpea is 0.4, for land preparation is 0.9 hectares, an average land area of 0.9 hectares for row planting and an average of 1.4 hectare went under weed control for each of the farmers under review. Furthermore, the average adoption for fertilizer application was 0.3 hectares, 1.5 hectares for pesticide application of areas under cultivation, and 0.7 hectares adopted for improved harvesting techniques. An average of 19.2 bags of harvest was stored using improved storage techniques acquired from the project

Table 17. Mean land area (ha) planted to cowpea on which improved practices were applied by respondents with access to AgroTech Radio

Listener Category	Sex	RowPplanting	Seed Variety	Weed Control	Fertilizer application	Pest Control	Harvest	Land preparationP	Land area (major season	Total land holding	Mean improed	% Improved area	% LHC
AgroTech Radio	Female	0.60	0.20	1.40	0.20	1.60	0.40	0.40	2.07	3.97	0.69	33.2	52.1
	Male	1.36	0.92	1.96	0.64	1.96	1.00	1.00	2.40	5.08	1.26	52.6	47.2
	Mean	1.08	0.65	1.75	0.48	1.83	0.88	0.88	2.28	4.66	1.08	47.3	48.8
No AgroTech Radio	Female	0.53	0.00	0.27	0.00	0.53	0.00	0.80	0.53	1.33	0.30	57.1	40.0
	Male	0.51	0.17	1.03	0.00	1.03	0.80	0.80	1.20	3.49	0.62	51.7	34.4
	Mean	0.52	0.12	0.80	0.00	0.88	0.40	0.80	1.00	2.84	0.50	50.3	35.2
Grand mean		0.86	0.45	1.38	0.29	1.46	0.74	0.86	1.78	3.96	0.86	48.4	45.0

COWPEA AGENT

The average land size under cultivation for farmers who have Agrotech support whose major crop is cowpea is 3.6 hectares. The average land area under cultivation for a male cowpea farmer is 4.4 hectares compared to 2.6 hectares for females. The average land size the past major season for cowpea farmers is 1.6 (this is 1.9 hectares for males and 1.3 for females). The average adoption area for improved seeds in the major season for cowpea is 0.4, for land preparation is 0.7 hectares, an average land area of 0.8 hectares for row planting and an average of 1.2 hectare went under weed control for each of the farmers under review. Furthermore, the average adoption for fertilizer application was 0.3 hectares, 1.3 hectares for pesticide application of areas under cultivation, and 0.7 hectares adopted for improved harvesting techniques. An average of 16.9 bags of harvest was stored using improved storage techniques acquired from the project

Table 18. Mean land area (ha) planted to cowpea on which improved practices were applied by respondents with access to AgroTech Agent

Category of respondent	Sex	RowPplanting	Seed Variety	Weed Contro	Fertilizer	Pest Contro	Harvest	Land prepar	Land area	Total land	Mean improe	% Improv	% LHC
Yes	Female	0.6	0.2	0.3	0.3	0.3	0.4	0.5	0.7	1.5	0.4	56.3	45.3
0	Male	2.4	2.4	2.4	0.8	2.4	1.2	1.2	2.4	5.2	1.8	76.2	46.2
0	Total	1.1	0.8	1.0	0.5	1.0	0.6	0.7	1.2	2.6	0.8	67.4	45.8
No	Female	0.5	0.0	1.3	0.0	1.5	0.0	0.0	2.0	3.8	0.7	34.0	53.1

0	Male	0.7	0.2	1.4	0.3	1.4	0.8	0.8	1.8	4.3	0.8	44.7	42.3
0	Total	0.7	0.2	1.4	0.2	1.4	0.8	0.8	1.9	4.1	0.8	41.8	45.3
Total	Female	0.6	0.1	0.8	0.2	0.9	0.4	0.5	1.3	2.6	0.5	38.2	50.6
0	Male	1.0	0.6	1.6	0.4	1.6	1.0	1.0	1.9	4.4	1.0	53.0	43.1
0	Total	0.8	0.4	1.2	0.3	1.3	0.7	0.7	1.6	3.6	0.8	47.0	45.4

YAM RADIO

The average land size under cultivation for farmers who listen to FRI partner radio whose major crop is yam is 4.3 hectares. The average land area under cultivation for a male yam farmer is 5.3 hectares compared to 2.3 hectares for females. The average land size the past major season for yam farmers is 1.3 (this is 1.2 hectares for males and 0.9 for females). The average adoption area for improved seeds in the major season is 0.6, for land preparation is 1.1 hectares, an average land area of 1.0 hectares for row planting and an average of 1.2 hectare went under weed control. Furthermore, the average adoption for fertilizer application was 0.4 hectares, 0.5 hectares for pesticide application of areas under cultivation, and 0.9 hectares adopted for improved harvesting techniques. An average of 428.1 tons of harvest was stored using improved storage techniques acquired from the project.

Table 19. Mean land area (ha) planted to yam on which improved practices were applied by respondents with access to AgroTech Radio

Listener Category	Sex	RowPplanting	Seed Variety	Weed Control	Fertilizer application	Pest Control	Harvest	Land preparation	Land area (major season	Total land holding	Mean improed practices (ha)	% Improved area	% LHC
AgroTech Radio	Female	0.76	0.45	0.82	0.53	0.45	0.55	0.64	0.88	2.53	0.60	68.3	34.8
	Male	1.03	0.63	1.33	0.42	0.68	1.07	1.14	1.39	5.18	0.90	64.6	26.9
	Total	0.95	0.58	1.18	0.45	0.62	0.92	1.00	1.25	4.42	0.81	65.4	28.1
No AgroTech Radio	Female	0.52	0.28	0.59	0.22	0.27	0.76	0.84	0.85	2.04	0.50	58.5	41.9
	Male	1.38	0.70	1.41	0.33	0.33	1.05	1.41	1.58	5.43	0.94	59.9	29.0
	Total	1.06	0.55	1.12	0.29	0.31	0.93	1.18	1.32	4.20	0.78	59.1	31.3
Grand mean		1.00	0.56	1.15	0.38	0.48	0.93	1.08	1.28	4.32	0.80	62.5	29.5

YAM AGENT

The average land size under cultivation for farmers who have Agrotech support whose major crop is yam is 4.2 hectares. The average land area under cultivation for a male yam farmer is 5.1 hectares compared to 2.3 hectares for females. The average land size the past major season for yam farmers is 1.3 (this is 1.4 hectares for males and 0.9 for females). The average adoption area for improved seeds in the major season is 0.5, for land preparation is 1.1 hectares, an average land area of 1.0 hectares for row planting and an average of 1.1 hectare went under weed control for each of the farmers under review. Furthermore, the average adoption for fertilizer application was 0.4 hectares, 0.5 hectares for pesticide application of areas under cultivation, and 0.9 hectares adopted for improved harvesting techniques. An average of 420.2 tons of harvest was stored using improved storage techniques acquired from the project

Table 20. Mean land area (ha) planted to yam on which improved practices were applied by respondents with access to AgroTech Agent

Category of respondent	Sex	RowPplanting	Seed Variety	Weed Control	Fertilizer application	Pest Control	Harvest	Land preparationP	Land area (major season	Total land holding	Mean improed practices (ha)	% Improved area	% LHC
Yes	Female	0.76	0.42	0.76	0.44	0.50	0.48	0.52	0.87	2.61	0.56	64.1	33.2
0	Male	1.03	0.61	1.21	0.43	0.73	0.96	1.05	1.29	5.37	0.86	67.0	24.0
0	Total	0.96	0.56	1.09	0.43	0.67	0.84	0.91	1.17	4.63	0.78	66.5	25.4
No	Female	0.57	0.32	0.65	0.32	0.25	0.74	0.85	0.88	2.02	0.53	60.2	43.5
0	Male	1.27	0.62	1.41	0.30	0.29	1.10	1.36	1.57	4.80	0.91	57.7	32.7
0	Total	1.02	0.52	1.15	0.31	0.27	0.96	1.16	1.33	3.83	0.77	57.9	34.7
Total	Female	0.65	0.36	0.69	0.37	0.35	0.65	0.73	0.87	2.26	0.54	62.2	38.7
0	Male	1.15	0.61	1.31	0.37	0.51	1.03	1.21	1.43	5.08	0.88	61.9	28.1
0	Total	0.99	0.54	1.12	0.37	0.46	0.91	1.05	1.26	4.21	0.78	61.8	29.9

4.7 Average yield

The average yield for SHF in the project locations shows significant difference between those who has AgroTech support and those who did not have AgroTech support. Figure 28 presents a comparison of mean grain yield for maize, rice and soybeans for the last major season under review for AgroTech beneficiaries and counterfactuals in the same community. The yield for maize and rice (2.1 and 0.76) is higher for AgroTech beneficiaries than for those who did not benefit from the project with a mean yield for rice and soybean of (1.0 and 2.18).

Figure 21 Major Crop of Farmer.

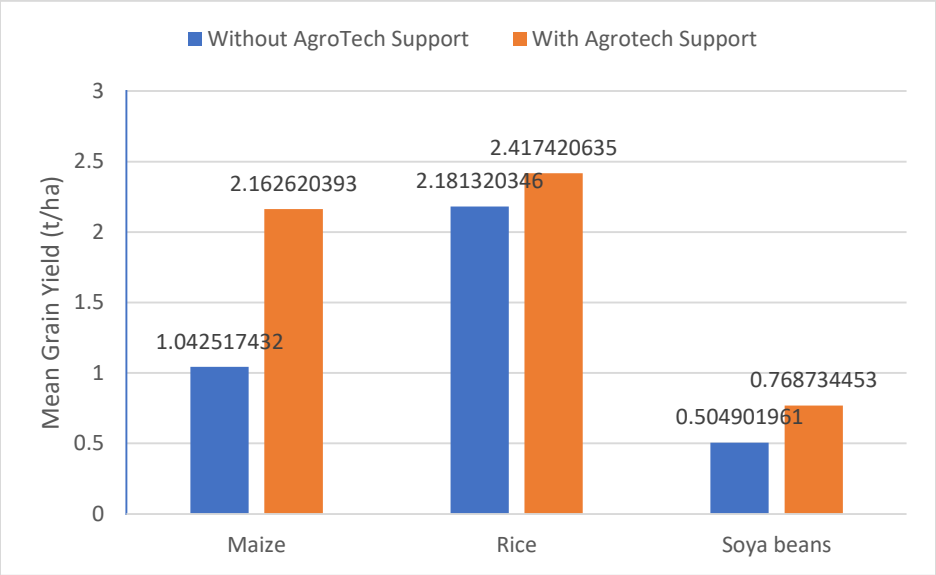


Figure 22. Mean yield of three key crops of respondents by access to AgroTech Agent.

Generally, beneficiaries of the project got higher average yields for their major crop other farmers in the same communities who did not benefit from the project. The story is the same when the yield data is cross tabulated with gender. Figure 29, shows that for all the three crops, average yields were significantly higher for both males and females with AgroTech than for those who did not have.

Figure 23 Average Crop Output AgroTech

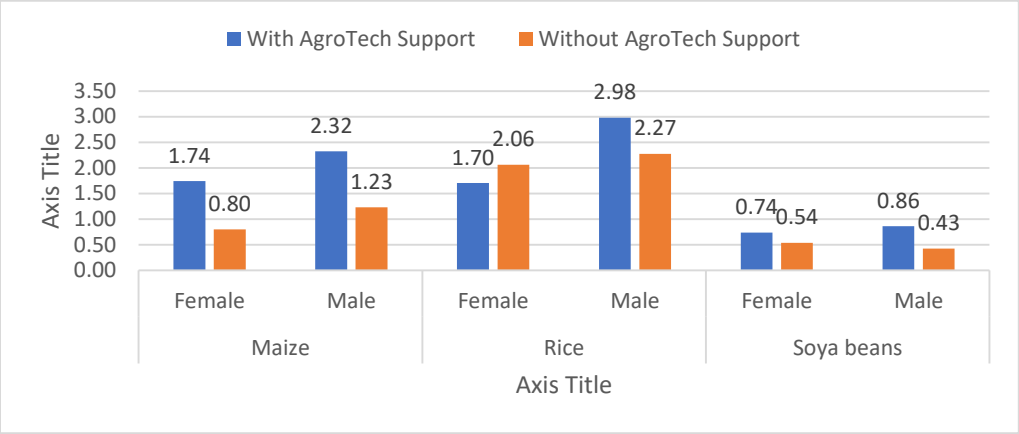
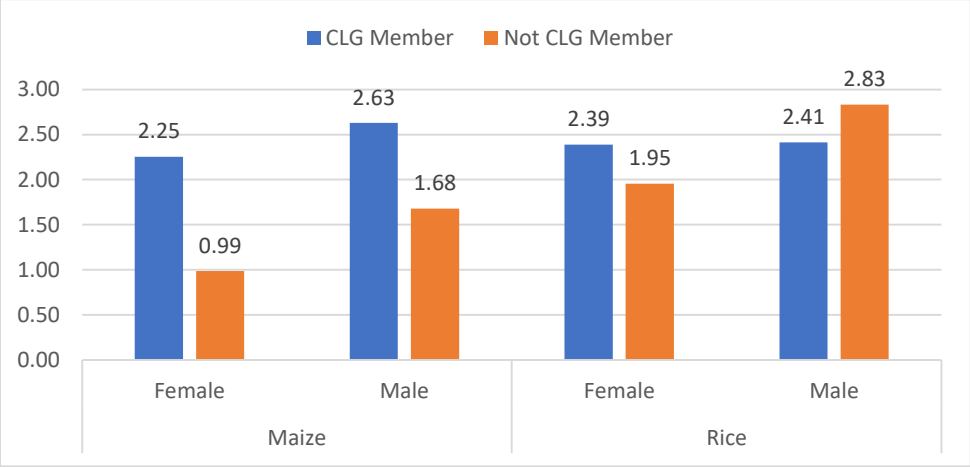


Figure 30 shows the level of yield for FRI partner radio listeners compared to yield for other farmers in the community who did no benefit from the project. Average yield for maize and rice for female FRI listeners is (2.25 compared to 0.99) for maize and (2.39 compared to 1.95) for non-FRI community members.

Figure 24 Average Crop Output_FRI



4.8 Satisfaction with Outcomes

The survey assessed the satisfaction of project outcomes from the perspective of small holder farmers. The survey assessed farmers at level of satisfaction with yield, as well as satisfaction with revenue. Overall, small holder farmers are satisfied with the outcomes of the project.

4.8.1 Satisfaction with Yield

Majority of small holder farmers expressed satisfaction with the yield they got in the main season. As many as 54 percent of all small holder farmers interviewed said they were satisfied with the yield they got in the main harvest (42 percent satisfied and 12 percent very satisfied)

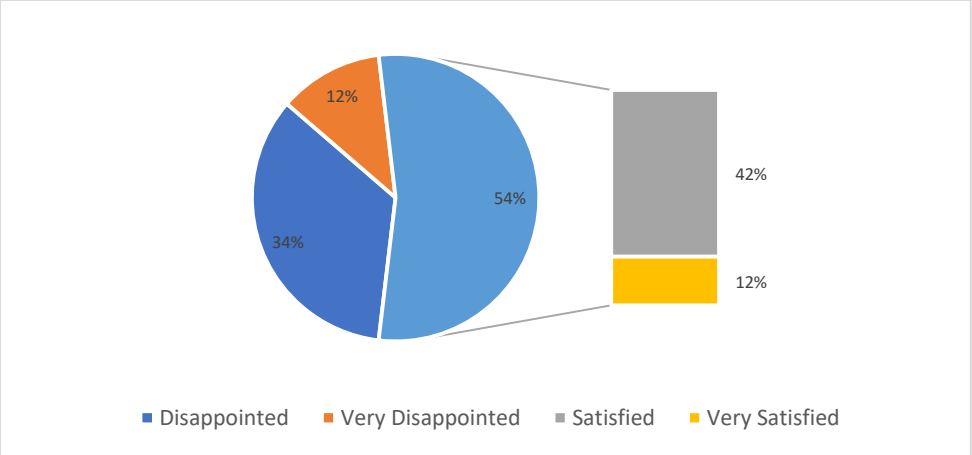


Figure 25 Satisfaction with Yield in the Main Season

A deeper analysis of the yield versus level of satisfaction indicates that a positive correlation between the level of yield and the level of satisfaction.

Figure 32 shows satisfaction levels across three major crops by gender distribution of the sample. Consistently however the satisfaction levels for males is higher than that of females. this could be as a result of the fact that the males are better able to cultivate large farms

Figure 26 Satisfaction with Yield_Major Crops

Farmers were also satisfied with the price of the produce for the main season. This could be the result of the intervention of the OB and their agents in facilitating access to markets for farmers. The project provided support to farmers to access markets through the OB and agents.

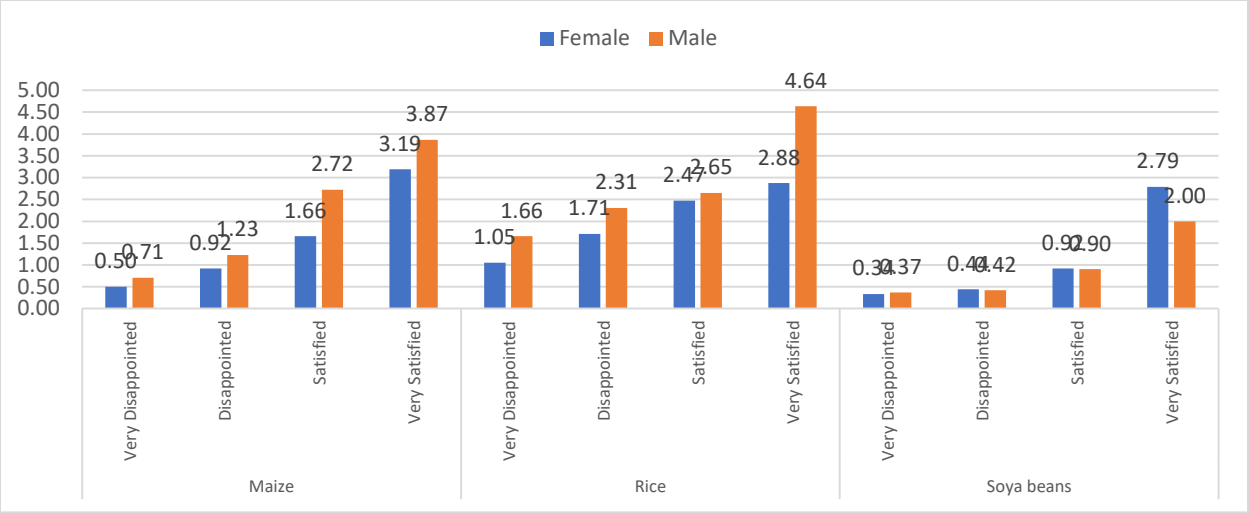


Figure 27 Satisfaction with Price of Produce for the Main Season

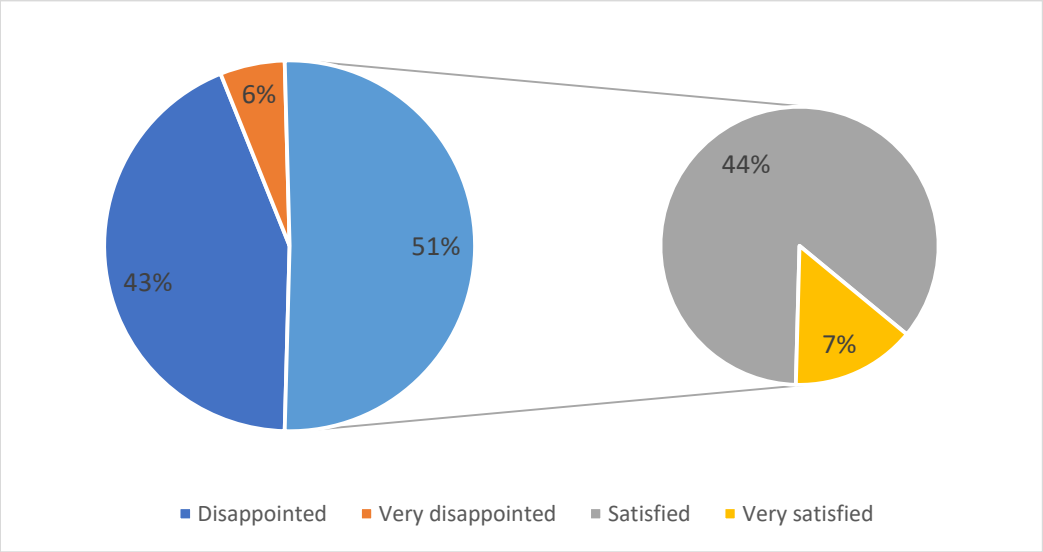


Figure 34 presents the gender breakdown of satisfaction with price of produce across 3 major crops.

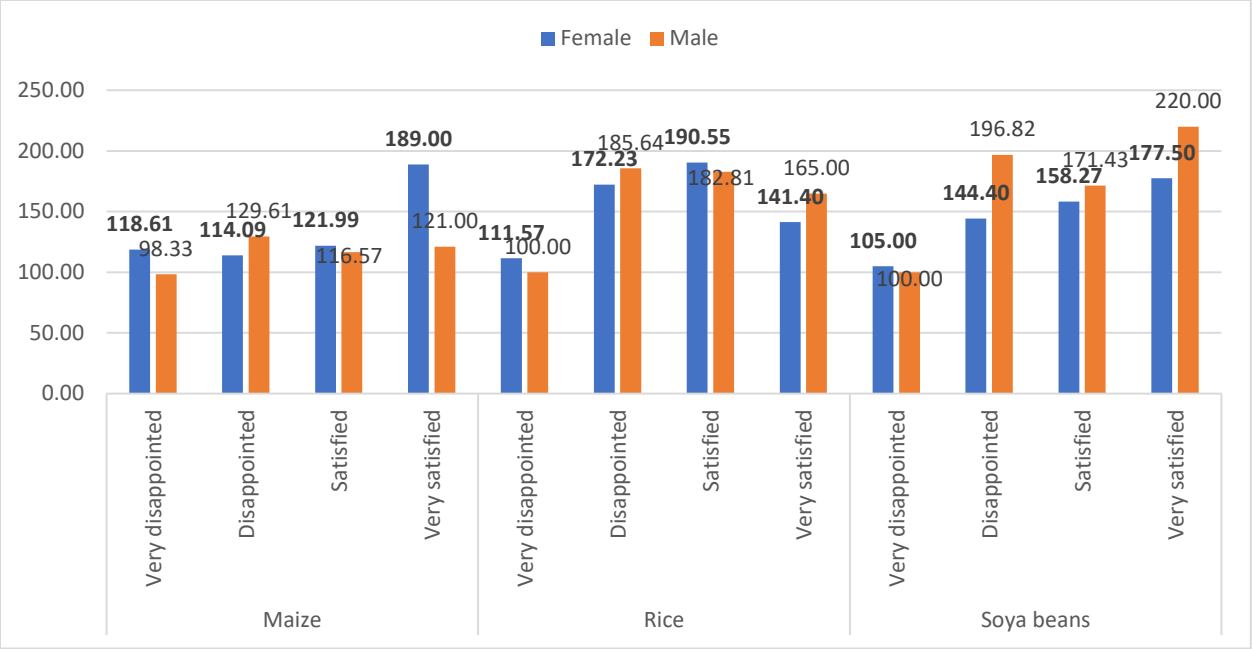
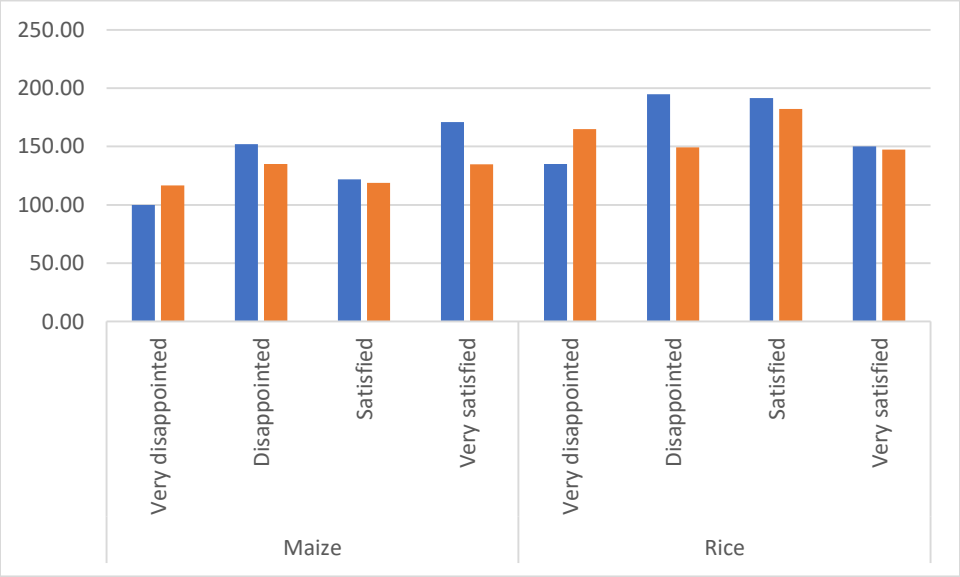

Female
Male
250.00
200.00
150.00
100.00
50.00
0.00
118.61
98.33
114.09
129.61
121.99
116.57
189.00
121.00
111.57
100.00
172.23
185.64
190.55
182.81
141.40
165.00
105.00
100.00
144.40
196.82
158.27
171.43
177.50
220.00
Very disappointed
Disappointed
Satisfied
Very satisfied
Maize
Rice
Soya beans

Figure 28.


250.00
200.00
150.00
100.00
50.00
0.00
Very disappointed
Disappointed
Satisfied
Very satisfied
Maize
Rice

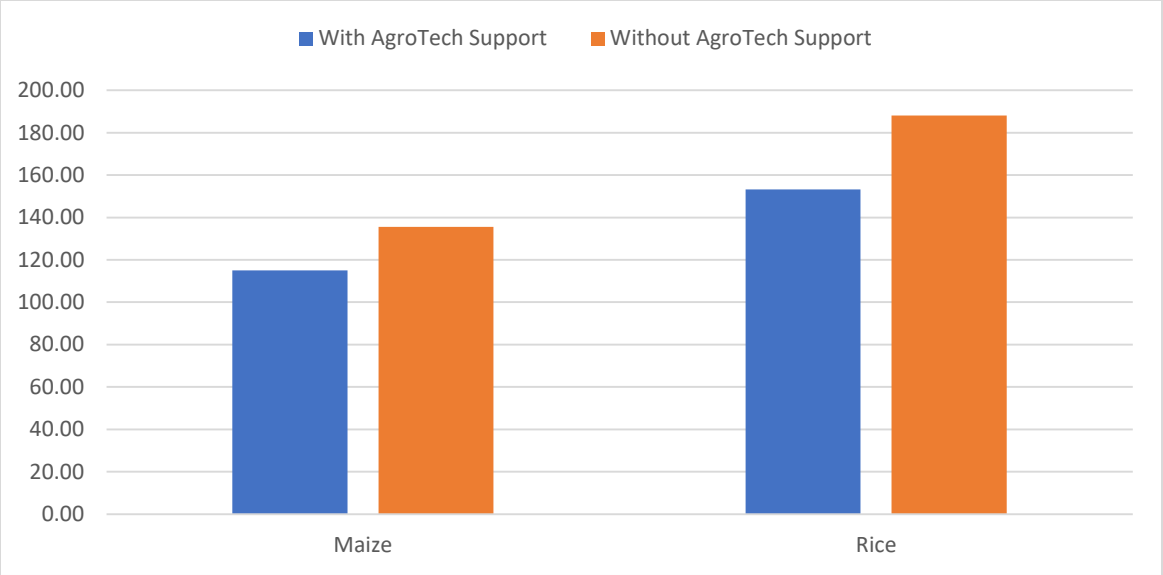


Figure 29 Satisfaction with Crop

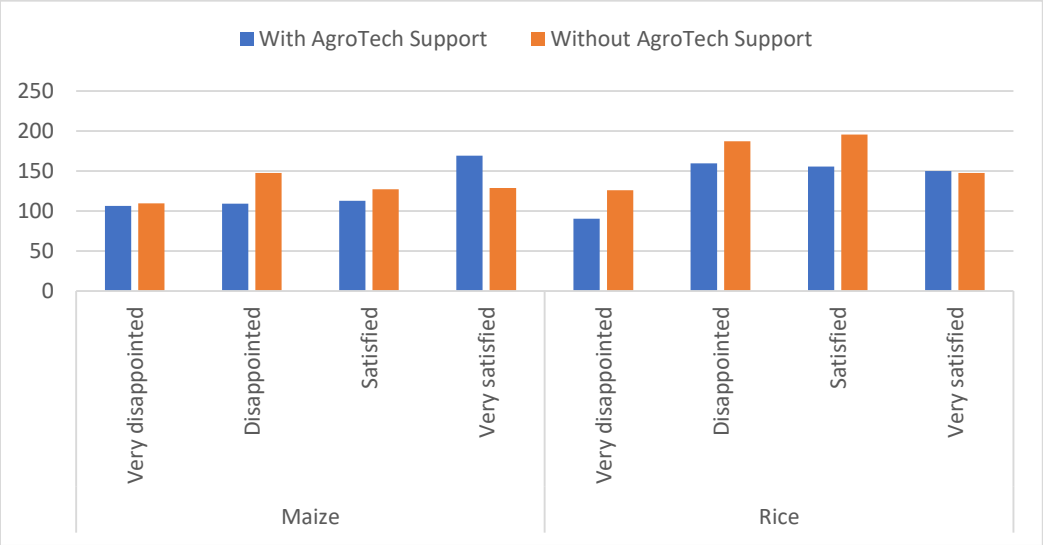


Figure 30 Satisfaction with outcomes _ Gender

4.8.2 Satisfaction with Revenue

Only 48 percent of small holder farmers expressed satisfaction with the level of revenue, this include 39 percent who said they were satisfied and 9 percent who said they were very satisfied with the revenue from their harvest. As many as 52 percent of small holder farmers said they were not satisfied with the revenue from the harvest.

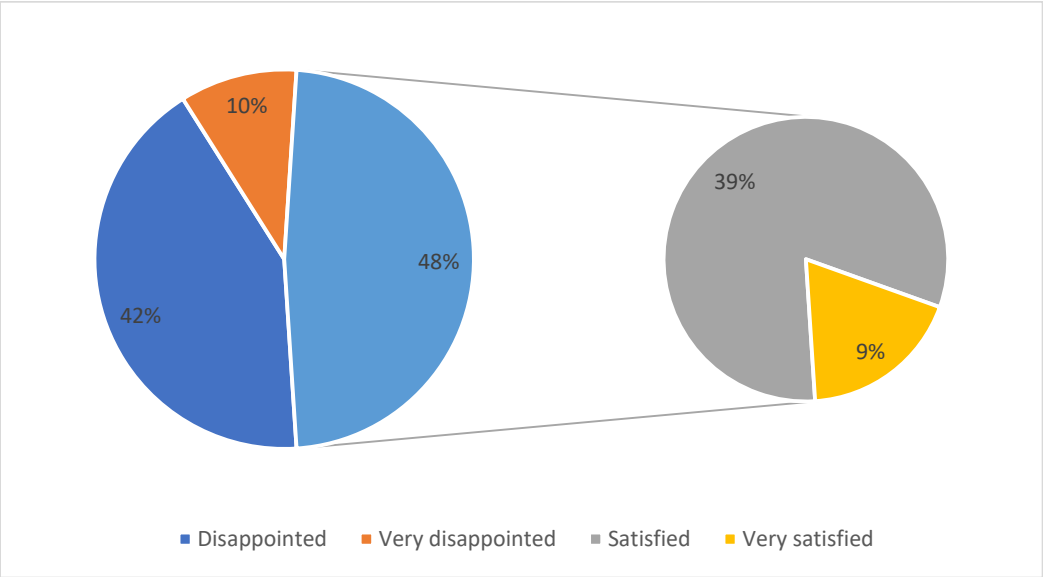


Figure 31 Level of satisfaction expressed by respondents with reference to revenue from crop production

5.0 Summary of Key Achievements according to project logframe

Overall, the project achieved the set targets in many areas. The project directly reached more than 500,000 smallholder farmers across all the 6 regions where the project operated. AgroTech Agents directly registered more than 14000 SHF and directly engaged these farmers on regular basis to improve their agronomic practices. Based on statistical estimation using the sampled population and the proportion of respondents who said they listened to FRI partner radio stations regularly, it is estimated that the stations together cover about 1.5 million people living in the catchment area of the FM stations. Further analysis indicates that more than 486,000 smallholder farmers listened regularly to broadcasts on improvements in the 3 regions with radio programs. Out of this number, over 163,000 SHF have adopted improvements.

Radio mapping audience coverage and reach
In order to create reliable estimates of potential listeners, actual listeners, and a radio station's "broadcast zone", FRI developed a process for creating maps that show broadcast coverage zones for its partner radio stations. For each station involved in the project, the following information was collected:

- the location of the radio station transmitter (using GPS)
- the transmitter height above average terrain (HAAT)
- the effective radiated power (ERP) of the transmitter (in watts)
- the gain of the transmitter (dBi)

These four variables were then fed into open-source GIS mapping software that adheres to Federal Communications Commission standards for determining FM radio contours based on the principles of FM radio signal propagation shown in the Irregular Terrain Model (ITM) (Longley and Rice, 1968). Population maps were overlaid with these radio contour maps, and two calculations were made in each broadcast zones:

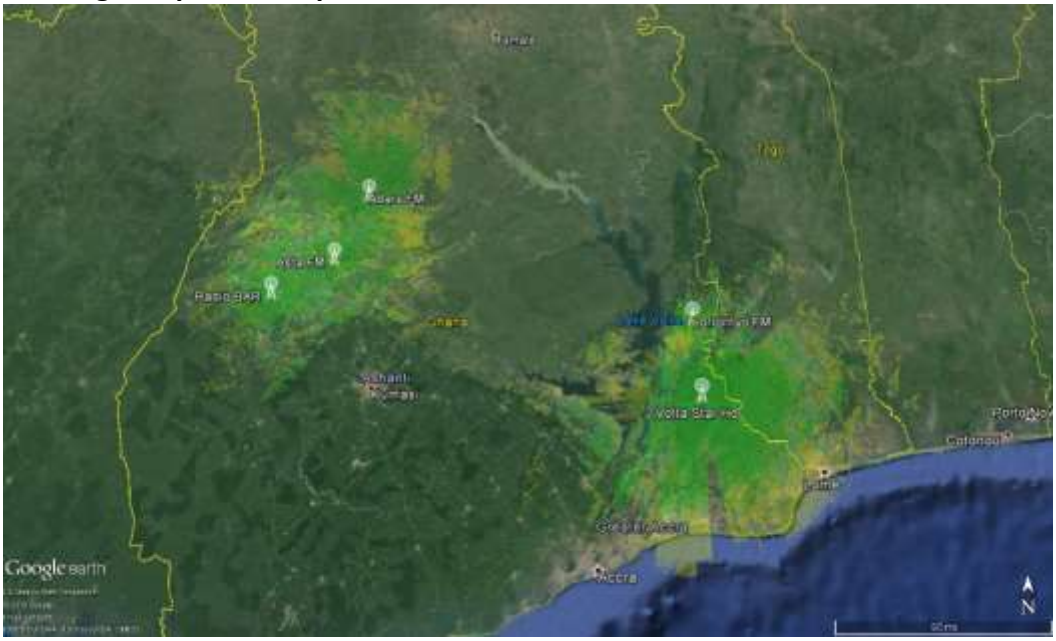
- total potential population – the population in the station's broadcast coverage zone, and
- total potential rural population – the rural population in the station's broadcast zone ("rural" is defined as less than 400 people/km^2).

Extrapolation estimations
Once the mapping data provided population estimates, extrapolation of listenership, as well as practice were done by multiplying the percentage of listenership and practice (one or more practices) by the calculated rural, working age population. It is worth noting that these numbers are only extrapolations and are not exact numbers. They should only be used to gauge the scale of reach and impact of the project.

AgroTech Radio coverage, reach and practice based on mapping and extrapolation

Region	Radio station	Radio coverage	Radio coverage minus overlaps (rural adults)	Active farmer percentage (from 2010 census)	Active farmers (extrapolated)	Listenership percentage (from survey)	Radio reach (listeners extrapolated)	Percentage of farmers who adopted one or more practices	Estimated number of farmers who adopted at least one promoted good agricultural practice
Volta	Volta Star FM	850,855							
	Lorlornyo FM	110,000	875,080	50.10%	437,540	67.40%	293,152	36%	105,535
Brong Ahafo	Adars FM	243,121							
	Asta FM	136,141							
	Atoobu FM	126,151							
	Radio BAR	127,071	546,709	61.30%	333,493	58.40%	193,426	30%	58,028
	TOTAL	**1,593,340**	**1,421,789**		**771,033**		**486,578**		**163,562**

Coverage map of all six partner radio stations in Ghana



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5.1 Assessment of Performance against Logframe Targets

Results Area	Evidence of Progress
Outcome 1: 60,000 SHHs adopt new technologies and farming techniques to improve productivity and food security	Develop and review terms of reference for consultants Questionnaire design and review Review of final evaluation report See final evidence of practice and adoption in the evaluation report
Output 1.1: 300,000 SHHs access quality, actionable extension services through our service (SMS, IVR, radio, and mobile-equipped agents)	575 number of radio programs aired 74,382 number of responses 13,299-number of unique respondents Coverage of all six radio stations See final evidence of smallholder access to quality, actionable extension services in the evaluation report
Output 1.2: Strengthened capacity of 3 radio stations to develop, produce, and broadcast interactive radio strategies (FRI)	20 days of in-station training for each radio station ----- of radio station staff trained and capacity strengthened See final evidence at the radio broadcaster assessment report
Output 1.3: 10,000 SHHs strengthen access to buyers through 100 trained, mobile-enabled buyer agents delivering extension	14,109 smallholder farmers have been provided access to buyers through 215 buyer agents
Output 1.4: Methodology for scaling enhanced ICT-	See formative research report for evidence

[4] Green coverage represents signal strength at 60dB on a regular handheld radio. Yellow represents signal strength at 48dB on a regular handheld radio. It can be assumed that anywhere within either the green or yellow can potentially tune into the AgroTech Radio broadcast.

based extension service established	See stakeholder meeting report for evidence

Results Area	Evidence of Progress
Outcome 2: 3rd party provider achieves up to 30% cost recovery through paying clients within 2 years (based on one scaling model or a combination of successful models)	B2C service providers achieves more than 30% cost recovery. Services are bundled and no distinct charge made for additional cost due to agent activities, Smallholders pay with harvested produce and Service Providers continue to record 100% cost recovery, except in credit default cases. The project did not test (Agrotech Agent) or achieve 30% cost recovery (AgroTech Radio) for B2B (TECH) Service Providers.
Output 2.1: Two business concepts and assessment protocol designed and validated with SteerCo	Three business concepts based on a B2C business model developed with assessment model and tested after discussion and validation at 3rd Advisory Board meeting Business model concept based on the B2B model for TECH provider developed for Radio and Agent. Models discussed at 5th Advisory Board meeting. Refer to PowerPoint presentations at meetings indicated.
Output 2.1: Business partnerships developed and concepts tested with buyer agents	Business partnerships with B2C model entities developed and tested for AgroTech Agent. Refer to Technical progress report for October 2017
Output 2.2: Data from test analysed and learnings drawn (including buyer willingness to pay) to be shared with business, donor, policymakers and other stakeholders	Several presentation made to B2C model partners and other stakeholders. Refer to powerpoint presentations. Presentation on B2B TECH model made in two forums (refer to minutes of meeting; 5th Advisory Board Meeting.
Output 2.3: Sustainable business model finalized with 3rd party provider	

Outcome area	Evidence of Progress
Outcome 3: Project evidence supports policy development around scalable, sustainable extension	The project orchestrated a number of dialogue sessions with policy makers to inform
Output 3.1 Steering Committee (SteerCo) selected	A 14-member project steering committee was established with representation from NGOs, private sector agribusiness representatives
Output 3.2: Learnings from project and research documented, discussed, and accepted by policy-makers and other key stakeholders (draft report on WU findings will be circulated midterm)	Policy recommendations outlines in five (5) theme papers. Key recommendation discussed, appraised and accepted by carefully selected policy stakeholders at a RoundTable Policy Event in February 2018. Refer to Minutes of meeting,
Activity 3.1.1: SteerCo member selection, charter, and regular convenings	Completed in early 2016, Refer to communication inviting members to meeting and minutes of meeting.

6.0 Key Challenges and Opportunities

Key Challenges

Poor Logistical Support Given to Agents

Agents complained of poor logistical support from OB and also from the project as one of the challenges they faced in the delivery of the project. Agents worked across large areas and have to travel long distances to communities to register and work with farmers. The initial arrangement with GFUSA to pay transportation allowance to agents didn't work well as the allowances always delayed.

Although the SmartEx application was easy to use after receiving training, Agents complained that some of the informational fields in the SmartEx application were empty e.g. market linkage and weather information services for the farmers.

Lack of Incentive for Farmers

The project did not make inputs available to farmers and this made it unattractive because the farmers felt that there were other projects that provided incentives to farmers that competed Farmers were not motivated to go the extra mile as they compared themselves with what other farmers were benefiting. A number of farmers did not embrace the AgroTech model because the project was not funding their farming activities and this resulted in some agents not being able to achieve their set targets of 100 farmers per farming season.

Challenges with Using AgroTech

Though most said the use of the tablet was pretty simple, a few agents had some problems navigating through the suite. A second training was organised for the farmers to address and they only familiarized themselves with it usage after a second training session. This affected their work initially.

Difficult to Cultural Practices

Introducing new ways of doing things always meets resistance in practice. This is especially s when dealing with practices that are rooted in the traditions of ethnic groups such as slash and

burning as a way of preparing land by farmers in parts of Ghana. In spite of efforts by agents to get farmers to stop this practice, many registered farmers still burned the bush off their fields.

Agents enumerated quite a lot of challenges they encountered that prevented them from achieving their set target per farming seasoning, these were but not limited to the list below:

I. Most of the agents were not able to make 100% recovery from the farmers they served which was a result of change in weather pattern, fall army invasion, erratic rainfall and other environmental factors outside of their control.
II. Transportation and how to reach out to the farmers on their various fields. Some of the farmers had their farms at very far distance there were also inaccessible.
III. The farmers' availability of the farmers, it was almost impossible to reach some of the farmers when they are out of their communities.
IV. Mobile network issues, data synchronization was very difficult as most of their communities had weak network.
V. Money was a challenge as sometimes the agents would have to use their own money to fund some of their activities.
VI. Some of the agents were never paid for the activities they rendered to the farmers and this served as a disincentive to them.
VII. Some of the OBs also didn't help in the registration of the farmers as they sometimes took the tablets from the agents and used it for their personal use and getting it back to continue with the farmer registration was a problem. This caused a delay in the registration process.
VIII. How to convince the farmers to gain their trust in order for them to get registered was a lengthy process that required constant and persistent follow ups. This was as a result of some promises made by some NGO's to the farmers that were never fulfilled.
IX. Challenges with some of the application portals on the tablet and also the tablet itself getting spoilt hindered some of the farmers in achieving their targets.
X. Some of the agents could not facilitate loans for their farmers to aid them to farm as most of the farmers they intended to register requested for this service and their inability to help them prevented the agents from achieving their targets.
XI. Land tenure system played a role in the number of farmers most agents could register especially in the Brong Ahafo region, as most of the farmers were settlers and sometimes

it took them long to acquire farmlands and even when they did, their lands were far and inaccessible.

XII. The registration targets were just too high for some of the agents who had other regular jobs and only served as part-time agents.

XIII. Some farmers requested to be motivated in monetary wise before they would join the scheme

XIV. Also, the AgroTech model was complex and it required a lot of explanation for farmers to buy into the concept and this often prolonged the registration process.

XV. The lack of provision of basic logistics as such wellington boots, rain coats, umbrellas, etc. during the raining season by either OBs or Grameen impeded the registration targets.

7.0 What Worked Well

Smooth Delivery of AgroTech Platform

The registration process for all the agents was smooth and farmers who were not part of their Farmer Organizations were willing to register to enjoy the services of the SmartEx application.

Some of the benefits the agents derived from the services included, getting more clientele base, gaining adequate knowledge on farming and basic agronomic practices which helped them to become good extension agents to their farmers and in managing their own farms.

Even though the system had a few challenges, the ICT challenge fund project tested and refined the AgroTech platform for a smooth delivery.

The participatory nature of radio programs afforded opportunity for SHFs exchange ideas widely with other farmers and with extension and other supportive resources for improved agricultural production.

New Learning Opportunities for Farmers and Agents

What worked for the agents in the delivery of their SmartEx services was the opportunity to learn which enabled them to acquire new set of innovative farming skills and knowledge to equip them serve their farmers well so that, they can maximize yield. Some of the new innovative technologies they learned were how to measure the farm using GPS, how and when to apply fertilizers and how to keep farm records electronically. The use of the tablet to register the farmers also helped to eliminate the manual way of registering farmers and enhanced data gathering and the development of a database. The service that delighted the farmers the most was measuring their farm size so they know how much it will cost them in terms of ploughing, land preparation, farming planning, etc. The education on the use of improved seeds, planting distance or plant population, new and improved harvesting and storing techniques and the general agronomic practices given to farmers helped them to maximize yield and produce quality rice and maize grains. Also for some of the agents, their OBs facilitated their transportation to visit the various farmer groups they supervise and this contributed immensely to the success of their work. The radio broadcast also helped in facilitating their work with the farmers. This is because most of the farmers listened to the radio program and learned from it so once the agent gets to their farms to help them practically it becomes easy for them to follow their lead.

Collaboration between Stakeholders

One of the important drivers of success for the project was collaboration between different stakeholders, each of whom brought their specialities to the table and developed synergies that enabled them to deliver results. FRI has expertise and developing and delivering programs to farmers on a range of issues around farming and has years of proven track record of delivery in Ghana and other parts of the world. GFUSA also a proven track record of delivering cutting edge solutions for social programs in different parts of the world. These two lead agencies naturally formed a winning team. Wageningen University is a centre of research and promotes research and learning the world over.

Another driver of success was the collaboration with ACDI/VOCA Advance. Advance brought with it a group of farmers who were already prepared to engage with an experiment such as AgroTech. The ground was thus prepared for the project to engage with this group of farmers. Advance also benefitted in the sense that AgroTech provided farmers with education and coaching on cultivating crops that were of interest to the project. This was value addition for Advance

8.0 Conclusions of the Evaluation

- AgroTech model is applicable to small as well as large scale farming operations. In can be effectively increased at scale
    - Database is capable of handling large amounts of complex data
    - Database can be linked up to national and regional wide database to provide critical data for policy
- The project demonstrated how private led agriculture extension service can complement government led agriculture extension service to farmers Ghana
- Significant efforts have been made in projects to introduce e-extension with positive results. AgroTech provided yet another test case of the capacity of e-extension to reach a multitude of small holder farmers over vast areas at minimum cost.
- Radio has a proven track record of delivering results in a number of social intervention setting as a mass communication medium. Combining radio and other ICT peripherals to deliver e-extension in this project was a potent combination that can be replicated