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WHY TRAINING IS HIGH FOR WOMEN YET ONLY FEW OF THEM ARE APPLYING INNOVATIVE TECHNOLOGIES

A USAID's ADVANCE II Project Report: JUNE 2018



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Executive Summary

Introduction

Recognizing the critical role of Knowledge Management and Learning (KM&L) in a knowledge-based economy and the importance of technology application and gender mainstreaming in contemporary development discourse, the Agricultural Development and Value Chain Enhancement Project II (ADVANCE II) commissioned this gender-linked KM&L study relating to women's training and application of farming technologies in the maize, rice and soy value chain. The Project is in line with the Feed the Future (FtF) initiative, which is funded by the United States Agency for International Development (USAID). This study, which was conducted in the Northern Region of Ghana, was necessitated by the outcome of analysis of data from ADVANCE II or ACIDI/VOCA office on the issue at stake. The main issue was that, in spite of the fact that both men and women farmers were trained on good agronomic practices with respect to application of farming technologies, the men were found to be adopting the technologies more than the women, which was contrary to the gender mainstreaming agenda of the Project and, therefore, needed to be remedied through evidence-based study results.

Objective(s)

The main objective of the study was to find out what was resulting in a significant lower rate of application of technology among women farmers as compared to men farmers although results from ACIDI/VOCA's monitoring data showed that when women farmers applied technologies, they significantly increased yield and their gross margins as compared to men farmers. Four main research issues were identified by the ACIDI/VOCA (ADVANCE II) to guide this study. The issues related mainly to:

1. Training in various farming practices and technologies for both male and female farmers, but limited application by women of the knowledge and technologies transferred to them as compared to their male counterparts;
2. Technologies that could easily be learnt during trainings by women and how the women could apply them effectively and efficiently on their field;
3. Causes of women not applying technologies they received through trainings; and
4. Technology mix that could be applied by women at a lower cost, but is associated with high yielding results.

Methodology

The study used the qualitative research design and was informed by the Diffusion of Innovation Theory as well as the Social Relations and the Women's Economic Empowerment Framework. Qualitative primary data were elicited from Female and Male Outgrowers (OGs), Outgrower Businesses (OBs), Community Opinion Leaders, Agricultural Extension Agents (AEAs) and Farmer Based Organizations (FBOs) in the Northern Region of Ghana and triangulated with secondary data from ACIDI/VOCA Project documents and scholarly development literature on gender mainstreaming and technology adoption

Key Findings

The main findings of the study were:

- Farmers in the study area (both males and females) across the maize, rice and soy value chains found the technologies relevant but some farmers, particularly most women, found row planting and fertilizer application very advantageous and helpful but tedious and laborious; and mechanized farming such as land preparation and combine harvesting services expensive and often not readily accessible.

- The patriarchal cultural practices and norms in the study area favored males more than females. The cultural milieu weakened women's decision-making power as well as their access to and control over productive resources such as land, labor and capital. Some married women in the maize, rice and soy value chains across all the districts did not have much time and freedom to work on their own farms since they were culturally obliged to concentrate on their husbands' farms first, thus, limiting their uptake of some of the technologies such as ploughing, row planting, application of agro-chemicals as well as harvesting and post harvesting handling. Additionally, the strategy of letting married women attend training sessions together with their husbands was found to be strategically good for cultural reasons but some women were not comfortable expressing themselves in the presence of men for cultural reasons.
- Row planting, fertilizer application, chemical weeds control were some of the high yielding technologies that could be easily learned and applied by women, however, some women saw spraying of chemicals as men's job due to the possible harmful effects of the chemicals. Women could also easily learn and apply good agronomic practices on post-harvest handling, including shelling, threshing and storage but the constraint for some of them related to cost and inadequate access to tools such as shellers and threshers.
- Supply of tractors, combine harvesters, threshers, shellers, tarpaulins, mobile phones and other tools and equipment to farmers for land preparation, harvesting and post-harvest handling, as well as provision of radio broadcast, text messages on good agronomic practices and linkage of farmers to input dealers were commendable interventions from ADVANCE, but some farmers, including women in all the study districts still complained about inadequate and untimely access to these inputs and technologies. The issue had to do with the scale of provision and possible distributional efficiency challenges, which could be addressed by the OBs in collaboration with ADVANCE.
- Access to credit for the purchase of agricultural inputs and hiring of labor was a challenge to some women farmers in spite of the Project's laudable effort to link framers to credit windows and input dealers.
- The current composition of Agricultural Extension Agents (AEAs) for the ACIDI/VOCA intervention in the study area was gender-unfriendly as it was reported to be male-dominated. All the AEAs that were interviewed during the survey were males. Additionally, a crosscheck from the ACIDI VOCA Office regarding the male-female ratio of the AEAs revealed that, all the AEAs in their records were males. This did not augur well for gender inclusive extension services as some female OGs had peculiar culture engendered-challenges, which could be better addressed by female AEAs.
- The emphasis by ACIDI/VOCA on the use of local languages, pictures, demonstration sites and free hours of the farmers for training programs worked well as a delivery strategy for technology transfer as reported by the beneficiaries of the intervention in the study area and across gender as well as maize, rice and soy value chains.
- The introduction of ICT (radio broadcast and mobile phone messages) at the instance of ADVANCE to disseminate information on good agronomic practices among the OGs was a brilliant idea, which was working to some extent but the strategy needed to be more gender-driven towards women adoption of technologies as most women farmers did not have mobile phones and/or radios or could not read and so did not benefit much from ICT-based technology transfer.

Conclusion

The relatively lower uptake of technology by women farmers compared to men did not result from the inherent characteristics of the technologies themselves such as relevance, utility, compatibility of the

technologies and acceptability by the farmers. They were rather attributable to the fact that, due to unfavorable patriarchal socio-cultural milieu, the women, compared to the men, had weaker access to productive resources; were more saddled with household chores and reproductive roles which limited their time for farming activities, including technology application. The phenomenon was also attributable to the tedious nature of some of the technologies such as row planting and fertilizer application which were time-consuming, mechanized farming services and agro chemical application which were expensive and often not readily available as well as male-dominated extension services illiteracy or lower education level of the female farmers.

Recommendations

Based on the key observations, findings and conclusion, the following recommendations are made for consideration by ACIDI/VOCA:

- Intensify advocacy and sensitization programs for community leaders and men, especially husbands of women beneficiaries of the intervention, on the need to let women have greater access to and control over productive resources (land, labor and capital) and participate in decision making at the household and community levels. Messaging should include the benefits that the husbands and households in particular and the community as a whole would derive from letting women have access to resources and helping them to adopt appropriate farming technologies for the maize, rice and soy value chains;
- Increase the number of Agricultural Extension Officers (AEAs), especially the female AEAs, not just to reduce the dominance of male AEAs, but rather to let women farmers have access to gender balanced extension services. Female AEAs would be better disposed to attend to the peculiar adoption challenges of the female farmers than male AEAs. ACIDI/VOCA could liaise with Ministry of Agriculture or recruit interns to assist in this direction;
- Given that row planting and fertilizer application were high-yielding agronomic practices but tedious and laborious as reported by both male and female Outgrowers (OGs), ADVANCE should consider more labor and energy saving methods for the farmers. In this regard, the introduction of hand planters and fertilizer applicators as contained in ADVANCE reports, was a healthy development that must be followed through, particularly in the interest of women OGs;
- Provide more credit opportunities for the women farmers to enable them mobilize and access funds to purchase agricultural inputs and/or hire labor to apply the technologies. In this connection, the Village Saving and Loans Associations (VSLAs) and payment for use of technologies with produce instead of cash that had already been introduced by ADVANCE for the farmers was a worthwhile development, which should be encouraged, strengthened and sustained;
- Design and implement special gender awareness trainings for actors such as OBs, AEAs and Community Leaders to enable them promote the uptake of agricultural technologies by the women. If such gender sensitization programs were already in place, then they needed to be reviewed or evaluated in term of approach, messaging and/or intensity for greater impact;
- Provide more opportunities for timely access to tools and inputs such as tractors, fertilizers, weedicides, insecticides, spraying machines, combine harvesters, threshers, shellers and tarpaulins for timely land preparation, harvesting and post-harvest activities by the farmers, paying special attention to female farmers;
- Identify women who have been successful (role models) or have reaped the benefits of applying the technologies to tell their success stories to other women, especially the non-adopters and limited adopters, in order to encourage them to apply. This could be done during training

sessions and radio broadcast sessions or any other appropriate platform created for such purpose;

- Organize more tailor-made trainings on good agronomic practices with special emphasis on technology uptake, targeting some trainings at women farmers only and others for both women and men farmers together;
- Institute incentive packages for OBs and AEAs for promoting the gender agenda of ACIDI/VOCA in the maize, rice and soy value chain intervention, particularly in dealings with the OGs, and put measures in place to discourage activities of same actors (OBs and AEAs) which are at variance with the gender mainstreaming strategy of ADVANCE. For instance, OBs and AEAs who ensure that, all their female OG adopt appropriate technologies as expected of them, should be rewarded while those who do not do so should be constantly reminded to be on track. They should be made to report regularly on their gender mainstreaming efforts or activities and the associated results with particular emphasis on technology uptake by female farmers.

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List of Acronyms and Abbreviations

ADVANCE	Agricultural Development and Value Chain Enhancement Project
AEAs	Agricultural Extension Agents
BI	Business Intelligence
DOI	Diffusion of Innovation
DRIC	Directorate of Research, Innovation and Consultancy
FaaB	Farming as a Business
FBOs	Farmer Based Organizations
FGDs	Focus Group Discussions
FtF	Feed the Future
GAP	Good Agronomic Practices
IDIs	In-Depth Interviews
KII	Key Informant Interview
KM	Knowledge Management
KM&L	Knowledge Management and Learning
OBs	Outgrower Businesses
OGs	Outgrowers
PHH	Post Harvesting Handling
TAM	Technology Acceptance Model
ToR	Terms of Reference
UCC	University of Cape Coast
USAID	United States Agency for International Development
VSLAs	Village Saving and Loans Associations

1.0 Background

Ghana's ability to fully utilize its agricultural production potential hinges, to a large extent, on the innovativeness of actors in the agricultural sector, particularly farmers. The capacity of farmers and other actors along the agricultural value chain to innovate in production activities depends on the availability of technology. The Green Revolution in Asia as demonstrated in the empirical literature (Moser & Barrett, 2003) is an indication that improved technology adoption for agricultural transformation is critical in modern day agriculture to ensure food security, poverty reduction and sustainable livelihoods, especially in the less developed and developing economies. Additionally, technical change in the form of adoption of improved agricultural production technologies has been reported to have positive impacts on agricultural productivity (Nin *et al.*, 2003). The promotion of technical change through the generation of agricultural technologies and their dissemination to end users plays a critical role in boosting agricultural productivity. Hence, the availability of modern agricultural production technologies to end users, and the capacities of end users to adopt and utilize these technologies cannot be underestimated. Unfortunately, the Ghanaian agricultural sector is characterized by a low level of technology adoption and this, according to Ghana's Ministry of Food and Agriculture (2010), contributes to the low agricultural productivity and food insecurity in the country. The USAID seeks to fill this gap through a number of interventions, including the ADVANCE Project.

ADVANCE is a five-year project, funded by USAID/Feed the Future and implemented by a consortium led by ACIDI/VOCA, with Technoserve, PAB Consult and ACDEP as the partners. The project's main goal is to increase the competitiveness of the maize, rice and soya value chains in Ghana, more specifically in the Northern, Upper East, Upper West, Ashanti, and Brong Ahafo regions. ADVANCE achieves this through boosting the agricultural productivity of the three commodities, improving the value chain actors' access to market and finance, and strengthening local capacities. One of ADVANCE's II key intermediate goals is to improve smallholder farmers' productivity. The Project works to achieve this by training farmers on improved agricultural technologies, which in turn, will influence uptake of technologies and improve farmers' yields and income. The Project recognizes that in a knowledge-based economy, effective management of knowledge is critical for improving individual and organizational performance as well as national strategies for development. Accordingly, organizations and institutions seek to transform their fortunes by adopting knowledge management (KM), learning and business intelligence (BI) initiatives.

It is asserted that an enterprise-wide KM solution cannot exist without a BI-based metadata repository. It is, therefore, the considered view of many an organization, that a metadata repository is the backbone of a KM solution. Consisting of a complete database of skills and expertise, knowledge repository can make information accessible for the accomplishment of important task in an organization and society. The repository is needed for analysis from which lessons can be learned to implement solutions to problems or generate knowledge that can be applied to ensure a competitive advantage in the market. As part of the ACIDI/VOVA Project' learning activities in 2016, the project analyzed the impact of training project beneficiaries on technology application and yields to test the validity of the following fundamental assumption from data collected during the 2015 Gross Margin survey:

- Training will influence uptake of technologies by women;
- The longer the farmers (male and female) interact with ADVANCE, the more they will apply certain technologies; and
- Application of technologies by both male and female farmers will increase their yield.

While it was found that the application of improved technologies resulted in significant gains in yields and income of men and women farmers, men farmers were applying more improved technologies than

women farmers although more women farmers were trained. According to the TOR, the analysis showed that when women farmers were trained on the use of improved seeds, fertilizers, row planting and mechanical land preparation in maize production, this resulted in 73 percent more women farmers using improved maize seeds, 84 percent in fertilizer use, 63 percent women farmers planting in rows and 36 percent applying mechanization on farms. This resulted in increase in yield and income for the maize farmers and similar results were obtained in soy and rice value chains. Due to the associated gain in yield and income, the expectation was that, the women were subsequently going to increase the application of the technologies, but this was not the case, hence the need for this study to investigate the phenomenon of low technology uptake by the women or female farmers.

2.0 Purpose and Expected Use of the Survey

The purpose of this study was to find out what was resulting in a significant lower application of technology among women farmers as compared to men farmers although results from analysis of data from ACIDI/VOCA's office showed that when women farmers applied technologies, they significantly increased yield and their gross margins as compared to men farmers. The findings of this study will inform measures that would be taken by the Project Implementers to increase female farmers' uptake of agricultural technologies for increased productivity in the maize rice and soy value chains for food security, improved livelihoods and poverty reduction in Ghana in line with the Project's results indicators.

3.0 Objectives of the Survey

The study sought to address the following research objectives as stated in the ToR:

1. Find out why women were receiving significant training in GAPs, PHH, FaaB, Numeracy, Quality Standards, but few of them were applying the technologies transferred to them during these trainings in their activities;
2. Examine the causes of limited application of technologies by women;
3. Identify the technologies that can easily be learnt during trainings by women and how they can apply the trainings effectively and efficiently on their field; and
4. Identify high yielding technology mix that can be applied by women at a lower cost.

4.0 Survey Methodology and Data Collection Techniques

4.1. Research Design

In line with the design prescribed by the ACIDI/VOCA [Terms of Reference (ToR) and confirmed during post-award inception meetings with the Client], the study adopted a qualitative research design. Qualitative research is anchored in the belief that social reality is constructed and purely quantitative design is limited in its ability to reveal social constructs, particularly in gender studies where the gender realities often need to be unraveled and described thoroughly or in detail. This design was, therefore, considered appropriate to ensure the possibility of distilling respondents' experiences, especially female farmers' experiences, in relation to their male counterparts and compare them with perspectives of Outgrower Businesses (OBs), Agricultural Extension Agent (AEAs), Farmer Based Organizations (FBOs) and Opinion Leaders in the study communities. Secondary data were also reviewed from Project documents, scholarly publications and other literature which provided a retrospective reflection on relevant issues that informed the development of the instrument as well as insights into making meaning out of data gathered from primary sources. The design and review of literature and their associated contextual reflections, led to the adoption of the Diffusion of Innovation (DOI) Theory and the Social Relations and Women's Economic Empowerment Framework that served as the theoretical and conceptual framework for the study as elaborated (on) just before the main findings of this study.

4.2 Population, Sample Size and Sampling Procedures

Based on the ToR, six sampling units were identified. They were the Female Smallholder Farmers [i.e. Outgrowers (OGs)], OBs, Community Opinion Leaders (COLs), and AEAs, FBOs and Male OGs. Of these, the female farmers or OGs were identified as the primary sampling respondents, and for that matter, the primary sampling units. As advised by the Client in the ToR, 160 women/female farmers (OGs) were randomly sampled from each year (2015 and 2016) Gross Margin Survey (GMS). Eighty were from the 2015 and the other 80 from the 2016 GMS. Sampling of the female OGs was restricted by district and training on Farming as a Business (FaaB), Quality Standards, Good Agronomic Practices (GAP), Numeracy and Post Harvesting Handling (PHH). From the 2015 Gross Margin Survey, the total number of farmers who received training in these areas in the Northern Region was 1084, out of which 475 were women. For sampling purposes data was restricted to farmers who participated in at least two of the trainings that involved technology transfer. Out of 475 women farmers, 369 had at least 2 training from which 80 were randomly selected for 2015. According to the 2016, Gross Margin Survey, the total number of farmers in the Northern Region who received training in the areas mentioned was 770 out of which 200 were women. Eighty out of the 200 women were randomly selected from the 2016 GMS as well.

Furthermore, 20 OBs were selected from the 2015 and 2016 data on OB-Smallholder Investment, Gross margin survey and data from Women in Agriculture Empowerment Index data collected during the 2015 and 2016 smallholder Gross Margin survey. Ten AEAs who provided services in the Northern Region during the periods were also selected while male farmers and FBOs were also purposively selected for Focus Group Discussions (FGDs).

4.3 Survey Instruments

Qualitative data collection instruments were developed for data collection for the various categories of respondents (see Annex I). The development of the instruments was informed by the objectives and research questions as well as lessons learned from literature review, Key Informants Interview (KII)/In-depth Interview (IDI) Guides were developed for Opinion Leaders, AEAs and OBs, while FGD Guides were designed for FBOs and Male and Female OGs and open ended questionnaire developed for the Female Farmers. The instruments were shared with the Clients for their inputs in the form of comments and suggestions, which were used to fine-tune the instruments for the Client's approval before they were used for data collection.

4.4 Recruitment and Training of Field Staff

Eleven field assistants (enumerators) were recruited and trained for this study. Training for field assistants was organized on 23rd October, 2017 at the International Conference Centre of the University for Development Studies, Tamale, after which the instruments were pretested at Tugu in the Tamale Metropolitan Area. The training was monitored by the Gender Specialist of ACIDI/VOCA. Based on the outcome of the pre-test, the instruments were finalized for data collection.

4.5 Data Collection

Primary data collection (fieldwork) was embarked upon in collaboration with ACIDI/VOCA from 2nd to 9th November, 2017. The Gender Specialist and Monitoring and Evaluation Officer of ACIDI/VOCA led the Consultant's data collection team to the field and monitored the data collection exercise for two days after which they introduced the data collection team members to Agricultural Production Officers in charge of the selected districts and communities who assisted in locating the communities and target respondents. The districts were Chereponi, Kumbungu, Tamale Metropolis, Mion, Nanumba North,

Nanumba South, West Manprusi, Kintampo North, Savalegu Nanton, Gushegu, Karaga, and Yendi Municipality. Although attempts were made to replace the respondents who could not be reached, the response rate was still not up to 100 percent; it was about 93 percent. This consisted of 160 randomly selected OGs as well as 15 OBs, six AEAs, four FGDs with male OGs and four FGDs with FBOs who were purposively selected.

4.6 Data Analysis

Data were analyzed using the qualitative thematic approach. In this connection, the data were transcribed, read thoroughly and thought through to distil broad themes and concepts based on the objectives and research questions. The analysis took into consideration the six main learning areas of the Project, namely relevance, effectiveness, efficiency, impact, sustainability and external utility. Employing the tenets of grounded theory, the thoughts and concept were qualitatively mapped and interpreted and triangulated based on the views and perspectives of the various categories of respondents across and within the study region, districts and communities as well as information from project documents and published and unpublished scholarly literature (books, articles, magazines, etc.). Analyses were done using the most significant stories approach. However, percentages were computed for the application of the selected technologies by the female farmers and some of them compared with the percentages indicated in the ToR. In presenting the results/findings of the study, relevant typical views and perspectives expressed by the various categories of respondents/discussants were quoted for illustrative and emphatic purposes.

4.7 Ethical Issues

In recognition of the role of ethics in research, high premium was put on ethical standards at all the stages of the study, but particularly so at the data collection stage. The consultant considered two primary issues that characterized the operations of the ACDI/VOCA- ADVANCE intervention and requirements for the study. These issues were confidentiality of information transmitted across the stakeholders during the implementation of the Project and the philosophy underlying the knowledge generation process to assess the progress of the KM&L. Confidentiality was critical to the implementation of the ACDI/VOCA-ADVANCE. This is because OBs, for instance, were ethically prohibited from divulging financial transactions, assistance received from the project and information of their clients (OGs) to a third party unless express approval had been sought from the clients concerned.

To ensure that confidentiality was adhered to, the consultant signed a Conflict of Interest Form. Moreover, all the documents and data related to the KM&L were made available only to the team leader. All respondents were assured of confidentiality of the data and information they would provide for this study. They were informed that the data would be used purposely and strictly for knowledge management and learning to improve the mode and method of implementation of the ACDI/VOCA intervention and would not be disclosed to any other person or group of persons except the data collectors and the Consultants. In order to satisfy ethical appropriateness requirements, each of the respondents was given an Informed Consent Form to read (and for the non-literate stakeholders it was explained to them) to assure them of confidentiality and anonymity.

It would be recalled from earlier explicit references and categorical allusions that the design, instrumentation, data collection and analysis benefited from the guidance of the Diffusion of Innovation Theory and the Social Relations and Women's Economic Empowerment Framework. For clarity of contextual setting's sake, the theory and the framework are briefly explained in the next sub-section as the theoretical underpinning of the study, which also sets the tone for analytical basis of the study.

4.8 Theoretical Underpinnings of the Study

4.8.1 *The Diffusion of Innovation (DOI) Theory*

The Diffusion of Innovation (DOI) Theory attempts to predict the behavior of individuals and social groups in the process of adoption of innovation, considering their personal characteristics, social relations, time factor and the characteristics of the innovation (Padel, 2001). Diffusion refers to the process in which an innovation is communicated through certain channels over time among the members of a social system. Innovation as a social construction is created in interaction of awareness and the need for innovation (utility, acceptability, compatibility of innovation), the need to overcome the existing and well-known innovation is an idea, practice or object that is perceived as new by an individual or other unit(s) of adoption (Rogers, 2003).

According to Rogers (2003), diffusion of innovation is a kind of social change. It is a social process that involves interpersonal communication. Communication is a process in which participants create and share information with one another in order to reach mutual understanding. Diffusion is a special form of communication related to new ideas. Hall (2003) states that in the study of innovation the term diffusion is most often used to describe the process by which individuals or groups in the society/economy adopt a new technology or replace an old technology with a new one.

The success of diffusion of a particular technology is often measured by the rate of adoption, uptake or application. Rate of adoption, in this context, refers to the relative speed with which an innovation is adopted by members of a social system (Rogers, 1983). The theory focuses on the five (5) main variables (*see Figure 2*) that determine the rate of adoption, namely (a) perceived attributes of the innovation, (b) the type of innovation-decision, (c) the nature of communication channels diffusing the innovation at various states in the innovation-decision process, (d) the nature of the social system in which the innovation is diffusing, and (e) the extent of change agents' promotion efforts in the innovation diffusions (Rogers, 2003). However, Rogers (2003) noted that because most adoption studies have shown that between 49 to 87 percent variance in the rate of adoption of innovations, has been explained by 'perceived attributes of the innovation', the other four (4) aforementioned variables have not received much attention by most diffusion scholars.

Hence, the DOI theory has focused on perceived attributes of innovation (namely: relative advantage, compatibility, complexity, 'trialability', and 'observability') to explain the variance in adoption. Adoption decision or intention is, therefore, driven by the five attributes of innovation discussed earlier.

It should be noted that even though DOI research originally focused on the innovation attributes to determine its rates of adoption, further studies have shown that the adopter characteristics are also very important to the decision to adopt. Applied to Agriculture Technology adoption, these five (5) attributes of innovation as well as adopter characteristics were adapted by the researchers to design a conceptual framework of Prospect and Challenges of Precision Agriculture in Cocoa Production, Ghana.

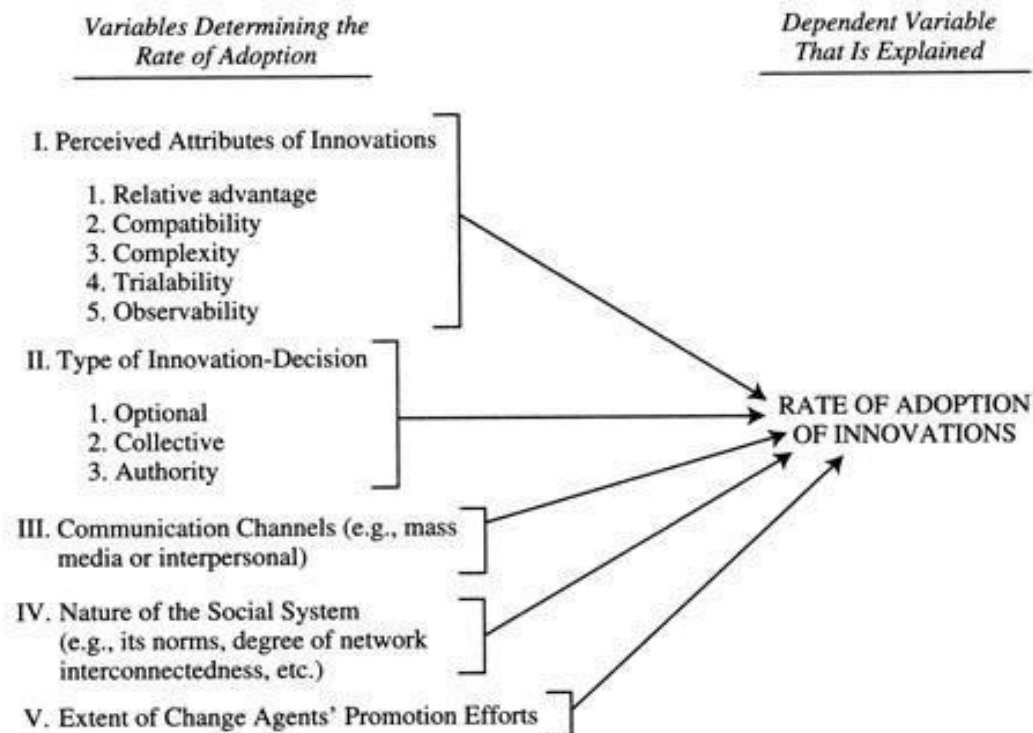


Figure 1: Rogers's Diffusion of Innovation Model

Source: Rogers (2003)

Closely related to the DOI is the Technology Acceptance Model (TAM) [Davis, 1989]. The TAM focuses on the behavioral attitudes towards a technology (especially Information Technology), while Rogers' DOI focuses on the perceived characteristics of an innovation (Aubert *et al.*, 2012). The TAM posits that individual's acceptance and usage of a technology are determined by two key perceptions: (1) Perceived Ease of Use (PEOU) and (2) Perceived Usefulness (PU) of the technology (Davis, 1989). Davis (1989) defined perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance" and perceived ease of use as the degree to which a person believes that using a particular system would be free of effort". Figure 2 shows the Davis' (1989) original TAM model illustrated by Kim and Garrison (2009).

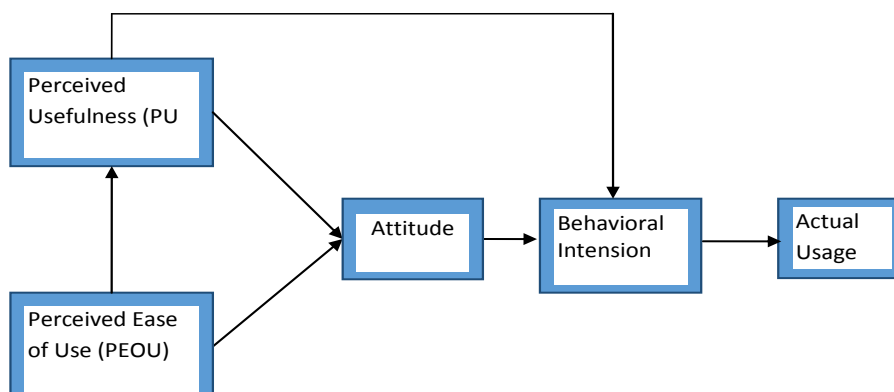


Figure 2: Technology Acceptance Model by Davis (1989)

Source: Kim and Garrison (2009)

Within the context of the agricultural industry, and particularly from the perspective of those involved in primary production such as the cultivation maize, rice and soy, the term 'technology transfer' has often

meant the delivery, diffusion or dissemination of the latest information on best farm management practices or technological tools. Literature on technology transfer acknowledges that technology application results from “Knowledge Translation and Transfer”, i.e. the transformation of knowledge into use through synthesis, exchange, dissemination, dialogue, collaboration and brokering among researchers and users of the outcome of the research. The transfer of knowledge from research into farming practice is a constant requirement for the agricultural industry to develop new ways of working to inure to the benefit and advantage of the farmers.

4.8.2 The Social Relations and Women’s Empowerment Framework

The social relations approach proceeds on the assumption that institutional rules set routines for executing social tasks in all communities. Social rules set the parameters for division of labor – the assignment of social responsibilities to specific social groups based on gender, class, age, and ethnicity. Peoples’ response to the rules so set over time become so engrained in their actions that they become self-fulfilling, legitimizing the hierarchical ordering of unequal distribution of rewards attached to such social roles. The division of labor by sex is so embedded within society that it appears natural, making people believe that gender roles are biologically determined.

Kabeer (1994) used the phrase ‘social relations’ to refer to the positional structuring of groups of people within a given community based on socially constituted systemic differences. These differences, at one stage, give some groups power and privilege over others, while simultaneously disadvantaging others. Thus, embedded in the term social relations are power relations.

Part of this analytical frame, is the term institutions. Kabeer outlines four institutions, two formal and two informal, as structuring women’s lives with set rules for resource access and control. They are the state, market, community, and household. They do not act in isolation, but are intricately intertwined. Hampel-Milagrosa and Frickenstein (2008) argue that apart from the social dimension of gender equality or inequality is the economic aspect, which is highlighted by the theory of Women Economic Empowerment as a key consideration in the inclusive market systems.

When a market system is inclusive, the structures within it enable and facilitate women’s equal access to resources. It also catalyzes the capability of decision making required for women to have the agency to act upon the acquisition of those resources and influence the systems in which they live. It enables women and men to equally compete for and reap the benefits of market systems on a level playing field. A market system is a dynamic space - incorporating resources, roles, relationships, rules, and results - in which public and private actors collaborate and compete for the production, distribution, and consumption of goods and services. An inclusive market system engages and benefits groups that are often excluded from, or even exploited by, traditional market systems. Gender equality refers to a society in which men and women enjoy the same rights, opportunities, resources, obligations, and benefits. Women’s empowerment is a critical aspect of achieving gender equality. Women’s empowerment is achieved when women acquire the power to act freely, exercise their rights, and fulfill their potential. While empowerment often comes from within individuals themselves, cultures, societies, and institutions create conditions that facilitate or undermine the possibilities for empowerment.

By stressing inclusivity, a development effort seeks to transform the market system so that it engages and benefits groups that have been traditionally excluded from or even exploited by that system. Women face unique barriers, such as lower ownership of assets, unequal access to productive resources, and disproportionate responsibility for unpaid, household work that limits their time to invest in profitable work – all of which prevent them from benefitting from these interventions. Empowering women to overcome discrimination and exclusion is an essential component of achieving gender equality and

transforming market systems to be more inclusive. Promoting women's economic empowerment in inclusive market systems requires donors and implementers to understand empowerment within its local context and its interactions with the system(s) targeted for change by a development project.

A woman's access is enhanced when she has the capacity to obtain greater economic resources. In other words, she has been able to access the opportunities, services, and assets required to upgrade her economic position. Women have multiple roles in the household, community, workplace, etc., and as such may access resources as consumers, entrepreneurs, workers, and/or beneficiaries. Institutions and businesses are key actors in enhancing access. For instance, an agricultural input supplier increases women's access to productive resources by offering smaller bags of fertilizer to meet the needs of female farmers who generally have smaller farm plots than men.

A woman's agency is enhanced when she has the capacity to make decisions and act on opportunities that lead to economic advancement. This tends to be described as her "voice". This means that she has both the power and capacity to speak up and influence decision making at various levels, such as within the household, during business transactions, or in local and national government policymaking processes.

Access and agency are interconnected and jointly essential for empowerment. A woman's access to resources and services can enhance her capability to act upon and influence the systems with which she interacts. Similarly, a woman's ability to make decisions and speak her mind is necessary for her to be able to capitalize on the economic resources that are available to her. Agency is essential for her to negotiate better access to resources such as skills training or business networks.

5.0 Main Findings

This section of the report presents the main findings of the study. Readers are pre-informed that, in addition to tailoring the findings to address the research objectives of the study, the presentation thereof is underpinned by the theory and framework elaborated above, and carried out in a manner that ensures an analytical triangulation of views and perspectives of the various categories of respondents regarding the research focus. In addition, it is worth emphasizing that, although it is understood and acknowledged that, this is a project report which was expected to essentially tease out the main findings of the study, the report should also pass the test of scholarly analytical presentation and, therefore, the findings are situated within and juxtaposed with findings from similar livelihood-oriented studies carried out in similar settings or environments. The adoption of these analytical approaches and presentation style, which are normally characteristic of academic environments, was informed by the conviction that they would serve as a useful learning curve for a study of this nature, which is primarily intended for knowledge management and learning.

5.1 Women Trainings on Technology Transfer and Application of the Technologies

ACDI/VOCA has, by design, focused on applied agricultural technology with the potential for on-farm application by both males (men) and females (women) OGs in the maize, rice and soy value chain. However, full utilization of technologies for these value chains requires reaching out to and collaborating with the farmers as the end users since the ultimate goal of the development and deployment of the technologies is to put it to meaningful use in the project area to benefit those for whom the technologies were developed. It is known that agricultural technology transfer is often done through training in the classroom setting and on demonstration sites. The ACDI/VOCA, realizing the essence of agricultural technology transfer through trainings, has facilitated several trainings for the farmers in the maize, rice

and soy value chains. The ACIDI/VOCA Project documents report of several training programs that have been rolled out for the maize, rice and soy farmers in the project's zone of influence, including the Northern Region of Ghana.

The technology transfer trainings, according to the ACIDI/VOCA report included, but were not limited to, land preparation, crop genetics, post-harvest handling, ICT application, row planting, fertilizer application and irrigation as good agronomic practices. The expectation was that the farmers (both male and females) would adopt these technologies to increase their yield and ultimately increase food security and income, improve livelihoods and reduce poverty in line with the sustainable development goals. Against this backdrop, and also in line with the first research question, the study delved into why women had received a number of trainings but were not applying the technologies as expected. This was found out from the perspectives of the female OGs, OBs, FBOs, men farmers, AEAs and community opinion leaders. The interpretation of the analysis starts with interpretation of percentages computed to show the extent of adoption or non-adoption of the technologies by the female farmers followed by qualitative narrations.

Out of 160 female farmers that were interviewed, five per cent indicated they adopted mechanized harvesting while the rest did their harvesting manually. The main reason for the low uptake of this technology was unavailability and/or unaffordability of mechanized harvesting services. While 81 per cent reported that they applied fertilizer compared to the 84 per cent as reported in the Terms of Reference for this study, 88 per cent reported that they adopted row planting as compared to 63 per cent adoption of this method that is reported in the ToR. It was deduced from their responses that the women recognized and appreciated the advantages of row planting and fertilizer application in terms of the methods' associated yield per acre and consequent increase in income and food security for the family. According to the farmers "planting in rows ensures proper aeration, optimum plant population and makes farm activities such as weed control, fertilizer application, insecticide control and harvesting easier and also leads to higher yields compared to broadcasting. It also helps to identify seeds that have failed to germinate for replanting or replacement". However, it was learnt from the non-adopters, as well as many of the adopters that row planting was tedious, laborious and time consuming. In addition, fertilizer was reported to be expensive but could sometimes be gotten on credit.

Thirty-one per cent of the female farmers reported using thresher/sheller services while the rest used the manual method. Two main reasons given for this by the non-adopters of this technology were that the thresher/sheller services were often unavailable or unaffordable. However, some adopters added that the services could, in some cases, be gotten on credit or be paid for with produce, which was a healthy development for the famers.

While 68 per cent of the female farmers said they applied weedicides and 53 per cent said they applied insecticides or pesticides, 19 per cent indicated that they applied mulching. For mulching, seven per cent of the total female farmers pointed out that they had not heard about it, while two per cent said it was meant for yam cultivation. Most of the women reported that they applied pesticides or insecticides only when they experienced infestation or invasion of pests/insects. The view was held by a few female OGs that the agro chemical could be harmful so it was not advisable for them as women to do the spraying themselves. However, they added that ADVANCE had taught them to use protective gadgets or clothes when spraying their farms. Only twelve (12) per cent of the female farmers reported that they practised irrigation or some form of dry season farming which they described as a variant of irrigation farming. The main reason for low uptake of this technology was lack of access to reliable water sources. Furthermore, while 58 per cent of the women said they got information on good agronomic practices from radio, only

11 per cent reported that they received information on same issues through the mobile phones, the majority of whom indicated that they could not read and so it was someone else who saw the messages and read to them. One of the main reasons for low adoption of ICT-based technology was lack of access to radio and mobile phones while another was illiteracy. Most of those who said they did not receive text messages added that even if they did, they would not know because they could not read.

It can be concluded that the rate of uptake was low for technologies such as mechanized farming and ICT while others such as row planting and fertilizer application were quite high. However, it can be said that generally there was more room for improvement. More reasons for the adoption or non-adoption of the technologies by the women are provided in the qualitative narratives below. It must be noted that the men or male farmers who were involved in the study were engaged in FGDs and so it was not possible to distil their responses into percentages to allow for comparison with the women farmers. Such responses and all other ones are analyzed qualitatively.

Qualitative investigation regarding women adoption of the technologies started by first ascertaining from the respondents the trainings that were organized for the farmers and technologies that were taught during such trainings, their relevance and how easy or not it was to apply the technologies. All the OGS (i.e. smallholder farmers), both males and females across all the districts indicated that they had received one form of training or the other under the ADVANCE project. These included, but were not limited to farming as business (FaAB), fertilizer application, post-harvest handling, use of improved seeds, row planting, numeracy, quality standards and crop genetics. Largely, the trainings, according to the farmers, met their expectations, particularly in terms of contents as the content had bearing on their farming activities.

The TAM of the DOI theory, posits that an individual's acceptance and usage of a technology are determined by two key perceptions: (1) Perceived Ease of Use (PEOU) and (2) Perceived Usefulness (PU) of the technology (Davis, 1989). Davis defines perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance or give him or her a greater advantage" and "perceived ease of use" as the degree to which a person believes that using a particular system would require the use of minimum effort. Based on the David's definition, respondents were asked about their perceptions of the relevance, usefulness or advantages of the various technologies that were taught during the various trainings at the instance of ACIDI/VOCA. The general response from the farmers (female and male OGS as well as the FBOs) was that the technologies were very useful, especially in terms of their associated increase in yield per acre and, for that matter, income. This confirmed the finding by the 2015 and 2016 Gross Margin Survey conducted by the ACIDI/VOCA that application of improved technologies resulted in significant gains in yields and income of men and women farmers.

However, on the issue of perceived ease of use of the technologies, the responses were mixed. Some of the technologies were found to be easy to apply while others, though not found difficult, were described as tedious. For example, broadcasting as a method of planting was easier than row planting and even-spacing for some women but for those (both male and female OGS) who applied row planting, they all acknowledged that it was a better option than broadcasting due to the associated higher yield per acre. While the men mostly found land preparation, application of weedicide, insecticide and fertilizer, row planting and storage easy most women found row planting, fertilizer application and storage easy as concepts. However, both males and females indicated that row planning and fertilizer application were tedious and labor intensive. Comparatively, the men also found mechanical land preparation easier and more affordable than the women although both male and females complained about monetary cost of application. However, as indicated, those who applied them acknowledged that ultimately these were

better options than the traditional methods as the new ones were associated with higher yield per acre and lower average cost of production. The following quotes from FGD with male soy farmers at Piong and a female maize farmer at Sung illustrate these points;

Well, nothing good comes easy. Initially, when these technologies (row planting, mechanical land, use of weedicide, insecticides, use of improved seeds, etc.) were introduced to us, it was difficult to practice them because some of us were not used to them; but as we continued practicing, we got used to them and so we no longer found them difficult. The little challenge lies in the fact that some of them require a lot of time and labor, but for most men, unlike most women, since we control resources, we find the application easier than most women (FGD, Male farmers, Piong)

The woman for Sung, on the other hand, had this to say;

As a woman, I can't weed inside my farm, so I buy the chemicals when I have the money to do so and hire someone to spray the weeds for me since I cannot do it myself as woman. I buy some improved seeds from the input dealers, but I do not have enough money to buy all the time so I select some seeds from my harvest. ADVANCE should support us (women) with soft loans and inputs because most of us, unlike most men are vulnerable since we do not control resources as much as the men do. (Female Maize Farmer, Sung in Karaga District)

The DOI theory also identifies communication channel as one of the factors that influence technology application and so the farmers were asked about how the technologies were transferred or communicated to them during trainings. On this issue, the farmers (female and male farmers as well as FBOs) reported that it was mostly mass or group in form for the trainings, but mostly individuals in the case of the extension services. That is, during the technology transfer training sessions, the participants were taught in groups, but the agricultural extension officers sometimes visited them individually to throw more light on farming practices, including technologies that had been taught during the trainings. On medium of communication, the respondents reported that it was mostly in local languages and sometimes pictorial. The following quote from a female farmer at Janga, which was shared by most respondents, illustrates this point.

The delivery strategy is good. The facilitators use local languages and sometimes they even use pictures to illustrate what they are teaching. They also take us to demonstration sites when necessary where the practical aspect of what they are teaching is demonstrated. Mostly the trainings are conducted during the times that we are free, not planting or harvesting time when we are busy. This strategy that has been adopted by ADVANCE is good. They know we are farmers and a lot of us, especially women, are not educated so they have patience for us. (Female Maize Farmer, Janga)

Regarding “trialability and observability” as concepts captured in the DOI theory, the farmers (both male and female) reported that during training sessions they were sometimes taken through practical lessons on demonstration farms to consolidate the theoretical lessons delivered in the classroom mode. This is exemplified in the quote above from the maize farmer. That is, through these on-farm demonstrations they observed and tried their hands on what was taught in the classroom setting at the demonstration sites. The demonstration sites concept was found to be a healthy practice in the ADVANCE’s attempt to increase productivity in the maize, rice and soy value chains through farmers’ uptake of technologies

The DOI theory recognizes decision making as key in technology adoption. Similarly the Social Relations an Women’ Economic Empowerment Framework places premium on agency, which relates to the role of decision making in empowering women to do a lot of things including adopting best practices. Now, having been introduced to or taught a particular best practice (technology) during a training session, it is

up to the learner(s) to decide whether to adopt it or not since he or she has the option to do so. Most of the OGs reported that before they were taken through the training, they were using the traditional method of farming such as slash and burn, manual weeding, planting their own seeds (i.e. unimproved/uncertified seeds), and broadcasting the seeds, storing farm produce on the floor and many more. They added that after the training they had adopted some of the technologies that were taught during the trainings, including application of weedicide and fertilizer, ploughing, sheller/threshers and row planting.

However, the differential rate of application between male and females was partly attributed to lack of decision-making power on the part of most women. It emerged from the study that generally in the districts and communities visited for primary data, decision-making power or authority was often vested more in the man than women, both in community and in marriage. The women did not have much “voice” as compared to the men. This finding was common to almost all the respondents and across all the study areas. For example, according to a female farmers’ association in the Kintampo North District, the women had to help their husbands on the farm and did not often get the support they needed from the men. Mostly the men expected the women to work on their (husbands’) farms. The men did not give much attention to the women’s farms. They were of the view that since their farms were larger than their wives’ farms and they (men or husbands) were responsible for household provisioning, the wives should help them first before they could take care of theirs.

Similar sentiments were expressed by a female FBO in Chere in the Chereponi District. According to the FBO, “There is the need to advise and encourage husbands to help their wives on their farm as the wives don’t get much time to work on their own farms as much as they want. This is because the wives do household chores after which they go to help the men on their farm first before going to work on theirs”. It was pointed out that the men had greater chance to apply the technologies because they usually had support from their wives but the women did not have much support from their husbands in their farming activities, including application of the technologies. Contrary to this assertion, however, an OB in Yemo Karaga-Yapalsi in the Karaga district indicated that, in his candid opinion, the women practiced the technologies better than the men. This, according to the OB, was because the women farmed to support their husbands and some got the needed support from their husbands to be able to adopt these technologies. According to the OB, ‘although the women go to the farm late as compared to the men, some of the husbands, especially the educated ones, support the wives on their farms and also help them to apply the technologies’.

Furthermore, a Yendi-based OB concurred with his counterpart OB in the Karaga District that the women applied the technologies more than the men. According to this OB, a lot of the female farmers had been applying these methods/technologies effectively. Specifically, the OB stated; “In my opinion, the women practice these new farming methods more than the men because a lot of the women are constantly on me as OB to monitor what they have been doing to see whether they are practicing them well”. Interestingly two OBs one for Janga and another for Zangum, both in the West Mamprusi Municipality also indicated that in their views the women applied the technology more than the men although the women usually had smaller farm sizes than the men. Responding to the extent to which the technologies had been adopted by the farmers in terms of differences in rates of application by gender, an OB for Zangum in West Mamprusi District stated as follows:

Currently, with respect to application of technologies by gender in my jurisdiction, I will give a mark of 60% to women and 40% to men in terms of efforts. The women are really pushing hard and they are sometimes able to top the men in the year in terms of effort at adoption. They are planting in rows and are making efforts to apply fertilizer. Although the men used to do better because they control resources and have bigger

farms, the women are really pushing very hard to apply due to my encouragement to them. Sometime I throw a challenge to the women so that they will be encouraged to do their best. If the women are encouraged and supported they will do better than they are doing now.

The above quote shows that the relationship between the OB and the OG could influence women's adoption of the technologies and, therefore, it would be useful if all OBs would encourage the women to apply the technologies. However, all these OBs indicated in confirmation of the women farmers' revelation that the women were usually too saddled with household chores and reproductive roles which often prevented them from giving the needed attention to their own farms where their farms were separate from their husbands'. It must be noted that apart from these OBs in the districts mentioned, the other OBs indicated that the men applied the technologies more or better than the women.

Furthermore, in contradistinction to the assertion by the three OBs that the women applied the technologies more than the men, an Extension Agent, in Kpatinga of the Gushiegu district said the men were able to apply some of the technologies like chemical weed control and mechanized farming, but the women were not doing well as far as the application of these technologies (e.g. mechanized farming) were concerned. Regarding the same issue, another Extension Agent at Gushegu in the Gushegu District put it this way, "The man being the head of the family determines what happens in all spheres of the family life. The men usually plough their farms and apply fertilizer before the women get access to tractors and fertilizer application services." A community opinion leader at Diare in Savelugu Nanton District pointed out that generally it was not advisable for women to use the spraying machine to spray their farms because it was tedious and the chemicals could be injurious to their health. This was confirmed by a maize farmer as follows:

As a woman, I cannot apply agro chemicals because it is difficult to do so and unhealthy for me. I also think that if the spraying is not well done the chemical could affect the plants, The row planting that I can do is also time-consuming and needs a lot of hands (Maize farmer, Naa Yili – Ticheli)

The farmer indicated that usually she relied on men for spraying services, which sometimes delayed her farming activities and hence the application of this technology. However, other women said ADVACE taught them how to use protective gadgets clothes when applying the agrochemicals.

Additionally, a community leader in the Kintampo North District indicated that, the cost of some farming inputs such as tractor services, improved seeds, weedicides and fertilizers were high and so it was difficult for some women farmers to afford, and this affected the application of some of these technologies by some female OGs. The community leader added that women did not have equal access to services of tractor operators and other machines as compared to their male counterparts and this affected the application of land based technologies such as ploughing by the women. Besides, the individual women's farms were often smaller than the men's and they had to help their husbands do theirs first as they were often regarded as helpers of the men or husbands.

In an FGD with an FBO at Chere, the participants indicated that:

We have learnt that farming is a business and so we should do it well. Doing it well entails a lot, including application of technologies. Although we apply some of the technologies that were taught during the trainings such as the use of fertilizer and weedicide as well as row planting, we don't have adequate time and money to practice all of them. Women, unlike men are overburdened with domestic activities such as cooking, fetching firewood and water as well as reproductive roles such as caring for children. All these activities prevent some of us (women) from doing other things that are equally important, including application of farming technologies.

This implies that, apart from cost, the women who are less saddled with these burdens and have the support of their husbands apply the technologies more than those who are more saddled with the burdens.

These findings, which cut across all the communities across all the districts as well as the maize, rice and soy value chains corroborated Dittoh's (2002) observation that women's involvement in productive activities was often viewed as secondary or supplementary to those of men, based on the notion that males were solely responsible for household provisioning. Dittoh further reported that, even in cases where the women constituted the main source of agricultural labor, they still were regarded as assistants. The evidence also reinforced the Women's Economic Empowerment argument concerning agency and for that matter decision making. It would be recalled from the Women's Economic Framework that, a woman's agency was enhanced when she had the capacity and authority to make decisions and act on opportunities that led to economic advancement. But contrary to this, it emerged from the study that the women farmers did not have much power to speak up and influence decision making at the household or community level. A woman's access to resources and services could enhance her capability to act upon and influence the systems with which she interacts. Similarly, a woman's ability to make decisions and speak her mind was necessary for her to be able to capitalize on the economic resources that were available to her. Agency was essential for the woman to negotiate better access to resources such as skills training or business networks.

The DOI Theory suggests that whether the farmers will apply the technology or not could also depend on the extent of efforts to promote the technology in question by the change agents. To this end, after the training, services of AEAs were engaged to assist the farmers to apply the technologies. The women outgrower farmers reported that the OBs and the Extension Agents were making some effort to promote adoption of technologies but they needed to do more. The extension agents were reported by the farmers and OBs to be inadequate and therefore their visits to the farmers were irregular and inadequate as they had a lot of farmers to visit.

Responding to a question on what should be done to enable women apply the technologies, an Extension Agent in Gushegu acknowledged that, because men were applying the technologies more than the women, his visits to farmers needed to be more regular for female farmers to ensure more women application of the technologies. Additionally, it must be pointed out that this study found that the AEAs were all males but some of the female OGs and even the OBs and Opinion Leaders were of the view that, to shore up women application of farming technologies, there needed to be an increase in the number of female extension officers to cater for peculiar needs of women farmers as some husbands would not take kindly to interaction between their wives and male extension agents without express permission from the husbands. This implied that an increase in the number of AEAs in general, and female AEAs in particular, could inure to the advantage of women farmers in terms of application of farming technologies although the study did not establish that the women who applied the technologies received extension services from female AEAs.

The findings above corroborated existing theoretical and empirical literature on extension services and female farmers' application of farming technologies. Literature showed that extension delivery in Ghana was a challenge for all farmers and that contact between extension officers and farmers was generally low, but lower for women than men. According to Aryeetey (2013), the lack of parity in accessing extension services for women was due to a number of reasons. The first was the inadequate women extension officers. Additionally, in communities with entrenched patriarchal values, like the Northern Region, for

example, cultural restrictions on the extent to which female farmers could interact with male extension officers further constricts women's access to extension services (Kelkar, 2013).

The AEAs reported that due to inadequate access to productive resources (land, labor and capital), women farmers often found it difficult to implement improved farming techniques recommended to them during training or by Extension Agents. What this meant was that, men had more advantages than women when it came to uptake of technologies due to their greater access to productive resources (land, labor and capital). This was true because it became evident from interviews and focus group discussions with the women farmers and male farmers that land, labor and capital were major issues for extent of application of the various technologies as exemplified in the following typical quotes;

As men we are the landlords. The women do not have land and so they have to take the land from us. If we do not give out the land, they cannot farm let alone apply the technologies they are taught during the trainings. We also control other resources in the house such as money and family labor, including women's labor because the women are to support us (FGD, Male Farmers, Wantugu)

Recounting the challenges she faced with regard to application of the technologies, a female rice farmer at Voggu Kpasorgu stated as follows:

There is difficulty in accessing land, dibbling and row planting are tedious and labor is not cheap. I have to borrow money to be able to hire labor so I slash and burn. I only plough when I succeed in raising a loan or obtain the tractor services on credit.

A female maize farmer at Sung in the Karaga District also stated that;

Before the ADVANCE trainings, I was slashing and burning without using ploughing services from tractor operators. I was planting my own seeds (not the improved or certified ones) haphazardly without spacing them evenly. Sometimes I was applying fertilizer, but I was putting the fertilizer under the plants, very close to the plant because I thought the closer the fertilizer to the plant the more available the nutrients will be for the plant. One of the challenges I face is that sometimes it is difficult to get land as a woman and when I get it too, it may be late or the land may be infertile. Timely tractor services and supply of inputs are also a challenge and often not affordable to me given my limited income as a woman. If I get the resources on time and on credit basis, I apply the ADVANCE technologies otherwise I don't.

The implication of these quotes is that those women who applied the technologies had timely access to affordable resources (land, labor and capital). Furthermore, a soy farmer opined as follows:

I apply some of the technologies taught during ADVANCE trainings but not all. I still use the hoe instead of the weedicide to control weeds because it is not easy for me to get the agro chemicals such as weedicide since it costs money to get it. However, I manage to use tractor services for ploughing and I plant in rows as well because I have access to family labor. I do not apply fertilizer because I think soy cultivation does not need the application of fertilizer but I apply insecticides when the need arises. I do manual instead of mechanized harvesting of my soy crops because I rely on my family labor and a few "by-day" services which are affordable to me because cost is an important consideration. I do not receive information on good agronomic practices on phones because I do not have a mobile phone but I sometimes listen to Radio Savannah broadcast on good agronomic practices which is free of charge. I neither use sheller nor thresher services due to cost and accessibility reasons, but ADVANCE gave us some tarpaulins so that after harvesting, we beat the produce

with sticks on the tarpaulin and store in sacks. What ADVANCE should do to enable women apply the technologies is to support us with the inputs and funds because for some of us (women) the main issues for adoption of the technologies are associated with inputs and funds. Women who have access to these in addition to land and extension services are motivated to apply the ADVANCE technologies because the technologies are good. (A forty-year old Female Soy farmer at Achiri Yili – Nyong Nayili)

Literature is replete with more of such observations. For instance, researching and writing on “factors influencing women farmers’ participation in extension activities in Savelugu/Nanton and Tamale Districts in Northern Region Ghana”. Kaleem (1997) made similar observations about gender and technology application.

5.2 Causes of Limited Application of Farming Technologies by Female Farmers

The gender strategy of ADVANCE requires the Project to actively engage women in capacity building recognize relevant technology, build women’s leadership capacities through training, mentorship, awareness campaign, and networking; improve women’s literacy and numeracy skills, facilitate women’s access to land, and increase women’s access to agriculture inputs. With regard to technology adoption, the literature revealed that women farmers were less likely than men to adopt improved crop varieties, use fertilizer, and apply agricultural chemicals. Doss and Morris (2001), in a study on maize production in Ghana, discovered that 39 percent of women maize farmers had adopted improved varieties. This was against 59 percent of male farmers. Their adoption of new crop varieties was the outcome of access to agricultural resources like land, extension services and labor. The reasons ascribed for low levels of fertilizer application included lower educational attainment in tandem with limited access to information (Quisumbing *et al.*, 1999).

It was gleaned from the data that although numeracy trainings had been implemented, the literacy level of most women was low and needed to be improved. Moreover, the project had done very well by providing access of the beneficiaries of the intervention, including women, to information through radio broadcast and use of mobile phones but most of the women reported not having access to mobile phones while others could neither read nor write. The observation was that though this strategy worked well to provide information on good agronomic practices, its effect was limited by lack of access to mobile phones, particularly by most of the women. Meanwhile, those who had benefitted from these services testified to the usefulness of the opportunity that ADVANCE had extended to them regarding access to technology information.

When the question on reasons for limited application of technology by women farmers under the ACDI/VOCA intervention was posed, various reasons were adduced by the various categories of respondents from the various communities in the study area. An OB in Janga in the West Mamprusi Municipality had this to express as his opinion on this issue:

I think part of the problem has to do with the difficulty in acquiring land by some women. Here the men own the land and it is difficult for some women to get land for farming. Sometimes the women depend on family lands and even if they get, it’s just a small piece of land or an infertile one. Besides, almost all decisions are made by the man and the woman virtually has no say. Some women do not get the freedom to do meaningful farming because their husbands do not understand that, after all, they are helping them (husbands) by so doing. So those who do not get the support cannot farm let alone apply farming technologies.

This reinforces the issue of women’s access to productive resource and support of their husbands as articulated by the male famers at Wantugu in the Gushegu District. However, a female maize farmer at Janga opined that;

I attended the ADVANCE training, but I have not applied any of the technologies because since then I have not farmed. For me, the issue is not about land because, if I want to farm my husband will give me land, but I am more interested in trading than farming so I have been trading.

Although this was an isolated case, it implied that for some women they did not apply the technologies not because of lack of access to land or any other reason but because of their attitude to farming or preference for other jobs. In any case, once the men and OBs themselves acknowledged that it was not always easy for women to have fertile land, it implied that, much as ADVANCE was working to facilitate women's access to land through advocacy activities, sensitization and development of linkages with OBs, access to land was still a challenge to a few of the women for cultural reasons and this required intensification of ADVANCE's efforts in this direction.

Another gender strategy adopted by ADVANCE is to increase women's access to agriculture inputs through community input promotion and Village and Savings Loans Associations (VSLAs) formation to save for inputs acquisition during crop season. When asked about reasons for non-application and /or limited application of ADVANCE-facilitated technologies, a 20-year old soy farmer at Nasoni in the Chereponi District opined that:

My inability to apply the technologies as expected of me is due to inadequate income for the purchase of inputs like certified seeds, fertilizer, weedicides as well as spraying machine; dependence on my husband for land for cultivation; unaffordability of labor; and above all, lack of opportunity to decide the time to work on my own farm because I must help my husband on his farm before I get to my mine. Meanwhile, the work is tedious and labor-intensive so I cannot do it on my own or alone.

The above quote, although an individual's submission, typified the views of many other women farmers. It meant that much as ADVANCE was trying to live up to its gender strategy of providing women access to input through input dealers and VSLAs formation, the desired level of success in this regard was lower than expected and so the strategy needed to be strengthened, scaled up and sustained.

In addition, the soy farmer opined that most decisions were taken by the husband and she had to take instructions from the husband, which was too restrictive for her. Many of the women referred to various forms of cultural inhibitions such as weak decision-making power, low control of resources, women's household and reproductive roles as contributing to lower uptake of technology by women as compared to men. The OBs, AEAs, male farmers and opinion leaders added their voice to this issue in their various submissions to confirm the cultural reasons for lower uptake of technology by the women. An opinion leader at Chereponi in the Chereponi District, added to the 20-year old soy farmer's submission by stating that until recently, it was even a taboo for women to do farming on their own because their core duties were culturally defined to mainly include household chores and reproductive roles and to work on their husband's farms as helpers. She added that "even now that women can farm on their own, they are traditionally compelled to work on their husbands' farms first, in addition to their reproductive roles. This puts a lot of pressure on the women, hence the low uptake of some farming technologies by the women, as compared to the men". In support of this an AEA at Nasoni submitted that;

The female farmers depend largely on men, mostly their husbands, for land and agricultural inputs and, therefore, the women usually work on their husbands' farms before they can work on their own farms. The farming decisions as to the number of acres a woman will farm, the fertility of the land and the inputs to use are largely made by the husbands. Women farmers depend mostly on communal labor among themselves, which at times is even difficult for them to organize. I have also observed that the women adapt to the new

farming technologies at a slower pace than the men because it is just recently that most women started farming; and so they do not have much knowledge and experience in the best farming practices; but they are picking up; Men as husbands and household heads should be encouraged to support their women/wives in farming. AEAAs should organize special monitoring for women farmers. OBs and opinion leaders can also do their part by giving the women, at least, words of encouragement to motivate them to apply.

An Extension Agent based in Kpatinga in the Gushegu District attributed the limited application of technologies by women to knowledge gap. According to the Extension Agent, during trainings, both men and women were put together so some of the women felt shy to ask questions or seek clarification on issues regarding technologies they did not understand. They would not open up because, culturally, the women were not supposed to be “disrespectful” to men. Besides, in terms of decision making at the community and household level, it was the men who distributed land and, therefore, decided what size and quality of land the woman should get. Additionally, the women did household chores which the men did not do and so the women did not have much time for their farms as the men did. The female farmers also complained about the difficulty in securing labor to work on their farms due mainly to cost of labor and availability of laborers. For example, a rice farmer, in the Tolon District said that,

Sometimes when I want to hire the services of men as laborers, they will be reluctant because they feel that, by working for a woman as laborers they are belittling themselves. This is due to our culture which makes the men feel superior.

It must be emphasized that, judging from existing literature on similar issues, some of these findings are neither new nor surprising. They corroborated findings from similar studies. For instance, Duncun (2004) and Apusigah (2009) cited in Britwum and Akorsu (2016) also made a number of observations about factors that have been identified over the years as affecting a woman’s right to her own labor and that of others in her household and the community. These include the disappearance of reciprocal labor relations between kin and neighbors, marriage, and inadequate access to cash that can be used to hire labor (Duncan & Brants, 2004). First and foremost is what Apusigah describes as the cultural appropriation of women’s labor, which defines their farm roles as supplementing men’s provider responsibilities (Apusigah, 2009). Thus, conjugal arrangements for household provisioning as well as the sexual division of domestic tasks govern women’s time use and their labor responsibilities (Britwum *et al.*, 2006). Additionally, women’s unequal share of domestic work reduces their time for farm activities where household provisioning requires her to have her own farm separate from that of the husband who is regarded as head of household. It further makes it clear that ownership of land is mainly for men. Women really have no access to land and the only land they have access to is for their husbands or their own family lands. Most men only give just small pieces of land to the women to farm and some of the lands are mostly not fertile.

Noteworthy also is the fact that most opinion leaders, extension officers and OBs pointed out that there were no religious restrictions that debarred the farmers, whether males or females, from applying farming technologies. According to an opinion leader in the Kintampo North District, “religion has not got much to do with application of farming technologies. The issue has to do with the culture of the people which allows men to control resources and take decision”. Unlike cultural issues which featured prominently in a lot of the women’s enumeration of the factors that prevented them from applying the technologies, none of the women farmers mentioned or even alluded to religion as such. However, there was an isolated case of one OB in the Cushegu District who felt that, to some extent, religion could also be a factor just like culture. According to the OB;

Religion and culture here do not normally encourage women to farm; women are for the kitchen; women do not own land and so their access to land becomes a challenge and decision making is also a problem for them due to religion and culture. Where women are allowed to farm, they are expected to help their husbands to work on their farms before they can attend to theirs.

Considering the number of interviews and FGDs conducted, such an isolated case cannot be regarded as significant influence of religion on female technology adoption although it cannot be disregarded. Religion was not recurring as culture was. It was an isolated case and therefore not significant as culture was. However, illiteracy was cited by some OBs and OGs as a factor that made it difficult for some of the women to be taught the technologies which also translated into difficulty in adoption of the technologies. According to the OBs, it was very few OGs that could read or speak English, meaning all things must be interpreted to them in their local languages but interpretation or translation has its own inherent challenges and so illiteracy could be a possible reason for lower technology uptake rate by female farmers than their male counterparts.

Another major cause of limited application of the farming technologies by female farmers that was identified by most respondents was cost of application. A female Community Opinion Leader at Chereponi said it was difficult for the women to apply the technologies because they did not have much money and strength like the men. For most of the women outgrowers, buying of materials and agro-chemicals for the farm was a problem. Sometimes, they wanted to hire some people to work on the land for them but could afford due to poverty. Almost every respondent, be he/she an OB, extension agent, female or male outgrower, community opinion leader or a member of an FBO mentioned cost as one of the factors responsible for limited uptake of farming technologies by the female outgrowers. They mentioned that, although cost was not peculiar to only the female farmers the incidence of poverty was higher among the females than the men since the men had more accesses to and control over resources, including money and most women had to be virtually subservient to the whims and caprices of their husbands since, culturally, they did not have the right to control much resources.

The cost-associated low technology application finding is consistent with literature. Britwum *et al.* (2014) have noted that agricultural production worldwide is fast becoming capital intensive creating a rising need for cash among agricultural producers. Literature states that the most inhibiting productive resource constraint is the lack of credit to pay for agricultural inputs like tractor and ploughing services, agro-chemicals, and seed varieties (Britwum *et al.*, 2014). Credit also provides the needed capital to access other productive resources like land and labor. In fact, it is noted that about 97 percent of loans raised for rural agriculture is for the acquisition of agricultural inputs (ADVANCE, 2013). Available credit tends to be restricted to large-scale cash crop farmers with small-scale food crop farmers hardly able to access formal lending from financial institutions (Adolwine & Dudima, 2010). The lending policies of the formal institutions are unfavorable to small-scale rural farmers generally. Both female and male subsistence farmers depend mainly on non-formal sources like relatives, friends, and moneylenders. However, according to an FAO report, there exist gender disparities in credit access “with men overall having better access to formal credit sources (public sector and private banks) compared to women” (FAO, 2013; 7). Also, noted are differences in female and male credit sources. Male market-oriented farms, according to the ADVANCE report, have better access to public sector credit (ADVANCE, 2013).

5.3 High-Yielding Technology Mix that can be Applied by Women at Low Cost

According to the ToR and other documents of ACIDI/VOA, including the Gross Margin Survey, 2015, Gross Margin 2016, Grammen Training of OBs and Agent, ADVANCE Annual Financial Year and Quarterly Reports, various trainings had been organized for the OGs during which various technologies

were taught. As mentioned, these technologies included fertilizer application, row planting, land base technologies such as mechanical land preparation, including ploughing and ripping. Others were harvest and post-harvest handling trainings. The ADVANCE FYQ1 Report, for instance, has it that in order to improve productivity and quality and reduce post-harvest losses in maize, rice and soya, the project conducted several trainings on good agronomic practices and post-harvest handling both on demo sites during field visits and field days and off-demo sites. The trainings covered topics such as benefits of using improved seeds, row planting, proper fertilizer application, pests and disease management, maturity dates and indices, timely harvest and methods of harvesting, shelling, temporary storage, bagging, and warehousing. In other words they covered both pre-harvest, harvest and post-harvest handling

All categories of respondents were asked to indicate the technology mix that could easily be learned and applied by the women farmers at a lower cost, while at the same time yielding high results. In response to this, a 52-year old male opinion leader at Yong Dakpeyili in the Tamale Municipality indicated that the use of improved seeds combined with row planting could lead to high yield at a lower cost although row planting was a bit time-consuming depending on the availability of labor. Furthermore, according to a 57 year-old male rice farmer at Piong in the Yendi District, row planting and weedicide application were the technology mix that could be applied at a lower cost because, planting in rows did not require capital, but the other technologies such as ploughing and combined harvesting were capital-intensive. However, a 43 year female soy farmer at Wulensi in the Wulensi District, said ploughing and row planting, were associated with high yield and low cost because it was possible to get ploughing services on credit while row planting only required labor so if the farmer had a lot of people in her house who could assist, it became a little cheaper, On her part, a 60 year old female farmer at Sekpe in the Mion District opined that, ploughing, use of improved seeds, row planting and fertilizer application were high yielding technologies but while row planting was not costly, ploughing and fertilizer application were associated with high cost as the fertilizer had to be purchased and the service of the tractor operator must also be paid for. In fact, almost all the female and male farmers as well as FBO in all the communities indicated that row planting and fertilizer application constituted the low cost technology mix that could be easily applied by the women farmers if women could organize themselves into self help groups or communal groups for row planting and be given credit to purchase fertilizer.

However, an Extension Agent at Kpatinga, in the Gushegu District was of the view that row planting and shelling were the low cost technologies that could be easily applied by the women farmers because shelling for instance could be paid for with produce, unlike the others such as fertilizer and weedicide whose application required the use of money for express payment. Similarly, an OB at Choggu Yapalsi in the Kumbungu District said row planting and ploughing or tractor services were affordable because tractor services for instance could be gotten on credit basis, while row planting required only labor which could be provided through the communal system (i.e. communal labor which is common in most villages). There were confirmations from some women farmers that technologies such as ploughing by tractors, thresher services and in some cases fertilizers and other agro chemicals could be gotten on credit or could be paid for in kind instead of in cash. For instance, female farmers at Janga and Chogu-Yapalsi had the following to share;

It is possible for us to access tractor ploughing and thresher services on credit or pay for thresher/sheller services with produce. Although both payment by cash and in kind are costs to us, the latter is more flexible and, therefore, is preferred to the former (Female maize farmers Janga and Chogu Yapalsi)

Contrary to the above, some other female farmers indicated that such services were not available or affordable to them. Farmers at Pion indicated that,

We thresh our rice manually because we cannot afford the services of a thresher even if it is made available to us. We dig a pit, put the rice in and then use the sticks to beat or thresh it in the pit.

In terms of yield, almost all the land-based technologies were identified to be high-yielding approaches while in term of ease of application; it could be gleaned from the responses that it depended on the individual. Technologies such as mulching and irrigation were not cited because few farmers were applying them. Concerning irrigation, for instance, the reason behind its low application was that a lot of the farmers claimed there was no river or reliable water sources close to their farms. The most significant point all the categories of respondents made, however, was that, considering the yield per acre of all the pre-harvest technologies such as ploughing, row planting, fertilizer and weedicide application, the average cost was ultimately lower than the traditional farming practices such as slash and burn, broadcasting and manual labor.

Additionally, some female farmers claimed that they had been receiving listening to radio and receiving text messages on good agronomic practices and climate smart agriculture. A lot of the female farmers claimed they did not have mobile phones to enable them benefit from such services. In Nansoni in the Cherponi District the women indicated that the only radio station available to the community was a Togolese radio station and so they hardly heard anything apart from the songs they played because everything was done in French. Most of the female farmers said they could not read so they were not keen on receiving such messages. For example while, like many other farmers, a rice farmer at Chiranda in the Kintampo North said “I have been listening to reminders and updates on planting season, weather and climate change, which have been very useful to me,” a maize farmer at Chomboso in the Chereponi said “I do not have a phone, but apart from that I am illiterate so I cannot read messages on phone even if I am offered a phone, unless I give it to someone to look at it for me”.

The quote, which was applicable to many of the farmers, suggests that illiteracy and access to ICT based devices (radio and mobile phone) were limiting factors to ICT-based technology uptake. Due to high level of illiteracy among the farmers, receiving information through the radio was more popular among them than text messages through phones.

5.4 Technologies to be Taught in Similar Training Sessions

In line with the objective relating to the technologies that could easily be learnt during trainings by women and how they could apply the trainings effectively and efficiently, respondents, particularly, female farmers, were asked to indicate what they felt subsequent trainings should entail in terms of technology contents. On this issue, the farmers had very little to say. Most of them, both male and female farmers, were of the view that same trainings should be repeated for deeper understanding because the technologies were in themselves very good and useful. A response by a female maize and rice farmer at Voggu Kpalsorgu in the Tolon District is a typical view that was shared by a lot of the farmers and is reproduced here for illustrative evidence.

Repeat the same trainings involving technologies that have already been taught to foster more understanding so that they will register more on our minds. What should be added is training on income generating activities such as rearing of small ruminant so we can make money to purchase inputs such as fertilizer, weedicides and spraying machine for our farming activities. Also, as part of the trainings, field trips should be organized so that we can learn from other people's experiences on application of the technologies. Furthermore, AEAs should be included in our trainings so that they will appreciate our challenges and be better disposed to help us in applying the technologies.

It is gathered from this typical submission that the contents of the trainings were not questionable from the perspectives of the beneficiaries of the intervention but the delivery strategy needed to be beefed up with more practical lessons, given the low level of education of the bulk of the farmers, particularly the female farmers. The ADVANCE strategy of including husbands of women in the training sessions or women attending training with their husbands was acknowledged as a good practice for cultural reasons. However, the view was also expressed by some women farmers as well as men that there should be training sessions that target single sex to allow female who are uncomfortable in the presence of men to feel free to participate fully for more understanding of the issues so as to enable women apply the technologies. This suggests that apart from combining them (male and female farmers) for training, other sessions could be held separately for women so that the shy-looking women could comfortably participate in trainings for better understanding of issues.

An Agricultural Extension Officer at Nansoni in the Cherponi District and another at Bimbila in the Bimbila District were of the view that there should be training on preparation of organic fertilizers because it was cheaper for the farmers than the chemical fertilizers. This was noteworthy because it tied in with the fact that the gender strategy of ADVANCE recognized promotion of relevant technologies; that is, technologies that met women's needs and preferences, and were time saving, less physically demanding, and affordable. However, the farmers themselves did not have much to say on this issue. Apart from suggesting the inclusion of income generating training such as rearing of animals and introducing more demonstrations in the trainings, most women said they were not aware of any other technologies apart from those that ADVANCE had taught them and so they should repeat them in subsequent trainings to enable them understand them better while others said any technology that ADVANCE felt could improve the lot of the farmers would be good for them. Considering the fact that a lot of the respondents complained about high cost of applying the technologies, it could be said that the AEA's suggestion on teaching preparation of organic manure is worth considering.

5.5 Perspectives on Solving the Gender-linked Low Uptake of Technologies

Another key issue that the ToR sought to address was solution to gender-linked differential in technology adoption by the maize, rice and soy farmers. The perspectives of all the categories of respondents for this study were sought on this issue. While diverse views were expressed on the issue by the various categories of respondents, they all gravitated towards common issues. Virtually, all the female outgrowers cited funding as a challenge and so they all opined that steps should be taken to assist women farmers financially to enable them hire labor and purchase other inputs such as fertilizers, weedicides and pesticides. The following is a typical response from an FBO in Bimbila, which was shared by most of the female farmers as well as other respondents in most districts and communities.

Our problems are related to funding and marketing. We want to be linked to sources of funds for agricultural production so that we can obtain credit for our activities. ADVANCE should also link us to market for our produce so we can have guaranteed market and prices. Women should also be assisted to undertake the rearing of small ruminants to enable us generate some income for other activities, including purchase of agricultural inputs and hiring of labor.

However, a review of ADVANCE project document indicated that the Project linked the farmers (both male and female as well as maize, rice and soy farmers) to market for purposes of guaranteed prices. Hence, what the farmers meant here was that this worthwhile effort needed to be scaled up.

Female rice farmers at Voggu Kpalsorgu in Kumbungu District also indicated that, there should be regular monitoring of women farmers by Out-grower Businesses and Extension Agents to encourage the

women to apply the technologies. This submission by the rice farmers confirmed the submission by the OB for Zangum in West Mamprusi Districts that the OBs' relationship with female OGs go a long way to encourage the women farmers to apply the technologies.

A 28 year-old rice farmer at Tibung in Tolon said she was finding it difficult to apply the technologies because the cost of applying the technologies was high, She indicated that, it was not easy to access labor; the extension agents were not readily accessible to her for assistance and it was difficult for her to take decisions in the home as a woman. The husband would hardly understand that she needed time for her farm. An OB in Karaga, said the new technologies were more expensive than the traditional methods of farming and most women did not have the resources to apply the new technologies. The cost involved in hiring a tractor, buying chemicals, insecticides, fertilizers, and other inputs were too high to enable encourage some women to adopt the new methods. A lot of the women were not economically endowed to be able to bear the cost involved and so the women farmers should be supported with agricultural inputs and loans for farming.

When asked about what should be done to encourage women farmers to adopt the technologies that they had been taught, a lot of suggestions were proffered by the various categories of respondents some of which have been quoted below as submissions worthy of taking lessons from.

ADVANCE should educate the community leaders and men to enable them understand the need for women to farm so they will allow the women to own or have land for farming; they also should call some of the women who have been successful with the application of the technologies to testify to others. Also, the women don't have money so they should be given soft loans to enable them practice what we have been taught such as ploughing, weedicide application, use of improved seeds as well as using shellers and thresher. Community leaders should arrange for communal labor on various farms to solve the labor challenges which most women face in their bid to farm because it is difficult to apply some of the technologies if the woman is working alone. (Female soy farmer, Chereponi District)

All the technologies require expenditure but as a woman I do not have money to spend on the technologies except those ones I can get on credit basis or pay with produce. There is also difficulty in organizing our colleague women to work together in providing labor, as our men are able to do. I also have to combine house chores and this makes it difficult for me to have enough time for farm work because I go to the farm late. It is my husband who has to help me but in most cases he will concentrate on his and as a woman I cannot say anything because he is the head. (Female soy farmer, Bogu in Gushiegu District)

In an FGD with male maize farmers at Wantugu, similar sentiments were shared. Generally, the discussants agreed that the men or husbands should be sensitized on gender awareness issues so they would allow and encourage the women (wives) to farm, be part of decision making in the house and help the wives to apply the technologies. There should be credit facilities for the farmers, including women to purchase inputs and hire labor. ADVANCE should liaise with MOFA for more extension officers, especially female AEAs, and motivate them to assist the farmers, especially the women, to adopt the technologies.

Other farmers were of the view that ADVANCE should create women groups and also use women facilitators as role model to the other women. The quote below from a woman farmer from Chereponi District, which was shared by another woman from West Mamprusi District, throws more light to this issue.

ADVANCE should train our local people as facilitators so that during the trainings we would be comfortable with them as some of us are inspired by our fellow women. More women trainers and facilitators will serve as role models for female farmers. They should also increase the number of demonstrations in their training programs and attach credit facilities to their technologies to enable women benefit to the fullest. The women should be assisted with tractor services and other labor-saving machinery to reduce time spent on our farms because we spend a lot of time doing household chores. (Female soy farmer, Nansoni, Cherponi; Female maize farmer, Zangum, West Mamprusi)

In a similar vein, a 49 year-old female rice farmer in Gupanarigu in the Tolon District opined that, basically, the assistance she needed bordered on supply of inputs and capital to hire labor to work on her farm. However, another important thing she would like to be done by whoever had the power and authority to do it was to sensitize her husband on the need to help her to apply the technologies. She added that apart from her husband, she would want to see other husbands helping their wives to apply because the technologies, especially row planting, fertilizer application and using improved seeds, were useful. On her part, a 43 year-old rice and maize farmer in Kpalga in the Tolon District, said more extension agents should be recruited and sent to the farming communities and steps taken to develop simple tools for sowing and fertilizer application as these activities were tedious and time-consuming as well as energy-sapping.

Other OBs were of the view that, providing the women with shellers, dibblers, planters and other pieces of agricultural equipment would reduce the cost of women in farming and encourage them to apply. A Dagbanjido-based OB in the Yendi Municipality was of the view that teaching the women farmers to do composting or prepare organic manure rather than using chemical fertilizer would be more cost effective for the women as affordability of chemical fertilizers was a challenge for a lot of women. A 65-year old Community Opinion Leader in Tali Community, indicated that, for women to adopt farming technologies, the program should involve the head of household (husband) because the married women could not take decisions on their own. They also had household chores and children to take care of and so did not have much time for the farming activities unlike their male or unmarried counterparts. It will be recalled that this sentiment has already been reported on as a typical sentiment of the women farmers. These findings are consistent with the tenets of the social relation framework, which recognizes that institutional and social rules set the parameters for division of labor – the assignment of social responsibilities to specific social groups based on gender, class, age, and ethnicity. According to the framework, peoples' response to the rules so set over time become so engrained in their actions that they become self-fulfilling, legitimizing the hierarchical ordering of unequal distribution of rewards attached to such social roles. It would also be recalled that the underlying theory (DOI Theory) as well as the underlying framework is explicit on the influence of the nature of social system, particularly in regard to norms and rules on the uptake of technology.

Additionally, it reinforces the women's economic empowerment argument regarding the unique barriers that women face such as lower ownership of assets, unequal access to productive resources, and disproportionate responsibility for unpaid, household work that limit their time to invest in profitable work – all of which prevent women from benefitting from well-meaning interventions such as the technology transfer one by ACDI/VOCA. The implication is that, for women's inclusivity in technology uptake in the maize, rice and soy value chains, women should be more empowered to overcome the exclusion that is associated with limited access to and control over resources as well as decision making.

Finally, on sustainability, although all male and female farmers who applied the technologies said they would continue to apply the technologies after ADVANCE's exit because the technologies were useful

and helpful, an Agricultural Extension Agent indicated that some of the women would not apply them because even with the intervention in progress now, some complained about labor, cost, time, and inputs and so did not apply the technologies as expected of them. The observation by the AEA was profound because the AEA and the OBs were the ones who would know if the farmers were actually adopting the technologies or not. This is because if a farmer claimed she was adopting while in actual fact she was not, or applying it but in the wrong way, it was a visit to the farmer's farm and interactions with the farmer on how she was doing it which would actually prove that she was adopting or not; and the role of the AEA and the OBs was crucial in this direction.

All suggestions from all categories of respondents from all the districts, targeted value chains (maize, rice and soy) bordered generally on addressing the labor, cost, time, inputs and culture-linked factors such as gender roles and women's access to resources. It must be pointed out, however, that all farmers who applied the technologies acknowledged that effective, efficient and timely combinations of the technologies eventually led to higher yield per acre, lower average cost of production and increase in income as compared to the traditional farming practices or methods. This was a pointer to the fact that the Project was, by and large, on course towards achieving its objective of increasing productivity, income and food security in the targeted value chains. The Project, therefore, can leverage on this acknowledgement and address the labor, cost, input, time as well as culture associated challenges to guarantee, or at least increase, the sustainability of the Project in a gender inclusive manner.

6.0. Key Observations

- All ACIDI/VOCA technology transfer intervention beneficiaries (both male and female farmers) across the entire study area recognized the relevance, efficiency effectiveness, impact, compatibility and utility of the technologies that have been taught during the trainings;
- The farmer beneficiaries of the intervention acknowledged that the technologies, compared to the traditional practices, were better because they were associated with higher yield and income and, therefore, were worth applying in their own socio-economic interests. This suggested high prospects of sustainability for the project but given that some farmers, mostly female farmers, were not applying the technologies, while the intervention was even in progress, there was more to do to ensure sustainability;
- The various technologies, such as ploughing; application of fertilizer, weedicide insecticide; row planting; use of threshers and shellers, were not too difficult to understand or grasp as concept, but the women were less disposed to apply some because they were disadvantaged compared to the males due to economic and cultural reasons. The socio-cultural milieu is patriarchal and, therefore, gives the men advantage over the women in terms application of the technologies; and
- All actors (ACIDI/VOCA, Extension Agents, Community Leaders, OBs, Male and Female OGs and MOFA) have a role to play in ensuring that women apply the technologies.

7.0 Conclusion

Conclusion

The observed gender-linked differences in the differential rates of technology uptake between male and female farmers, did not result from the inherent characteristics of the technologies themselves such as relevance, utility, compatibility of the technologies and acceptability by the farmers. They were rather attributable to the fact that, due to unfavorable patriarchal socio-cultural milieu, the women, compared to the men, had weaker access to productive resources; were more saddled with household chores and reproductive roles which limited their time for farming activities, including technology application. The

phenomenon was also attributable to the tedious nature of some of the technologies such as row planting and fertilizer application which were consuming, and ploughing services and agro chemical application which were expensive; cost of and timely access to inputs and mechanized services; male-dominated extension services; lower level of women education and weaker decision-making power of women. The evidence corroborates most existing studies and anecdotal evidence regarding gender and technology adoption in agricultural production in Ghana.

8.0 Lessons Learnt

The lessons learnt are as follows:

- Farmers in the study area (both males and females) across the maize, rice and soy value chains found the technologies relevant but some farmers, particularly some women, found row planting tedious, application of fertilizers laborious and mechanized farming such as land preparation and combine harvesting expensive.
- The patriarchal cultural practices and norms in the study area favored males more than females. The cultural milieu weakened women's decision-making power as well as their access to and control over productive resources such as land, labor and capital. Some married women in the maize, rice and soy value chains across all the districts did not have much time and freedom to work on their own farms since they were culturally obliged to concentrate on their husbands' farms first, thus, limiting their uptake of some of the technologies such as ploughing, row planting, application of agro-chemicals as well as harvesting and post harvesting handling. Additionally, the practice of letting married women attend training sessions together with their husbands was found to be strategically good for cultural reasons but some women were not comfortable expressing themselves in the presence of men for cultural reasons.
- Mechanical land preparation, row planting, fertilizer application, chemical weeds control were some of the high yielding technologies that could be easily learned and applied by women, however, some women saw spraying of chemicals as men's job due to the possible harmful effects of the chemicals. Women could also easily learn and apply good agronomic practices on post-harvest handling, including shelling, threshing and storage but the constraint for some of them related to timely access tools such as sheller and thresher.
- Supply of tractors, combine harvesters, threshers, shellers, tarpaulins, mobile phones and other tools and equipment to farmers for land preparation, harvesting and post-harvest handling, as well as provision of radio broadcast, text messages on good agronomic practices and linkage of farmers to input dealers were commendable interventions from ADVANCE, but some farmers, including women in all the study districts still complained about inadequate and untimely access to some of these inputs and technologies. The issue had to do with the scale of provision and possible distributional efficiency challenges, which could be addressed by the OBs in collaboration with ADVANCE.
- Access to credit for the purchase of agricultural inputs and hiring of labor was a challenge to some women farmers in spite of the Project's laudable effort to link framers to credit windows and input dealers.
- The current composition of Agricultural Extension Agents (AEAs) for the ACIDI/VOCA intervention in the study area was gender-unfriendly as it was reported to be male-dominated. All the AEAs that were interviewed during the survey were males. Additionally, a crosscheck from the ACIDI VOCA Office regarding the male-female ratio of the AEAs revealed that, all the AEAs in their records were males. This did not augur well for gender inclusive extension services as some female OGs had peculiar culture engendered-challenges, which could be better addressed by female AEAs.

- The emphasis by ACIDI/VOCA on the use of local languages, pictures, demonstration sites and free hours of the farmers for training programs worked well as a delivery strategy for the technology transfer as reported by the beneficiaries of the intervention in the study area and across gender as well as maize, rice and soy value chains.
- The introduction of radio broadcast at the instance of ADVANCE to disseminate information on good agronomic practices among the OGs was a brilliant idea, which was working well but the strategy needed to be more gender-driven towards women adoption of technologies.

9.0 Recommendations

- Intensify advocacy and sensitization programs for community leaders and men, especially husbands of women beneficiaries of the intervention, on the need to let women have greater access to and control over productive resources (land, labor and capital) and participate in decision making at the household and community levels. Messaging should include the benefits that the husbands and households in particular and the community as a whole would derive from letting women have access to resources and helping them to adopt appropriate farming technologies for the maize, rice and soy value chains;
- Increase the number of Agricultural Extension Officers (AEAs), especially the female AEAs, not just to reduce the dominance of male AEAs, but rather to let women farmers have access to gender balanced extension services. Female AEAs would be better disposed to attend to the peculiar adoption challenges of the female farmers than male AEAs. ACIDI/VOCA could liaise with Ministry of Agriculture or recruit interns to assist in this direction;
- Given that row planting and fertilizer application were high-yielding agronomic practices but tedious and laborious as reported by both male and female Outgrowers (OGs), ADVANCE should consider more labor and energy saving methods for the farmers. In this regard, the introduction of hand planters and fertilizer applicators as contained in ADVANCE reports, was a healthy development that must be followed through, particularly in the interest of women OGs;
- Provide more credit opportunities for the women farmers to enable them mobilize and access funds to purchase agricultural inputs and/or hire labor to apply the technologies. In this connection, the Village Saving and Loans Associations (VSLAs) that had already been introduced by ADVANCE for the farmers was a worthwhile development, which should be strengthened and sustained;
- Design and implement special gender awareness trainings for actors such as OBs, AEAs, Community Leaders, Farmer-based Organizations (FBOs) to enable them promote the uptake of agricultural technologies by the women. If such gender sensitization programs were already in place, then they needed to be reviewed or evaluated in term of approach, messaging and/or intensity for greater impact;
- Provide more opportunities for timely access to tools and inputs such as tractors, fertilizers, weedicides, insecticides, spraying machines, combine harvesters, threshers, shellers and tarpaulins for timely land preparation, harvesting and post-harvest activities by the farmers, paying special attention to women who had not been applying the technologies
- Identify women who had been successful (role models) or had reaped the benefits of applying the technologies to tell their success stories to other women, especially those who were not applying the technologies in order to encourage them to apply. This could be done during training sessions and radio broadcast sessions or any other appropriate platform created for such purpose;

- Organize more tailor-made trainings on good agronomic practices with special emphasis on technology uptake for female farmers, targeting particularly those who have not been applying the technologies and/or have been applying but not to the expected extent or level;
- Institute incentive packages for OBs and AEAs for advancing the cause of ADVANCE regarding gender mainstreaming in the ACIDI/VOCA maize, rice and soy value chain intervention, particularly in dealings with the OGs, and put measures in place to discourage activities of some actors (OB and AEAs), which were at variance with the gender strategy of ADVANCE. For instance, OBs and AEAs who ensured that, all their female OG adopted appropriate technologies they were taught during the trainings as expected of them, should be rewarded

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