UNIVERSITY FOR DEVELOPMENT STUDIES

AN EVALUATION OF JAPAN INTERNATIONAL COOPERATION AGENCY TRAINING ON SUSTAINABLE RAIN-FED LOWLAND RICE PRODUCTION TECHNOLOGY ON FARMERS' LIVELIHOOD IN NORTHERN REGION, GHANA

ADAMS ISSAHAKU

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BY

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THESIS SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL EXTENSION, RURAL DEVELOPMENT AND GENDER STUDIES, FACULTY OF AGRIBUSINESS AND APPLIED ECONOMICS, UNIVERSITY FOR DEVELOPMENT STUDIES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF DOCTOR OF PHILOSOPHY IN INNOVATION COMMUNICATION

MARCH 2020

DECLARATION

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

Signature: …… Date: ……..

Adams Issahaku

SUPERVISORS' CERTIFICATION

We hereby certify that the preparation of this thesis was supervised in accordance with the guidelines on supervision of theses laid down by the University for Development Studies.

Principal Supervisor: Prof. Francis K. Obeng

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ABSTRACT

Japan International Cooperation Agency (JICA) in collaboration with the Ministry of Agriculture through its Human Resource Management programme and training initiative has been conducting training for rice farmers for many years in the selected areas: Tamale Metro, West Mamprusi Municipality and East Gonja Municipality for sustainable rain-fed lowland rice production to help double rice yield. The study, therefore evaluated the worthiness and the robustness of this training with a view to ascertain the effect on rice yield, socio-economic benefits and the livelihood of farmers. Descriptive survey was used, 257 farmers out of 880 were sampled purposively and proportionately with a 5-point rating scale questionnaire for data collection. This was complemented with oral interviews on some AEAs. Land development, rice cultivation, acquisition of knowledge and skill and farmers' livelihood were the key thematic variables. The results showed that training on land development and rice cultivation all recorded positive significant correlation with increase in rice yield. There is a significant difference between rice yield before and the yield after the training with a t-value of -34.208 and p-value of .000. The increase in rice yield after the training positively affected farmers' socio-economic benefits and their livelihood assets acquisition. Farming being labour intensive and acquiring tractors and their services were major constraints. JICA's interventions and initiatives are in the right direction and a good means of promoting rice production in Ghana and should be adopted and regularised as rice production method in similar rice production environments in Ghana. Governments and other development partners should provide tractors and other incentives to rice farmers in order that Ghana becomes a net exporter of rice in the sub-region and beyond for revenue mobilisation.

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My final acknowledgement goes to the research assistants who helped in the data gathering process and all faculty members of the Department of Agricultural Extension, Rural Development and Gender Studies for their immense contribution in guiding me through this period.

DEDICATION

This work is dedicated to my Late Mum, wives, children, my brother and sisters.

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AAGDS	-	Accelerated Agriculture Growth and Development Strategy
AEAs	-	Agriculture Extension Agents
CARD	-	Coalition for Africa Rice Development
CGD	-	Centre for Global Development
CGIAR	-	Consultative Group on International Agricultural Research
CIPD	-	Chartered Institute of Personnel Development
CIRAD	-	French Agricultural Research Centre for International Development
FAO	-	Food and Agriculture Organisation
FAPIM	-	Farmers' Participation in Irrigation Management
FASDEP	-	Food and Agriculture Sector Development Policy
GFSR	-	Global Food Security Response
GIDA	-	Ghana Irrigation Development Authority
GNRDS	-	Ghana National Rice Development Strategy
GPRS	-	Ghana Poverty Reduction Strategy
HRBV	-	Human Resource Based View
IDC	-	Irrigation Development Centre
ISSER	-	Institute of Statistical, Social and Economic Research.
JBIC	-	Japan Bank for International Cooperation
JICA	-	Japan International Corporation Agency
MCA	-	Millennium Challenge Account
MiDA	-	Millennium Development Authority

MoFA	-	Ministry of Food and Agriculture
MTADP	-	Medium Term Agricultural Development Programme
NGOs	-	Non Governmental Organisations
NRDS	-	National Rice Development Strategy
SSA	-	sub-Saharan Africa
SSIAPP	-	Small-Scale Irrigated Agriculture Promotion Project
SSIAPP-FU	-	Small-Scale Irrigated Agriculture Promotion Project Follow-up
TNA	-	Training Needs Assessment
WHO	-	World Health Organisation

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

In the developing world, rice is a very important food crop produced especially in sub-Saharan Africa (SSA), and its consumption has increased about three times from 9.2mt to 31.5mt since 1990 to date (Tsujimoto, Rakotoson, Tanaka & Saito, 2019; USDA, 2018). All over the World, over 3.5 billion people consume rice as their major food item deriving more than 20% of their calories need daily (CARI 2017; Demont & Stein, 2013). Rice serves as a main food consumed by about 2.7 billion people in Asia, and it provides between 20% and 35% of the calories they consume (CARI 2017, Kadiri, *et al.*, 2014). Asia is mostly noted for rice production, accounting for about 93% output and about 90% of rice area cultivated.

Rice farming is seen as a major occupation and serves as source of generating income worldwide for billions of farmers and households (Kadiri *et al*, 2014). Many countries in Asia and Africa depend highly on rice cultivation as a source of income, earning foreign exchange and as a major tax revenue to governments (AfricaRice, 2011). Kadiri *et al* (2014) indicated that rice is the second largest produced cereal in the world which is ranked next to wheat production. The consumption of rice as a major food stuff transcends religion, culture, regional, national, ethnicity and even international boundaries which comes with very high demand. Interestingly, countries that produce rice in larger quantity are equally noted as higher consumers.

Rice has always been a staple food for some countries in Africa and is now the most rapidly growing food source across the continent (Tsujimoto *et al*, 2019; USDA, 2018). The rate of urbanisation in Africa is greater than any other region in the world, and this means a shift towards convenience food like rice (Tsujimoto *et al*, 2019; van Oort *et al*., 2015; Tiamiyu, *et al*., 2015; African Rice Centre, 2011). However, the production of rice in Africa falls short of quantity needed for domestic consumption and this has necessitated the need for increased importation of rice which is a drain on foreign exchange potential for African countries in general and Ghana in particular.

van Oort *et al.*, (2015); Balasubramanian, Sie, Hijmans and Otsuka (2007) and Africa Rice Center (2011), in their studies observed that the demand for rice for consumption in sub-Saharan Africa (SSA) is more than twice the population growth rate and the consumption of rice is growing faster than actual production. Tsujimoto *et al.*, (2019); van Oort, and Zwart (2018) and Balasubramanian *et al*, (2007) and Africa Rice Center (2008) argued that throughout Africa, local production of rice has failed to match up with the rate of demand. USDA (2018); Nwanze, Mohapatra, Kormawa, Shellemiah and Bruce-Oliver (2006), opined that rice production in sub-Saharan Africa (SSA) has quadrupled, between 1961 and 2003, from about 3 metric tons to about 13 metric tons, and this increase is attributed to the increase in rice cultivation. This is an indication that in most African countries where rice is cultivated, farmers do not practice rice intensification. Ironically, this tremendous increase in SSA's rice production effort failed to provide the needed quantity of rice to solve this rice deficiency problem (Tiamiyu *et al.*, (2015). Nwanze *et al* (2006) in their study indicated that in most African countries, the

availability and prices of rice have become a main yardstick in the measurement of the welfare of the poorest segments of rice consuming citizens who are considered least in food security. Rice is therefore on the front line in the fight against hunger and poverty in SSA (Otsuka, 2019) and Azumah and Zakaria (2019) stated that rice is considered one of food security crops.

In Ghana and for that matter Northern Region, cereals of particular interest for consumption are maize, rice, millet and sorghum. Rice has recently become a major food crop mostly cultivated and consumed by majority of farmers in the Northern Region and the nation at large. As the second important staple food in Ghana after maize (Azumah & Zakariah (2019), its consumption is increasing at an increasing rate due to rapid population growth, urbanisation, improvement in income levels of most Ghanaians (urban and rural) and a change in consumer habits (Tsujimoto *et al.*, 2019; van Oort ***et al***., 2015; MoFA/JICA 2008; Balasubramanian ***et al***, 2007). Rice as being cultivated in Ghana, is seen and treated as a staple food and a cash crop. As a cash crop, rice is explicitly different from traditional cash crops such as cocoa and coffee. This difference stems from the fact that rice can be consumed at home with little value addition.

NRDS (2009) observed that between 1996 and 2005, paddy production in Ghana ranged between 200,000 and 280,000 tons (130,000 to 182,000 tons of milled rice) with huge fluctuations year by year. The yearly variations in rice production figures were largely attributed to the area cultivated in hectares rather than yield variations, but the quantity of rice consumed in 2005 stood at about 500,000tons (JICA, 2007). Many countries in sub-

Saharan Africa and Ghana rely so much on the importation of rice to supplement its low production to keep pace with high consumption. Averagely, yearly rate of rice importation is about 400,000 tons (Tsujimoto *et al*, 2019; USDA 2018 and CARI 2017).

MAFAP (2013) in its report submitted that from 2005 to 2010, Ghana imported rice from several countries; about 36% was from Thailand, 30% from Vietnam and 22% from USA, with the rest coming from Pakistan, India, Togo, UAE, La Cote d'Ivoire and Uruguay. Global Food Security Response (GFSR) (2009) in a corroborative report indicated that rice is the highest cereal imported into Ghana and this constitutes about 58% of total cereals imports. Table 1.1 shows the total imports of rice into Ghana from 2010 to 2017.

(https://www.indexmundi.com/agriculture/?country=gh&commodity=milled-ice&graph=imports). There has been a consistent rise in the quantity of rice being imported into Ghana and this situation does not help the local rice farmers as well as the government in managing the economic indicators.

Table 1.1: The volume of rice importation into Ghana between 2010 and 2017

YEAR	IMPORT VOLUME (1,000MT)	GROWTH RATE
2010	580	-
2011	605	4.31%
2012	665	9.92%
2013	530	-20.30%
2014	585	10.38%
2015	610	4.27%
2016	590	-3.28%
2017	600	1.69%

Source: USDA (2017), https://www.indexmundi.com/agriculture/?country=gh&commodity=milled-rice&graph=imports Access, 10-Mar-18

From Table 1.1, suffice to say that all stakeholders (government, MoFA, NGOs in the agriculture sector, AEAs, farmers, universities and agriculture related institutions) should come together to design a novel rice production plan. A good domestic plan would ensure high quantity and quality rice production to sustain both food security and exportation to earn foreign exchange that can help grow the Ghanaian economy. Rice is very important in Ghana such that there have been policy interventions as captured in MTADP (1991-2000); AAGDS (1996); GPRS I (2003 – 2005) and II; FASDEP I (2002); FASDEP II (2007), and GNRDS (2009). Ministry of Food and Agriculture policy

documents all geared towards reducing the importation of rice and to increase production levels to ensure food security and import substitution.

Private sector organisations, local and international NGOs have joined the crusade to ensure that Ghana is able to produce sufficient rice to feed the over 29 million Ghanaians (www.statsghana.gov.gh) and if possible becomes a net exporter of rice. Therefore, effort to increase rice production in Ghana should be a major goal driving agricultural policy objectives of current and successive governments in the country. Suffice it to say that the achievement of this goal is dependent on knowledge of best agricultural practices which is disseminated through training via agricultural extension workers, hence the need for the improvement of farmers knowledge on best agronomic practices with particular reference to rice production in Ghana.

Agyei-Holme, Ayerakwa, Osei and Osei-Akoto (2011) in their study argued that all facets of life in the world as a whole revolve around knowledge and which is acquired through training, education and learning. This knowledge is spread through information in the form of advice and technology. This cannot be seen differently in the agriculture sector in Ghana. Knowledge base of agricultural systems in Ghana has traditionally been informed by those acquired from parents and other family members. Education and training provokes increased capacity of staff, boost confidence and the willingness to transform, to pursue and accept innovative technologies and best-practice management techniques, and to empower workers to manage and accept risk. It is common knowledge

that farmers who participate in training are more productive and profitable than those who are not trained. There is also the situation where extension agents transfer knowledge to farmers with the aim of linking agricultural systems with technologies developed by agricultural research institutions.

Farmers who engage in rice production in Ghana need to have the requisite knowledge about improved farming techniques to help increase their yields thereby leading to an improvement in livelihoods. JICA through MoFA in corroborative and collaboration made moves to improve rice production in Ghana to guarantee food security through rice for consumption and export.

1.2 Japan International Cooperation Agency (JICA)

JICA was established in 1974 and since then, the Agency (JICA) has helped in providing different forms of technical assistance to over 150 countries including Ghana. (https://www.jica.go.jp/english/ir/financial/c8h0vm0000aypxs7-att/articles_120405.pdf). However, some of JICA's role has changed with time. Its activities have become more field oriented and it is functioning more intimately with partner governments, international donor organisations, private establishments and, above all, local people and communities, by providing them with greater hope for the future. JICA provides technical assistance and financial support in the form of loans and grants in a consistent fashion, covering areas ranging from infrastructural development to grassroots agro based projects (http://www.ecdc.net.cn/escap/jicaprofile2010_01.pdf). JICA relationship with

Ghana is in six major sectors following Ghana's development policy infrastructure, agriculture, health, education, private and governance sectors. (http://www.jica.go.jp/ghana/english/office/others/c8h0vm000001qn3v-att/brochure01.pdf.)

In the agricultural sector, JICA support for rice production in Ghana dates back to 1988 and it has through partnership, executed several technical cooperation with the Ghana Irrigation Development Authority (GIDA), by establishing Irrigation Development Centre (IDC) (1988-1992), implemented a small project aimed at enhancing the institutional capacity of IDC (1992-1995) and implemented a Small-Scale Irrigated Agriculture Promotion Project (SSIAPP) (1997-2001) and its follow-up project (SSIAPP-FU) (2002-2004) geared at improving farming systems in Ashaiman and Okyereko irrigation schemes and strengthening GIDA's human resource capacity for dissemination into other 20 irrigation schemes. These activities have not only improved GIDA's capacity, but have also accelerated farming technologies of small-scale farmers in existing GIDA irrigation schemes through the comprehensive trainings during JICA's cooperation period.

1.2.1 Project for promotion of Farmers' Participation in Irrigation Management (FAPIM)

The first major rice development project JICA implemented in Ghana was the Project for Promotion of Farmers' Participation in Irrigation Management (FAPIM) implemented for a period of two years from October 2004 to September, 2006 with Ghana Irrigation

Development Authority (GIDA) as implementing agency. https://www.jica.go.jp/english/our_work/evaluation/tech_and_grant/project/term/africa/c8h0vm000001rp75-att/gha_01.pdf. The project's purpose was to fashion out an understanding on irrigation management between GIDA and farmers' cooperatives, with the overall goals of: (1) increasing income per farmer from irrigated agriculture and (2) ensuring farmers' participation in irrigation management in Ghana.

1.2.2 The study on the promotion of domestic rice in the Republic of Ghana

The study had two objectives: (1) preparation of policy recommendations and an action plan to advance rice production including post-harvest and marketing management through improving the quality and competitiveness of rice produced in Ghana and (2) the transfer of technology to the Ghanaian counterpart personnel using on-the-job training methods. The study designed a master plan and an action plan for implementation.

The objectives of the master plan were to: 1) promote sustainable rice cultivation for increased rice production and poverty reduction 2) encourage quality improvement of local rice to be supplied to anticipated urban markets and 3) improve economic environments to ensure smooth distribution and marketing of local rice (MoFA/JICA, 2008).

This study paved the way for the sustainable rain-fed lowland rice production technology. The results of the study are the recommendations that led to the counterpart funding for

the project for sustainable rain-fed lowland rice production technologies in Northern and Ashanti regions in Ghana.

1.2.3 Project for sustainable development of rain-fed lowland rice production

This **w**as a JICA project with the aim of increasing rice productivity and profitability of rice farmers in three districts in the Northern Region and four districts in Ashanti Region. The project was for a five-year period from 2009 to 2014. The project was engaged in the development of technical package, improvement of farming support systems and establishment of extension procedure for sustainable rain-fed lowland rice development. This project provided training to AEAs and framers in four key areas using workshop in the form of Training of Trainers (ToT) and method demonstration methods. The training covered areas of land development, rice cultivation, farming support system and extension service. The project aimed at increasing rice production, hence the rice cultivation component of the training constitutes the core of the training, covering about 70 percent of the project training (Baba, 2014). Baba (2014) outlined the detailed components as covered in each thematic areas of the training;

i. Land development: this aspect of the project provides knowledge on area measurement, bund construction and good ploughing to AEAs and farmers.

ii. Rice cultivation: which constitutes the major aspect of the training, covered the following activities: good seed selection for planting, proper planting, timely and appropriate fertilizer management, early weed management, effective pest and disease management and seed production.

iii. Extension services: this covered project strategies for technology dissemination.

iv. Farming support system in post-harvest management: it covered harvesting, threshing, storage, milling and marketing of final produce. There were also farm management aspects that helped the farmers to understand farming as a business.

For the purpose of this study, the researcher's focus was on evaluating the project to help determine the effectiveness of the training in achieving intended objectives of the project which includes increase rice yields and other unintended benefits such as socio-economic benefits like livelihood assets acquired by farmers and change in status that can be associated directly to the training project primary objectives.

For this reason, attention was on the first two key thematic areas – land development and rice cultivation, hence this research did not investigate the effect of the farming support system and extension services on the farmers. The reason for limiting the study to these two key aspects was that, these areas contribute directly to meeting the project intended objectives. Also, this decision was premised on the time limitation for the study. This is an academic exercise and required to be completed within a certain time frame and the lack of funding to enable the researcher to broaden the scope since this would have a huge financial implication on the study.

The sustainable development of rain-fed lowland rice production training was jointly funded by the Japanese Government through JICA and the Government of Ghana through MoFA. It was a five-year project with an ultimate aim of facilitating improvement in productivity and profitability of rice farmers in rain-fed lowlands rice in selected districts in two regions in Ghana, namely, Northern and Ashanti regions. The project covered over 2,100 beneficiaries including farmers, rice processors and marketers. The purpose was to disseminate the model for sustainable rain-fed lowland rice production techniques to all farmers within the selected areas, to all farmers in the four regions and if possible, to all farmers in Ghana. The expected outputs were the development of technical package of improved rain-fed lowland rice production, verification of methodology to advance farming support systems for sustainable rain-fed lowland rice production and development of a dissemination plan for sustainable rain-fed low land rice, comprising technical package and farming support system (Zakaria, Ansah, Abdulai, & Donkoh, 2016; MoFA/JICA 2014; Baba, 2014 and Mumuni & Oladele, 2012).

The site selection criteria for the project were based on two main considerations: biophysics and socio-economics. These factors were considered in all districts in the Northern Region and finally, Tamale Metropolis, and the then West Mamprusi and East Gonja Districts, now Municipalities were selected for the project (MoFA/JICA TENSUI RICE 2012). Biophysics factors that were considered relevant were: (1) the valleys should be flooded for more than 2 months, (2) soil should have a fine texture, (3) the possibility of constructing bunds, (4) low weed density, (5) no destructive rodent and birds and (6) area should be more than 20 hectares. The criteria for the selection of the

areas based on biophysics is a move to select District/Municipalities where the existing farmlands and their properties highly support rice cultivation.

Socio-economics factors that were considered before the selection of the areas where the training could be implemented were: (1) there should exist highly motivated farmers, (2) no land conflict, (3) lack of sacred places, (4) land to be cultivated should be within 5 km radius from a village, (5) available access roads and (6) existence of traditional rice farmers.

The socio-economic factors considered also created a picture that the project was aware that existing traditional rice farmers already possess rice cultivation knowledge either from other rice training projects or experience gained from previous years of rice farming and that previous knowledge in rice cultivation could be helpful to the project and its objectives.

These biophysics and socio-economic factors as prerequisite requirement for the selection on the municipalities where the training took place was to be assured that the farmers would embrace the training since they are aware of the benefits of rice farming.

1.3 Statement of the Problem

Training is necessary whenever there is a gap in knowledge, skills and attitudes. When workers lack interpersonal, conceptual, technical, social, and organisational skills, management can organise training programmes which are directed toward addressing

these problems. In this vein, many training programmes have been carried out by MoFA for AEAs and farmers in the Northern Region aimed at building the capacities of AEAs and farmers for improved performance in rice production in particular and ensuring food security in general. Training, education and learning can be a direct way of improving productivity and food security in the Agriculture sector in Ghana. Training undeniably can contribute to agricultural development and increase yield, though with some doubts over its effectiveness and efficiency. In as much as training is necessary, its evaluation is very important. Executing a training programme without evaluation can be conceived as an investment which its viability cannot be confirmed. The researcher believed that when a project is evaluated and its benefits are made known, that could provide good justification for its extension and replication in other areas. The relationship between a project and its intended purpose, whether positive or negative, is known only when evaluation is carried out. It is established in literature that there is a positive connection between farmer training and farmer output, productivity and greater financial earnings (Gondwe *et al.*, (2019); Davis *et al.*, (2012); Oyebanji (1997); Benin and Pender (2001); and Marlaine, Dean & Lawrence (1987).

Ousman (2007) in his review of reports on training and discussions of issues bothering on training of AEAs and farmers indicated dissatisfaction with what he discovered. Ousman (2007) opined that there are inadequacies in the ways training for AEAs and rice farmers are designed, implemented, monitored, and evaluated in the past. FAO (1995), stressed that performance evaluation after a training project should be one of top priority to the trainers, managers organising the training and the policy makers who hold typical interest

in the training project. These opinions about the importance of evaluation informed the researcher's decision to evaluate the JICA rain-fed lowland rice production training technology which was carried out in three districts in the Northern region.

JICA's 'training on sustainable development of rain-fed lowland rice production' was designed to provide training to rice farmers to help increase rice yield and profitability of rice farmers in the Northern and Ashanti regions in Ghana. Despite the effort and investment in this project, the empirical achievements of increase in rice yield throughout all the selected areas in the Northern, Savana and North-east Regions remain uncertain since the project has not been comprehensively evaluated (Zakariah *et al*. (2016) and Mumuni & Oladele (2012). Empirical evaluation of a training programme would help indicate which part of the programme was ineffective and needed to be either modified, changed or be discarded. The emphasis is that if evaluation results indicate that the training programme proves very effective in serving the participants well, it may be replicated in other parts of the region and the country. The relevance and functionality of agricultural training can be determined when it is evaluated, hence, the decision to evaluate JICA rain-fed lowland rice production training project to ascertain whether the training project intended objectives were achieved.

Comprehensive evaluation on the yield across all districts, effects on livelihood of farmers and socio-economic benefits derived by farmers from the JICA training on sustainable rain-fed lowland rice production technology in the Northern sector has not been carried out, except the terminal report by JICA.

However, Mumuni and Oladele (2012) conducted a limited evaluation of the project with particular reference to factors influencing the adoption of rain-fed lowland rice production technology and their effect on high output of rice farmers in the Sagnarigu Municipality in the Northern Region of Ghana. They indicated that since the introduction of the project for sustainable rain-fed lowland rice production technologies to farmers in the Northern and Ashanti regions, there has not been any study to evaluate the extent of adoption and the effects on output as the justification for their study.

Reasons for Mumuni and Oladele's study was to examine how funding has affected the operations of the project, identify and describe the challenges faced by the project, analyse the positive impact of the project on farmers/beneficiaries in the project area, and adoption levels of the beneficiaries of the project. The results from their study were that adoption rate during the first phase for rice cultivation activities and land development led to increase in farmers yield to an average of 2.9ton/ha in the Northern Region. Their study focused on only the first phase of the project. Concentration was on the primary objectives of the project, that is, increase rice production and profitability of rice farmers. Their findings even though comprehensive and detailed, it did not provide a complete picture of the project achievements because it evaluated the achievements of the first three years of the project and they did not consider any unintended benefits.

Zakariah, Ansah, Abdulai and Donkor (2016) in a corroborative study also undertook a limited evaluation of the JICA rain-fed lowland rice production project to establish the extent of adoption and the effects on output in the Sagnarigu municipality. Zakariah *et al* (2016) indicated that since the introduction of the technologies, there has not been any study to evaluate the extent of adoption and the effects on output to the best of their knowledge despite the fact that Mumuni and Oladele (2012) evaluated the project after its first phase, hence they undertook the study to investigate the factors that influenced the adoption of the JICA training on rice production technologies and its effect on rice output in Sagnarigu Municipality of Northern Region of Ghana. The results of their study revealed that; membership of farmers' association and fertilizer subsidy positively and significantly influenced adoption of the rice production technology whereas farm size, access to agricultural extension, use of other improved seed and household size negatively affected adoption of the rice production technology and the adoption of the technology led to significant improvement of rice output.

Zakariah *et al*'s study was carried out after the completion of the project. However, their study was limited to only Sagnarigu Municipality which is problematic for generalisation because of the coverage. Their study was comprehensive but since it was limited to only one district in the Northern Region, this researcher is of the opinion that further study to cover all the districts will be more revealing. Zakariah *et al* in their study did not also consider unintended benefits such as livelihood assets acquisition as a result of increase in yield, socio-economic benefits and status change of farmers.

In January 2014, a joint terminal evaluation of the project was carried out which showed the accomplishment level of the project as followed;

1. The project purpose of dissemination of the "model for sustainable development of rain-fed lowland rice production was accelerated within the areas,
2. Technical package of improved rain-fed lowland rice production practices was developed.
3. The methodology to improve farming support systems for sustainable rain-fed lowland rice production was verified, and
4. Extension procedure for sustainable rain-fed lowland rice development was established.

The terminal report was signed on 28th January 2014 between MoFA and JICA. The terminal report indicated that the project led to increase income to many farmers in the project. It indicated that there is clear difference between the project farmers and non-project farmers. The terminal report revealed that the project farmers are now able to spend more money on their children education, purchase motorbikes, built and/or renovated houses with corrugated sheets, and improved household food security. Some groups started saving to buy tractor, the success stories of the project have been disseminated in surrounding communities leading to non-project farmers now applying the project technology, the project led to community level cohesiveness and unity due to their group activities and no negative impact was identified by the terminal report. From the analysis of the three separate evaluation reports, all were focused on adoption rate and increase in yield. They all stayed within the project intended benefits.

Since most training project produces unintended benefits to the trainees, it would be appropriate for a study that would make effort to find out if the project produced any unintended benefits such as status change of farmers, socio-economic benefits and change to their livelihood assets. This study would therefore, in addition to evaluating the effect of the project on rice yield, explore any unintended benefits to the project farmers.

The thrust in this research was on socio-economic benefits with interest on change in status of farmers and the contribution of project to livelihood assets acquisition by the farmers. Emphasis was also given to the project objectives, however, attention was dwelled on certain specific aspects of the training as they contribute to meeting the project objectives. The above stated evaluation reports assessed the project generally, but this research would assess the various components of the two key thematic areas of the training regarding the usefulness of the training, farmers capabilities built, the project contribution to yield per hectare, and relationship between the key areas of the training and rice yield.

Critical questions that are of interest and need answers include; was the training useful to the farmers, how was the training perceived in terms of its contribution to the capabilities of the farmers and did farmers experienced increase in yield per hectare? Unintended benefits even though not part of the project objectives, the researcher intend to ascertain if benefits such as socio-economic and livelihood related benefits were accrued to the farmers as a result of increase yield through the training. Hence, this study was

conducted to evaluate the effects of the training project on farmers' livelihood, socio-economic benefits and status changes resulting from the training. This researcher intends to evaluate the training project in all three selected areas in the Northern, Savana and North-east Regions in Northern Ghana where the training was carried out.

1.4 Research Questions

The main research question for the study is: what are the effects of the training aspect of JICA project on sustainable rain-fed lowland rice production technology on the farmers' livelihood assets and socio-economic status in three Regions in Northern Ghana?

This researcher sought answers to the following specific questions to help address the main research question;

1. What is the usefulness of the training to the rice farmers in the selected areas?
2. What are the perceived capabilities gained by rice farmers' after the training in the selected areas?
3. To what extent has the training contributed to increase in rice yield (per hectare) of farmers in the selected areas?
4. Is there any correlation between the training components of the project (land development and rice cultivation) with increase rice yield in the selected areas?
5. In which way(s) did the increase in rice yield contribute to the change in the socio-economic status and livelihood of farmers after adopting the JICA methods of rice cultivation in the selected areas?
6. What were the constraints encountered by farmers during the implementation of the training programme in the selected areas?

1.5 Objective of the Study

1.5.1 Main objective

The main objective of this study was to determine the effects of the JICA training project on sustainable rain-fed lowland rice production technology on the rice farmers' livelihood assets and socio-economic status after the training in three Regions in Northern Ghana.

1.5.2 Specific objectives

The specific objectives of this study are to:

1. Determine the usefulness of the training to the rice farmers in the selected districts.
2. Examine the perceived capabilities gained by rice farmers' after the training in the selected areas.
3. Ascertain the extent to which the training has contributed to increase in rice yield (per hectare) of farmers in the selected areas.
4. Assess the correlation between the components (land development and rice cultivation) of the training project on rice yield in the selected areas.
5. Determine the effects of increase in rice yield on the socio-economic status and livelihood of farmers in the selected areas.
6. Examine the constraints faced by farmers during implementation of the training technology in the selected areas.

1.6 Significance of the Study

Most researches are designed to identify gaps in knowledge and to find solutions to such knowledge gaps and this study is no exception. Much research has been carried out to find the effects of training projects on productivity. However, little findings exist on the effect of training projects on farmers' socio-economic benefits and livelihood assets acquisition influenced by training in the Northern Region of Ghana.

The primary targets of this research are the rice farmers in the three selected Municipalities in the Northern, Savana and North-east Regions, who received training from JICA on knowledge and technology designed to increase rice production in lowland areas. The findings would help JICA to smoothen any rough edges that may be identified concerning implementation for future replication or should there be a second phase.

The findings would also help agriculture policy makers to design similar training projects that can help further increase rice production and other related cereals in Ghana. The results of the study would also allow the AEAs to determine how the training has benefitted the farmers and the role they played. It would go a long way to support the spread of the technology since the AEAs would get to know areas that worked and areas that need improvement.

This study would inform farmers of their efforts, and how the project truly contributed to the yield increase in rice. The effects of the project on their livelihood assets

improvement would also be communicated to farmers to serve as motivation and reinforcement to them. In concluding, this would contribute to existing knowledge which would serve a useful purpose for academia and students. The results of the study would deepen literature on the correlation between increase in rice yield and farmers' socio-economic benefits, farmers' status chance and how increase farmers' rice yield can influence increase in livelihood assets of farmers. It would also add to the evaluation reports on the JICA rain-fed lowland rice production technology in the Northern Region.

1.7 Limitations of the Study

Like any academic research, the researcher was confronted with certain limitations in the process of carrying out this study. Time was one major limitation faced by the researcher. This research had defined time regarding its completion. As an academic activity, the researcher was given a finite time to complete the work, and this constituted a limitation.

Funding to get the research carry out was another limitation. The researcher consciously solicited funding from his employer, family members, friends and well-wishers to ensure the timely and adequate execution of this research.

Another major limitation was response rate. Majority of the respondents had little or no formal education. Getting them to respond sincerely and accurately to questionnaire was difficult and time consuming. It is not uncommon that getting respondents to complete

the questionnaire sometimes takes two to three days. To help minimise these problems, the researcher collaborated with the initiating agency (JICA), AEAs, opinion leaders in the communities and leaders of farmer groups for the purpose of building respondents' confidence and acceptance.

With tact and diplomacy, the researcher with the help of five researcher assistants, JICA officers and AEAs in charge of the various operational areas, adequate and accurate data were collected and this research was made a success.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction

This chapter is devoted to related literature in line with this study in general. Of interest are the concepts on training and training evaluation. The researcher through this chapter reviewed relevant related literature, works of other authors, in relation to training, evaluation and its processes, types and appropriate models used in evaluating training.

2.1 The Concept of Training

The constant need for organisational and individual development in knowledge, skills and ability can be explained by the numerous demands placed on organisations, including retaining their superior position on the market, enhancing employee job performance knowledge and skills, and enhancing productivity. One universal method to be considered as a means of increasing the productivity of organisations and individuals and to help in communicating organisational objectives to newly recruited personnel is training. Training can be said to be a personal and individual or group value addition process. Training can aid an individual to add value to him/herself. To Rahman, Khatun, Rahman and Haque (2018) training is a process of acquisition of new skills, attitude and knowledge in preparing for entry into a new vocation or enhancing one's productivity in an organisation. Rahman *et al*, (2018) further observed that training does not connote knowing more but behaving differently and training of farmers essentially contributes to human resource development in agriculture. In much the same way, training has the potential of facilitating value addition to groups or team members. This value addition

focus of training inspires the thinking that training can be a process, an act or activity, a system or a practice, thus, training is defined variously.

Training is seen as a systematic process of acquiring knowledge, skills and attitudes that collectively lend credence to enhancing performance in some specific environments. Training is acquisition of the best way of utilizing knowledge and skill (Rahman *et al.* 2018; Salas *et al*., 2006) and training encapsulate practices and processes that employees need to know with particular reference to what is expected of them, what they really need to do and what feeling to experience which would lead to successful performance of their tasks. Tsado *et al*. (2014) and Maund (2001) discovered that when employees in an organisation are comprehensively trained, it becomes a vital component to help gain and maintain competitiveness on local and the international arena, but training must place the organisation competitively on the local market before thought can be conceived of going international. Kshash (2016) and Yüksel (2000) posit from an organisations' perspective that, training involves management targets and aspirations which is aimed at increasing the commercial viability and successful performance towards achieving effectiveness and productivity while Gina & Madsen (2013) in a corroborative study assert that, it is generally assumed that agricultural education and training has majorly creates the capacity of farmers and is a supplier of the human resources necessary to increase agricultural productivity and sustainability of farming systems. In the words of Mwesigwa (2010), training is recognised significantly as a vital means of socialisation mostly between employees from different parts of the organisation.

Training can play a critical role in maintaining and developing capabilities of individuals and organisations and contributes to organisational change process and can help improve the retention capacity of qualified employees. Training according Pandey *et al*'s (2015) argument and Barker, as cited in Mwesigwa (2010) can lead to changes in people social skills and help improve the achievement of goals of the organisation and it is an integral part of any development activity (Rahman *et al.* 2018). Training can help improve employee co-existence behaviours which in turn reduce misunderstanding and fruitless struggling among staff. Training can engender improved communication within the organisation, build trust and respect for others, encourage proactive and initiatives, help build interpersonal skills of employees, enhances employees' confidence and self-responsibility and reduces inferiority complex behaviours among employees (Rahman *et al.* 2018; Pandey *et al*., 2015; Barker 1980).

Practically, changes that emanate as a results of political pressures, technological and process changes, socio-demographic and cultural issues, economic and business downturn and competitions create the need for business to train their staff. All these combined have compelled many organisations to put emphasis on developing their human capital in general and in line with their corporate objectives (Rahman *et al.* 2018 and Thayer 1997). In similar vein, the shift for consumption of convenience food like rice has placed heavy demand on rice. This calls for improvement in rice farming technology to help increase rice yield to match up with the demand hence, training of rice farmers in necessary especially in Ghana.

For organisations to sustain their competitiveness on their local and international arena, learning at the workplace and continuous improvement must be emphasised and encouraged (London & Moore, 1999). Additionally, organisations must change their perspectives about training from a stand-alone activity to that of a well-integrated activity capable of partnering the strategy of the organisation. The implication is that no organisation could achieve its set objectives without training.

Salas *et al*., (2006) argued that training has become a major concern and most organisations now rely on learning strategies that take advantage of training technologies to develop and prepare their employees. Improve skills of rice growers in managing their farms is through training, which is aimed at providing them with the necessary skills (Kshash 2016), while Rahman (2018) opined that training of farmers fundamentally contributes to human resource development in agriculture. As farming processes and procedures change, there is the call on farmers to increasingly develop wide range and adjustable skills that are considered crucial to the success of managing farm work. Farming jobs are changing as a result of shift in technology, equipment used, rainfall pattern, chemical application requirements and the nature of improved seeds and varieties. However, few farmers possess the requisite skills, cultural competence, and technological proficiency necessary for these changing requirement on the farming especially rice farming (Kshash, 2016; Pandey *et al*., 2015 and Salas & Stagl, 2009).

Training is considered an important means of facilitating increased productivity (Chow, Woodford & Chow, 2008). To Sultana, Irum, Ahmed and Mehmood (2012), any time training is necessary, it could be for the purpose of ensuring adequate supply of human resources who can be seen as technically and socially competent for the general interest of a particular vocation. Training is key in generating benefits for the farmers in particular and the communities and the nation in general. When rice farmers are trained, there is the belief that their performance on the rice farms would be influenced positively.

Training, when offered to farmers, has the tendency of helping minimise frustrations and anxiety, reduce pressure emanating from demands on the farmers energy. Training has been an important contributor to increasing rice farmers productivity. Many researchers including Rahman (2018); Pandey *et al.*, (2015); Colombo and Stanca (2008) and Oguntimehin (2001) identified the purposes of training to include: increasing productivity, improving the quality of work; improving skills, knowledge, understanding and attitude; enhancing the use of tools and machine; help in reducing waste, accidents, turnover, lateness, absenteeism and other overhead costs, eliminating obsolescence in skills, technologies, methods, products, capital management among other deficiencies associated with work. If well conducted, training brings job incumbents performance to level which meets the expectations as requirements of the job; enhances the understanding and implementation of new farming procedures, practices, and policies, preparing farmers for higher achievements, improving human capital development and guaranteeing the survival and growth of the enterprises.

2.1.1 Importance of training

It is perceived that training mostly helps in developing employees with enduring cognitive and the right behavioural characteristics leading to the acquisition of critical competencies to meet job performance expectations. Higher productivity, improve work quality, increased motivation and commitment, building higher morale and teamwork among employees are end products of effective training. Trained employees will experience fewer errors, culminating in creating a strong competitive advantage for the organisation (Salas *et al*, 2006).

Training help farmers acquire knowledge and skill about principals and practice of crop production, protecting from weeds and field management, seed production, water management, crop diversification, nursery management practice and cropping systems (Rahman *et al*, 2018; Pandey *et al.* 2015 and Sajeev & Singha, 2010).

To Gondwe *et al*, (2017), training is important to farmers because they are able to acquire knowledge on sustainable farming methods, improve agronomic practices, food preservation, processing and utilisation, food storage and improved varieties and nutrient-rich varieties. In their conclusion, they indicated that training of farmers on different agronomic practices can influence crop diversity and productivity and training of farmers aimed at improving crop diversification leads to diet quality of farmers and their household.

To this researcher, training can be seen as deliberate and purpose driven institutional set of activities designed and executed to provide a value addition opportunity for its employees or individuals to whom it has obligation. It is deliberate because the activities must be planned and put together consciously. It is purpose driven in the sense that there is always a targeted result to be achieved after the training, which could help enhance self-worth, improve performance, increase productivity and increase sales or profits. Training of rice farmers if carefully designed and executed should lead to an enhanced and self-motivated farmer.

2.1.2 Training of farmers

Training of farmers involves a planned learning activity for acquisition of information, knowledge and developing abilities, attitudes and behaviours relevant in engendering competences at higher level to guarantee superior performance of a farm work. There are three main agents in training viz; the trainee, trainer and management who sanction the training. At every stage of the training, the active participation of all agents is desirable for a successful training programme.

Generally, it is assumed that agricultural training presents a major role in creating the capacity and supplying the human resources necessary to increase agricultural productivity and sustainability of farming systems (Kshash, 2016; Gina and Madsen, 2013) and it is directed at improving the capacity of trainees to do vocation more effectively and efficiently. In the words of Ansari (2006), training could be used to help

improve rice farmers' skills and to help them manage their rice farms. There is the belief that agricultural training plays a significant role in building farmers' capacity for improved agricultural productivity and help sustain farming systems.

For individual farmers to carry out farming vocation more effectively and efficiently, training is mostly used. To make any training of farmers relevant and effective, the training organisers must importantly identify the needs for the training of the farmers which will influence training module necessary and appropriate to help produce the right yield and profitability (Kshash 2016; Tsado *et al*., 2014 and Chawang & Jha, 2010). It is important also that the training project organisers and all other stakeholders to identify the farmers' training needs which will lead to designing a suitable training module capable of ensuring increase yield.

For training to be successful, training needs assessment is important to understand the skills gap of farmers so as to design appropriate training type and system which would facilitate improvement in knowledge, skills, abilities and expertise of rice farmers and subsequently increase in yield (Rahman, 2018; Kshash, 2016; Benard, *et al*. 2014; Tsado *et al*., 2014; Devarani, 2013; Goli *et al*., 2013; Nahfees, 2013; Alarima *et al*., 2011 and Nath & Chowdhury, 2010). In corroborative studies, these researchers discovered that majority of rice farmers' knowledge needs that training can help address were: land preparation, fertilizer management, bund construction, identifying good plough, seed selection, proper sowing or planting or transplanting, insect and disease management, weed management and timely and proper application of fertilizer.

2.1.3 Effects of training on farmers

Andam, Makhida and Splelman (2019), Rahman *et al*., (2018); Bonan and Pagani, (2017); Oyebanji, (2010) and Benin and Pender, (2001) discovered that training of farmers can lead to the acceptance of improved or new technologies resulting in productivity increase and higher income for farmers. To Rahman *et al* (2018); Tsado, Ojo, and Ajayi (2014) and Alfred (2000), majority of participating farmers who benefited from various training activities enhanced their output and income greatly and significantly, and eventually improved their standard of living. It is important to note that the ultimate aim of all training interventions for farmers is to increase yield and income. Tsado, *et al* (2014) discovered that 99.4% of the rice farmers trained in Nigeria indicated that the training they received led to an increment in rice yield, income and new properties acquired (bicycles, motor cycle, cars). Nakano, Tanaka and Otsuka (2014) found that training leads to effective adoption of improved rice cultivation practices, increase paddy yield, and increase profit of rice cultivation by rice farmers.

Through interactions with the JICA training project farmers in the three selected areas in the Northern Region, it becomes clear that the training made the farmers more complex, courteous and self-aware of their personal hygiene. All farmer groups met revealed a situation where the farmers who were called for a meeting for the administering of the research questionnaire appeared well dressed. The training taught them one thing which they all attest to, neatness in appearance. This is an indication that training of farmers goes beyond what pertains in the farm. It goes to enhance their personal hygiene and

appearance. Training of farmers also makes them conscious of matters relating to their health and wealth.

These are known as cognitive benefits which are not easily quantifiable. When farmers are given training, they become more enlighten on general issues concerning farming. They will mostly learn how to read basic instruction even if their level of education is very low, become more conscious about timing, use right implements, seeds and seedling, herbicides, how to take personal care of themselves and the farm equipment. Farmers who go through training by their outlook are cognitively distinct from non-trained participants.

However, training of farmers comes with certain negative effects which cannot be overlooked. Basically, training makes farmers more complex to handle than before. As they become enlightened, they turn to question every decision and become suspicious of new technologies that they do not have proven records of. For rice farmers, since training leads to increased yield, there is mostly a corresponding reduction in prices on the market (Dibba *et al*., 2015; Asante *et al*., 2014). It is, therefore, common that after training, the increase in yield leads to glut on the market. This is more serious if the training does not come with contract for marketing the produce.

2.1.4 Training process

Training process is a defined and approved system for conducting training programme. It can be considered as a logical and coherent approach in determining people level of

knowledge, what they need to know and what they need to do on specific jobs in specific position within an organisation. It ensures proper conduct of training programme; trainees learn important things; and can be assigned work competently. Armstrong (2003) argued that the process of training comprises all those activities necessary to support the organisation achieve its objectives through training to the benefit of trainees. It is important to state that managers, supervisors and experienced workers from an organisation must collectively play an important role in the planning and implementation of the training process.

Rahman *et al* (2018) asserts that effective training process ensures the creation of a clear picture of how the trainees would need to use and apply information after training in place of what they already know before the training. This researcher belief that training ought to be timely, so inappropriate timing of the entire training and specific training sessions can be a recipe for failure. One most raised problem associated with training, producing complaints from both trainers and trainees is inappropriate timing (Bennett & Leduchowicz, 2007; Tenant *et al.*, 2002). Kirkpatrick and Kirkpatrick (2006) indicated ten factors which can be modelled diagrammatically in a self-renewing cyclical form shown in Figure 2.1.

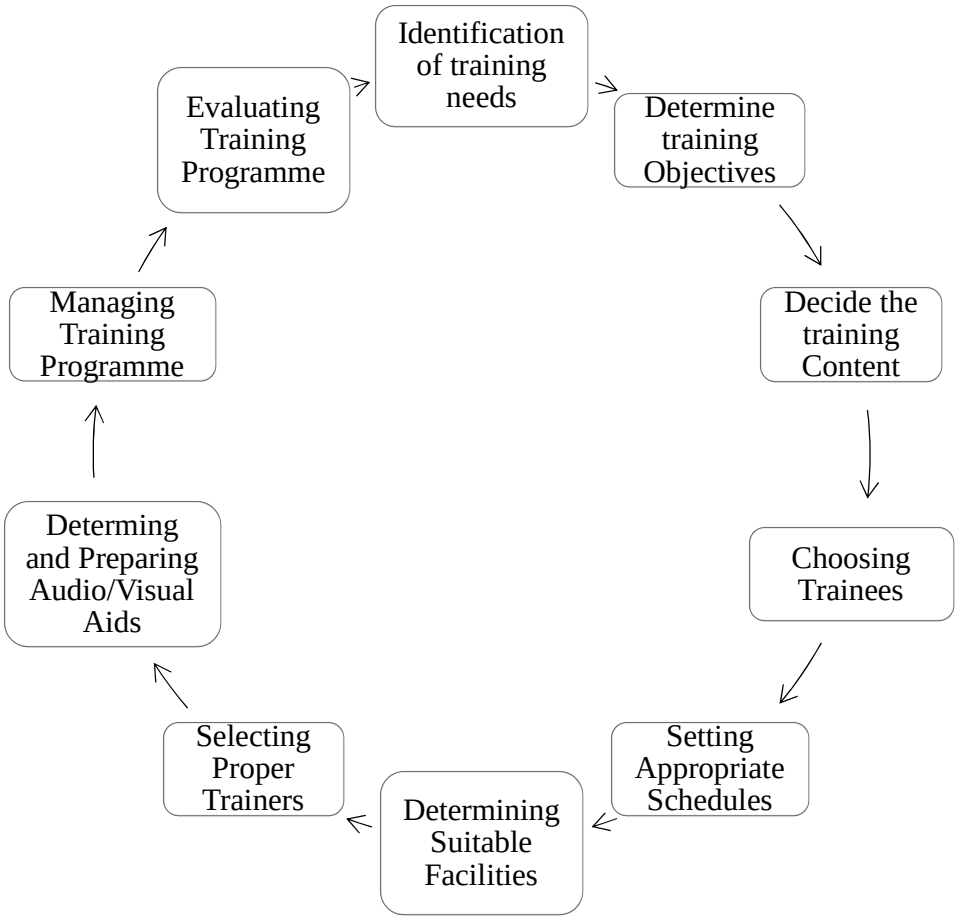


Figure 2.1: Factors to Consider when Planning an Effective Training Course

Source: Adapted from Kirkpatrick and Kirkpatrick (2006).

To get the best results from training, it must be planned and this requires that trainers and trainees of the organisation should therefore prepare in advance. Nassazi (2013) observed that planned training is deliberately designed, aim to achieve knowledge necessary for improving employee performance which consists of the following steps;

i. Identifying and defining who need the training,

ii. Defining the learning required regarding what knowledge and abilities have to be learnt and the behaviours and attitudes that need to change,

iii. Specifying the training objectives,

iv. Planning the training programme to meet the objectives,

v. Deciding who the trainer will be,

vi. Planning for evaluating the training, and

vii. Amending and extending training where necessary.

To Nassazi (2013) and Kirkpatrick and Kirkpatrick (2006), the processes are similar and have the same import except that the first planned process proceeded along ten steps while the latter proceeds along seven steps. The Kirkpatrick and Kirkpatrick (2006) process ended with evaluating the programme, however, further examination revealed that evaluation programme can be amended or extended where necessary based on the evaluation results and recommendations expected.

Training process should be preceded by environmental or situational analysis. The subsequent activities in the process may vary and in no particular order, except what really is in the best interest of the organisers of the training. The researcher believes that situational or environmental assessment as the first step, involves thoroughly examining the environment in which the training would be carried out. Since situations vary from location to location, organisers desiring to train any group of people must know the interest and preference of the trainees.

Rahman *et al*, (2018); Pandey *et al*, (2015); Buckley and Caple (2004); Gomez and Cespedes, (2004); Armstrong (2003); Author *et al*, (2003) and Goldstein and Ford, (2002) indicated that in systematic training process, the choice of who to train is determined based on skills and knowledge shortage that is identified through need assessment. They argued that training need to be appropriate for what is expected by the trainees and the programmes must also be properly organised and be considered as the major responsibility of the training organisers. The definite stages in designing a training should be tracked for the top potential results to be achieved (Carliner, 2003; Charney & Conway, 2005). The researchers argued that for effective design and execution of the training programme, the interest of all stakeholders, spanning from the trainees, their managers, the institution, trainers and possible clients likely to benefit from the training either directly or indirectly should be considered. However, the current state of the trainees should be a priority in determining the training programme.

2.1.5 Training needs identification

For training programmes to be effective and meet set training objectives, they must satisfy the needs of personnel to be trained (Rahman *et al*, 2018; Pandey *et al*., 2015; Kirkpatrick & Kirkpatrick, 2006; Noe, 1999; Torrington & Hall, 1995; Robinson, 1988). Training need is the difference between the exact knowledge needs of a particular task and the possessed capability of the job holder (Robinson, 1988). To Stewart (1999), training need is the deficiency between existing capability of the employee and what is

required of him/her to meet performance objectives. Armstrong (2003) posits that all training and learning activities need to be stated on the understanding of what work is expected to be performed and why the work should be performed. Thus, a critical opening step in designing of training is to carry out a systematic training needs assessment (Arthur *et al*., 2003) and to train or not would depend on the need and whether the problem can be resolved by training (Buckley and Caple 2004).

The results of assessing training needs are to enable the organisers of the training to set the required training objectives by finding answers to two fundamental questions: a) who, should be trained, if any and b) what knowledge is needed and which type of training is needed. Miller and Osinski (2002) concluded that training need analysis is in three levels: a) organisational analysis, b) task analysis and c) individual analysis. Organisational analysis considers the effectiveness of the organisation and this assessment help in determining where training would bring solutions and under what conditions training would be carried out. According to Miller and Osinski (2002), the organisational analysis should be capable of identifying the environmental implications, state of the economy and how it impacts on operating costs, socio-demographic changes in workforce and the need to address cultural, technological, automation, political trends, climate changes and increasing globalisation of business operations. Training need exists in two forms: a) when training is considered the appropriate tool of overcoming an existing or expected deficiency in performance and b) when current or future objectives are clearly integrated with corporate objectives. Correspondingly, Armstrong (2003) and Stewart (1999) opined that identifying training needs should be along corporate, group

and individual needs while Kirkpatrick and Kirkpatrick (2006) argued that there are many ways to identifying training needs, which among others include; asking the individuals, the supervisors, immediate stakeholders, ie, customers, peers and subordinates, testing the participants and analysing performance evaluation results. Noe (2005) also suggested that observations, interviews, surveys and questionnaires are useful techniques that can be used to identify training needs, while Cole (2002) indicated that performance appraisal is another useful technique that can help in identifying training needs.

Rahman *et al* (2018) suggested that training needs assessment is one of the crucial steps towards identifying the area of farmers' interest, design and development of curriculum that can best suit to the existing real conditions of farmers. Training needs identification is one indispensable step that need to be carried out by training organisers, because major reasons why training failed to meet its intended purpose is attributed to failure in performing training need identification (Armstrong, 2003; Buckley & Caple, 2004; Torrington & Hall, 1995 and Robinson 1988). Importantly, training is not the only solution to performance deficits until training need assessment revealed so. Certain identified performance deficiencies can be resolved through other management best practices such as effectively communicating management expectations, providing a supportive work environment, removing work related obstacles and ensuring job fit through placement (Kazimi & Saeed, 2012; Miller & Osinski, 2002). Since all performance deficiencies cannot be attributed to lack of knowledge, skills or competences on the part of the job holder and since the job holders could possess varied knowledge levels and functioning at different job areas, there is the need to figure out

who truly need to be trained and in which areas training should target, hence, the need for training needs analysis. Training assessment need to be conducted to help design relevant and need based training programmes that can accommodate possible changes over time. Rahman *et al*., (2018); Pandey *et al*., (2015) and Barbazette (2006) noted that before any actual training is conducted, the training organisers must determine who, what, when, where, why and how of training. The priority of changes in knowledge, skill, attitude and behaviour that would provide the greatest impact on achieving farmer goals through training is determine via training needs analysis.

2.1.6 Training needs analysis (TNA)

Training needs analysis should be purposeful and to Rahman *et al* (2018); Chawang and Jha (2010) and Ousman (2007), training needs analysis is the process of determining if there is a discrepancy between desired and actual performance of the trainees. The analysis leads to the decision about the types of training and how much training needs to be conducted. Training needs assessment is considered the first stage of a training process and the foundation on which training programme is anchored (Kshash, 2016; Bimpitos & Petridou, 2012; Ansari, 2006), but the quality of any training outcome is the product of TNA (Odiorne and Rummler, 1988).

Goldstein and Ford (2002) posited that support coming from the organisation is a vital ingredient for a successful training needs assessment process. When gathering information for training needs assessment, care must be taken on how external specialists

are used. Employees within the organisation might be disrupted and those selected to provide information are most often unwilling to co-operate with external experts. However, if the needs identification process is carefully conducted by first orientating the employees, they are likely to feel comfortable. This would minimise or eliminate the disruptions and suspicion and they would cooperate and provide useful information to feed properly into the training need assessment exercise. If there is failure in establishing organisational support, this would make needs assessment difficult (Goldstein & Ford, 2002).

Chiu *et al* (1999) provided a broad model for conducting needs analysis, which focus on finding answers to four questions:

i. Who are considered the main architects of training needs analysis?
ii. What are the organisational, group and individual levels of interest?
iii. What is or/are the planned outcome(s) of the analysis? and
iv. What methods of analysis are used?

Training need analysis could be supply-led or demand-led. Chiu *et al* (1999) found that most training needs analysis is supply-led, that is, trainer-driven and authority-oriented, which comes from the interests of trainers (Thompson, 1994). To Goldstein and Ford (2002), four stages are considered necessary in achieving a successful training needs assessment starting with: a) organisational analysis, b) job requirement analysis, c) task, knowledge, skill, and ability analysis and d) individual/person analysis.

The demand-led approach to training needs analysis is basically business-oriented which involves top managers, chief executive officers and directors showing commitment and investing in training due to its apparent relevance to the success of the organisation. Key to this approach is the business planning process, which defines the setting and mission of an organisation, with its prime features being top-down, a finance-driven process, with emphasis on high business outcomes.

Contrary to the business-oriented approach is the process-oriented approach, which lay emphasis on departments rather than on the entire organisation. Also is the trainee-oriented approach, in which a self-assessment approach is carried out, where the employees' needs are considered important than business outcome (Chiu *et al* 1999). To Chiu *et al* (1999) key initiators are the trainers who constitute the major proportion of training needs analysis team (supply-led contributors). With regard to the levels of analysis, Chiu *et al* (1999) stated in descending order that, the biggest proportion of studies on training needs analysis focused on analysing organisational needs, analysing group level needs, analysing the process or task level needs and analysing the individual level needs. The authors concluded that irrespective of the level of training needs analysis and the scores, the prime objective is to facilitate an improvement in organisational effectiveness.

Cheatle (2001) suggested that an effective training needs assessment must provide the grounds on which training actions can be based in clarifying what employees are doing and for what reason. TNA should help diagnose training priorities and concerns logically by re-examining organisational features in general and individual features in particular. Conducting a systematic needs assessment is therefore vital in designing training that will largely influence the successful implementation of training programme (Goldstein & Ford, 2002; Sleezer, 1993; Zemke, 1994). A systematic needs assessment information in vital and can be used in specifying the key aspects of the training, how the training programme would be implementation and how and when evaluation of training programme should be conducted.

In conclusion, training needs analysis can serve as a guide for the designing, developing, delivering and evaluating the training programme. The existence, comprehensiveness and well communicated training needs assessment information should aid and facilitate training effectiveness. In designing and developing training programmes, conscious efforts is necessary to analyse the organisations' training needs, identify the job requirements that need new knowledge, identifying who needs to be train and the type of training to be designed and delivered and who would deliver the training in order to ensure effective training (Kirkpatrick & Kirkpatrick 2006; Arthur *et al*., 2003).

The project for sustainable development of rain-fed lowland rice production by JICA saw the need for training by considering the low yield of rice produced in the Northern and

Ashanti regions of Ghana respectively. The need assessment for this project was done through a baseline survey in the Northern region which led to the identification of the specific districts where the training took place. Although all rice farmers in the selected districts and areas were farmers with the need to be trained on rice farming, the selection was based on volition. A comprehensive, well-structured and executed training needs analysis serves as a blue print for training evaluation. Bases for evaluating a training project, what to evaluate, when to evaluate and which evaluation approach to use are determined during training needs analysis.

Training as a concept if properly conducted helps institutions to maintain high performing and motivated staff. Institutions interested in training farmers make it possible for farmers to acquire the requisite farm management knowledge and skill necessary for improved and easy execution of farm work. Farming is a vocation that needs to be carried out with all the interest and if farmers are trained, they would perceive farming as a profession and not a last resort to enable them to get food to feed their family. Training stands to impact farmers positively just like it impacts white collar workers. It is clear from the literature that farmers training needs should be assessed and be identified for effective selection of farmers to be trained and the design of training model relevant to ensure maximum effect.

2.2 Types of Evaluation

Performance can be viewed as perceptual and to prove that it can be made possible only after evaluation. Evaluation can be the process to assess the worth or merit, to reflect a

description on a study, an implementation analysis, or a formative evaluation. It could also emphasise the information processing, or a feedback functions of evaluation.

Bramley (1999) indicated that evaluation involves establishing the worth of something. Applying this to training evaluation, it means engaging in a process which establishes the relative worth of any training programme undertaken, where "worth" here, refers to value placed on the training. Training evaluation measures the value of a training. Training evaluation comprises the activities of gathering information which would be used to aid decision making about training activities, its achievement, value and contribution to transforming the lives of the trainees. To Sharma *et al* (2017), and Goldstein and Ford (2002), training evaluation is the systematic process of collecting of descriptive and judgmental data for analysis necessary to support effective decision on training. To make training evaluation possible, both qualitative and quantitative data about the training should be collected and analysed so as to determine the usefulness and value of the training.

Since most evaluation studies involve gathering and filtering through data and making valued judgments about the soundness or otherwise of the data, definitions that put emphasis on acquisition and assessing information are acceptable. Evaluation facilitates feedback, which is the provision of information to the stakeholders after the training evaluation exercise. In evaluation, the term stakeholder covers anyone having no formal role in an organisation's functioning, but could be positively or negatively, directly or

indirectly affected by its activities. The aims of evaluation are to positively affect decision-making about a training project by providing accurate and relevant information to all parties. It is imperative to make sure that all persons involved are considered in choosing the evaluation type to use and the evaluation process necessary to give required results (WHO, DHRH, 2008).

2.2.1 Aims of training evaluation

There are many and varied reasons why organisations conduct training evaluation as demonstrated in literature. Aims provided by any author reflect the perspective of the author at the time and intension of the training programme undertaken. Marchington and Wilkinson (2000), indicated that it is essential to first clarify the overall objective of training evaluation before an organisation undertakes any training evaluation activities. Evaluating a training project is important for the purpose of determining the effects of the training project in order to ascertain the usefulness of the training project. The rational for training project evaluation among others includes: i) justification of financial investment in the training project, ii) gathering feedback for continuous improvement along the project expectation space, iii) for the facilitation of comparison of a particular project achievement to other related projects, and iv) to determine whether the project meets the requirement of the project initiators (Salas & Stagl, 2009).

Sharma *et al* (2017) and Easterby-Smith and Mackness (1992) in their findings indicated that the aim of training evaluation is to prove that a training course or learning event has certain outcomes and consequences. The value of the judgement placed on these outcomes or consequences should be viewed based on their impact on the trainees, the trainer or organiser of the training and the society at large. Other aims of training evaluation may include: to improve the quality of a training course or learning event; to help participants recognise what they have learned; to reinforce the most important parts of a training programme by reminding participants of what they had learned on the training through follow up evaluation work (Mann and Robertson, 1996; Easterby-Smith and Mackness, 1992); and to improving the value of the training or learning event (Thomson, 2007).

One noticeable theme informing the reason why organisations conduct training evaluation is to encourage efficiency (Scriven, 1999; Lewis & Thornhill, 1994). It is sometimes difficult in certain areas of training for evaluation to deliver a precise measurement of what is spent on training and exactly what outcome has been, particularly regarding the management of training. Return on investment is important and can be achieved even though it is challenging to undertake. Metz (2007) outlined five major aims for conducting training programme evaluation (participants benefit, recruitment effectiveness, staff delivering, participants satisfaction and sub-groups benefiting) that would serve the best interests of the programme, trainees, trainers, management, and all stakeholders. Bramley (1999) asserts that the main organisational objective for conducting and evaluating training is to provide feedback on the design and

the training delivery activities whereby the training processes could be altered and re-designed to meet the contracts and action plans.

For the evaluation of the JICA's 'project for sustainable development of rain-fed lowland rice production, the focus of this study is to assess the effectiveness of the processes and the intended and unintended outcomes.

Wankhade and Gujarathi (2012) opined that the purpose of evaluation is best understood by identifying what it would be used for. There are various ways of describing purposes of evaluation (Donovan and Townsend, 2004). Some of which are design, developmental, formative, implementation, process, impact, outcome and summative, with some of them used for more than one purpose.

2.2.2 Outcomes of training evaluation

Training evaluation can align training aims with organisational objectives. A robust training evaluation framework can provide useful information about an organisation and its training programme which can then lead to improved organisational effectiveness (Brinkerhoff, 2006). A well-crafted and executed training evaluation programme helps to highlight mismatches by pointing out areas where there is a lack of alignment between training and required needs (Gibson, 2012), this provides evidence of a failure, lack of training objectives and providing direction and focus. Phillips and Phillips (2003) and Bramley (1999) observed that training improves organisation's overall performance by aligning its processes, policies and resources to individual goals. Evaluation may be used

as diagnostic system to make input for project revision and budgets allocated (Adler & Swiercz 1997; Mann & Robertson 1996) and this qualifies any changes in knowledge that may occur and how it is transferred onto the workplace. This is used as evidence to support promotion, as justification of the cost of a particular learning event (Mann & Robertson, 1996). To make valued judgement about the benefits of an investment, increase project viability, identify what works well and that a project is worthwhile (Metz, 2007; Bronte-Tinkew, Allan & Joyner, 2007).

In the view of Mann (1996), the huge investment in developing training programme is not only an indication that training is important, but that the training is worthwhile and effective. There is a wide range of literature (Ameeq-ul-Ameeq and Hanif (2013); Bates and Kang (2010); CIPD (2007), and Guerra-Lopez (2007), all accepted that training is important, but it recognises that training evaluation must be considered a key component if training is to be justified. In the words of Lewis and Thornhill (1994), there is a widespread argument that evaluation of training is an activity that is least considered. This therefore suggests that there is a need for organisations to give much attention to evaluating training project if training is to be seen as meeting its objective.

The important nature of training evaluation generates interest from varied stakeholders. For management, thoroughly evaluated training programme would help in reaching a decisions regarding which intervention worked for the people and therefore need replication in the future. Evaluating training is perceived as important, so Sharma *et al*

(2017) asserted that evaluation of the training programme has the importance of measuring the impact of training in order to determine the effectiveness of the training programmes. Evaluation provides evidence of investment in training in organisations and its human capital and showcases the value of the interventions (Burkett, 2005). Management views training evaluation as a justification of the expenditure incurred by the training departments (Goldwasser 2001). It is seen as business efficiency process that assists in determining who needs to be retrained and helped identify alternative ways of getting required results. To the trainees, training evaluation provides them the avenue to give feedback to their facilitators or trainers of the programme they partake (Mani, 2010) especially when conducted early during the training period (Mavin, Lee & Robson, 2010) while Mani (2010); Lewis and Thornhill (1994) posits that participants stand to benefit from the evaluation process if there is effective feedback which is acted upon. The trainers or facilitators use the evaluation results as a justification for their relevance.

2.3 Models of Training Evaluation

Evaluation literature provides series of models which would constitute the focus discussion in this section. Abernathy (1999) and Guerra-Lopez (2007), observed that there are many ideas about how to measure training. The world of evaluation is vast and rich, and this prompted Patton (1997) who opined that the study of evaluation, like any other area of study is still expanding. The choice of evaluation models presented in this section is intended to provide comprehensive empirical literature on evaluation and their contributions. Some key evaluation models necessary for this study would include,

Kirkpatrick (1959) Four Levels Model, The Stage Model by Dick and Carey (1996), the Endless Belt Model by Industrial Society (1994), the Nine Outcome Model by Donovan and Townsend (2004), the Realist Model by Pawson and Tilley (1997), the Refined Model (Rae, 1999), the Brinkerhoff Model by Brinkerhoff (1988), the CIPA Model (CIPD 2008), the Business Driven Model by Kemp (2007) and Phillips Five-Level Return on Investment Model, Phillips (1991).

2.3.1 Kirkpatrick four levels model

The first and most widely used training evaluation model is the Kirkpatrick Model which was developed by Kirkpatrick (1959). It is based on four levels; Reaction, Learning, Behaviour and Results. By reaction, Kirkpatrick (1959) meant the reaction to training from the trainee which is an important starting point for evaluation. At this level, the evaluation is to assess the trainee reaction to the training received (Grossman & Salas, 2011; Aguinis & Kraiger, 2009). Several training programmes focus on only evaluating the first level. As Giangreco, Carugati and Sebastiano (2010) and Blume *et al* (2010) argued, if the training participants are happy, everybody is happy and there is a higher possibility that the training would be a success. It is believed that at this level, self-report methods are used to ascertain reactions from trainees. It is the stage where interest of trainees need to be sustained in the training process and lack of it could spell doom for the whole exercise. This level has the potential of determining the success or failure of the entire training programme. The value of undertaking evaluation at the first level

which solicits responses from trainees through data collected from training reaction has value to an organisation (Brown, 2005), but the reaction or trainees to training seems a worthless exercise designed to find out whether the programme is interesting, challenging, stimulating, and enjoyable because since it might not be comprehensive in determining the effectiveness of a training programme. Arthur *et al* (2003) also postulated that reaction evaluation says little about the organisation. The reaction level of the model has the potential of providing insightful data in respect of the training being evaluated. The level could be used to ascertain the appropriateness of the location, delivery methods, training materials, quality of food served, and quality of facilities used for the training.

Evaluating learning as the second level of the Kirkpatrick training evaluation model seeks to assess knowledge outcomes. To Powell and Yalcin (2010), this level examines the extent to which trainees' attitudes, knowledge and skills have been influenced by the training while Gibson (2012) proposed the use of control and experimental groups and that pre and post testing be employed to evaluate training at the learning level. This learning level of the model has the capacity to provide relevant insight with regard to the level of knowledge trainees have added to their existing knowledge as a result of the training received. Evaluating learning can be conducted using test, interviews, observations and examinations before and immediately after the training programme to gain feedback. Any method employed in gathering this information should be in line with the training objectives and must have well defined scoring guidelines. Evaluation at

this level is particularly suitable for training programmes that are fundamentally measurable skill oriented.

The third level, behaviour is considered an outcome in Kirkpatrick's model of training evaluation. This seeks to assess the actual application of the skills, knowledge and information acquired at the training in the real work-setting (Powell & Yalcin, 2010). Chen and Chen (2006) stated that Kirkpatrick backs the use of control and experimental groups at the behaviour level of evaluation, but ample time is needed to be given for meaningful variation in behaviour to be evident. Evaluating behaviour could be carried out using pre and post assessments, surveys, interviews and feedback from superiors. Key is to gauge the impact of training on the behaviour of the trainee at the work place. Even though training and behavioural standards are theoretically related, there is scanty of empirical evidence supporting this claim since behavioural standards that are predisposed to environmental factors can influence the use of acquired skills at work. (Arthur *et al*, 2003)

For the final level, the result level of the Kirkpatrick model of training evaluation, emphasis is on results as achieved. This could be in the form of increases in sales, reductions in cost, employee retention, improvement and increase in production including others (Arthur *et al* 2003). Chen and Chen (2006) observed that most organisations do not make any effort to measure the impact of training on key results. This level is normally considered the most challenging one to evaluate. To Spitzer and Conway (2002), most organisations are not interested in making any link between training provided and its consequences on business performances though it has the capacity to

provide vital information on training outcomes. A range of tools exit that can be used in determining the impact of training on business performances which may include periodic sales reports, labour turnover, cost benefit analysis among others. Arguably, the level four (results) of the model is the most visible and practicable. It is common for trainers and organisations implementing training programmes to ignore the first three levels but solely relied on the level four and still generates evidence to demonstrate how the training programme was useful.

2.3.2 Stage model of training evaluation

Dick and Carey (1996) formulated the Stage Model of training evaluation. This model proposed three stages to formative evaluation with the aim of minimising errors in the training, and verifying that the training influences the trainees as intended. The model makes good use of a combine field tests, smaller group evaluations, attitude questionnaires, and conducting interviews with a small number of participants. Brown (2005) in his contribution to this model stated that the strength of this model is that at each stage there are clear guidelines as to what methods to use. Pointing on the weakness, Brown mentioned that the model is that rigid and of limited scope and requires clearly defined training objectives and learning material, which is not always the case. For a training evaluation model to be useful, it must be simple, easily usable and capable of yielding accurate and precise results. The stage model as indicated shows that it is not flexible and requires clearly defined training objective and its limitedness in scope makes

it not suitable for training programmes in the agricultural sector especially training for rice farmers in the Northern region.

2.3.3 'Endless Belt' of development model

The Industrial Society (1994) put forward a model for evaluating training and labels it as an "Endless Belt" of development model. This model has six stages. Stage one of the model would involve a recognition of a business need. The second stage is the definition of the development objectives and a method of measuring them agreed by stakeholders. The third stage is the design of the learning process with the use of a prior knowledge assessment. The fourth stage is the experience of the learning process using a reaction sheet and a test or questionnaire. The fifth stage is the use and reinforcement of the learning using line managers debrief. Stage six is the judgment of whether the learning event has benefited the organisation.

Using this model, the Society emphasised the role of the line manager learning style and types of measurement of knowledge, skills and attitude. What makes this model quiet distinct from other models is that, it applies evaluation earlier in the training cycle, i.e., before anything happens at the design stage. The limiting factors of this model however are that if the manager lacks good learning style and not able to design an accurate measuring scale, the model would lose its value. Meeting the requirements for this model to be used in evaluating a training programme for farmers therefore would not be appropriate.

2.3.4 Nine outcomes model

Donovan and Townsend (2004) introduced the "Nine Outcomes" evaluation model which seeks to measure the success level of training. In identifying the nine outcomes, Donovan and Townsend posed 9 questions with the training participants in mind. The focus and nature of the questions are; 1) *Reaction* to training – was the training and its design liked? 2) *Satisfaction* – were the trainees satisfied with the logistics provided and used for the training? 3) *Knowledge* acquisition – were they able to learn anything meaningful? 4) *Skills* improvement – would they be able to do something new or better that they could not do before the training? 5) *Attitude* shift – are their opinions about the work and the organisation changed after the training? 6) *Behaviour* change – have they altered and improved their behaviour in doing things after the training? 7) *Results* – how has the training impact any changes on the organisation's key success factors? 8) *Return on investment* – to what extent did the training benefit the trainees compared to what it cost them? and 9) *Psychological capital* – has the training led to improved corporate image?

The success of the training would be contingent on the responses provided for these questions. A well delivered training would yield positive answers to all nine questions. What the model failed to indicate is what score would among to a well delivered training. The researcher is of the view that an outright score might not also be appropriate, however, each question can be put on a scale of five points so that a score of above

average in all nine questions must be met before the training could be said to be successful. The last question which borders on corporate image or psychological capital is most often difficult to measure and determine with certainty.

2.3.5 Realist training evaluation model

The "Realist Training Evaluation" model, propounded by Pawson and Tilley (1997), indicates that a successful evaluation is that which distinguishes between mechanism, outcome and context. The realist training evaluation model involves the examination of how the workings of such mechanisms are contingent and conditional on local and international factors such as economic, socio-cultural, technological, legal and competition. This includes taking into account local, historical and institutional contexts that are subservient to accepted performance. Hypotheses or propositions need to be developed relating to what mechanisms might apply. This stage needs to be completed at the design stage of the training cycle.

2.3.6 Refined evaluation model

Rae (1999) posited that a refined evaluation model, forming fourteen steps can be used to match the training cycle. The model begins with a training needs analysis which leads to training objectives being defined. The evaluation process is defined at this stage, and a pre-course assessment of the trainee knowledge, skills and attitudes is carried out. The line manager performs a pre-course briefing, and there is an interim assessment and validation. The evaluation model continues with an end of programme testing and

reaction review, plus a learner action planning session. This is followed up by a further line manager post course de-briefing. The model closes with a cost and value effectiveness analysis and an assessment and report on the achievement of the objectives. Rae (1999) argued that Kirkpatrick's model despite having only four levels can "cloud the wealth of activity and difficulty within each one".

2.3.7 Brinkerhoff model

Brinkerhoff (1988) argued against any model of evaluation which only focuses on the outcomes of training; like the reactions to training. Lewis and Thornhill (1994) agreed with this and suggested that there is a need to look for broader links between training and the organisation in general.

The Brinkerhoff model is defined as an integrated model which involves evaluation before the delivery of training as well as looking at the outcomes. It is understood that this model is a strategic approach which should begin alongside prioritising and identification of the need for training stage and this is corroborated by Redshaw (2000) who posited that evaluation and training project should be considered at the point when training needs were originally identified.

2.3.8 Phillips's Five-Level Return on Investment (ROI) model

Return on investment (ROI) has been employed in many organisations as a means of determining the value of an investment in financial terms. Phillips's model is an expansion of Kirkpatrick's four-level framework with the (ROI) being the additional level. Return on investment is determined in order to ascertain the value in financial terms of investment made in a training programme (Phillips, 1991). The levels of the framework are (1) reaction and planned action; (2) learning; (3) job application; (4) business results; and (5) return on investment. The level one which is reaction and planned action is similar to Kirkpatrick's level one, but also includes an action plan of what participants intend to apply from the programme. Other researchers contend that ROI is contained in Kirkpatrick's fourth level, results, and that the fifth level in Phillips's is irrelevant (Lanigan, 1997). However, Phillips (2003) argued that the fifth level adds the cost-benefit analysis that is essential for the calculation of ROI, and that any change in level four would amount to converting it into monetary value, thereby making it the total cost of the programme.

2.3.9 Other models

The Chartered Institute of Personnel and Development (CIPD) (2008) also developed a model of training evaluation specifically highlighting the importance of the delivery and validating cost-effective and collaboration learning processes that are integrated with the organisation's strategic priorities. This model is interesting as it focuses on partnership, which is rarely seen in other training evaluation models and it involves the

organisation, functional manager, individual trainees and the trainers. This is a process driven model with the link between objectives and outcomes clearly showing at the epicentre.

The **"Business Driven Evaluation" model** was developed by Kemp (2007), which helps trainers and their business clients to link the training contribution to business performance in a different way. The basic framework of the model relies on four research areas of activity namely i) business outcomes, ii) a focus on the working environment, iii) critical behaviours; and iv) people. This model seems holistic and would need to have in place skilled research and evaluation specialists with a clear idea of what the business performance priorities actually are, as well as clear business outcomes (Ji, Huang, Liu, Zhu & Cai, 2011).

Other relevant training evaluation models are **360^0 Evaluation Model** which is done from a variety of stakeholder (Tyson & Ward, 2004) and relevant for management development training; Hamblin's (1974) **Five Level Evaluation Model** which is an expansion of the Kirkpatrick (1959) model. Hamblin added fifth level to the four level by Kirkpatrick thus (1) Reaction level, (2) Learning level, (3) Job behaviour level, (4) Organisation, and (5) Ultimate value, which is intended to evaluate the training on the basis of financial improvement after the training. **The Cost-Benefit Analysis Model** which is drawn from the theories of economics and finance is a process used to evaluate the viability of expenses on programmes. Its purpose is to ensure that organisations

undertaking training maintain optimal level of efficiency in resources allocation (Nas, 1996). The Cost-benefit analysis concept could be traced back to London in 1667, and in the United States, it witnessed widespread usage after the passage of the River and Harbor Act of 1902 and the Flood Control Act of 1936 (Thompson, 1994). This process compares the training programme's cost with the benefits by dividing the programme benefits by the cost of the programme.

This model may not have the capacity to assist evaluators in ascertaining the right benefits or losses of training programmes immediately after the training since it takes time for certain benefits to mature. Besides, there could be other unintended advantages arising out of the training which might not have been included in the original expected benefits.

2.4 Why some Training Organisers do not Take Training Evaluation Seriously

Despite the integral position of evaluation in the process of training, most training programmes are not evaluated. Interestingly, some organisers of training try justifying why evaluating training project is not often carried for various reasons. According to Kraiger, Ford and Salas (1993), some perceive training as a luxury, provided only as a way of either rewarding workers, meeting certain legal requirement or a mere formality as part of the institutions process, hence the evaluation of such training does not appear necessary.

Commonly cited reasons for the absence of effective training evaluation is that evaluation is perceived to be too costly and time-consuming, which makes people care less about it (Kraiger, Ford & Salas 1993) hence, very few are interested in evaluation.

Yet serious reason for none evaluation of training programmes is fear of the expected results. If valuable time and hard earned monies are used on a training project and an evaluation results revealed that the learning was not effective or the impact on job performance was minimal notwithstanding the training, difficult questions would be asked (Subrahmanian 2010). The expression is that evaluation presupposes a final outcome at the end of a particular project revealing either a success or failure. When the indicators point to a failure, the manager who sanctioned the training or the trainer who carried out the training are likely to feel threatened.

Metz (2007) identified five reasons why managers of training programmes are not enthused about conducting evaluation. These reasons are;

i. Evaluation take resources from the main training programme budget.

ii. Some evaluations are too complicated. However, an independent evaluator or consultant can develop an evaluation programme that is simple and more appropriate for a programme (Bronte-Tinkew, Allan & Joyner, 2007).

iii. Evaluation serves as an additional burden on project staff. This can be minimised by incorporating the activities into the on-going programme activities so that training and evaluation can be run concurrently.

iv. Evaluation may likely produce undesirable results. Establishing "what does not work" is as important as "what does work."

v. Evaluation is considered as another form of programme monitoring. Programme monitoring assesses whether a programme is in compliance with specified standards but an evaluation considers whether expected outcomes are achieved. With this in mind, where monitoring of the training programme is undertaken, most managers feel reluctant to undertake evaluation of the programme.

Evaluation is a costly venture much as it is useful in providing a guide to the project. In the first place, unless the evaluation is carried out by an external evaluator, there exists the possibility of compromising the true effect of the project (Metz, 2007).

The research experience drawn from this exercise shows that any move to evaluate a project must be done with the consent of the project owners. In most cases, it is difficult getting access to participants without going through the officers who marshalled the training. One important question is, 'is it not possible for the projects owner to coach the participant on what to say in case an external interested party contact them for information regarding the project? The researcher is not sure about that. But the fact that participants will not willingly talk to an evaluator unless they get assurance from the officers, in this instance the AEAs was revealing. However, the 'key' to gain access to participants was important, since the nature of the questionnaire design was to make the participants give information beyond what they would have been coached to say if that was the case.

Secondly, unless there is a strong motivation for the evaluation, its profundity could be compromised. Project evaluation process is tasking, challenging and costly. If the cost is not to be borne by the project and logistics not provided by the project, the evaluation is faced with serious constraints. This explains why agricultural training projects in Ghana receives little attention in terms of their evaluation. Training projects in the Agriculture sector that need to be evaluated therefore need to be given serious attention by way of funding when it comes to evaluation because of the nature of communities engaged in agricultural activities who benefitted from training projects. For these constraints, most organisers of training projects shy away from evaluation but for agricultural training projects, evaluation should be encouraged but not made mandatory because of the cost of such training projects as well as the magnitude of their effect.

2.5 Evaluating Agriculture Training Programmes and Their Impacts

2.5.1 Evaluating agriculture training programmes

Any agricultural training needs to be evaluated to help the organisers, agriculture authorities, famers and financiers of the training make an informed decision about the programme and methods of instruction or training. The evaluating results would indicate which part of a programme is ineffective and need to either be changed or discarded (Ousman, 2007), and or if certain programme proves very effective and serving the

participant well, it may be replicated in other parts of the organisations. The relevancy and functionality of agricultural training can be determined only when it is evaluated. According to FAO (2002) if the organisers of the training programme cannot substantiate the training's contribution to the organisation, then funding the training programme is likely to suffer especially when there is budget review to consider cost.

Kefyalew's (2006) submission postulated that giving considerations to the needs of the farmers before designing farmers training was insignificant. He found that systematic and formal need assessment was not conducted by both GOs and NGOs in his study. He emphasised that this lack of formal need assessment was because of the use of conventional approach and planning for farmers, instead of involving the farmers. He reported that the training contents was related with the agricultural activities of the farmers, but the degree of relevance varies with their priority needs. He concluded that farmers' trainings that were provided by GOs and NGOs were reported to be more of theoretical in nature, delivered through lecture mode which made the training non-participative, hence not farmer friendly.

2.5.2 Impacts of agriculture training programmes

Dibba, Zeller and Diagne (2015) indicated that there is a positive effect on food security and health of households as a result of training leading to adopting new variety of rice (Dibba *et al*, 2012; Dontsop *et al*, 2011; Adekambi *et al*, 2009). Sharma *et al* (2017) discovered that majority of farmers, through training now considered themselves as better

farm managers, able to develop their SKAs and transfer them to their farm fields. Dibba *et al* (2012) found that training of rice farmers on NERICA adoption and cultivation significantly led to average increased in rice yields by 157 kg per hectare in The Gambia. Dontsop *et al* (2011) and Adekambi *et al* (2009) also found that training of farmers leading to adoption of NERICA rice showed positive impacts on farmers' expenditure in Nigeria and Benin respectively. Kabunga *et al*'s study (2014) also revealed that training of farmers on banana tissue culture technology led to improved food security in Kenya. The study by Kabunga *et al* (2014) using Household Food Insecurity Access Scale (HFIAS) found a positive impact between training on new technology adoption and food security. Dibba, Zeller and Diagne (2015) in their study show that training on improved agricultural technology and its adoption led to improvement in food security for households. Their finding revealed that the average yields of traditional upland rice varieties in Africa is estimated to be 1 tonne per hectare whereas the average yield of NERICA in farmers' fields after applying the technology acquired is estimated to be 2.5 tons per hectare. On the part of food security, better food management practice, reduction in household population, alternative means of feeding could contribute to food security and not just the adoption and implementation of knowledge acquired from training.

Agricultural training evaluation results also showed that there are countless evidence showing farmers who adopted improved rice varieties through training, experiences higher production and realised higher yield in rice cultivation compared to non-adopting farmers (Kijima *et al*, 2006; Mendola, 2006; Dibba *et al*, 2012; and Jones *et al*, 1997), however, Wopereis *et al*, (2008) opined that most improved rice varieties are resistant to

biotic factors affecting rice yield. For this reason, farmers adopting new farming technologies in rice cultivation as well as planting improved rice seeds such as Jasmine 85 variety are more efficient and experience increase yield in rice production.

Dibba *et al* (2015) found that farmers participating in agricultural training programmes experience higher technical efficiency scores than non-participating farmers and the difference in technical efficiency scores was estimated to be 5 percentage points, which shows statistical significance at 99% confidence level. Clearly, literature indicate that agricultural training has the capability to positively influence rice yield. Kijima *et al*., (2012) also asserted that farmers participating in agricultural training programme have the potential to increase lowland rice yield in Uganda. Sharma *et al* (2017); Dibba *et al* (2015) and Asante *et al* (2014) also revealed that agricultural technologies if adopted have the ability to positively influence technical efficiency of rice farming households. Nakaro and Kajisa (2011) also found that agricultural training can impact the productivity and yield of rice farmers positively in Tanzania. These findings clearly show that when farmers are given training, their ability improves which eventually influences rice production and productivity positively. It is also noted that most of the training on improved rice farming mostly is not on large scale and in most case the technology is not widely disseminated among all farmers after the demonstration farms and the participating farmers. From available literature, the researcher formed the opinion that there is always little and slow transfer of technology from participating farmers to non-participating farmers.

2.6 Livelihood Activities

Every household relies on multiple sources of livelihood assets to support their household expenditure. Livelihoods analysis considers the different types of household activities that helps in sustaining the family and the contribution each member of the family can make to the household. Livelihood activities are not limited to only activities generating money and food but includes all other different and numerous activities that the household relies upon for survival and reproduction. These activities are closely related and as to who carries out what type of activity is informed by gender and age.

A livelihood encompasses household people, their capabilities, knowledge and skills and their means of living, including food, income and assets. Livelihood assets are tangible assets like resources and stores, and intangible assets such as claims and access (Bouteiller & Karyotis, 2010). According to Shackleton, Shackleton and Cousin (2000) the composition of the five livelihood assets comprises the following:

H = human capital: this represents the skills, knowledge, availability of labour and good health considered important in pursuing different livelihood strategies;

P = physical capital: this is the basic infrastructure such as transport, shelter, water, energy and communications; and the means of production that enable people to pursue livelihoods;

S = social capital: this represents social resources in the form of networks,

membership of groups, relationships of trust and access to wider institutions of society which people draw in pursuit of livelihoods;

F = financial capital: this represents financial resources and capabilities which are available to people. This could be in the form of savings, supplies of credit or regular remittances or pensions, which provide the household with different livelihood options; and

N = natural capital: this refers to natural resource stocks from which resources useful for livelihoods are derived. These include land, water, wildlife, biodiversity and environmental resources.

Livelihood assets is broadly used to refer to the sources of earning a living, which includes employing skills, tangible and intangible assets (Chambers, 1995). What constitute livelihood depend on the individual's household assets. Livelihood assets commonly refer to stocks of productive factors that generates benefits in the form of cash or in kind returns, and they have substantial importance to the individual at certain material moment.

In an attempt to establish the type of livelihood assets acquired by farmers involved in the JICA training projects for increase rice production in the Northern Region and the relationship between rice production and livelihood assets acquired, spearman correlations was used to establish the nature of any relationship.

Livelihood assets are very necessary in the human life. In some instances, their meaning and very nature overlap thereby making clarity in understanding difficult. Livelihood could mean living standard. Livelihood assets are life supporting assets that contributes basically and significantly to making living standards of more meaningful. Livelihood assets could be physical assets, processes of making a living or knowledge and ability that can be engaged productively to support better and meaningful life. Through literature, in is clear that rice farmers need livelihood assets to serve as buffer against hard times and lean seasons. Livelihood assets makes rice farmers more self-sufficient the year round. However, it takes discipline to acquire livelihood assets. They must be acquired by reducing or denying current consumption to accumulate them for enhanced and better future consumption. This helps explains why in some instances, identification and defining livelihood assets is a bit difficult.

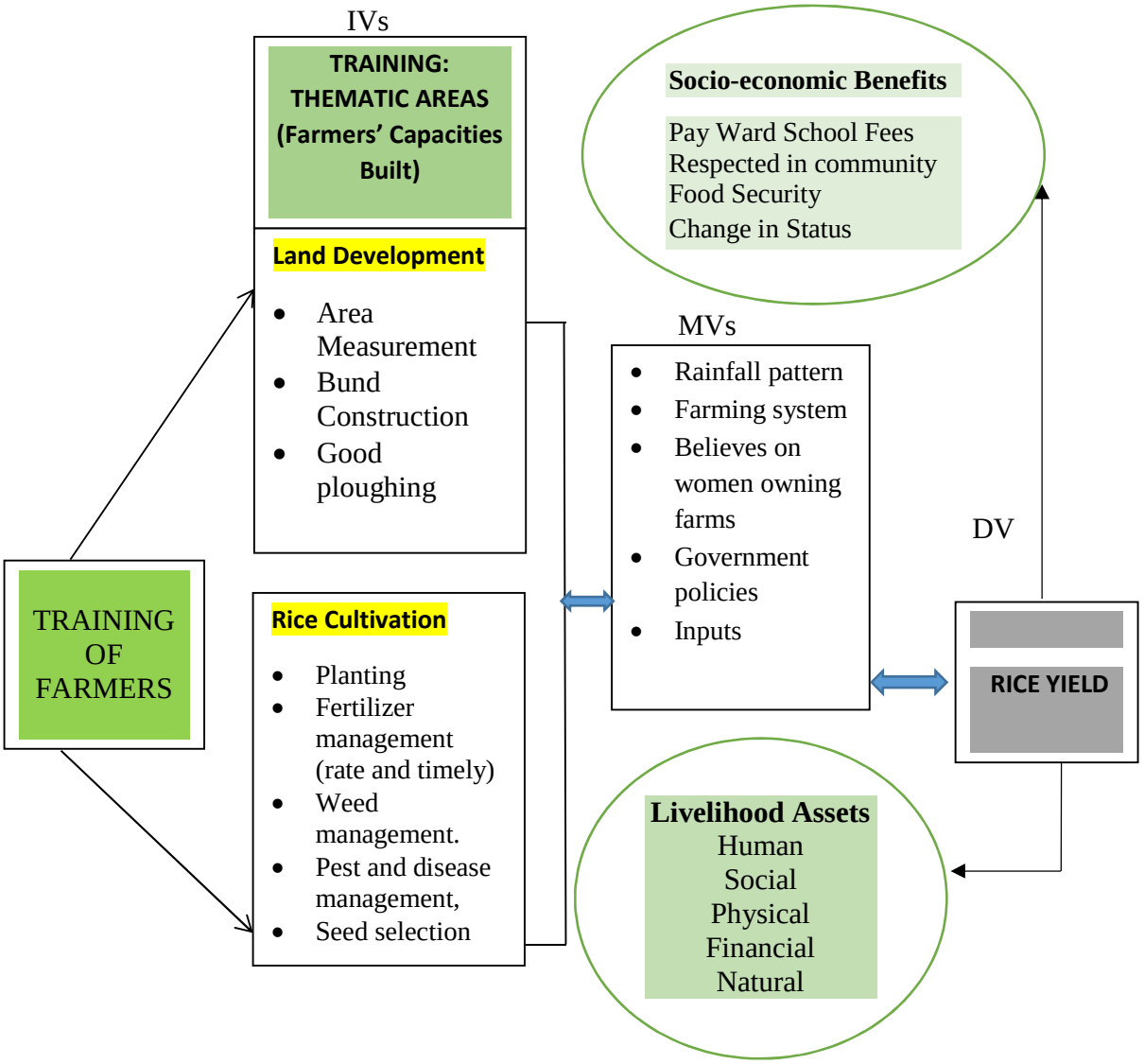
2.7 Conceptual Framework of the Study

Conceptual framework can be seen as a network of interconnected concepts that work together to provide a complete understanding of a phenomenon. The variables constituting a conceptual framework must be linked to one another in an understandable manner, articulate their respective phenomena, and establish a framework (Jabareen, 2009). Methodologically, a framework portrays the process of building the conceptual framework and assesses what it seeks to tell us, whether real, assumed or imagined.

Building a conceptual framework for this study, the thematic areas of the training were primarily considered with particular reference to the variables of the training. The conceptual framework provided a construct in which each variable played an important role. It laid down the key variables, constructs and presumes a relationship among them and illustrates how the relationship exists. The idea behind the conceptual framework was to provide an interpretative approach to social reality of training farmers on rice production to help increase rice yield in the Northern Region in particular and Ghana at large. The framework sought to provide understanding, provide knowledge of soft interpretation of intentions, it is indeterminist in nature and therefore does not enable the prediction of the outcome and it was developed through the process of qualitative analysis. The conceptual framework, figure 2.1, has three segments; the independent variables comprising the thematic areas of the training as planned by JICA, the intervening variables which were perceived as having the capability to moderate the relationship that exists between the independent and dependent variables, and the final segments was the dependent variable which represented the performance or rice yield by farmers engaged in the training. The ending point of the conceptual framework facilitated a feedback and a relationship that exists with socio-economic benefits and livelihood of farmers. The feedback process seeks to trigger re-examination of the training variables and possibly the moderating variables.

2.7.1 Conceptual framework

The effect of JICA training of sustainable rain-fed lowland rice production on farmers yield, livelihoods and socio-economic status in the Northern, Savana and North-East Regions



IVs = Independent Variables: MVs = Moderating Variables: DV = Dependent Variable

Figure 2.2: Conceptual Framework

Source: Researcher's Own Construct, 2014

2.7.2 Independent variables

The independent variables consisted of training on land development and training on rice cultivation. Core areas of the training for the farmers were in the areas of land development covering rice farm area measurement, bund construction on the rice farm to help conserve water any time and ensuring good ploughing on the rice farm while the training in rice cultivation covered seed selection, planting, fertilizer management, weed management, pest and disease management, time and proper application of fertilizer.

2.7.2.1 Land development in rice farming

Preparing land appropriately is one of the key factors that determine higher rice yield in inland-valley lowland rice production systems. Preparation of land timely for rice farming is vital for boosting early crop establishment and to facilitate organic material such as crop residues and weeds decomposition (Defoer *et al*, 2009). Defoer *et al* (2009) indicated that land-levelling facilitates water management, minimise weed germination and increases the efficiency of mineral fertilizers. They advised that the systematic steps in rice farm land preparation, that is, starting with the initial removal of weeds to land-levelling should strictly be followed.

Under the JICA project for sustainable rain-fed lowland rice production, land development as a key component of the training covered three areas namely; Area measurement, Bund construction and Good ploughing.

A well-prepared rice farmland controls weeds, ensures uniform recycled plant nutrients, provides a soft soil mass for transplanting and a suitable soil surface for direct seeding. For effective weed control and to ensure enriched soil, it is important to commence land preparation immediately after harvest or during fallow period. Generally, it will take a period of three to four weeks, depending on the size and nature of the field before planting (MOFA/JICA TENSUI RICE, 2014).

Area Measurement

Area measurement enables farmers and agriculture extension agents to know the farm size per farmer, the total land size used for rice farming in the district, in the country and the world at large. For example, in 2012, rice was cultivated on about 11.5% of the World's arable land; *i.e.*, 160.5 million hectares of land was under rice (FAO, 2014), while the total arable land was 1,395 million hectares (FAO, 2014) and according to Mosleh, Hassan and Chowdhury (2015), rice area mapping is essential for ensuring food security, where demands mostly will exceed production due to perpetual increasing population. They emphasised that timely and accurate estimation and measurement of rice areas can provide valuable information for governments for policy making purposes, planners, and decision makers in formulating agriculture related policies regarding rice production. Under the JICA rain-fed lowland rice production training project, land size must be properly and accurately measured to enable the AEAs to advise farmers on the quantum of seeds, fertilizer and herbicides to apply with certainty.

Bund construction

Bund construction is considered a rainwater harvesting technique purposed for rice farming. Rainwater harvesting can be understood as a strategy for inducing, collecting, storing and conserving local surface runoff water for agricultural in arid and semi-arid regions (Nonvide, 2018; Olarinde *et al*, 2012; Boers & Ben-Asher, 1982). Rainfall induces surface flow on the runoff area. At the lower end of the slope, runoff collects in the basin area, where a major portion infiltrates and is stored in the root zone. After infiltration has ceased, then follows the conservation of the stored soil water.

In bund construction in rural areas, simple stone lines are used for bund construction. The main objective of bund construction was to minimise the effects of drought through water management to help improve rice plant production (Nonvide, 2018, Vondolia, Eggert & Stage, 2012, Olarinde *et al*, 2012, Critchley & Reij, 1989). Bund must be maintained mostly before the beginning of the farming reason. Good bunds are an antidote to water losses by seepage. Bouman *et al* (2005) established a reduction of 450 mm in total water use in a rice field by lining the bunds with plastic. However, such measures are probably not financially attractive to most peasant or micro farmers. For the project farmers, bunds were constructed through the help of tractor operators. Bunds were mostly constructed on rice fields that have natural slope downstream. For the project farmers, bunds helped minimise the effects of draught on the rice farms.

Good ploughing

Finding from International Rice Research Institute (IRRI) (2015) revealed that a properly prepared and levelled rice farm facilitates healthy and uniform crop that can compete with weeds, uses less water, and ensures higher rice yield at a lower cost. The training thought farmer how to ensure that their rice farms were properly ploughed. In the words of the farmers, they took this aspect of the training seriously and benefits they realised when they properly prepared rice farms were: a) many small soil clods helped give good seed soil contact, b) less weeds; c) stopped water penetration; d) level and smooth surface after working; and e) facilitates well-constructed bunds.

2.7.2.2 Rice cultivation

The training on rice cultivation focus on seed selection, planting or direct sowing, fertilizer management, weed management, pest and disease control (MOFA/JICA TENSUI RICE, 2014)

Planting

To prepare the rice field for effective seed sowing or transplanting, the training recommends that: i) plough should be done immediately after harvesting - especially if the soil is still moist: ii) with the first or primary ploughing, a disc or mould board plough should be used to kill weeds and incorporate crop residue, preferably 6–8 weeks before planting with maximum depth of 10 cm; iii) with second ploughing, farmer should plough across the field with the disc or tine harrow at least twice to make small clod

sizes. Second ploughing should be 2–3 weeks before planting and the last harrowing 1 week before planting with maximum depth of 5–7.5 cm; iv) effort should be made to prepare and/or repair bunds, destroy rat burrows, repair any holes and cracks, and re-compact the bunds. Bunds should be at least 0.5 m high and 1 m wide; v) levelling the field to give better water coverage, better crop establishment, and better weed control; soil puddling should be done at least 1–2 days before seeding to allow the water to clear when direct seeding is used. These recommendations corroborate the IRRI (2015) standards for the preparation of rice farms that can guarantee higher rice yield.

Seed selection

Seeds are important in improving rice yield. Seeds carry the genetic characteristics for successful crop production. It is important that clean and healthy seeds should be used as planting materials in order to increase rice productivity (Diaz *et al*, 2009). Contaminated seeds can often result in poor germination and poor seedling vigour, resulting to unhealthy crop, so the project farmers were thought and urged to avoid poor quality seeds. The deterioration of the seed vigour in rice crop accounted for 20% of the yield losses (Ella *et al*, 2011). In a study on farmer's seed management practices, it was revealed that most farmers do not purchase certified seeds but rather procure or exchange seeds of available varieties with other farmers. This practice according to Diaz *et al* (2009); Escalada *et al*, (1996) and Fujino *et al*, (2008) leads to farmers using seeds that have impurities and contaminants, and seeds that are infected with pathogens. Ella et al, (2011) and Diaz *et al*, (2009) discovered that if farmers increase the use of clean and healthy seeds for growing, rice productivity can be significantly raised without much

additional cost. Farmers who participated in the use of quality and healthy seeds showed an increase in rice yield by nearly 20% compared to farmers who used their own seeds considered less quality and less healthy (Diaz *et al*, 1998). According to MoFA/JICA, (2014) handbook on rice cultivation, selecting seeds for sowing must be done carefully following recommended procedures such as soak seeds in salt water (specific gravity 1.10) and remove floated grains. Then wash salt away from the sunken seeds and wash the seeds 5 times before sowing (MoFA/JICA, Tensui Rice, 2014).

Fertilizer management

Fertilizers represent the food for plants and they contain vital mineral nutrients necessary to support rice plant growth and increase yield. The major nutrients in fertilizers are Nitrogen (N), Phosphorus (P) and Potassium (K), according to Azumah and Zakaria (2019), while Tsujimoto *et al* (2017) opined that fertilizer plays a crucial role in rice productivity enhancement in Ghana. It is considered a major component of soil and water conservation techniques and supported Latin America and Asia and many countries to achieve green revolution (Azumah & Zakaria, 2019; Ogheneruemu & Abdul-Hameed, 2017). Apply fertilizers when the soil does not supply enough nutrients. Fertilizers are organic, such as farm manure or inorganic, such as urea. The functions of fertilizer include; increases number of tillers, increase size and weight of grains, enables plants absorb and make beneficial use of phosphorus, enable the plants withstand adverse environmental conditions, enables the plants withstand rice diseases, increases the numbers of grains per panicle, and increase the protein content of the grains (MoFA/JICA, 2014). The training prescribed a recommended rate and periods of

fertilizer application to the rice farmers. Farmers were encouraged and guided by the AEAs to apply the recommended rate of fertilizer on time and compliance to this contributed greatly to increase rice yield.

Weed management

Weeds are major constraints to rice production especially in lowland labour intensive cultivation methods and is cited among the main rice production constraints. Common agronomic practices cause weed problems are inadequate land preparation, rice seed contamination with weed seeds, poor quality rice seeds, broadcast seeding in lowlands, old rice seedlings for transplanting, inadequate water management, inadequate fertilizer management, mono-cropping, labour shortages for hand weeding and delayed herbicide applications (Mola & Belachew, 2015; Johnson, 2013). Weeds and pests are important biotic constraints reducing rice yields by nearly 25% in both sites which induce farmers to use harmful agrochemicals (Mola & Beachew, 2015; Islam *et al*, (2012). In Philippines, a major cause of the increase in rice yield was due to lower weed and pest pressures achieved by the use of high quality seeds (Diaz, *et al*. 2009). According to Islam *et al*. (2012), Devasinghe, Premarathne and Sangakkara (2011) and De Datta and Beltazar (1996), hand weeding and weed control comprise approximately 20% of rice production cost and that effective and economical weed management is an important component of technology to improve rice productivity. The use of non-chemical weed controls methods can help reduce herbicide usage as well as protect the environment. The rate of yield reduction from harmful weeds is tremendous. Rice yield declines

significantly without weed control. Weeding must be done at least twice within the rice farming season (MoFA/JICA, 2014).

2.7.3 Moderating variables

Moderating variables represent a combination of factors that have the potential of influencing positively or negatively the ability of the AEAs to deliver the training to the farmers appropriately. They are also capable of influencing positively or negatively ability of the farmers to practice and implement the knowledge acquired from the training programme, hence capable of reducing or increasing rice yield expected from rice farm. These comprise natural factors that management of any training programme mostly have very little or no influence over.

2.8 Conclusion

The literature and all the various empirical studies in this thesis provided understanding of theories on which this study is anchored. The literature served as a guide and it is used to show the work of others and how collectively researchers' views and ideas agree or depart from each other. This study took shape because of the guidance of other researchers works, prominent among which are works on concepts and needs for training, evaluation and its relevance to training and issues on rice farming and its benefits to farmers. The literature helped in shaping the thinking for the conceptual framework and with particular reference to dependent, moderating. independent variables and their relationships with livelihood assets and socio-economic benefits farmers derive from rice farming in the study areas.

CHAPTER THREE

METHODOLOGY

3.1 The Study Areas

The study was specifically conducted in three selected Municipalities in Northern, Savana and North-east Regions where the Project for Sustainable Rain-fed Lowland Rice Production was implemented by JICA. The districts were Tamale Metropolis (which comprised Sagnarigu Municipality and current Tamale Metropolis), West Mamprusi Municipality, and East Gonja Municipality. The profiles of the districts selected for the training are outlined below. Table 3.1 shows the population of the districts under study.

Table 3.1: Population Profile of Municipalities Studied

Variables	Tamale Metro	East Gonja	West Mamprusi
Population	*233,252	135,450	121,117
Male (%)	49.5	51.5	49.2
Female (%)	50.5	48.5	50.8
Households into agric (%)	69.4	72.6	85.5
Youth Population (%)	36.4	44.0	46.2

Source: GSS, 2014

*Figure represents population for then Tamale Metropolis (current Tamale Metro and Sagnarigu Municipality)

3.1.1 West Mamprusi Municipality

The West Mamprusi Municipality which is currently in the North-east Region was created in 1988 under Legislative Instrument (LI) I 1448 which was later in 2012 replaced with LI 2061 following the creation of the Mamprugu-Moagduri District. The district is located within longitudes 0°35'W and 1°45'W and Latitude 9°55'N and 10°35'N. It has a total land size of 2,610.44 sq km and shares boundaries with East Mamprusi, North Gonja, Savelugu and Kumbungu Districts to the south; Builsa, Kassena-Nankana East Districts and Bolgatanga Municipal and Talensi District (Upper East Region) to the north and; to the west, Mamprusi-Moagduri District (GSS, 2014).

The West Mamprusi Municipality is one of the 6 administrative Assemblies in the then North-East Region of Ghana with Walewale as its capital which has a strong economic and functional linkage with some major settlements in the Northern and Upper East Regions like Bolgatanga and Fumbisi. At the time of implementation of the training project, East Mamprusi Municipality was part of Northern Region. It is now a Municipality. The West Mamprusi Municipality has a population of 121,117 and which accounts for 4.9% of the region's total population (GSS, 2010). About 50.8% of the district's population is female while 49.2% are male. The Municipality is predominantly rural, with a population of 76,503 living in rural settlements (GSS, 2014). Urbanisation in the Municipality is centred in Walewale, which is the dominant urban centre having many social amenities. The total age dependency ratio for the Municipality is 102.6, the

age dependency ratio for males is higher (109.8) while that of females is (96.1) (GSS, 2014).

As high as 85.5% of households in the Municipality are engaged in agriculture (96.1% in rural localities and 69.2% in urban localities) (GSS, 2014). Most of them are involved in crop farming (96.9%) and livestock rearing (69.7%). Crop production in the Municipality is by small holder farmers who produce for family upkeep and occasional sale. Maize, millet, rice, groundnut, cowpea, sorghum, bambara beans and yam, and the major crops grown in the district. Large fertile lands exist in the Yizesi, Kunkua, Katigri and Soo valleys, suitable for large-scale rice farming. There is loamy and rich soil in this area with a very high water holding capacity good enough for lowland rice cultivation. The average yield of rice in the 2011 crop season was 3.5 metric tons/hectare (MoFA, 2011).

3.1.2 East Gonja Municipality

The East Gonja Municipality which is now in the Savana Region was created by a legislative instrument (LI 1938) in 2007. The Municipality lies within Latitude 8^0N and 9.29^0N and, Longitude 0.29E and 1.26^0W and shares boundaries with the Mion District, Yendi Municipality and the North East Gonja District, Central Gonja District to the West, Nanumba-North, Nanumba-South and Kpandai Districts to the East, and the Kintampo North District in the Brong-Ahafo Region to the South. The total land area of the Municipality is 8,340.10 sq km, occupying about 11.95% of the landmass of the Savana Region making it the largest municipality in the country (GSS, 2014). According to GSS

(2014), the East Gonja Municipality lies in the Tropical Continental Climatic Zone. Temperatures are fairly high ranging between 29^0C and 40^0C. The population of East Gonja Municipality, according to the 2010 Population and Housing Census, is 135,450 representing 5.5% of the region's total population. Males constitute 51.5% and females represent 48.5%. About 81% of the population is rural. Over 72.6% of households in the Municipality are engaged in agriculture. In the rural localities, eight out of ten households (81.3%) are agricultural households while in the urban localities, 43.1% of households are into agriculture. Most households in the municipality (93.9%) are involved in crop farming especially rice (GSS, 2014).

3.1.3 Tamale Metropolis

The Tamale Metropolitan Assembly was established by legislative instrument (LI 2068) which elevated the then Municipal Assembly to a Metropolis in 2004. It is currently one of the six Metropolitan Assemblies in the country and the only Metropolis in the five regions in Northern Ghana. It has Tamale as the Metropolitan capital city and at the same time the regional capital of the Northern Region (GSS, 2014). It is located in the central part of the Region and shares boundaries with the Sagnarigu Municipality to the west and north, Mion District to the east, East Gonja to the south and Central Gonja to the south-west, Savelugu Municipality, Nanton and Kumbungu to the north. The Metropolis has a total estimated land size of 646.92sq km. Geographically, the Metropolis lies between latitude 9º16 and 9º 34 North and longitudes 0º 36 and 0º 57 West.

The population of Tamale Metropolis, according to the 2010 Population and Housing Census, is 233,252 representing 9.4% of the region's population. Males constitute 49.7% and females represent 50.3%. The proportion of the population living in urban localities (80.8%) is higher than that living in rural localities (19.1%) of the metropolis. The population of the metropolis is youthful (almost 36.4% of the population is below 15 years) depicting a broad base population pyramid which tapers off with a small number of elderly persons (60 years and older) representing 5.1% (GSS, 2014). Only a small proportion (26.1%), of households in the metropolis is engaged in agriculture. In the rural localities, the proportion of households engaged in agricultural (43.3%) is less than that of urban households which is 56.7%. Most (84.8%) of the agricultural households in the metropolis are involved in crop farming, 52.9% in urban and 47.1% in rural localities.

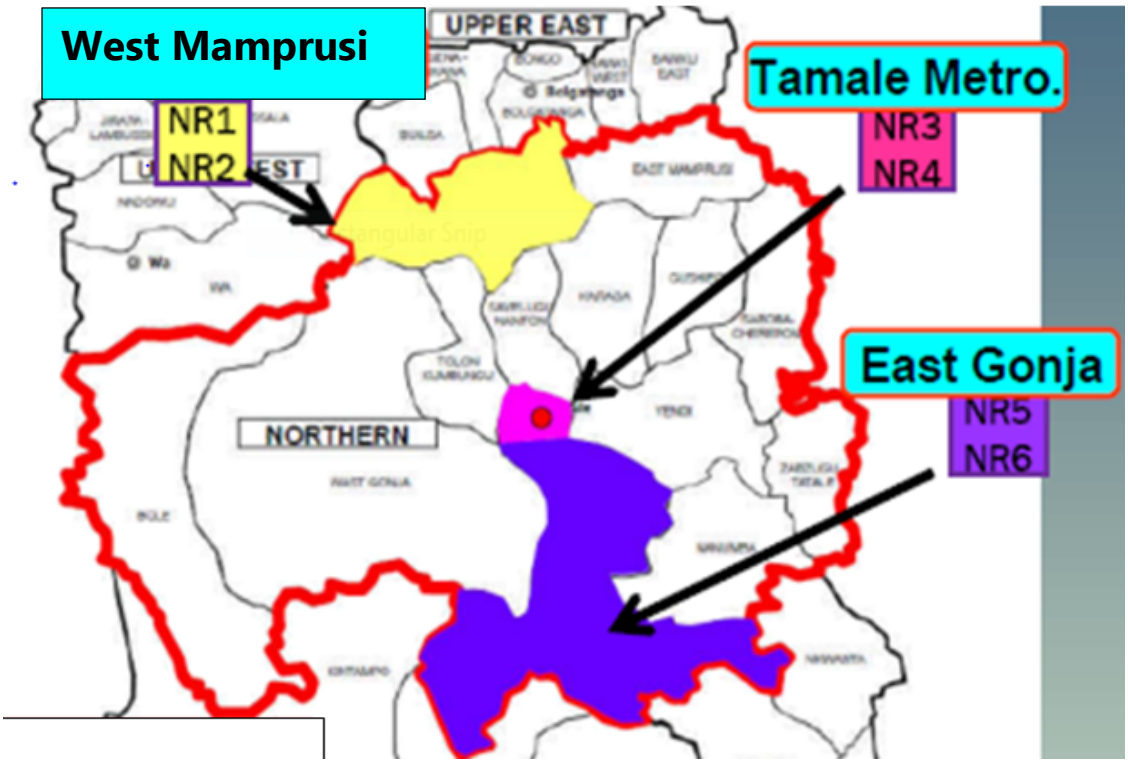


Figure 3.1: Map of Northern Ghana showing the three selected areas for the JICA project in the Northern Region.

Source: The Project for Sustainable Development of Rain-fed Lowland Rice Production in Ghana (2012).

3.2 Research Methodology

Research is carried out for various reasons including an examination and synthesis of existing knowledge, scrutinising some existing situation or problem, proffering solutions to a problem, exploring and analysing more general issues, conceiving and creating a new procedure or system, explaining a new phenomenon, producing new knowledge or a combination of any of the above.

Methodology on the other hand, defines how research should be conducted, including the theoretical and philosophical assumptions on which the researcher grounds the theories and the consequences of these for the methods used.

This study is carefully conducted to realise its objectives. Effective procedures were followed in choosing the topic, identifying the participants of the project, determination of the sample size and the selection of the sample as well as the design of the questionnaire used in collecting the data. The data collected was also thoroughly analysed following research methodological standards as prescribed by Maxwell (2016); Collis and Hessey (2009); Saunders *et al* (2007); Adam and Healy (2000); Zickmund (2000); Hussey and Hussey (1997) and Taylor and Bogdan (1984).

3.3 Research Design

The research design provides the framework for the gathering and analysis of data. These research designs used was quantitative and qualitative approaches. A quantitative approach generally refers to the systematic empirical investigation of quantitative properties and phenomena and their relationships. The objective for the quantitative research design was to develop and employ mathematical models, theories and/or formulas pertaining to phenomena. The process of measurement is essential to quantitative research because it provides the fundamental connection between empirical observation and mathematical expression of quantitative relationships. Qualitative research, however, is a process of inquiry suitable for many different academic disciplines, traditionally in the social sciences, but also in market research. The goal for using the qualitative research was to gather an in-depth understanding of human behaviour, the motives behind such behaviour and investigate the why and how of decision making, not just what, where and when.

For the purpose of this study, a mixed method approach was adopted which involved using quantitative and qualitative approaches in a single study (Mwesigwa, 2010 and Creswell, 2003).

Choosing the appropriate research methods is a major element of any research (Almalki, 2016; Cai, Shi & Hi, 2016; and Creswell, 2014). In using the mixed method, there are three avenues. The first is the use of quantitative methods such as questionnaires, data gathering and data analysis. The second is the use of qualitative method through

interviews, observation and documented data. The last is careful analysis of both quantitative and qualitative data to make meaning towards writing final report.

As the aim and objectives of this research required in-depth investigation and facts about the effects of the JICA training programme on rice yield of farmers, the survey design was used by the researcher. This involves using both quantitative and qualitative approaches. The researcher thus adopted the mixed methods approach. This approach was preferred because it helped to build a broader picture of recording and detailing respondents' views and also helped in capturing quantitative data for holistic analysis.

3.4 Population for the Study

The population of this study comprised all farmers engaged by the JICA project. The population of the farmers was 880 in all three districts. The breakdown of the population and the sample selected from each district for the study is shown in Table 3.2.

3.5 Sampling Techniques and Sample Size

The multistage sampling technique was used for the selection of the sample for this study. The population comprised farmers who were selected from the various communities in the three districts by JICA for the training. Purposive sampling was used to select the districts because they were the districts where the project was implemented.

Since the farmers were already clustered into groups of 10 by the project, purposive sampling was used in selecting these groups for the study.

The Krejcie and Morgan (1970) Table for determining sample size was used in determining the sample size of the farmers for this study. A population comprising 880 farmers (sampling frame) when traced on the Krejcie and Morgan (1970) Table gave a sample size of 265 farmers. Details of the number of farmer groups per district and the number of farmers per group are presented in Table 3.2.

Table 3.2: Population of the Study

Metropolis/ Municipalities	Number of groups	Number of farmers per group	Total number of farmers
Tamale Metro	33	10	330
West Mamprusi	34	10	340
East Gonja	21	10	210
Total	**88**	**30**	**880**

Source: The Project for Sustainable Development of Rain-fed Lowland Rice Production in Ghana, (2012).

Proportional representation was used to determine the number of respondents for each area. The formula used is indicated as:

(x/N)*n, where:

x = total number of farmers per district/metropolis

N = sampling frame

n = sample size

* = multiplication

The proportional representation for each area based on the formula above was arrived at as follows:

Tamale Metro: (330/880) * 265 = 99.37 farmers

West Mamprusi: (340/880) * 265 = 102.38 farmers

East Gonja: (210/880) * 265 = 63.23 farmers

These figures were approximated to 99 for Tamale Metro, 103 for West Mamprusi Municipality and 63 East Gonja Municipality as indicated in Table 3.3.

Table 3.3: Population and Sample Size of Farmers in the Selected Districts

Metro/ Municipalities	**Total No. of Groups**	**Pop. of Farmers**	**Sample size**
Tamale Metro	33	330	99
West Mamprusi	34	340	103
East Gonja	21	210	63
TOTAL	88	**880**	**265**

Source: JICA Project documents, 2014

The farmers were stratified based on sex to ensure equal representation of the male and female members of the groups. The individual respondents were then selected first by purposive sampling techniques where the group leader was selected purposively because some of them were part of the farmers who were first trained by JICA/MoFA. Any woman who was part of the group was also purposively selected to ensure good representation of the female and any other member was then selected using simple random sampling technique.

3.6 Sources and Types of Data

Data were collected from primary and secondary sources for this study. Primary data were collected from farmers, AEAs, MoFA and JICA staff who were involved in the training process.

Secondary data refers to already existing information which includes archival records, company documentation, publications and annual reports with particular reference to the study organisation. Secondary information is most often supported by literature review, which refers to data or information obtained from journals, books, performance appraisals, training reports, training forms, and study leave forms. For the secondary data to support this study, the first point of search was JICA project reports. The project objectives were sourced from JICA office. The names, operational areas, contact numbers and location of AEAs were sourced from JICA office which enabled the researcher to get into contact with the AEAs for in-depth interview sessions.

3.7 Research Instruments, Validity and Reliability

3.7.1 Research instruments used

To gather data for this study, a semi-structured survey questionnaire was designed and administered to the farmers. This questionnaire was designed using semi-structured questions to help elicit both qualitative and quantitative data. The study covered discussions with JICA regional office staff in the Tamale office who run the project and some AEAs whose views were solicited. The perceptions of the AEAs on how the training and the application of the technology had affected yield of rice farmers were sought. Both close and open-ended questions were used with most of them designed using the five point Likert's scale ranging from highest agreement = 5 to least agreement = 1.

3.7.2 Validity and reliability of research instruments used

Face Validation: The questionnaire for data collection was validated through face validation. By face validation, the researcher thoroughly screened and examined the questionnaire, answered them to test how accurate, clear, complete and simple the questionnaire items were to the understanding of the research assistants and the farmers. The structure, positioning, typesetting the questions appearance on the paper were considered. The purpose of this face validation was to ensure that the questions truly

represented the variables the researcher meant and to help solicit the responses in the manner desired. This was to ensure that the responses solicited through the questionnaire accurately measured what it aimed at measuring.

Content Validation: To ensure content validity of this questionnaire, persons with relatively good knowledge on the topic of study were given copies of this questionnaire to study and make input. For this purpose, copies were given to interested colleagues comprising PhD Candidates and Faculty members who studied the questionnaire and made input. They helped examine the questionnaire, question-by-question to determine the suitability or otherwise of each question in the questionnaire. The final process of content validity was carried out by giving the questionnaire to the supervisors to make input. This process helped streamline the questions for the purpose of accuracy and usefulness.

Reliability: Reliability in research is important and as such, the researcher tried to ensure reliability of the questionnaire by pre-testing it. The questionnaire was pre-tested in the Savelugu Municipality. Though this project is unique and was carried out in defined districts by JICA, it is expected that there is farmer-to-farmer dissemination of the technologies introduced by JICA because the Savelugu Municipality is a neighbouring district. The aim of the pre-testing was to ensure that the questionnaire is well structured and designed to elicit the needed responses to help address the research questions leading to the achievement of the research objectives. The pre-test

questionnaire was administered to fifty farmers. The data was analysed and the results used to update and correct the questionnaire.

3.8 Data Collection

The researcher and the research assistants helped the respondents to fill the questionnaire by reading and interpreting the questions to them since the educational levels of the farmers were perceived to be low. The researcher and his research assistants personally administered the questionnaire. The questionnaire was used to collect primary data while the interview guides were designed to enable the researcher to collect qualitative data. Fifteen (15) of the AEAs who received training from JICA and supervised the farmers during the implementation of the project were randomly selected and interviewed and their views on the effects of the project on beneficiary farmers solicited.

The researcher selected five research assistants and trained them on how to administer the questionnaire. Two assistants who could speak Mampruli very well were selected for the West Mamprusi Municipality, two Dagbanli speaking assistants for Tamale Metro and part of the area East Gonja Municipality who could speak Dagbanli and one Gonja speaking assistant for the areas in the East Gonja Municipality who speaks only Gonja. Proficiency in the local languages of the selected districts was considered important in the choice of research assistants because most rice farmers in the study districts could not read or write, hence the need for persons who could speak the local language.

3.9 Methods of Data Analyses

The overall goal in data analysis is to treat the evidence fairly, produce compelling, analytic conclusions and rule out alternative interpretations. The researcher carried out the analysis by employing qualitative data analysis techniques for qualitative data while quantitative statistical tools were used to analyse and interpret quantitative data gathered from respondents.

3.9.1 Qualitative data analysis technique and processes

This method of analysis is inductive in nature with the researcher generally exploring meanings and insights regarding a specific scenario (Haradhan, 2018; Levitt *et al.*, 2017; Gopaldas, 2016). Typically, qualitative technique of data collection and analysis uses purposive sampling, semi-structured, open-ended questions interviews.

As a type of social science research that collects and works with non-numerical data, it is used to interpret meaning from data that help make understanding of social life by studying a target population or place. Qualitative technique involves the observation and interpretation of people's perception of the same or different event, concentrate on words not numbers, investigate local knowledge, people's experiences and relationships. To Gentles *et al* (2015) and Walia (2015) it takes the snapshot of the people's perception in a natural environment and it focus on words rather than numbers.

Yin (2003), however, opined that qualitative data analysis consists of examining, categorising, and tabulating data collected in relation to the research objectives. Rahman (2017) and Viswambharan, and Priya (2016) stated that the objective of qualitative data analysis is to identify, examine, compare and interpret patterns and themes drawn from the responses received from respondents.

In the choice of the qualitative research technique appropriate to provide the needed information for this study, the narrative and phenomenological research qualitative approaches were employed.

The narrative approach focuses on rice farmer's narratives about set of events that characterises the JICA rain-fed lowland rice cultivation technology. The focus was on stories about the project told by participants.

According to Felton and Stickley (2018), the story aspect is seen as a complete entity in itself with a beginning, middle, and an end. Narrative research help gave unique insight about procedure and impalpable aspects of participant experience, allowing for unique and context-based evaluations which reveals how changes occur and evolve from a farmers and AEAs personal perspective.

Phenomenology is an approach to explore people's everyday life experience which is mostly used when the study is about the life experiences of a concept or phenomenon

experienced by one or more individuals (Haradhan, 2018; Guerrero-Castañeda *et al*., 2017; Creswell, 2014).

Qualitative analysis was used to analyse responses for objective three of this study which sought to determine the effect of the training on the yield increase of farmers. Qualitative data were gathered through interactions with AEAs to corroborate the responses of farmers.

The processes followed in analysing the qualitative data were:

1. The first step was immersing (Belotto, 2018; Ulin, Robinson & Tolley, 2005). This involved continually reading the transcripts to familiarize with the content. It helped me assessed the quality of the data to determine whether responses were ambiguous or contradictory and whether the information was accurate to help answer my research questions.
2. I scrutinised the interview technique identified and addressed any biases.
3. Words and sentences that conveyed similar meanings were identified and labelled into codes and then translated into themes.
4. Interpretation of information with regard to how the emerging themes helped in addressing the research question and objective, and finally,
5. General ideas were incorporated into the final report which formed part of the narratives in the final thesis.

3.9.2 Quantitative data analysis techniques

Quantitative data collected were analysed using appropriate statistical tools based on each specific research objective as follows:

Objective One: To determine the usefulness of the training to the rice farmers in the selected areas.

Descriptive statistics, that is, frequencies and percentages were used to analyse data gathered on the training method used in training farmers. The descriptive statistics was converted to bar chart for easy interpretations and understanding.

Objective Two: To examine the perceived capabilities gained by rice farmers' after the training in the selected areas.

Data gathered on this objective were coded and analysed using SPSS version 20. Analysis were done using descriptive statistics. Frequencies, percentages and means were extracted from the analysis, the responses of the farmers in each of the perceptive statements in the form of percentages were ascertained. The percentage of farmers who indicated a change in the perceived knowledge area were identified against the percentage of farmers who indicated no change in the perceived knowledge area.

Objective Three: To ascertain the extent to which the training has contributed to Increase in rice yield (per hectare) of farmers in the selected areas.

Results on yield per hectare after the adoption of the technology were compared with the yield per hectare before the training project. For this objective, before and after data were collected, coded and analysed using SPSS, but the researcher did not consider respondents on the basis of with or without. Also, paired sample t-test was used to determine the significance of the increase in yield.

Qualitative data were also sought from AEAs. Their views were recorded, soughed and group into themes, reconciled and presented as their perspectives in the report. These qualitative narrations of the AEAs are stated in addressing this objective.

Objective Four: To assess the correlation between the components (land development and rice cultivation) of the training project on rice yield in the selected areas.

Spearman correlation was used to determine the strength of the relationship between each thematic area/component of the training and increase in rice yield in the study areas. A five point Likert scale of 5 highest agreement to 1 least agreement was used. In running association test, experts express worry about using Pearson correlations on ordinal data using Likert scale. However, Nussbaum (2019, 2014); Norman (2010); Choi, Peters & Mueller, (2010); Chen & Popovich, (2002) and Kendall & Gibbons (1990) recommended the use of Spearman rho and Kendall correlation for conducting association test when using ordinal data on Likert scale.

Objective Five: To determine the effects of increase in rice yield on the livelihood and socio-economic status of farmers in the selected areas.

i. Descriptive statistics in the form of percentages and means was used to determine the perceived changes in rice farmers' statuses as a result of rice yield increase in the selected districts. Descriptive statistics was used to analyse their responses.

ii. Spearman correlation was also used to establish the relationship between increase in rice yield and livelihood assets acquired by the farmers on a five point Likert scale of 1 to 5, on least agreement to highest agreement.

Objective Six: To examine the constraints faced by farmers during the implementation of the training technology in the selected areas.

Descriptive statistics was used to compute the percentages of agreement and disagreement to the statement by the farmers.

3.10 Theoretical Evidence of Running Spearman Correlation Using Ordinal Data

Many researchers feared performing Pearson's correlation analysis using ordinal data from Likert scale for example for lack of certainty of the results. Chen and Popovich (2002) opined that Pearson's correlations should only be considered when both variables are measured on an interval or ration scale. They however suggest that Kendall's and Spearman's correlations are more appropriate correlational analysis options for ordinal

data. According to Nussbaum (2019); Kendall and Gibbons (1990), several alternative correlational methods such as Spearman's and Kendal's are being developed for the analysis of ordinal data. Choi, Peters and Mueller (2010) argued that Pearson's correlations can be used to run association test but cautioned, which is in line with Kampen and Swyngedouw (2000) that to use Pearson's for associated test, assumption must be made to indicate that "in a psychological continuum, equal distance exists between all participants' responses over the four or five consecutive categories". However, Choi, Peters and Mueller (2010) and Murray (2013) strongly cautioned researchers that other measures of association more appropriate for analysing ordinal data are Spearman's, Kendall's and Polychoric correlations. Bollen and Barb (1981) also argued that it is acceptable, with negligible amount of attenuation using Pearson's correlation estimates to treat ordinal data. There is extensive research which illustrates the problems resulting from analysing ordinal data using Pearson's correlation, (Jo ¨reskog & Moustaki, 2001; Kaplan, 2000; O'Brien, 1985; Borgatta & Bohrnstedt, 1980; Ware & Benson, 1975 and Mayer, 1971;). However, there are two commonly used nonparametric measures of association that are recommended for researchers who want to analyse ordinal data, and these are Spearman's and Kendall's correlations (Nussbaum (2019, 2014); Szmidt & Kacprzyk (2011); Norman (2010); Choi, Peters & Mueller (2010); Chen & Popovich (2002); Kendall & Gibbons (1990). Spearman's correlation does not require that the two variables be linearly related and does not assume that the variables are measured on interval or ratio scales (Choi, Peters and Mueller, 2010). Norman (2010) using real scale data found that parametric tests such as Pearson

correlation and regression analysis can be used with Likert data without fear of "coming to the wrong conclusion".

Murray (2013), in her study "Likert Data: What to Use, Parametric or Non-Parametric?" also concluded that parametric and non-parametric tests such as Pearson and Spearman rho conducted on Likert scale data do not affect the conclusions drawn from the results and this affirms Norman's (2010) finding that parametric tests can be conducted on Likert scale data without coming to the wrong conclusion. Szmidt and Kacprzyk (2011) and Aczel (1998) indicated that when the assumption about the normal distributions of variables to be considered is not valid or the data are in the form of ranks, it is recommended to use Spearman correlation test of association.

In examining these researches and their findings on the use of association test such as spearman correlations, the researcher applied Spearman correlations to analyse the relationship between increase rice yield and the variables of the training aspect of the JICA training for rice farmers. Spearman correlations were also used by the researcher to test the relationship between increase in rice yield and livelihood assets acquired by the farmers. Relying strongly on Nussbaum (2019); Murray (2013); Szmidt and Kacprzyk (2011); Norman (2010); Choi, Peters and Mueller (2010); Chen and Popovich, (2002) and Kendall and Gibbons, (1990), the researcher is of the strong belief that using Spearman correlation to test the association on ordinal data would not affect the conclusions drawn.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

This chapter covers the study results, which are presented and discussed. Key issues contained in this chapter include demographic data of respondents, reasons for engaging in rice farming, training methods used, the most preferred training method used in training farmers and the effects of the training. AEAs perceptions of the effects of the key areas of the training, the relationships between the key areas of training and increased rice yield, socio-economic benefits of the training to rice farmers, effect of increased rice yield on livelihood assets acquired, changes in status of beneficiaries and constraints encountered by farmers during implementation of the project are discussed.

4.1 Socio-demographic variables and basic farming information about farmers

The socio-demographic and economic variables on which data were gathered and presented include sex, marital status, level of education, income earned, the influence of income earned on farming practice, number of years in rice farming, reasons for rice farming, rice farm size, rice varieties cultivated and the source of rice seeds. Details are shown in tables below.

Table 4.1: Demographic Variables of Respondents – Sex and Age

Responses		Frequency	Percent (%)
SEX			
Male		220	85.6
Female		37	14.4
AGE	Minimum	18	
	Maximum	75	
	Mean Age	39.6	
	Std. Deviation	11.05	

Source: Field Survey, 2015 **N = 257**

4.1.1 Sex and age of respondents

From the results in Table 4.1, 85.6% of the respondents were males while 14.4% were females. This result demonstrates that rice farming profession in the study areas (West Mamprusi, East Gonja Municipalities and Tamale Metropolis) is a male dominated occupation requiring high level of physique to ensure complied performance which is similar to most districts in Ghana (Addison, Eduseh & Sarfo-Mensah, 2014) and most developing countries (Adekenle, 2013 and Noor & Dola, 2011). Beside, the labour-intensive nature that makes farming a male dominated profession, farming is contingent on land ownership and capital to pay for ploughing and other farm inputs. In the three selected areas under study, women do not have much right to land ownership except when their husbands or brothers decide and permit them to farm on their portion and this can be taken back any time. Women in these three districts are not also engaged in

profitable ventures that can guarantee income to support farming. As a result of these constraints, women find it difficult engaging in rice farming for lack of access to farm land and capital. This finding is consistent with the findings of Addison *et al*, (2014) who discovered that 83% of rice farmers in the Ahafo Ano North District in the Ashanti Region of Ghana were males while 17% were females. Adekenle (2013) and Noor and Dola (2011) attributed the low participation of women in rice farming to constraints such as great physical effort required, low resource endowment, inadequate capital, traditional land ownership, and farming perceived as male dominated profession. Kranjac-Berisavljevic, Blench and Chapman (2003) found that in the northern part of Ghana, women cannot own land for rice cultivation, but can only help their husbands, fathers or brothers in their farm work by performing activities such as weeding and threshing of harvested rice

Farming is perceived as a labour-intensive profession. In the Northern Region, the use of machines for farming activities is very minimal and much of farm work is carried out using hand-held farming tools such as hoes and cutlasses. This presupposes that farming requires grater physical effort, and so people in the youthful stage are suitable for farming.

As presented in Table 4.1, the mean age of the farmers who took part in the JICA sustainable rain-fed lowland rice development training project was 39.6 years with 18 years as the minimum and 75 years as the maximum. This suggests that majority of rice farmers were young adults who had ventured into farming as their profession. It could be

deduced that government efforts at encouraging more young people to go into farming profession is yielding some positive responses. This result mirrors that of Noor and Dola (2011), but does not agree with Adesope *et al* (2012), whose finding indicated that a significant proportion of the farmers in the Rivers State in Nigeria, were between 41 and 50 years, indicating that the farmers were mainly middle aged, were in their economically active stage and could cope with stress. This has implications for productivity of the farmers.

Table 4.2: Marital Status of Respondents

MARITAL STATUS	Freq.	Percent (%)
Single	11	4.3
Married	244	94.9
Separated	1	0.4
Divorced	1	0.4
Total	**257**	**100**

Source: Field Survey, 2015 **N = 257**

4.1.2 Marital status

On the marital status of the respondents, only 4.3% indicated being single, 0.4% were separated and divorced respectively, with the majority, (94.9%) being married. The number of marital separation and divorce is very low at the rural areas in Northern Ghana because social support systems are working very well. Marriages are not meant for the two individuals joint together but are seen to be for the entire family. In other words,

marriage goes beyond the couples. Marital divorce or separation impinges on the reputation of the family, so each family as a social unit prevents it by managing conflicts in marriages. It can be inferred that majority of farmers being married signifies higher level of responsibility placed on the married couples headed by the man. Most married farmers are seen as capable of taking care of themselves, the women they marry and the children they will bring forth. The implication on rice farming is increase effort to position themselves in readiness to shoulder the financial responsibility of a husband and father, hence more effort and attention is directed towards farming which is considered as the main source of income and livelihood.

Table 4.3: Level of Education of Respondents

Qualification	Freq.	Percent (%)
No Formal Education	187	72.8
Primary	27	10.5
Middle School	11	4.3
JSS	13	5.1
SHS	16	6.2
Diploma	2	0.8
First Degree	1	0.4
Total	**257**	**100**

Source: Field Survey, 2015 **N = 257**

4.1.3 Level of formal education

About 73% of the farmers had no formal education. Those with at least Primary level education were 10.5%, farmers with Middle School level education were 4.3%, Junior High School leavers were 5.1% and Senior High School leavers engaged in rice farming comprised 6.2%. A small number of 0.8% and 0.4% represented farmers with Diploma and First Degree qualification engaged in farming and participated in the JICA training project respectively as shown in Table 4.3. This finding reveals that there is very low literacy rate among the respondents and this corroborates the finding of Addison *et al* (2014), that fewer females are involved in rice farming in Ghana due to its labour intensive nature. Roles performed by women in rice farming are mainly sowing and transplanting, weeding, fertilizer application, bird scaring and harvesting activities. Men dominance in the cultivation of cash crops and rice farming is no exception. However, this result differs from the findings of Adesope *et al* (2012) who discovered that 26.7% of the farmers had no formal education in River State in Nigeria, 33.3% had adult education, and 22.2% had primary education. Suffice to say from the finding that farming is perceived as a profession for less educated folk especially in Ghana. The educated who venture into farming, do that as a hobby with few (1.2%, from Table 4.3) farming for economic gains with the aim to making good use of their idle time and financial resources.

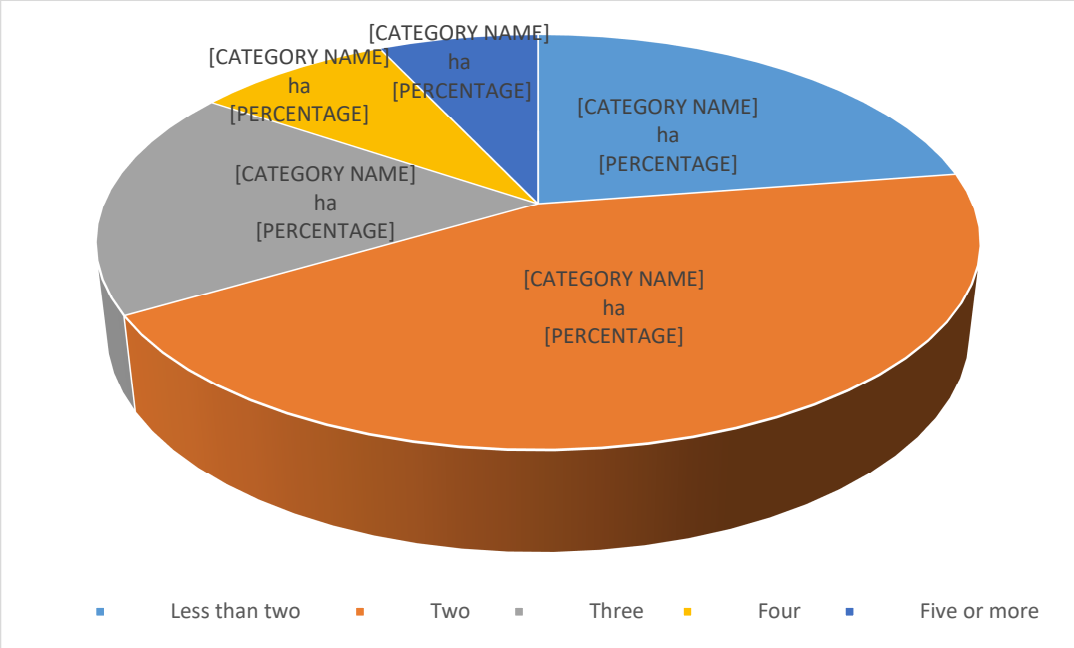


Figure 4.1: Farm Size of Rice Farmers in hectares (ha)

Source: Field Survey, 2015

4.1.4 Farm size

From Figure 4.1, about a quarter (23%) of the respondents had farm size of less than two hectares, with the majority (44%) having farm size of two hectares. Close to 18% cultivated three hectares and 8.6% and 7.0% cultivated four hectares and five hectares and above respectively. The mean farm size is 2.33 hectares. These results corroborate that of Addison *et al* (2014), about rice farmers in the Ahafo Ano North District which

established that the mean farm size was 2.0 hectares. Lowlands for rice cultivation are dispersed and hardly very large compared with the number of farmers who need the land for rice production, hence the small sizes of land holdings per farmer.

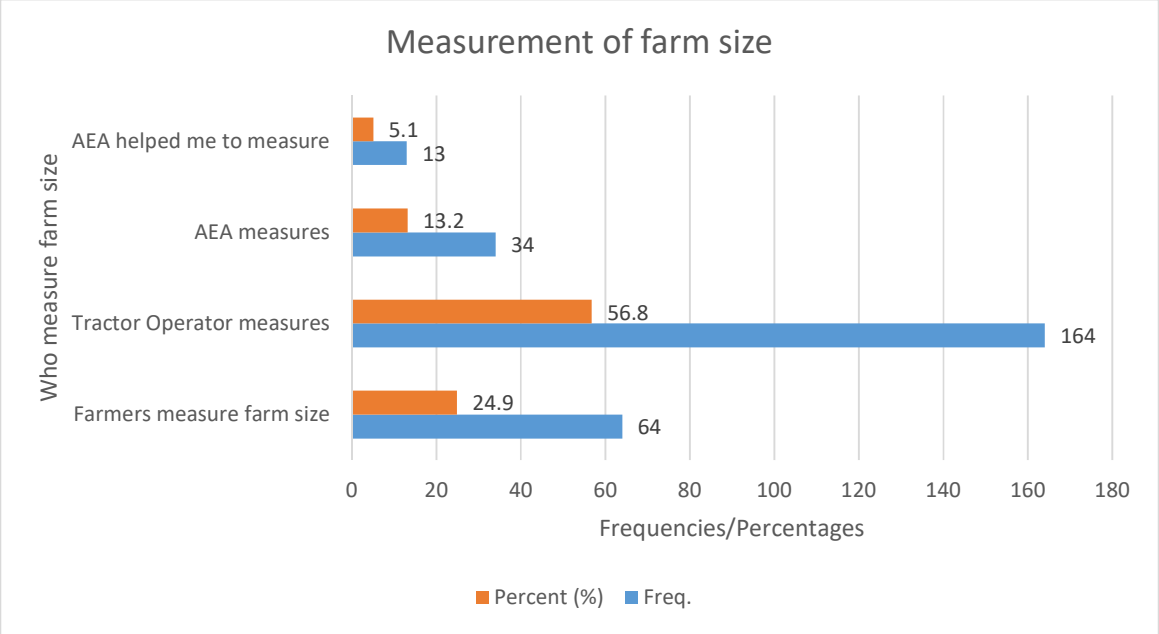


Figure 4.2: Measurement of Farm Size

Source: Field survey, 2015

4.1.5 Measurement of farm size

The farmers were trained on how to accurately measure farm size using a tape measure. Accurate farm size measurement is necessary for purposes of applying recommended levels of inputs. If the farm size is above the recommended measurement, inputs such as fertilizer, seeds and herbicides would not be adequately applied thereby leading to poor yield. Only 24.9% of the respondents said they could accurately measure the size of their farms by themselves in hectares. The majority (56.8%) stated that it is tractor operators who measure their farm size for them as shown in Table 4.4. About 13% indicated that the AEAs measure their farm size for them while 5.1% said AEAs helped them to carry

out the measurement. The 56.8% whose farm sizes are measured by tractor operators indicated that most tractor operators do not allow the farmers to measure the size for them to plough because they believed farmers ways of measuring in hectares are inaccurate and the size is normally more than a hectare. The tractor operators are suspicious of farmers and for that matter they normally measure the farm size themselves before ploughing. This attitude of tractor operators therefore, negatively affected farmers response, even though they indicated that they learnt how to properly measure their farm size. They, however, indicated that their knowledge on how to measure hectare properly gives them advantage to monitor the tractor operators when they are measuring to avoid gross under-measurement of a hectare which would disadvantage them.

4.1.6 Non-farm income earned by farmers

The results in Table 4.5 show that about a fifth of respondents (20.6%) earn some income from non-farm activities in addition to farm income. The income they earned was from sources such as petty trading, butchering, blacksmith, bicycle and motor repairing, vulcanising and wood curving. The majority 44 (83%) of the respondents who earned non-farm income as shown in Table 4.5 indicated that the income, to a very large extent, helped in influencing the farming activities, while the minority 9 (17%) said the non-farm income they earned do not have influence on their farming prospects. Rice farming requires some level of financing to help pay for tractor ploughing, pay labour where extra hands needed but cannot be provided by household member, buy fertilizer and herbicide. Those who earned non-farm income are able to use such income to support their rice farming activities. This is said to have significant effect on the rice farm management.

For those who do not earn non-farm income, they believe that they are able to manage their farms adequately without much negative effect regarding yield of rice per hectare.

Table 4.4: Income Earned from Non-Farm Activities

Responses	Frequency	Percentage (%)
Non-farm Income Earned		
Non-farm income	53	20.6
No non-farm income	204	79.4
Income Influence on Rice Farming		
Very High Influence	44	83
No Influence	9	17
Source: Field Survey, 2015:		**N = 53**

4.1.7 Rice varieties cultivated and source of seed

The rice variety cultivated by all the farmers (100%) is Jasmine 85. Jasmine 85 is perceived by the farmers as a high and early yielding variety if planted properly and cultivated following approved agronomic practices compared to other varieties. It is noted for its quality thus making it a preferred variety by consumers on the market. It also has a shorter maturity period of 110-115 days. They cultivated Jasmine 85 also because it was recommended by JICA for the sustainable rain-fed lowland rice development training project. Before the project, the farmers indicated that some rice varieties they used to cultivate include Faro15, Digang, Nabogu, Katanga and Sikamu. The project supplied the seeds for the farmers and all the farmers in the affirmative said they were cultivating the Jasmine 85 variety. Some farmers in Nakimbiya, Sayoo and

Nyamalga were trained as seed growers and subsequently served as providers of seeds to other farmers in the project.

4.1.8 Types of training methods used in training farmers by JICA

This section deals with objective one which sought to identify and determine the training methods used to train the farmers as well as determine the usefulness of the training method in delivering the JICA technology to farmers for effective implementation and subsequent propagation to other farmers.

Two training methods, according to the farmers were used by the JICA rain-fed lowland rice development project.

The training was done at two levels: (1) at the level of AEAs and selected farmers and (2) at the project beneficiary farmers level. JICA staff trained AEAs and some selected farmers using workshop whiles the selected farmers and the AEAs then trained other beneficiary farmers using method demonstration.

From the responses received, 17.5% said workshop was used while 98.1% said method demonstration was used as shown in Table 4.6. Clearly, majority of the respondents (98.1%) agreed that the most used training method by JICA in training farmers under the project for sustainable rain-fed lowland rice production training project was method demonstration. The farmers were very satisfied with the method demonstration because

to them, it involved seeing what is expected of them being done by someone and a conscious effort from that person to take them through. They emphasised that seeing the AEAs perform the act on the farm practically gave them the interest and strength to carry out their farming activities dutifully as taught. They indicated that method demonstration is devoid of long talk and time wasting. They appreciate it more when the AEAs demonstrate on the farming practices for them to see and then guide them to perform such practices on their own. The fact that majority of the farmers do not have formal education makes them comfortable with practical work than too much talking as in workshops or seminars.

Table 4.5: Types of Training Methods Used to Train Farmers

Training Methods (Responses)	Frequency	Percent (%)
Workshop key farmer	45	17.5
Method Demonstration	252	98.1

Source: Field survey, 2015. **N = 257**

During the data collection stage, the researcher had discussions with AEAs to determine the veracity of the farmers responses on the type of training methods used. Excerpts from the discussions with some of the AEAs are stated in the quotes that follow:

According to the AEA in charge of Sayoo operational area, Mr. Abraham Ayerike;

> Training rice farmers using method demonstration is very simple, fast and convenient. The farmers will like to see what they are expected to do with the technology when they get back to their individual rice farms. As a learning-

> by-doing method, method demonstration ensures that the participants get the practical knowledge and skills required in using the technology (idi).

In reality, method demonstration as a method for farmer is devoid of long talk, complex explanations and handling repeated questions from participants. The low level of farmers educational background makes method demonstration the preferred and recommended training method that can guarantee maximum understanding and retention of knowledge taught to farmers.

In the words of Mr Peter Baako, AEAs in charge of Wulugu operational area,

> Method demonstration makes training for rice farmers simple. It is practical oriented and makes training of farmers in the Municipality, in my operational area and in Ghana practical in nature. It is the best method to be used. The use of technical terms in explaining the processes involved in bund construction is avoided if method demonstration is applied. It is also important to note that most farmers cannot take down notes during learning process, especially if the concept is explained. Since they cannot read and write, they very much appreciate the use of method demonstration during training (idi).

Mr. Abukari Ziblim of Jangyili operational area and Mr. Iddi Bukari Mahama of Nyesheigu operational area all confirmed that;

> Method demonstration makes the training process very simple for both the AEAs (trainers) and the rice farmers (idi).

They emphasised that the literacy level of the farmers makes any form of training rice farmers very difficult except the use of method demonstration. They concluded that in training rice farmers, it is mostly method demonstration that ensures participants full concentration during training.

Mr. Dauda Abdul Salaam JICA Officer in the Tamale office, in charge of Training on Rice cultivation had this to say about using method demonstration to train rice farmers.

> Some practices are so complex that trying to explain them orally to the understanding of the rice farmer is difficult. Citing the example of seed selection using the salt solution and the fresh egg formula, he indicated that it is better done by demonstration than explanation because majority of rice farmers have no formal education, hence their ability to follow the explanations of concepts is low (idi).

From the researcher's interaction with selected rice farmers in the Municipality and the AEAs, method demonstration seemed to be the most preferred method of training by the farmers. Farmers are adult learners and method demonstration seem andragogic and therefore most suitable for the farmers. The concept of explaining principles and the theoretical practises to adult learners seem challenging to the trainers and the learners as well. It was also revealed that with the exception of method demonstration, other methods of training would require giving and taking notes which poses a challenge to majority of the farmers because of their low levels of formal education. Also, key knowledge areas of the training such as farm area measurement using the tape measure or the count of steps through walking, seed selection method using salted water and fresh

egg, row planting and bund construction can best be taught to farmers using method demonstration.

4.2 Determine the Usefulness of the Training to the Rice Farmers in the Selected Areas

The concern of all financiers of training is mostly associated with the cost of the training. Is training useful especially in the agricultural sector in developing countries? This was a concern that prompted an investigation by the researcher. It is noted that training designed for rice farmers is effective, if it ensures an increase in rice yield. Murshed-E-Jahan and Pemsl (2011) in their study on Bangladeshi small farmers found that it is more valuable building the capacity of farmers through training to raise production and income than providing them with financial support. In a similar study by Tripp and Hiroshimil (2005), it was revealed that training can be a contributor to the enhancement of farmers' skill which would lead to increase yield. The analysis on the usefulness of the training project is shown in Table 4.6.

Table 4.6: Usefulness of the Training

How Useful	Frequency	Percent (%)
Very Useful	234	91.1
Useful	23	8.9

Total	257	100.0

Source: Field Survey, 2015

From the results in Table 4.6, all farmers indicated that the training on sustainable rain-fed lowland rice development provided by JICA was useful, with 91.1% stating that it was very useful while 8.9% said it was useful. They explained that they were better off in terms of knowledge, skills and techniques to deal with minor challenges they faced in rice farming. In the process of data collection, the farmers attested to the fact that they experience rice yield increases after they joined the JICA rain-fed lowland rice training project. Correspondingly, they are now assured of food security and have experienced reduction in their poverty levels. Murshed-E-Jahan and Pemsl (2011); Cai, Shi and Hu (2016), and Brinkerhoff (2006), submit that farmers must be exposed to avenues of knowledge acquisition to help them improve their performance on proper and accepted rice farming methods which would help increase rice productivity leading to poverty alleviation in rural areas.

A number of ways can be used to teach best agricultural practical knowledge to farmers. Prominent among them include, farmer field schools (FFS) (Yang *et al*, 2008; David and Asamoah, 2011), lectures (Yang *et al*, 2008), television, radio, extension services and demonstration among others. Cai, Shi and Hu (2016), FAO (2016) and Davis *et al* (2012) observed that FFS as a training method for farmers led to improvement on crop production and increase income among women, low-literacy and medium land size farmers in East Africa with an estimated 61% increase in income to farmers.

4.2.1 Reasons for usefulness of training

To establish specific reasons why the respondents stated that the training was useful, they were asked to indicate their levels of agreement with six perceptive statements using a 5-point Likert scale of strongly agree (5) to strongly disagree (1). The results are as presented in Table 4.7.

Table 4.7: Reasons for Usefulness of the Training Programme

Responses	**SA**		**A**		**NC**		**D**		**SD**	
Reasons for Usefulness after the Project	**Fr**	**%**	**Fr**	**%**	**Fr**	**%**	**Fr**	**%**	**Fr**	**%**
I have Better yield	188	73.2	57	22.2	5	1.9	3	1.2	4	1.6
My knowledge and skills in rice production increased	187	72.8	47	18.3	12	4.7	8	3.1	3	1.2
I produce quality rice than before	182	70.8	47	18.3	7	2.7	16	6.2	5	1.9
I gain much income because of increase in rice yield after the project	173	67.3	49	19.1	6	2.3	19	7.4	10	3.9
I earn more profit from sale of rice after the project	163	63.4	47	18.3	24	9.3	13	5.1	10	3.9
I am now linked to many farmers and we share ideas after the project	108	42.0	49	19.1	45	17.5	32	12.5	23	8.9

Source: Field Survey, 2015 **N = 257**

SA = Strongly Agree (5), A = Agree (4), NC = Not Certain (3), D = Disagree (2) and SD = Strongly Disagree (1): Fr = Frequency.

In explaining the reasons for the usefulness of the training using perceptive statements on the Likert scale with response categories ranging from strongly agree (5) to strongly disagree (1), the researcher combined strongly agree and agree and disagree and strongly disagree for the interpretation of the figures in Table 4.7. From the results in Table 4.7, 95.4% (73.2% SA + 22.4% A) agreed that the training has been useful because they have better yields now than before the training and the application of the technology, 1.9% were not certain and 2.8% (1.2% D + 1.6% SD) disagreed that the training and adoption of the JICA technology has been useful to them. This finding corroborates that of Gondwe *et al* (2017); Mwangi & Kariuki (2015); Sezgin *et al* (2015); Noor and Dola (2011) and Tsado *et al* (2007) that training leads to increase in output to farmers. In a study in North Central Nigeria, Tsado *et al* (2007) found that 99.4% of rice farmers indicated that their rice yields increased as a result of training they received.

The results also show that 89.1% (70.8% SA + 18.3% A) of the respondents agreed that they now produce quality rice than before. This result corresponds with that of Noor and Dola (2011) that training for rice farmers led to increase in quality of rice produced and Gondwe *et al* (2017) findings that farmers that are properly trained and supported in agronomic practices tend to produce a variety of crops and realise high yields. About 2.7% and 8.1% indicating that they were not certain and disagreed respectively with the statement that the "training led to increase in rice production". Tsado *et al* (2007) in their

study in North Central, Nigeria', discovered that 73.1% said there was improvement in the quality of rice they produced after they adopted the training practices.

About 91% of the farmers agreed that their knowledge and skills in rice production techniques have increased as a result of the training they received from JICA. This result agrees with that of Tripp and Hiroshimil (2005), that training is a contributor to farmers' skills enhancement for the purpose of farming. Oreszczyn and Carr (2010) and Yang *et al* (2008) also assert that broader spectrum of farmer empowerment including knowledge dissemination on farming practice contributes to farmers' knowledge and increase in farm yield. In a study by Noor and Dola (2011) about 68.5% of rice farmers indicated attending training programmes enable them to acquire more than 70% of the new skills and knowledge they apply on their farms. It is evident from the results that the effect of training on the knowledge of rice farmers has been positive and significant.

Regarding gains in income, the results (Table 4.7) reveal that 86.4% of respondents agreed that they have gained much income while 2.3% were not certain and 11.3% disagreed that practicing the knowledge gained from JICA training on rain-fed lowland rice production project has led to increase in their income level. The increase in income was attributed to increase of volume of rice now produced after the training. The farmers also indicated that the training enabled them to produce quality rice than before the training. The recommended rice brand for the farmers, Jasmine 85 is a preferred variety on the rice market which goes with higher demand and price. Even though increase in yield is naturally associated with fall in price, the Jasmine rice variety is the most

preferred, hence, its price on the rice market is always high as compared to others. The results of this study are in tandem with the findings of Gondwe *et al* (2017); Noor and Dola (2011) and also Tsado *et al* (2007), whose finding discovered that 99.4% of farmers in North Central Nigeria agreed that training received enabled them increase their income level.

About 82% of respondents in this study agreed that they now earn more profit from the sale of rice with 9.3% saying they were not certain and 9.0% disagreeing. Those who agreed indicated that they are able to feed their families adequately than before, and also, they realise more profit now than before. This in is line with Gondwe *et al* (2017) who observed that training enable farmers to be food secure and can diversify their diets. They made this statement in relation to their previous sales before adopting the JICA rice production techniques. The implication is that they are able to meet more of their household financial needs or demand than before. Tsado *et al* (2007) have indicated that 97.5% of farmers in North Central Nigeria experienced increase in financial contributions to household after participating in the training programme.

In conclusion, 61.1% of the respondents agreed that they are now linked to many farmers in the area, which makes it possible for them to share farming ideas on some basic farming inputs and machinery. This result concurs with Noor and Dola (2011) finding that all farmers concord that their ability to gather and share information through networking to improve their farming jobs is attributed to training programmes they participated in. About 17.5% of the farmers were not certain while 21.4% said the

training programme did not make it possible for them to be linked up with other farmers. Generally, the results of this study are in line with Sharma *et al* (2017); Noor and Dola (2011); Oreszczyn, Lane and Carr (2010) and Benin and Pender (2001) findings that farmers participation in training and subsequent adoption of improved technologies from the training led to increase in productivity, networking and higher income to the farmers.

It can be implied from the results in Table 4.7 that the cumulative effects of the increase in rice yield, increase in rice quality and increase in income has led to improvement in the farmers' living standard. This corroborates Odurukwe, Matthew-Njoki and Ejiogu-Okereke (2006) and Alfred (2000) finding whose findings discovered that the participation of women in Women-in-Agriculture extension programme had a significant and positive effect on the livelihood of beneficiaries'. The findings of the study slightly differ from the findings of Tsado *et al* (2007) which ranked increase in income first alongside increase yield. This result confirms the training objective of JICA's rain-fed lowland rice development training project of increasing rice yield and farmers profitability in the selected areas in particular. The result of this study regarding the usefulness of the project to rice farmers is in tandem with Azumah, Donkoh and Awuni (2018); Noor and Dola (2011); Oreszczyn and Carr (2010); Yang *et al* (2008); Tsado *et al*, (2007); Odurukwe, Matthew-Njoki and Ejiogu-Okereke (2006); Benin and Pender (2001) and Alfred (2000).

4.3 Examine the Perceived Capabilities Gained by Farmers after the Training in Selected Areas

This objective sought to examine the perceived capabilities gained by rice farmers after the training in the selected areas. The training sought to inculcate some level of competencies and capabilities in the farmers to enable them to improve upon their farming methods and eventually increase their rice yield. Seven perceived capabilities were presented to the farmers for them to indicate which capabilities were mostly built and used to facilitate the increase in rice yield. These seven perceived capabilities were: 'ability to properly measure land in hectares, proper ploughing, selection of quality seeds, knowledge of right planting time, correct and timely control of weeds and correct identification and control of diseases. The results of analysed data are shown in Table 4.8.

Table 4.8: Perceived Capabilities Gained by Farmers after Training

Responses	Frequency	Percent (%)
I can measure an acre of land properly after the training.	80	31.1
I can determine if ploughing is properly done.	247	96.1
I know how to select quality seeds for planting.	235	91.4
I know the exact time to start planting rice.	117	68.9
I can control weeds properly and timely.	200	77.8
I know how to identify and control diseases.	187	72.8
I get more rice from cultivating the same piece of land (rice intensification)	236	91.8

Source: Field survey, 2015. **N = 257**

From the results shown in Table 4.8, 31.1% indicated that they can now measure the size of their farm land in hectares properly. This clearly means majority of the farmers (68.9%) do not measure the size of their farm land in hectares after the training. This could be attributed to their level of education because the tape measure used for the training required reading the figure which majority of the farmers (72.8%) could not read. Interrogating this attitude further, it was revealed that most farmers do not own tractors, hence, it is the tractor operators who measure the size of a hectare(s) before they plough. There is some level of mistrust between the farmers and the tractor operators in terms of the actual size of a hectare. If measured by the farmer, tractor operator feels there is the likelihood of the farmer over measuring and if the measurement is done by the tractor operator, the farmers also feel there is the likelihood of under-measurement. In a nutshell, the farmers would have to compromise since tractor operators are perceived to be powerful during land preparation for rice farming. It is also commonly perceived that the tractor operators are doing the farmers a favour during the farming season.

Majority of the farmers do further indicated that arguing with tractor operator on the measurement of farm size can cause your rice valley to be flooded beyond recovery. Most farmers lamented that:

> Tractor operators form a cabal during the beginning of the farming season and if you have problem with one tractor operator, his contact with the other tractor operators could spell doom for you that particular season. If you cannot

> move out of the area fast to get an independent tractor operator, those within the area where your farm is located will frustrate you (idi).

Regarding proper ploughing, 96.1% of the respondents said they can now ensure that ploughing is properly done. This level of knowledge is crucial in farming and considered vital so far as the JICA rain-fed lowland rice training project was concerned. To this effect, majority indicated that they acquired knowledge in this area and are capable of applying same. To ensure that the rice field is ready for planting, land preparation is very important. According to rice farmers, when the land is well prepared, it is easy to control weeds, plant nutrients are recycled properly, it provides a soft soil mass for transplanting and there is suitable soil surface for direct seeding. This finding corroborates Defoer *et al* (2009) findings that properly prepared farmland makes weed control easy, improves soil nutrients and makes the soil mass suitable for transplanting. It basically involves (1) ploughing to dig-up, mix, and overturn the soil; (2) harrowing to break soil clods into smaller mass and incorporate plant residue, and (3) levelling the field. It can, therefore, be concluded that almost all farmers involved in the training understood and are able to identify good land preparation suitable for rice cultivation. According to the farmers, properly prepared farmland makes it possible for adequate water absorption, evenly spreading of the nutrients on the land with the resultant effect of strong roots and healthy rice plants which will culminate into increase rice yield. The result is in line with Buri, Issaka, Wakatsuki and Kawano (2012) whose study discovered that effective land preparation significantly contributed to increased grain yield in Ghana.

About 91% of the farmers said they are now able to identify and select quality seeds for planting. Quality rice seeds and seedlings is a panacea for yield increase in rice farming. Selecting an appropriate rice variety to suit environmental conditions, farm management practices, is the beginning of seed quality. The study revealed that quality rice seeds would result in crops of the best quality in the field which would lead to higher rice yields. Furthermore, the interaction of the researcher with the farmers indicated that quality seeds contain minimum impurities. The main characteristics for describing seed quality include varietal characteristics, seed lot characteristics and seed viability. These findings are similar to IRRI (2009); Mbora *et al* (2009) and Rickman *et al* (2006).

Through the project, farmers are made aware that quality seeds germinate vigorously have strong stems, grow appropriately and survive drought. Ocran *et al* (1998) in their study asserted that the minimum acceptable standard for germination percentage of certified rice seed in Ghana is 80% and above while Tokah (2010) opined that if the germination rate is known, it would help farmers in adjusting the planting rates to ensure that the desired plant population is attained on the field. With Regard to rice seeds, the JICA training had a component that took farmers through quality seed selection that would guarantee effective germination and draught resistance after germination. The procedure for quality seed selection according to the farmers is based on what they learnt from the training and the basic characteristic of quality seed is weight (heavier seeds)

Interaction with the farmers in one of the communities (Nakimbiya in the East Gonja Municipality) indicated that some specific rice farms had been designated as seed farms.

They were trained on how to cultivate a seed farm for distribution to other farmers. The high rate of positive response to this capability shows how important it was to the farmers.

Climate change and unreliable or erratic rainfall pattern in the Northern Region requires perfect timing regarding when to start land preparation and specifically when to plant or sow. The farmers must do accurate timing, track rainfall pattern and sow timeously. Responding to the issue of planting time, 45.5% indicated that they now know the right time to start sowing with the help of some indicators as well as using the days of the months. However, all respondents stated that they liaise with AEAs who are experts and are linked to higher bodies that give accurate information on agriculture regarding land preparation and sowing schedules. Though the 45.5% represents a sizeable number, majority of the respondents (140), representing 54.5% of the farmers indicated that they only rely on information from the AEAs regarding when they should start planting. Those who said they could not accurately identify the right time for planting indicated that they rely on the AEAs. Information regarding planting time is passed on to them by AEAs and MoFA educative programmes through ratio. According to the farmers, appropriate time of planting provides a greater chance for higher yield. Before the training, farmers indicated that they relied on 'hear-say', intuition and the number of rains so far in the beginning of the season. This unscientific way of determining when to plant rice exposes them to either droughts or early maturity. They said the training encouraged them to listen to radio programmes most especially the beginning of every planting season.

About 78% of the farmers indicated that they now have good knowledge on when to start controlling weeds on their farms and that early control of weeds led to increase rice yield. They said the weeds compete with the rice plant for water and nutrients from the soil, the rate of yield reduction from harmful weeds is tremendous and the yield declines significantly without weed control. It was revealed that early weed control leads to increasing rice yields on the rice field, which is in line with Mola and Belachew (2015) and Mohammadi and Amiri (2011) findings that early weeding on rice farms have shown positive effect on plant height, number of tillers per plant, panicle length, culm length and increase in actual rice yield per hectare. It is reported that poor soil fertility and weed competition with rice leads to low yield (Balasubramanian *et al* 2007 and Rodenburg *et al* 2009) which corroborates this finding.

In the course of this study, it was observed that weeds are major constraints to increase rice production in labour-limited, rice-based systems in the selected districts which is in tandem with findings by Adesina *et al* (1994) in southeast Ethopia; Rodenburg *et al* (2009) in the southern Guinea Savanna; Becker & Johnson (1999) in la Coˆte D'ivoire; Diallo & Johnson (1997) in Dakar; and Rodenburg & Johnson (2009) in southern Guinea. According to the JICA rain-fed lowland rice production technology, weed clearing must be done at least twice: per the JICA training requirement, first weeding must be done three (3) weeks after sowing and second weeding should be done five (5) weeks after the first weeding to help boost yield. Farmers gained this knowledge through the JICA

training. Hoe weeding in 1st weeding and herbicide in 2nd weeding can be integrated in direct sowing method. However, they also indicated that weeding must be done when necessary besides the two periods mentioned above (JICA/MoFA TENSUI Rice Project, 2012).

The JICA technology as practised in the selected districts mostly used the traditional weed clearing technique using hand hoes with minimum application of herbicides. Weeds are considered major constraints in rain-fed unbunded lowlands, for instance, where they cannot be controlled by flooding the soil surface (Rodenburg & Johnson, 2009; Ampong-Nyarko, 1996), and uncontrolled weed growth often results in very low or zero yield Mola & Belachew (2015) and Johnson (2013) reported that rice yield losses due to uncontrolled weed growth were within the range of 20-100%. These are reflected in the JICA training where the farmers are trained to conduct first weeding three weeks after sowing.

Diseases, virus and pests have the potential of negatively affecting rice yield. Common diseases that affect rice plants are blast, false smut, bakanae disease (foolish seedling) and brown spot. Common pests in rice farms are known as stem borers. Blast could be leaf blast or pinnacle blast and it has the potential of spreading throughout the whole farm if not treated (JICA/MoFA TENSUI Rice, 2012). Conditions suitable for the development of blast include low-temperature, high-humidity, less sunlight and excessive

fertilizer application. False smut is caused by excessive application of fertilizer and virus is transmitted by insects.

About 73% of the farmers agreed that they can now identify and control diseases that affect rice farms. Although timely control of weeds forms the basis of fighting diseases on the rice farm, it is important for farmers to identify diseases on the rice farm early enough and get rid of them. One other key solution to diseases, viruses and pests affecting rice farms is the application of herbicide. The result of disease control is pleasing since majority of the rice farmers stated that they can identify and control diseases and pest on the rice farms. The minority (22.2%) who were not able to identify disease and pest indicated that they mostly relied on the AEAs and colleague farmers who visited their farms for advice and help. It is pleasing to note that the AEAs were on regular visits to the farmers and their farms and any unusual situation noticed on the farm was quickly communicated to the AEAs for immediate advice and action. The farmers recognised that pests and diseases can cause reduction in rice yield which corresponds with the findings of Savary *et al* (2000) and Willocquet *et al* (2004) that, averagely, pests and diseases cause farmers to lose 37% of their rice yield, and in some instances, these losses range between 24% and 41% depending on the production situation.

4.4 Ascertain the Extent to which the Training Contributed to Increase in Rice Yield of Farmers in Selected Areas

Objective three sough to ascertain the extent to which the training contributed to increase in rice yield of farmers in the selected areas. The researcher made effort to establish the quantity produced before the training and the quantity produced after practising the technology in order to ascertain the increase in rice yield among rice farmers in the selected districts.

In 2009, there was a base line survey before the project began. Results from the survey revealed that rice yield per hectare in the Northern Region was 2.3 t/ha. By the end of the 2010 crop season, the results from demonstration plots supervised by MoFA/AEAs and JICA officials gave the yield per hectare as 3.3 t/ha in the Northern Region while rice yield from the trial plots in 2011 stood at 3.6 t/ha.

It is, however, important to note that the yield from trial plots were slightly higher than the yield from the farmers' farms due to the uneven application of fertilizer and other farm inputs. The result on the quantity of rice produced before and after the training is presented in Table 4.9.

Table 4.9: Changes in Rice Yield over the Period

	Before Training		After Training	
Quantity(t/ha)	**Freq.**	**Percent (%)**	**Freq.**	**Percent (%)**
0.1– 1	202	78.6	6	2.3

1.1 – 2	45	17.5	29	11.3
2.1 – 3	10	3.9	123	47.9
3.1+	0	0.0	99	38.5
Total	**257**	**100.0**	**257**	**100.0**

Source: Field survey, 2015 **N = 257**

Table 4.9 shows that as many as 202 respondents, representing 78.6% indicated that their yield/ha before the training was between 0.1kg and 1t/ha, 17.5% produced 1.1t/ha to 2.0t/ha and 3.9% said they used to produce between 2.1t/ha to 3.0t/ha. The results further show that the yield of rice increased after farmers received and practised the knowledge and skills gained from the JICA Rain-fed Lowland Rice training project.

The results show that only 2.3% of farmers had 0.1kg to 1.0t/ha of rice after the training. Majority of the farmers (47.9%) increased their yield to between 2.1t/ha – 3.0t/ha whiles 38.5% increased yield to 3.1t/ha and above after the training. It is clear from the study results that 86.4% of respondents now produce more than 2.0t/ha of rice after they received the training from JICA compared to 96.1% who produced up to 2.0 t/ha before the training. On the average, farmers yield increased about two times after the training, a confirmation that the training has led to increase in rice yield in the selected communities as shown in Table 4.9.

The results of this study conforms to those of Takahashi and Barrett (2014) and Styger *et al* (2011) whose studies found that farmers adoption of system of rice intensification (SRI) training in rural Bangladesh helped increase yield by about 64%, and even farmers who partially adopted the training realised an increase in their rice yield by 32% (Sinha & Jayesh, 2007). Similar finding by Islam *et al* (2012) in Bangladesh revealed that there were increases in rice productivity by 86% from SRI adoption by farmers. Another pilot project by BRAC in Bangladesh studied by Barrett *et al*. (2016) showed higher yields of around 50% among those who adopted SRI. Noltze *et al* (2013), however, argued that there were significant increases in yields among SRI farmers, but the farmers faced negative income effects upon adopting the SRI technology. It can, therefore, be concluded that the JICA rain-fed lowland rice training project has led to increase in rice yield in the three study districts in the Northern Region of Ghana.

The before and after data in Table 4.9 was used to run a paired sample t-test to determine the statistical significance of the increase in rice yield. As shown in Table 4.10, the mean difference was calculated to determine the actual difference between rice average yield before and after the training. Before the training, the mean yield was 1.253 with a standard deviation of 0.518. The mean yield computed after the training was as high as 3.226 with a standard deviation of 0.737. The test results as presented in Table 4.10 clearly indicated that there is a significant difference between rice yield before and rice yield after the training with a t-value of -34.208 and p< =.000.

Interaction with some farmers indicated that, some of them were experienced rice farmers and had received similar training on rice production from MoFA and other projects before the JICA rain-fed lowland rice development training project. This in a way could have an impact on rice yield, but the focus of this study was limited to the JICA project. Even though the increase in rice yield could be influenced by other reasons, the researcher is confident that the JICA project made the greatest impact as revealed by the results of this study.

Table 4.10: Paired Samples Statistics

Paired Samples Statistics	Mean	N	Std. Dev.	T	D*f*	*P*
Quantity per hectare: Before	1.252	257	.51751	-34.208	256	.000
Quantity per hectare: After	3.226	257	.73663			

Source: Field survey, 2015 **N = 257**

4.4.1 Perceived contributions of the training to yield changes

All the respondents (100%) accepted that the project had led to increase in rice yield in the study areas. Of the 257 valid responses received, 65% indicated that the project led to very high increase in rice yield whiles 35% said the increase in rice yield is high. The results are shown in Table 4.10. This is in line with Tsado *et al* (2014) whose study revealed that training of trainers programme and adoption of improved rice package had mostly impacted participants lives positively. They found that majority (99.4%) of the participants claimed that their farm output and income increased significantly, 98.8% of

the participants also claimed that participation and adoption had led to additional acquisition of property like motorcycle, bicycle and cars.

Table 4.11: The Extent of Increase in Rice Yield

Response	Frequency	Percent (%)
Very High	167	65
High	90	35
Total	257	100

Source: Field Survey, 2015

The researcher assessed the effect of the training on rice farmers and their yield from the AEAs perspective. This assessment was carried out to ascertain the AEAs personal assessment and opinion on the benefits of the training on farmers whom they supervised and guided by providing extension services during the period. Commenting on the effects of the rain-fed lowland rice development training project on farmers and the rice yield they achieved, Mr. Abdul-Karim Haruna, the AEA at Kpalbe operational area indicated that*;*

> The project objectives were very realistic even though challenging. It was able to impact the farmers with the knowledge from the training which led to increase rice yield in my operational area in the Kpalbe model site. Both women and men worked together in groups that I helped to form for the purpose of synergy. In the Kpalbe operational area, the project on the average helped farmers achieve higher rice yield from the same piece of land they cultivated. The increase in rice yield experienced by the

> farmers went a long way to change their living conditions through the acquisition of assets and that shows improvement in their lives (idi).

Mr. Iddi Bukari Mahama, an AEA in-charge of the Nyesheigu operational area in the Tamale Metropolis stated that:

> Rice yield level of all farmers who participated and adopted the JICA project for sustainable rain-fed lowland rice production technology at least doubled in the area. Emphasising the effect of the training on the farmers in general, he recounted how the training project was perceived in the initial stage as cumbersome and time consuming. The germination rate of rice planted on the rice fields prepared according to JICA specifications encouraged the farmers to intensify the application of the JICA rice cultivation technology. To Mr. Mahama, the practice was rice intensification, and this method reduces cost of rice production drastically to the advantage of the farmers. The project is transforming all farmers who were directly involved as well as other farmers who were not part officially but took keen interest on what the project farmers were doing after the first year. The higher yields experienced after the first year encouraged others farmers to join the project during subsequent years. There is massive transfer of knowledge to other farmers who were not directly involved in the project (idi).

Mr. Adams J. D. emphasised that,

> The training sharpened the skills of rice farmers on rice intensification, using basic machines to achieve maximum effect and guiding farmers on quality seed production. The project has resulted in increased yield per hectare as a result of high plant population due to row planting adopted by the farmers. For me, my happiness is the fact that the farmers are better off in terms of their standard of living, improved food security and acquisition of basic life supporting assets such as bicycles, cell phones and cooking utensils for the female farmers (idi).

Mr. Stephen Agalic, AEA for Kukuazugu operational area, even though retired at the time of the study, could not hide his excitement about the success and benefits of the training to the farmers in general. Mr. Agalic contends that,

> The project achieved all its objectives and that the knowledge that farmers acquired from the training was highly valuable. What was necessary for now was to ensure that the farmers do not abandon the JICA technology of rice cultivation and return to their old methods of rice cultivation. If MoFA could ensure that all AEAs under MoFA adopt and teach the JICA rice cultivation technology to all farmers in the districts and the region, that will go a long way to guarantee rice as food crop to the Ghanaian populace (idi).

4.5 Assess the Correlation Between Components (land development and rice cultivation) of the Training Project on Rice Yield in Selected Areas

This objective assessed the correlation between the two main components of the training on rice yield in the selected areas. Association test was run to test the relationship between rice yield and the components of the training using Spearman rho correlations.

The JICA training project was designed to cover four key thematic areas namely; land development, rice cultivation, extension services and farming support services (Baba, 2015). The focus was to ensure that AEAs and farmers are trained on best practices in rain-fed lowland rice cultivation technology that would lead to increase rice yield and quality. To achieve higher rice yield and quality, the training covered rice farmland preparation and rice cultivation techniques in addition to extension services and farming support services.

4.5.1 Land development

The training on land development covered proper area measurement, bund construction, and good ploughing or land preparation. This area of training constitutes the first step in effective rice cultivation. The parcel of land to be used for rice cultivation must be properly measured since the inputs to be used must be gauged in terms of their accuracy and adequacy. It would therefore be problematic to say for instance that the fertilizer was adequate or inadequate if reference cannot be made to the size of the farm land. Bund construction is seen as a major boost to rice cultivation in Africa and for that matter Ghana and Northern Region, especially in times of very limited rainfall.

Bund construction, as part of the training on land development, sought to teach farmers how to conserve and control water on their rice farms. Bunds constructed enable farmers to regulate water level on their farms and in times when rainfall is sporadic and irregular, they help hold water on the farm for a longer period instead of the water flowing or running downstream.

Another key training area under the land development was good land preparation or ploughing. The farmers were taught how to guide tractor operators for good ploughing. According to JICA rice cultivation handbook (2012), proper land preparation ensures equal distribution of water in the field, adequate use of water by the plants and enhances the optimum use of fertilizer by the plants. Land, if properly ploughed, would facilitate good yield. For this reason, farmers were taken through proper land preparation

techniques. Interaction with the farmers revealed that the specific area of the training on land development is very beneficial if observed as stipulated by the training. According to the farmers, proper measurement allows for adequacy in the use of seeds, application of fertilizer and herbicide. Some rice valleys they cultivate are not flat and therefore the water continuously flows causing leaching and erosion.

The bunds helped in preventing that continuous flow of water in such valleys and are particularly helpful in times of drought. On the proper ploughing, they indicated that when the land is well ploughed and the soil is loose, it facilitates proper and even germination of seeds and reduces the effect of weeds on the farm. They indicated that if land for rice farming is prepared in accordance with JICA training programme specifications, there is the high possibility of realising increased rice yield. The results of land development and its relationship with rice yield are shown in the Table 4.12.

Table 4.12: Relationship between Increase in Rice Yield and Land Development using Spearman Correlation

Correlation matrix

V/No	Variables (V)	1	2	3	4
1	Increase in Yield	1			
2	Proper Area Measurement	.751**	1		
3	Bund Construction	.719**	.538**	1	
4	Good Land Preparation	.784**	.578**	.581**	1

Correlation is significant at 0.05 level (2-tailed). **N = 257

Source: Field Survey, 2015

In an attempt to establish the relationship between the specific areas of the training on land development and increase in rice yield, Spearman correlations were used to test the relationship at 5% significant level. The results on the relationships between increase in rice yield and the three variables – proper area measurement, bund construction and good land preparation - were investigated using Spearman's rho correlation coefficient. There was a strong positive correlation between increase in rice yield and the three key areas of the training under land development. The correlation coefficients were computed using two tailed test at 5% significant level. From the results, there exists a positive strong relationship, rho = 0.751, between increased rice yield and proper area measurement. There was also a strong positive correlation between increased rice yield and bund construction (rho = 0.719). There was also a strong positive correlation, (rho = 0.538) between bund construction and proper area measurement. Good land preparation was

also established to have a strong positive correlation (rho = 0.784, 0.578 and 0.581) with increased rice yield, proper area measurement and bund construction respectively.

The implication of the results above is that, farmers who measure land accurately and adequately stand the chance of experiencing a corresponding increase in rice yield on their farms. This is for the purpose of adequate seeds for planting, fertilizer and herbicide application. If the land is not adequately measured, especially if over measured, the quantum of fertilizer and herbicide that is supposed to be applied would be insufficient and that could lead to poor or low rice yield. On bund construction, the implication is that if the bund is not properly constructed to hold the require volume of water, the expected rice yield could be hampered. Also, if the land is poorly ploughed, it is likely going to influence rice germination and growth negatively, and the rice in the farm cannot resist drought and this will ultimately lead to low rice yield. The finding supports Defoer *et al* (2009) finding that well-prepared field controls weed and recycles plant nutrients and that of Buri, *et al* (2012) that effective land preparation significantly contributed to increase grain yield in Ghana.

4.5.2 Rice cultivation

Training on rice cultivation was considered the core of the rain-fed lowland rice development project. Farmers were taken through how to select good seed for planting, the best method of planting rice, how to apply the recommended rate of fertilizer, when

to apply fertilizer, when to clear weeds or apply herbicide and how to identify and control pests and diseases on their rice farms.

Under the training on rice cultivation, areas covered were selecting and planting good seeds, adopting good methods of planting, applying recommended rates of fertilizer, timely application of fertilizer, weed control and pest and disease control. These areas constituted the core of the rain-fed lowland rice development training project. Baba (2015) observed that if farmers pay keen attention to this area of the training, practice and implement what was taught, there is the highest likelihood that the farmers would double rice yield on their farms. Interacting with the farmers, most of them were of the view that each aspect of the training on rice cultivation, though difficult, took them closer to realising the JICA sustainable rain-fed lowland rice training project prime objective of doubling rice production in the selected districts. Result on the association test of rice cultivation aspect of the training and increase in rice yield are shown in Table 4.13.

Table 4.13: Relationship between Increase in Rice Yield and Good Agronomic Practices

Correlation matrix

V/No	Variables(V)	1	2	3	4	5	6	7
1	Increase in rice Yield	1						
2	Good seeds selection	.820**	1					
3	Good method of planting (drilling in holes)	.815**	.704**	1				
4	Applying recommended rate of fertilizer	.776**	.610**	.663**	1			
5	Timely application of fertilizer	.796**	.719**	.687**	.612**	1		
6	Timely weed control	.810**	.643**	.664**	.651**	.621**	1	
7	Timely pests and diseases control	.848**	.731**	.700**	.667**	.739**	.702**	1

Correlation is significant at 0.05 level (2-tailed). **N = 257

Source: Field Survey, 2015

From Table 4.13, the relationship between increase in rice yield was investigated against six variables – good seed selection, good methods of planting, applying recommended rate of fertilizer, timely application of fertilizer, proper weed control and timely pest and disease control. These six variables were also tested against each other to determine the significant level of the relationship between them. All these variables were correlated with each other using Spearman correlation at 95% confidence level.

From the results, it was established that there is a strong positive correlation between increase in rice yield and all six variables covered by the training under rice cultivation and the correlations were all significant at 0.05 level (2-tailed). There was a strong positive correlation (rho = 0.820) between good seed selection and increase in rice yield. This gave a coefficient of determination of 67.2% meaning there is about 67% shared variance between good seed selection and increase in rice yield by farmers. In effect, good seed selection helps to explain nearly 67% of the variance in respondents' scores on the increase in rice yield scale.

There was a strong positive correlation between good method of planting (rho = 0.815) and increase rice yield. There was also a strong positive correlation (rho = 0.704) between good method of planting and good seed selection. This strong positive correlation coefficient indicates that good planting method employed is highly associated with increase in rice yield with a coefficient of 0.815. Good seed selection and good method of planting also have a positive association.

Applying recommended rate of fertilizer has a strong positive correlation with increase rice yield with a coefficient of 0.776. The results also showed that there was a strong positive correlation (rho = 0.610 and rho = 0.663) between applying recommended rate of fertilizer and good seed selection and good method of planting respectively. The implication of these results is that if fertilizer is applied at the recommended rate, it has a high relation with increase in rice yield on the farm. This result is in agreement with

Azumah & Zakaria (2019); Tsujimoto *et al* (2019) and Tsujimoto *et al* (2017) findings that proper use of fertilizer has a positive effect on rice yield in Ghana.

Applying fertilizer on time also has a strong positive correlation (rho = 0.796) with increase in rice yield. This means that if fertilizer is applied timely, there is the likelihood that rice yield of farmers would also increase. With this positive association, one can conclude that if farmers pay attention to the issues on fertilizer in terms of applying the recommended rate, in terms of the right quantity and applying it on time, there would be corresponding increase in rice yield. Applying fertilizer at the right time was also established to have a strong positive correlation with good seeds selection (rho = 0.719), good method of planting (rho = 0.687) and applying recommended rate of fertilizer (rho = 0.612). Proper weeds control was also found to have a strong positive correlation with increase in rice yield (0.810). Proper and timely weed control was also established to have a strong positive correlation with good seed selection (rho = 0.643), good method of planting (rho = 0.664), applying recommended rate of fertilizer (rho = 0.651) and timely application of fertilizer (rho = 0.621).

The relationship between timely pests and diseases control and increase rice yield was analysed and found to be highly and positively correlated. This strong positive correlation between increased rice yield and timely pests and diseases control (rho = 0.848), gave a nearly 92% coefficient of determination. Timely pest and disease control was also positively correlated with the other variables at 0.05 significant level, 2-tailed.

Timely pests and diseases control correlation coefficients with other variables are shown in table 4.13. The correlations were significant at 0.05 level (2-tailed). Bucheyeki *et al* (2011) argued that there would be an increment in rice yield if agronomic practices such as timely planting, proper spacing, timely weeding, timely and correct use of fertilizers and insecticides are improved. Kijima (2014) posits that cultivation practices have positive impact on rice yield. Kijima discovered that marginal effect of applying good cultivation practice on rice yield was about 0.26 tons per hectare in Uganda, and by marginal effect, a yield of about 10% increase can be realised.

4.6 Determine the Effects of Increase in Rice Yield on the Socio-economic Status and Livelihood of Farmers in Selected Areas

With regard to objective five, the researcher sought to determine the effects of increase in rice yield as experienced by the farmers after adopting JICA rain-fed lowland rice development technology and how the yield rise contributed to the socio-economic status and livelihood of farmers in the selected districts.

4.6.1 Socio-economic benefits to farmers after the training

Every training programme should have an impact on the lives or behaviour of the trainees or beneficiaries. The JICA training project on rain-fed lowland rice development training project is no exception. The project was designed to help double rice yield and increase farmers profitability in the selected areas. Life changing programmes are mostly generic – the effects mostly extend beyond the immediately known or proposed benefits. The

benefits of increase in rice yield would not end just at the food security or sufficient feeding stage, but would transcend the socio-cultural and socio-economic level of the farmers. Increase in rice yield reflects increase in wealth. Increase in wealth would lead to change or increase in socio-economic status. Some notable socio-cultural and socio-economic statuses that people move on to with increase in wealth include chieftaincy titles, community recognition, Assembly membership, inclusion in formal committees like School Management Committees (SMC) and nominations for best farmer awards.

In this study, six key socio-economic status related issues that were indicated by the farmers are; increase in wealth, food security, respect in the community, living a healthier and happier life, able to pay children school fees, and capable of solving personal problems. Ironically, happiness maybe misconstrued as a none socio-economic asset to the city dweller, but to the rural dweller, happiness is a highly cherished socio-economic asset. Happiness is influenced by society and influences society. In the rural setting, happiness is an indication of good life propelled by being self-sufficient with the concern for others. These six socio-economic status related variables were analysed using descriptive statistics to determine the percentage of agreement. This statistics is presented in the bar chart for easy reading and interpretation.

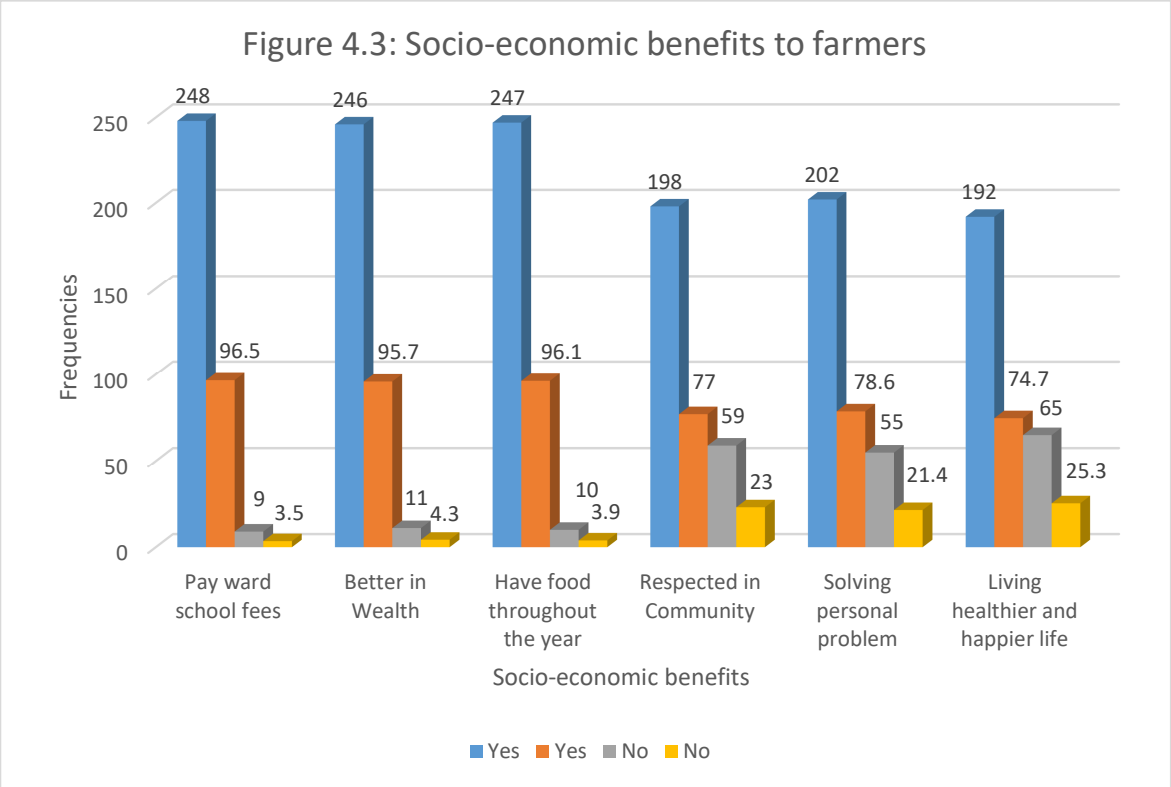


Figure 4.3: Socio-Economic Benefits after the Training

Source: Field survey, 2015

From Figure 4.3, 96.5% of rice farmers indicated that they are able to pay children school fee which is considered an important socio-economic variable that most farmers said had changed after they experienced increase in rice yield. They were emphatic that school fee is one key financial commitment that farmers were not able to meet easily before adopting JICA rain-fed lowland rice development technology. Most farmers said their reputation was always compromised anytime a child was sent home for non-payment of school fees or PTA dues. This statement corroborates Abrar-ul-haq, Akram and Farooq (2015) findings that the increase in parents' financial capital leads to educational achievement of children in rural Pakistan.

About 96% of the respondents agreed that they have enough food throughout the year (food security). The majority of rice farmers agreed that they are now able to feed their family appropriately and adequately after the JICA training which led to increase in rice yield. This increase in food sufficiency to an extent, helped reduce poverty among the rice farmers practising the rain-fed lowland rice production technology. Norton (2004) observed that interventions in the agriculture sector are designed to help in improving food security, increasing incomes and reducing poverty via improved farm-level performance. Wu (2005) opined that any behavioural changes and decisions that are made as a result of any training interventions lead to high-level performance by farmers.

A large majority (96%) of rice farmers indicated that they are 'Better in wealth' after the training project than before the training. The adoption of JICA rain-fed lowland rice production technology helped in enhancing rice yield which has led to increase in income and improvement in the wealth of farmers in the selected districts. This finding supports Asante *et al*'s finding (2004) whose study discovered that adoption of technological interventions in agriculture is expected to enhance productivity of farmers and consequently increase incomes and reduce poverty among beneficiaries. ISSER (2006, 2007, 2008) is of the opinion that agricultural sector has received a myriad of interventions that led to improved yield, reduced poverty and increased incomes particularly to rice farmers.

The statement 'I am capable of solving personal problems' scored 78.6% of farmers' positive response. Majority indicated that they can handle personal problems without resorting to collegial support or contributions from family members and well-wishers. In a typical local community, community spirit makes it possible for solving personal problems when one is not personally capable through financial contributions from family members. Majority (78.6%) of the farmers indicated that they are now capable of solving personal problems themselves. In explaining further, such personal problems include performing funerals of deceased relatives, naming ceremonies, wedding ceremonies, meeting in-laws' requirements for marriages and festival requirement.

'I am respected in the community' responses aggregated at 77%. Thus, majority of rice farmers in the Northern Region who benefited from the JICA rain-fed lowland rice production technology felt that they are now respected in their communities. For the rural dweller, ability to provide food security for your family, pay your wards school fees, support others when in need are the main sources of respect. The results revealed that farmers' rice yield increase is good ground for them to meet the variables for respect, hence, the majority (77%) accession that they are not respected in their communities can be held to be true.

'Living a healthier and happier life (wellbeing)' had a percentage score of 74.7%. Majority of farmers agreed that they live healthier and happier life as a result of the benefits they got from increased rice yield after the project. Living healthier and happier life (wellbeing) as status symbol is a concept that is best defined by the people

themselves. The results indicate that adopting the JICA rain-fed lowland rice technology led to improved living standards of rice farmers in the selected districts. The results of this study are in line with most impact studies that revealed that there is positive relationship between technology adoption and farmers' livelihoods, hence their living standard (Kijima *et al* 2008; Mwabu *et al* 2006; Mendola 2006; Hossain *et al* 2003; Bourdillon *et al* 2002; de Janvry & Sadoulet, 2002; and Winters *et al* 1998). Wiredu *et al* (2010) also found that adoption of improved technology had positive impact on farmers' rice yields in Ghana.

From the results shown in Figure 4.3, the thinking and feeling of the farmers correspond with the objectives of the training, that is, to increase rice yield as a means of ensuring food security in the selected districts. The results indicate that, in all 6 socio-economic benefits identified, majority of the farmers agreed to all the statements that they experienced an increase in all of them.

4.6.2 Additional assets acquired by farmers after increase in rice yield

It is believed that when the output of people increases, they stand the chance of acquiring more assets or properties. Assets are integral part of human life and society places value on the type and value of assets people possess. In rural Ghana, where the population is predominantly engaged in farming, they derive their source of livelihood and its sustainability from the proceeds of farm output. Since the results revealed that the project on sustainable rain-fed lowland rice production led to increase in rice yield among rice farmers in the study districts, effort was made to ascertain if the increase in yield

translated into increase in assets possessed and what type of assets they were able to acquire after the project. The researcher was mindful that farmers could have more than one source of income which collectively contribute to their assets acquisition. However, the questions were focused on how specifically they perceived the JICA training project as a main determinant of the assets they acquired. To get the real contribution of the JICA training, responses were narrowed to assets they confidently attributed to the increase in rice yield resulting from the JICA training project.

Being economic animals as described by Maslow in the premises informing the hierarchy of needs theory of motivation, human beings would always want more (Maslow, 1954) and for that matter, when their farm output increase, they acquire more other properties from the extra income received from sale of extra farm produce. The researcher was guided by the fact that a farmer could acquire more than one asset, so multiple responses were sought from the farmers to address this question. The results are shown in Table 4.14.

Table 4.14: Additional Assets Acquired by Farmers from Excess Rice Sold

Assets Acquired by Farmers	Freq.	Percent (%)
Bicycle	184	71.6
Motor Bike	46	17.9
Motor Tricycle (Motor King)	56	21.8
Mobile Phone	212	82.5
Goats/Sheep for Rearing	109	42.4
Zinc (corrugated roofing sheets)	164	63.8
Smock	211	82.1
Foam Mattresses	156	60.7
Standing/Ceiling fan	82	31.9
Cooking utensils	37	14.4
Solar Lantern	186	65.4
Fridge	76	29.6
Television Set	156	60.7
Satellite Decoder	124	48.2
Home theatre	49	19.1

Source: Field survey, 2015 **N = 257**

From the results as shown in Table 4.14, 184 respondents, representing 72%, indicated that they were able to acquire bicycles for their personal use as means of transport to and from farm, and also movement from one community to another for purposes of attending markets, funerals and other social gatherings. Although there are other more efficient means of transportation compared to bicycle, it serves as the most common, less expensive in terms of cost and maintenance and appropriate for transportation to the rural farmers. A low number of 46 respondents, representing 17.9%, said they were able to

buy Motor bikes as a means of transport for the farming and daily activities while about 22% said they were able to acquire Motor Tricycle commonly called 'Motor King' as an income generating asset as well as a means of carting farm produce. About 42% said they were able to acquire goats and or sheep for raring which is another form of farming but perceived as an income generating venture. As rural dwellers, they are mindful of their rooms which are mostly thatched roofed, so for farmers whose yield is rising, majority (64%) indicated that they were able to buy corrugated roofing sheets for the purpose of roofing their rooms properly to feel more safe and secure. Acquisition of smock recorded the second highest percentage of 82.1%. Smock is seen as a prestigious clothes among people of the Northern Region and is used for all occasions by both men and women. It has recently gained national and international recognition and most farmers pride themselves if they can own one or two smocks.

Acquisition of cell phone scored 82.5% and the highest percentage in terms of asset acquired by rice farmers and bed/foam mattress scored 60.1%. Majority of the farmers (65.4%) indicated that they were able to acquire solar lanterns to provide lighting for domestic use, and 60.7% acquired television sets for entertainment. About 48% of the respondents said they acquired satellite decoders and 49 farmers (19.1%) said they acquired home theatres (sound system) for domestic entertainment. The least acquired asset from the results is cooking utensils and this was one asset that every female beneficiary farmer (100%) in the project communities indicated that they acquired.

The assets acquired after the project were cross tabulated by the gender of the respondents to help determine what percentage of the male respondents acquired what

assets and the percentage of female who also acquired what assets. The results of the crosstabs are shown in Table 4.15.

Table 4.15: Additional Assets Acquired after Increase in Rice Yield by Sex of Respondents Crosstabs

Assets Acquired After the Project	Male		Female	
	Freq.	%	Freq.	%
Bicycle	152	59.1	32	12.5
Motor Bike	39	15.2	7	2.7
Motor Tricycle	51	19.8	5	1.9
Cell Phone	183	71.2	29	11.3
Goats and Sheep for Rearing	89	34.6	20	7.8
Zinc (Corrugated Roofing Sheets)	136	52.9	28	10.9
Smock	180	70.0	31	12.1
Foam Mattress	127	49.4	29	11.3
Standing/Ceiling Fan	71	27.6	11	4.3
Cooking Utensils	0	0	37	100
Solar Lantern	154	59.9	32	12.5
Fridge	65	25.3	11	4.3
Television Set	126	49.0	30	11.7
Satellite Decoder	103	40.0	21	8.2
Home theatre	45	17.5	4	1.6

Source: Field survey, 2015 **N = 257**

From Table 4.15, using crosstabs to segregate the assets acquired based on gender category, 152 (59.1%) of the farmers who acquired bicycle were males while 32 (12.5%) were females. Bicycle is a multi-purpose means of transportation for both male and female alike but intensively used by men more than female. For the rural rice farmer, bicycle serves as the cheapest means of transport for both domestic and farm purpose. It is also commonly used by school children who travel relatively long distance to access formal education.

Motor bike and motor tricycle (Motor-King or Motor-Kia) recorded 39 (15.2%) for males, 7 (2.7%) for females and 51 (19.8%) for males and 5 (1.9%) for females respectfully. Interestingly, these are all means of transport. However, the motor tricycle dominated because it is used for commercial purposes and also very convenient in carting farm produce of all kind.

Mobile or Cell phone is one asset that recorded the highest level of acquisition among both male and female rice farmers. A total of 183 (71.2%) male and 29 (11.3%) female acquired mobile/cell phones. The multi-purpose nature of the cell phone accounted for its high level of acquisition. Most of the farmers indicated that aside using it to get in touch with family, friends, other farmers and AEAs, it is easier to use it as radio for information on farming practices, source of entertainment by playing music and to some extent, watch movies.

About 35% of the males and 8% female farmers respectively indicated that through the proceeds they get from sale of excess rice they sell, they invested the income into raring goats and sheep. Even though this is another form of farming, it serves as current assets for the farmers since they can rely on the sale of goat and sheep quickly in time of short-term financial distress.

Buying corrugated roofing sheet also witnessed high level of acquisition from the male farmers. About 53% who acquired roofing sheets were males while 28 (11%) were females. Smock, which is a prestigious wear for both men and women in the north was also associated with high level of patronage. As many as 180 (70%) males and 31 (12.1%) females indicated that they were able to acquire smock for themselves. This high acquisition is explained by the high demand for the northern smock nationwide within these recent past years. Majority of the males, 127 (49.4%) and 29 (11.3%) females and 71 (27.6%) males and 11 (4.3%) females acquired foam mattresses and ceiling/standing fans respectively, from proceeds from sale of rice after the project.

One particular asset that all the female farmers acquired is cooking utensils. This asset is very important in the life of every woman. Some indicated that they acquired them for their personal use while some said they acquired them in preparation for their daughters' marriage or settlement in their marriage homes.

About 59.9% (154) males and 12.5% (32) females and 65 (25.3%) males and 11 (4.3%) females said they acquired solar lanterns and fridges respectively after gaining extra income after the project. Those who indicated that they acquired television set were 126 (49%) males and 30 (11.7%) females while 103 (40%) males, 21 (8.2%) females and 45 (17.5%) males and 4 (1.6%) females said they were able to acquire multi-TV decoders and home theatre respectively for their domestic entertainment.

The results from Table 4.15 show that except cooking utensils, all other assets are acquired by both male and female farmers. This is an indication that the material needs of both male and female rice farmers are similar if not the same. The acquisition of certain assets such as corrugated roofing sheets, motor tricycle and foam mattresses are indication of the female rice farmers' willingness to support their spouse's effort in making life meaningful for the entire family.

4.6.3 The effect of increased rice yield on livelihood assets acquired by farmers

The benefits derived from increased rice yield to farmers as a result of JICA sustainable rain-fed lowland rice production technology has a direct contribution to the acquisition of livelihood assets by the farmers. The livelihood assets were picked from the DFID (1999) Livelihood Framework. Five livelihood assets were outlined: human, social, natural, physical and financial assets. Under the human assets, four assets were listed: skills and abilities, knowledge, cultural practices and level of education and their relationship tested against increase in rice yield after the training, and so are the others as shown in Table

4.16. Saenz and Morales (2006) and Murray (2000) indicate that educational attainment in the form of abilities and skills is a common measure of human capital. The results showed that the correlations were significant at 0.05 level (2-tailed test) as shown in Table 4.16.

Table 4.16: Correlation between Human Livelihood Assets Acquired by Farmers and Increased Rice Yield

Correlation matrix

V/No	Livelihood Assets (Human Assets)	1	2	3	4	5
1	Increase in Rice Yield	1				
2	My skills and ability in rice cultivation have increased	.639**	1			
3	I am now knowledgeable in rice production than before	.751**	.528**	1		
4	I maintain good cultural practices in rice production now	.719**	.454**	.538**	1	
5	I feel better educated on general farming practice	.784**	.484**	.578**	.581**	1

**Correlation is significant at 0.05 level (2-tailed). N = 257

Source: Field Survey, 2015

Human assets

From the results in Table 4.16, 'improvement in skills and ability' has a coefficient of 0.639 signifying a strong positive correlation between improvement in skills and ability

in rice production and increase in rice yield after the training. This suggests that improvement in skills and ability as a livelihood human asset in rice production is highly related to increase in rice yield. This is an indication that as rice yield increases farmers skills and ability in rice production technology increase by almost the same magnitude. This result corroborates Adebayo and Alagunju (2015) findings that agricultural research interventions can have a positive impact on the livelihood outcomes of rural farmers in Nigeria. They further indicate that agricultural innovation impact direct and indirect on livelihood and productivity of the beneficiaries. Adebayo and Alagunju found that the effects of Growth Enhancement Support Scheme on farmers were found to be statistically significant in many aspects of livelihood of the considered farmers. This also supports Saenz and Morales (2006); Murray (2000) argument that educational attainment in the form of abilities and skills is a common measure of human capital.

'Increase in knowledge of rice production' also has a strong positive correlation, (r = 0.751) with increase in rice yield after the training, suggesting a strong positive relationship. 'Maintained good cultural practices in rice production' is strongly and positively correlated (r = 0.719) with increase in rice yield. Suffice to say that 'better education in rice farming practices' also has a strong positive correlation (r = 0.784) with increase in rice yield. It is clear from the results that the farmers' livelihood in human assets increased after training and adopting JICA rain-fed lowland rice production technology and practising same.

Table 4.17: Correlation between Social Livelihood Assets Acquired by Farmers and Increased Rice Yield

Correlation matrix

V/No.	Livelihood Assets (Social Assets)	1	2	3	4
1	Increase in Rice Yield	1			
2	Now connected with other farmers within and outside	.784**	1		
3	I am now a member of farming group in the community	.820**	.636**	1	
4	I have learnt to trust, build trust and relate well with others	.815**	.666**	.704**	1

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Field Survey, 2015

Social assets determination is complex, a relational concept and very difficult to measure. Lopez (2008) asserted that social assets is complex and it is much easier to measure the other livelihood assets compared to social assets. In the words of Narayan and Pritchett (1999), social capital can be referred to as the rules, norms, obligations, reciprocity and trust embedded in social relations and social structures, which enable people to achieve their individual and community objectives. Rakodi (1999) argued that social asset is a relational concept and therefore cannot be measured with certainty and its assessment relies on proxy indicators. In this study, its understanding includes unity and spirit of participation in civil organisations, election of authorities and association with external groups. With this understanding, three relevant social livelihood assets, namely:

'connectedness', 'belonging to a group', and 'building trust' were identified for consideration. The results showed that there is positive and significant relationship between increase rice yield and all the items under social assets at a 0.05 level using 2-tailed test as shown in Table 4.17. 'I am now connected with other farmers within and outside my community' has a strong correlation (r = 0.784) with increase in rice yield after the training, suggesting a strong relationship. This implies that the farmers share ideas with others on the uses of excess rice produced, get better market information on rice and get investment ideas from colleagues on the use of profits from sale of rice.

'Membership of farming group(s) in the community' had the strongest positive correlation (r = 0.820) with increase in rice yield after adopting JICA rice production technology. Building trust and relating well with others also has a strong positive correlation (r = 0.815) with increase in yield acquired after the training. With these relationships, it can be inferred that the project helped the farmers to connect with other farmers, join farming groups in the communities and build trust among themselves for purposes of sharing useful and beneficial ideas and information. It is important to note that acquiring social livelihood assets has a strong positive relationship with acquiring other assets for everyday life and usage. The importance of social assets to farmers is reported by Lawal, Omonona and Ayinleye (2011) in their finding that a unit increase of aggregate social index would reduce the probability of a household being in poverty by 0.7 percent.

Table 4.18: Correlation between Natural Livelihood Assets Acquired by Farmers and Increased Rice Yield

Correlation matrix				
V/No.	**Livelihood Assets (Natural Assets)**	**1**	**2**	**3**
1	Increase in Rice Yield after adapting JICA Practice	1		
2	I have acquired my own land for farming	.077	1	
3	I protect my house and farm land against erosion	-.090	.219**	1

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Field Survey, 2015

From Table 4.18, the key natural asset that was considered as livelihood asset for farmers was land. It was however, not deemed significant at 0.05 level, 2-tailed test. Ownership of farm land is an important element in agricultural practice. Farmers who own land or have uninterrupted access to farmland have greater potential in reducing poverty compared to those who do not own land or have limited access to farm land (Lawal, Omonona & Ayinleye 2011) and Lopez 2008). 'I have acquired my own land for farming' has a positive but very low correlation coefficient of 0.077 with increased rice yield after adopting JICA rain-fed lowland rice production technology. The fact that the relationship is not significant as indicated by the correlation coefficient suggests a weak relationship. This could mean that income gained from the sale of rice due to increase in yield did not relate much to the farmers' acquisition of land for farming. This is so because in rural Ghana, especially Northern Region, farmlands are owned by families and

not individuals and are passed on from generation to generation, hence no individual farmer can claim ownership of rice farmlands in most communities. In other jurisdictions, the entire land is owned by the entire community but controlled and managed by the Chief who gives permission for usage to any farmer who wishes to use any farmland upon request. In such situations, the farmers do not need ownership to farmland before they can use it. The relationship between increased rice yield and 'Protecting their farmland against erosion' was also seen to have a negative correlation coefficient (r = -0.090).

Table 4.19: Correlation between Physical Livelihood Assets Acquired by Farmers and Increased Rice Yield

		Correlation matrix									
V/No.	Livelihood Assets (Physical Assets)	1	2	3	4	5	6	7	8	9	10
1	Increase in Rice Yield	1									
2	I purchased motor or bicycle as means of transport	.639**	1								
3	I have extended or renovated my house	.607**	.460**	1							
4	Now have access to portable drinking water (able to pay for)	-.067	-.108	-.008	1						
5	Now connected to electricity (able to pay bills)	.589**	.449**	.991**	-.006	1					
6	Have acquired TV, Radio, or Cell Phone	-.010	-.042	.023	.261**	.024	1				
7	Have acquired bullocks for the farming my farm and others	.114	-.002	.195**	.242**	.192**	.122	1			
8	I have acquired tractor for my farm use and others	-.001	.000	.028	.259**	.033	.013	.303**	1		
9	Now using modern farming tools	-.145*	-.116	-.092	.239**	-.085	.211**	.094	.195**	1	
10	Now rearing livestock to supplement my rice farming	.545**	.402**	.876**	.006	.868**	.080	.192**	.060	-.045	1

**Correlation is significant at 0.05 level (2-tailed).
*Correlation is significant at 0.05 level (2-tailed).

Source: Field Survey, 2015

The livelihood area with the most listed assets was physical assets with nine assets. In all, four of the listed physical assets were considered statistically significant at 0.05 level using 2-tailed test, one was significant at 0.10 level whiles the remaining four were considered not significant based on the results in Table 4.19. 'I purchased motor bike or bicycle as a means of transport' and 'I have extended or renovated my house' have high and positive correlation coefficients (0.639 and 0.607) respectively with increase in rice yield after the training suggesting a strong relationship. This means purchasing machines such as motor bike or bicycle as a means of transport would increase as rice yield of farmers increase. This result is in line with those of Lawal *et al* (2011) and Omonona and Okunmadewa (2009), that farmers who use machinery as means of transport to support their farming activities and facilitate their movements have 26.2% less poverty than those not using machinery to support their activities and movements.

'My house is now connected to electricity (able to pay light bills)' has a high positive correlation coefficient of 0.589 suggesting a strong positive relationship with increase in rice yield whiles 'I am now rearing livestock to supplement my rice farming' also has a strong positive coefficient (0.545) with increase in yield, an indication that if rice yield of farmers increased, there is the high possibility of the farmers acquiring livestock for rearing to supplement their household expenditure. 'I now have access to potable drinking water' (r = -.067), 'I have acquired bullocks for farming and other activities' (r = 0.114) and 'I have acquired a tractor for use on my farm and other activities' (r = -0.001) all had weak correlations with increase rice yield. However, 'I am now using modern farming equipment' has a coefficient of -.145 and is significant at 0.10 level (2-tailed).

This could mean that most farmers do not have access to modern farm equipment, hence the weak relationship.

Table 4.20: Correlation between Financial Livelihood Assets Acquired by Farmers and Increased Rice Yield

Correlation matrix

V/No.	Livelihood Assets (Financial Assets)	1	2	3	4	5
1	My livelihood assets have increased after adapting JICA Practice?	1				
2	Always have cash-in-hand to meet daily needs	.583**	1			
3	Have current assets to rely one	.526**	.324**	1		
4	Have opened a savings account (money) with a bank	.361**	.193**	.163**	1	
5	I am credit worthy to secure loan from any lender	.934**	.586**	.532**	.341**	1

**Correlation is significant at 0.05 level (2-tailed).

Source: Field survey, 2015

Regarding financial assets, four assets were looked at. These were cash-in-hand, current assets (assets capable of being converted into cash easily and quickly, for example some quantity of millet, Soya bean, groundnut, shea nut and shea butter). They indicated they mostly use proceeds from the excess rice they sold to buy these other food stuff which value appreciate quickly and fast than rice. It also comprises money in saving accounts

in the form of 'susu' either with rural banks, micro-finance institutions or self-managed and credit worthiness. All the four assets were considered statistically significant at 0.05 level. 'I always have cash-in-hand to meet daily needs' has a strong positive correlation coefficient (r = 0.583) with increase rice yield and this suggests a strong positive relationship as shown in Table 4.20. Current assets are basically those assets that can easily be converted into cash. This refers to the assets that the farmers were able to acquire from the sale of rice that have ready market. The correlation between having current assets and increase in yield after the training has positive coefficient of 0.526 which suggests a strong positive relationship. 'I have opened and deposited money in a savings account with a bank (Susu)' has a medium but positive coefficient (0.361) suggesting a moderate positive relationship. 'I am credit worthy to secure loan from any lender' has the highest positive correlation coefficient (0.934) with increase in rice yield after the training. This suggests a very strong and positive relationship between the variables. These results are in line with Carney (1999) finding that financial assets provide the needed opportunity for the individual to pursue different livelihood options that are relevant to their basic survival and also the findings of Carney *et al* (1999); Carney (1999); Carney (1998) and Butler and Greenstein (1999) that financial assets provide a wealth index that categorised individuals in poverty lines.

4.6.4 Change in status of beneficiaries after the training

People's status change when their economic conditions change. Status is any rank, position or standing in society that categorises an individual by giving recognition to the individual that has the potential of making the person feel exceptionally good with feelings of importance and recognition. As people earn more income, their quest to seek self-esteem needs is high. The results established that the status of majority of the farmers changed after implementing what they were taught during the JICA training project and subsequent increase in yield. As high as 81.3%, (209 farmers) indicated that their statuses had changed after the project whiles 48 respondents, representing 18.7%, said they have not seen any changes after implementing the knowledge and skills gained from the training project. Further probe through discussion with some farmers during the data collection period revealed that this minority were the few women and the young farmers who were under parental control. It is common in the rural setting for women seeking recognition by way of position or office to do so with the consent of their husbands. However, most men do not easily give their consent to their wives who seek public office or position with the belief that they will pay little or no attention to their children once they are elevated to a high position to serve. Investigation revealed that young farmers who are still under the tutelage of their parents are considered not mature for positions or titles of honour in the communities.

Change is broad and generic, so the researcher tried to distinguish the various types of changes that the 81.3% of the farmers experienced. The areas of change in status as

indicated by the respondents were respect in community, assumption of new position (Assemblyman, Unit Committee Member, School Management Committee (SMC) member or Chieftaincy title), ability to solve personal problems, and increase in wealth. This data and results are shown in Table 4.21.

Table 4.21: Age * Type of Change in Status

Type of Change		Age						Total
		18-25	26-35	36-45	46-55	56-65	66+	
Respect in community	Count	8	24	27	16	5	0	80
	% of Total	3.8	11.5	12.9	7.7	2.4	0.0	38.3
New Position (Assembly man, unit committee member, or chieftaincy title)	Count	0	2	0	0	1	0	3
	% of Total	0.0	0.95	0.0	0.0	0.5	0.0	1.4
Ability to solve personal problems	Count	10	20	20	14	4	0	68
	% of Total	4.8	9.6	9.6	6.6	1.9	0	32.5
Increase Wealth	Count	10	14	14	15	4	1	58
	% of Total	4.8	6.7	16.7	7.2	1.9	0.5	27.8
Total	Count	28	60	61	45	14	1	209
	% of Total	13.4	28.7	29.2	21.5	6.7	0.5	100

Source: Field Survey, 2015 **N = 209**

The changes in status were cross-tabulated with the ages of the farmers to determine the relationship between status change and age group as shown in Table 4.21.

The respondents were asked to indicate the type of status change they have experienced. Four types of status change (respect in community, assumption of new position of title, ability to solve personal problems, and increase in wealth) were indicated. Eighty (80) (38.3%) of the respondents intimated that they experienced status change by way of respect in the community, 3 (1.4%) said they now hold new positions in the form of Assembly Membership, Unit Committee Membership or chieftaincy title, 68 (32.5%) indicated their ability to solve personal problems was the change in status they enjoyed while 58 (27.8%) said the change in status they experienced is increase in wealth.

From the results in Table 4.21, of the 38.3% respondents who indicated that their status has changed by way of respect they gain in the community when they experienced increase in rice yield after adopting JICA rain-fed lowland rice cultivation technology, 8 (3.8%) were between ages 18-25, 24 (11.5%) aged between 26-35, 27 (12.9%) aged between 36-45 while 16 (7.7%) and 5 (2.4%) aged between 46-55 and 56-65 respectively. They cut across all the age groups but none above the age 66 indicated respect in the community as a change in status. This could also be that they already had respect from community members before the rice training project.

Of the 3 (1.4%) respondents who indicated they experienced new position because of the higher incomes they now get from the sale of rice as a result of the implementation of the JICA rice production technology, 2 (0.96%) were within the ages 26-35 while 1 (0.48%) was between ages 55-65. These categories have the least respondents. Prominent among

the new positions held are Assembly members and School Management Committee (SMC) members in their various communities. Further investigation revealed that most men at the rural level have the desire for power to rule. They indicated that it is very difficult to go for position of influence in the community if you are unable to part with some amount of money to pave the way for the chief to enskin you or the electorate to vote for you. With the increase in their level of income as a result of the increase in rice yield they experience from the JICA project, they were able to part with money to pave the way for others to have that confidence in them and to give them that mandate to lead.

For 68 (32.5%) respondents who indicated that they are able to solve their personal problems now with little or no financial assistance from others, 10 (4.8%) were within the ages 18-25 years, 20 (9.6%) were within ages 26-35 years and 36-45 years respectively, 14 (6.6%) aged between 46-56 while only 4 (1.9%) aged between 56-65 with none above 66 years.

Of the 58 (27.8%) respondents who indicated their wealth has increased, 10 (4.8%) were within the ages 18-25 while 14 (6.7%) were between ages 26-35 and 36-45 years respectively. About 7% were between 46-55 years, 4 (1.9%) were between 56-65 years while only 1 (0.48%) was more than 66 years.

In summary, 28 respondents representing 13.4% of those who experienced change in status were aged between 18-25, 60 (28.7%) were between 26-35 years old and majority,

61 (29.2%) were between ages 36-45 with 45 (21.5%), 14 (6.7%) and 1 (0.5%) were between the ages 46-55, 56-65 and 66 and above respectively.

The results of this study clearly indicate that in addition to improved food security and household self-sufficiency in food requirements, increased farmers' knowledge and skills in rice production, the technology has also enabled majority of the individual farmers to meet their self-esteem needs.

4.6.5 Sex and change in status

A cross tabulation of sex and change in status was done and the results are presented in table 4.22.

Table 4.22: Sex * Change in Status

Changes in Status		Sex		Total
		Male	Female	
Respect in Community	Count	65	15	80
	% of Total	31.1	7.2	38.3
New Position (Assembly man, Unit Committee Member, or Chieftaincy title	Count	3	0	3
	% of Total	1.4	0.0	1.4
Ability to solve personal problems	Count	63	5	68
	% of Total	30.1	2.4	32.5
Increase Wealth	Count	49	9	58
	% of Total	23.4	4.3	27.7
Total	Count	180	29	209
	% of Total	86.1	13.9	100.0

Source: Field survey, 2015 **N = 209**

From Table 4.22, about 86% and 14% of the male and female farmers respectively, indicated that they experienced changes in status. From the results, 65 (31.1%) of those who said they had gained respect in their communities were males as compared to 15 (7.2%) who were females. The outcome of the study revealed that among the four status change variables, women experienced 'respect in my community' most.

A total of 3 (1.4%) out of the 209 respondents who indicated that they have assumed new positions in their communities were all males. Also, 63 (30.1%) of the 68 respondents who indicated they can solve their personal problems without much assistance from family members, especially if it has to do with finance, were males. The remaining 5 (2.4%) respondents were females. Further probing revealed that the culture of the people of the Northern Region is such that, men are in the fore front of finding solutions to social problems instead of women. Women are not allowed to lead delegations and so even if a woman has all the necessary resources to solve societal or family problems she must, by necessity, do so through a male representative. The few women who indicated that they could take initiative in solving personal problems without consulting males made reference to the solution of specific personal problems that do not necessarily require male input.

For the 58 (27.7%) respondents who indicated 'Increase in wealth', 49 (23.4%) were males while 9 (4.3) were females. The results clearly depict male dominance in all the status change areas indicated in Table 4.22. Certain societal norms and beliefs tend to limit women's quest for wealth acquisition in the Northern Region and these include notions such as 'the woman is the property of the husband' and 'woman's place is the kitchen and therefore do not need farmlands'. Some of these beliefs are typically cultural.

4.7 Examine the Constraints Encountered by Farmers During Implementation of the Training Technology in the Selected Areas

No training programme can be devoid of constraints and the JICA training is no exception. As a training programme designed for farmers to help increase rice yield, expectations were high from both parties. Even though due diligence was carried out prior to the training and implementation of the training project, it was suspected that certain limitations were likely to be associated with the project, hence effort was made to identify and rank these constraints as they negatively affected the implementation of the technology from the project.

Interaction with beneficiary farmers revealed that the training objectives were closely matched to the farmers' knowledge need. The project also facilitated improved yield to the rice farmers selected for the training project which in turn resulted in economic, material, socio-cultural and livelihood related benefits to the farmers. However, some constraints were encountered during the implementation of the project that cannot be overlooked. Twelve (12) constraints were identified through gaps in literature (Chaudhary, Nanda & Tran, 2003) and discussions with the project office staff, agricultural officers and interested parties. These were phrased into perceptual statements and presented to the respondents for them to indicate their agreement level for each of the statements. The scale used to weigh the constraints were 'strongly agreed' (5) to 'strongly disagreed' (1). In analysing the responses, strongly agreed and agreed were considered as 'agreed' while disagreed and strongly disagreed were also considered as

'disagreed' for the purpose of simplifying the analysis and the results are presented in Table 4.23.

Table 4.23: Constraints from the Perspective of Farmers During Implementation

Responses	Agreed		NC		Disagreed		M	StD
Constraints	**Fq**	**%**	**Fq**	**%**	**Fq**	**%**		
Farming system is labour intensive which affects output	246	95.7	4	1.6	7	2.7	4.29	.635
Erratic rainfall makes it difficult to know planting time	245	95.3	6	2.3	6	2.3	4.23	.623
Difficult getting tractor to prepare land	233	90.7	0	0	24	9.3	4.15	.859
Difficult getting equipment	205	79.8	8	3.1	44	17.1	3.69	.885
Difficult getting fertilizer in required quantity,	193	75.1	5	2.0	59	22.9	3.63	1.023
Not difficult constructing and repairing bunds	195	75.9	5	1.9	57	22.2	3.60	.979
JICA rice variety attracts Birds	165	64.2	13	5.1	79	30.7	3.42	1.143
Difficult to practice what was taught	108	42.0	15	5.8	134	52.1	2.86	1.195
Training was done late so I could not put to practice	51	19.8	29	11.3	177	68.9	2.44	1.015
Difficult getting quality seeds	80	31.1	0	0	177	68.9	2.42	1.190
AEAs are not enough to serve all farmers,	52	20.2	3	1.2	202	78.6	2.13	1.141
Socio-cultural factors limit women in rice farming.	17	6.6	4	1.6	237	92.2	1.95	1.12

Source: Field Survey, 2015 - N = 257

Scale: SA = Strongly Agreed (5), A = Agreed (4), NC = Not Certain (3), D = Disagreed (2), SD = Strongly Disagreed (1), M = Mean, StD = Standard Deviation and Fq = Frequency

From the results in Table 4.23, majority (96%) of the farmers, agreed that 'farming system is considered as labour intensive' while 2.7% disagreed with 1.6% not certain about the statement. In Ghana and the Northern Region in particular, farmers lack equipment such as tractors, planters, harvesters, harrows, threshers and financial ability to engage in mechanised farming thereby making farming labour intensive. They rely on hand held devises and equipment that make farming difficult and scary to the youth. The 96% respondents emphasised that the labour-intensive nature of farming occupation hinders youth participation in farming more especially taking farming as a profession. This scares the youth who mostly resort to seeking alternative jobs, however menial instead of farming. This labour intensiveness of rice farming tends to reduce the number of farmers who engage in rice farming or compel farmers to reduce the farm size so as to minimise the difficulty involved.

'Erratic rainfall made it difficult to know planting time' which eventually affects yield negatively also had a higher response of 95.4% who agreed (30% strongly agreed and 65.4% agreed). Interaction with rice farmers in the study areas revealed that rainfall variability has the tendency to cause flood, gully erosion, drought and desertification which can impact negatively on rice farming prospects. It was reported by Oyewole *et al* (2014) that, the most relevant characteristics of rainfall variability is determined in space and time that has socio-economic and ecological implications for rice production. Environmental problems in rice farming such as flood, gully erosion, drought and desertification, rainfall intensity and duration, humidity and temperature which are triggered by extreme rainfall variability, seriously affect rice yield in the Northern,

Savana and North-east Regions, and this result corroborates Oort and Zwart (2018); Sarangi *et al* (2015); Kajisa (2016); Ogbuene (2010); van Madu and Ayogu (2010); and Edeh, Eboh and Mbam (2011). Tiamiyu *et al* (2015) and Chamhuri, *et al* (2014), argued that the adverse effect on the yield of rice in the Sudan savannah is due to rainfall variability. Though the adverse effect of erratic rainfall seemed insignificant during the period of study, the farmers stressed that it represents a warning that stakeholders in rice production should put measures in place to curb this from escalating. However, they were quick to state that the bunds they construct in their rice farms as well as the early maturing nature of Jasmine 85 makes the effect of rainfall variability on rice yield in the study areas very minimal.

With regard to tractor for ploughing, 90.6% respondents agreed that it was difficult getting tractor to prepare the land for planting. Very few private individuals can afford their own tractors whiles the majority of farmers needed the services of tractor operators during land preparation. The farmers indicated that it is common to use two to three days tracking tractor operators before getting them to plough their farm land for them. The implication is that it leads to late ploughing, improper ploughing and sometimes inability to farm rice, because if it rains heavily within the waiting period, it becomes impossible for the tractor to plough in the rice valley. The delay in getting tractor as well as improper ploughing because the tractor operators are in haste to finish and plough others farms so as to maximise profit mostly lead to low yield in rice production in the selected districts in particular and in the Northern Region in general.

About 80% agreed with the statement that 'it is difficult getting farming equipment' such as planters, threshers, harvesters, bird scaring nets and tarpaulins to facilitate farming activities. This implies that most of the farming activities that could be done using equipment had to be done manually with hand-held devices that require energy. Although the training technology is on rice intensification, if farmers are able to secure and use farming equipment or if the services were available, they will be more efficient in production. This situation discourages potential farmers from venturing into farming as a business which is capable of earning them income as well as discourage existing rice farmers from expanding their rice farms. The rice farmers express worry that they most lose their rice farms to bush fires because of lack of combine harvesters. The project for sustainable rain-fed lowland rice production required certain standardised land preparation and planting, hence the need for appropriate farming equipment. The farmers indicated that for effective and maximum plant population, row-planting was recommended by the project though it is very difficult to practice compared to broadcasting.

From the farmers' perspective, majority of farmers (75.1%) agreed that it was difficulty getting fertilizer timely and in recommended quantities to apply. This difficulty was attributed to two key reasons, that is, (1) lack of money to buy and (2) delays in sometimes getting the coupons to buy at the government subsidised price. Fertilizer is sold on the open market at a higher price compared to the government subsidised price. In addition to the subsidy provided by government, fertilizer supply was rationed to

ensure equitable distribution. Farmers were required to purchase a coupon from an accredited dealer and then present the coupon to any sales point for the fertilizer to be issued to them at an approved subsidised price. The farmers indicated that there were times when farmers were not allowed to purchase beyond a certain number of coupons. This was to avoid some farmers buying more than they truly needed to the disadvantage of others. To many of the farmers, coupon system and the process of getting fertilizer sometimes delays the process of getting fertilizer which negatively affected rice yield as found by (Tsujimoto *et al* 2017) and there were instances where the benefits of fertilizer applied on the farm were minimal due to the time the fertilizer was acquired which also affirms the findings of (Koussoubé & Nauges 2017). There were also few incidents where some farmers could not afford the cost of fertilizer when it was needed. This means difficulty in getting fertilizer timely and in required quantities negatively impacted on increase rice yield. It is imperative to note that in spite of all the difficulties in getting fertilizer, the AEAs support mitigated the impact by educating the farmers on how to overcome this challenge.

Bund construction, which is seen as a major facilitator of rice cultivation in the Northern Region where rainfall pattern is very sporadic is one concept of the training that the farmers liked most. With the results on bund construction, about 76% agreed that bund construction is difficult, hence bund construction takes much of the farmers' time and effort. The majority (76%) agreed that bund construction and repair is a difficulty. However, they also indicated that the benefits associated with bund construction is

greater than the cost in terms of money, time and effort involved and this encouraged them to spend time in the construction of bunds on their rice farms.

About 64.2% agreed to the statement that the variety of rice recommended by JICA for the farmers, that is, Jasmine 85 attracts birds. However, 30.7% disagreed with the statement. The reason given by the majority (64.2%) is that the Jasmine 85 is an early maturing variety compared to other varieties. It therefore serves as the only source of available food for the birds. Even though the quantity of rice consumed by birds on the rice farm cannot be quantified with certainty, it is believed that the devastating effect of birds caused reduction in rice yield. This finding agrees with that of Amedi (2014) that the second most serious constraint in rice production among farmers in Hohoe Municipality in Ghana was the devastating effect of birds and rodents (rats, grass cutters and squirrels). Amedi (2014) explained that this caused reduction in yield and subsequently affected loan repayment by rice farmers. This finding is also in line with those of Omofonmwan and Kadiri (2007), and Adeyemo (1984) who observed the devastating effects of pests on rice farms in Nigeria. It is for this reason that the JICA sustainable rain-fed lowland rice production project encouraged farmers to use bird scaring nets when the rice begins to mature. One advantage of this early yielding variety is that in seasons when there is low rainfall, they mature before the water in the rice farm dries up.

The recommended standard practice in rice farming, according to JICA project, was perceived by 35.8% of the farmers as difficult to practice. However, majority of the farmers (52.1%) disagreed with the statement that 'the JICA recommended procedure in rice farming was difficult'. This implies that the majority of rice farmers did not perceive the recommended JICA practices to be difficult. They saw the practices and procedures as the best ways possible to realise high yield in rice production. For example, JICA training recommended that rice should be planted in rows using planter or hand sticks to mark the ground whiles the traditional practice of most of the rice farmers was 'impregnation', i.e. broadcasting the seeds on the unploughed land before ploughing.

The majority of the farmers (68.9%) disagreed with the statement that 'the training was done late thus making it difficult for the farmers to practice' fully during the season. They were of the view that following the JICA recommended practices leads to increase in rice yield compared to the traditional broadcasting method of planting. In effect, the training was conducted just before the farming season and farmers had ample time to implement what was taught during the training. The implication of this result is that farmers were equipped with the knowledge and skills on time to enable them to make good use of them to ensure increased rice yield.

On the responses regarding quality seeds for planting, about 69% disagreed with the statement that it was difficult getting quality seed for planting. The majority of the respondents about (69%) indicated that good quality seed was provided by JICA to all farmers on the project. Some farmers were also selected and trained as seed producers

and taken through the process of producing and selecting quality seed for distribution to other farmers for planting.

The majority of the farmers (78.6%), registered their disagreement with the constraint that AEAs were not enough to serve all the farmers selected for the rain-fed lowland rice training project. This was therefore not considered as a constraint by majority farmers. The implication is that farmers were given adequate extension services required to help realise the objectives of the project. In effect, AEAs were always available to guide farmers as and when the need arose. The indication is that majority of the farmers were satisfied with the advice they received from the AEAs during the implementation of the technology. This is possible and realistic given the total number of farmers who participated in the JICA rice training project as against the number of AEAs selected and trained for the project. The 31 AEAs as against the 880 farmers translates into a ratio of 1:38 AEAs to farmers, which means that for the project, one AEA was responsible for the needs of 38 farmers. This looks quite impressive compared to the current national ratio of 1:1,500 farmers (SEND Ghana, 2013).

The constraint with the least score in response to agreement was that socio-cultural belief limits women participation in rice cultivation, with 91.8% disagreeing. This means that very few people think that there are socio-cultural factors that hinder the participation of women in rice farming. Most of the groups formed for the training included women and such women members were purposively selected during the administration of the

questionnaire for the right responses to be elicited bearing in mind the variables in this study.

Though all the constraints identified are very common with rice cultivation in the Northern, Savana and North-east Regions and all of these are known to have negative effects on rice yield, but the JICA technology had superior provisions incorporated into the training that made the effects of these constraints very minimal on the participants' rice yield levels.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter looks at the summary of the study, the conclusions drawn and from which recommendations are made.

5.1 Summary

The study was carried out to evaluate JICA rice production training project. This training project was provided for rice farmers in the Tamale Metro including Sagnarigu in the Northern Region, West Mamprusi Municipality, now in the North East Region and East Gonja Municipality, also now in the Savana Region. At the time the training began, these areas were all under one region, that is, the Northern Region.

5.1.1 Objectives and sampling

The objectives of the study were fashioned around the training on land development and rice cultivation provided as they influence yield in rice farming. Mixed method approach was adopted in carrying out this study. This approach allowed the gathering and use of both quantitative and qualitative data as adopted in this study. Data were gathered from rice farmers across all areas where the training took place. A sample size of 265 was used out of a population of 880 farmers for the study using the Krejcei and Morgan (1970) table for determining sample size. Eight copies of the questionnaire were inappropriately answered and had to be excluded. This brought the number of validly answered questionnaires to 257, giving a 3% default rate which can be considered as acceptable under research conditions. Data were analysed using percentages, frequencies, means, standard deviations, correlation coefficients and the results were presented using tables, bar charts, pie chart and histograms.

5.1.2 Socio-demographics variables

The major findings of the study are summarised as follows. Rice farming in the selected areas is a male dominated profession. The results shown that majority of the farmers were males as compared to females Table 4.1, married people constituted majority of the respondents (table 4.2) and majority, about 73% of the respondents indicated that they have no formal education. The minimum age of the farmers was found to be 18 years while the maximum age was 75 years, with a mean age of 39.6 years. The results further indicate that majority of the people engaged in rice farming in the three selected districts are still in their active age group and are capable of carrying out effective farming

activities leading to increase in rice production. Majority of respondents said tractor operators are involved in measuring farm size, minority of farmers earned non-farm income. The rice variety for the project farmers was Jasmine 85 and the method demonstration was the main training method used which the AEAs emphasised the appropriateness of the method.

5.1.3 Usefulness of the training to the farmers

Majority of the rice farmers indicated the training was usefulness. Reasons given for the usefulness of the training according to majority of the farmers included better yield, increase in rice production knowledge and skills, quality rice produced, increase in income and profit and linkage with other farmers for the purpose of sharing farming ideas.

5.1.4 Perceived capabilities gained after the training

The study revealed that holding all things constant, rice farmers capabilities were enhanced in areas of measuring hectare of farmland properly, determining proper ploughing, selecting quality seeds for planting, knowledge of the right time to plant rice, proper weed management, diseases identification and control and plant population planning (rice intensification). With this enhanced knowledge in rice cultivation, farmers in the selected areas experiences exponentially increase in rice yield.

5.1.5 Extent to which training contributed to yield increase within the period

A large number of the rice farmers (48%) increased their yield to between 2.1t/ha – 3.0t/ha whiles 38.5% increased yield to 3t/ha and above after the training project. It is

clear from the study results that 86.4% of the respondents produce more than 2.0t/ha of rice after their participation in the JICA project as compared to 96.1% who produced up to 2 t/ha before the project.

5.1.6 Correlation between increase in rice yield and components of the training

The main emphasis was the analysis of the contributions of the components of the training to increased rice yield in the study areas. With reference to land development as a component of the training, all three areas of training on land development (proper area measurement, bund construction and good land preparation) showed positive significant correlations (0.75; 0.72 and 0.78) respectively between training and increased rice yield as shown in Table 4.12. Rice cultivation as a component of the training also shows positive and significant correlations (Table 4.13) between all six areas of the training on rice cultivation and increased rice yield respectively. This is an indication that if attention is given to proper rice farmland development and best agronomic practices as provided by JICA training, rice yield in the Northern, Savana and North-east Regions would increase.

5.1.7 Socio-economic status and livelihood

Interaction with the rice farmers revealed that proceeds from sale of excess rice due to increase in yield enables them to acquire some additional assets or properties after they met their domestic consumption requirements. Most acquired additional assets were cell phone, smock clothes, bicycles, solar lanterns, corrugated roofing sheets, foam mattresses

and television sets and some income generating assets such as motor tricycle, goats and sheep for rearing as shown in Table 4.14. In the acquisition of these additional assets, males constituted the majority as reflected in the demographic variables in Table 4.1. Some also indicated that they are able to pay their wards' school fee. Effect of the training on livelihood assets of rice farmers was analysed. Holding all variables constant, the results revealed that the increase in rice yield resulting from the JICA rain-fed lowland rice production technology positively affected almost all livelihood assets, using the DFID livelihood assets framework. The correlation coefficients computed showed strong and positive significant association between increase rice yield and all four human livelihood assets table 4.16, social livelihood assets, Table 4.17 and financial livelihood assets, Table 4.20. The relationship was not significant for natural livelihood assets Table 4.18. For physical livelihood assets, four had strong and positive significant relationship with increase rice yield while four were found to have weak or negative relationship with increase rice yield as shown in Table 4.19.

Regarding change in status, the majority (81%)) agreed that their participation in the project has led to changes in their statuses such as Assembly men and Member of School Management Committee in the communities.

5.1.8 Constraints

The study also revealed that the farmers encountered constraints during the implementation phase of the rice production technology and major constraint was the

labour intensive nature of rice farming (Table 4.23) which scares the youth from engaging in rice farming and also limiting the size of their rice farms.

5.2 Conclusion

JICA's effort to facilitate increase in rice yield in the three selected districts was well intended and the effort yielded the desired results. Bearing in mind the variables and objectives of this study, farmers who participated in the training project demonstrated through the results of this study that their rice yields increased year after year during the project period. From the results of the study the following conclusions are drawn:

1. The training they received during the implementation of the project for sustainable rain-fed lowland rice production has been very useful to the farmers because it has helped farmers to increase their rice yield, helps increased the knowledge and skill in rice production, they now earned more income and profit.

2. It can be deduced from this study that holding all things constant, rice farmers capabilities were enhanced in the selected areas because farmers can now measure hectare of farmland properly, determining proper ploughing, selecting quality seeds for planting, known the right time to plant rice, proper weed management, diseases identification and control and plant population planning (rice intensification). This led to increase in rice yield.

3. It can be inferred from this study that 86.4% of the respondents produce more than 2.0t/ha of rice after their participation in the JICA project. Rice production in the selected areas increased significantly with the period of the training.

4. All the three key activities under land development and six key activities under rice cultivation gave strong and positive significant correlations with increased rice yield and this is indicative that the project provided superior methods of rice cultivation in the study districts.

5. The financial gains made through the project enabled the farmers to acquire assets including bicycles, motor bikes, roofing sheets (zinc), cell phones and livestock such as goats and sheep. The increase in rice yield led to changes in rice farmers' socio-economic benefits and status changes. Socio-economic benefits include ability pay their wards school fees, living a healthier and happier life, food security among others. Status changes experienced included respected in community, new positions like Assembly member, ability to solve personal problems and increase in wealth.

6. The labour intensive nature of farming, erratic rainfall pattern and not getting tractors services early to prepare land before planting were the most serious constraints identified by the farmers.

5.3 Contribution to Knowledge

This study has made significant contribution to knowledge at both the academia and practical levels in Ghana as a comprehensive evaluation of the JICA rain-fed lowland rice production project in the Northern, Savana and North East Regions. The nature and depth of this study of the JICA rain-fed lowland rice production training project in the Northern, Savana and North-east Regions in Ghana and taking into cognisance JICA contribution to practical application of training in agricultural practice is imperative and worthwhile. It has provided an in-depth exploration on the effectiveness of agricultural training project in providing students with comprehensive literature on evaluating training and practical insight on evaluation.

Earlier studies on the JICA rain-fed lowland rice training project were conducted in specific areas limiting their scope to evaluating only the primary objectives of the project. This study broadens the scope to cover the entire areas covered by the project in the Northern, Savana and North-east Regions. This evaluation also went beyond the primary objectives to the project, hence establishing that evaluating training project should not be limited to the primary objectives but should be extended to unintended benefits such as the socio-economic benefits, status change of the participants and livelihood assets acquisition. Key area where this study contributed to knowledge is the incursion made into how the benefits derived from the JICA rain-fed lowland rice training project has transformed the lives of farmers through the livelihood assets acquired by the

participants. This study has linked the effect of training on rice production to livelihood assets acquired by rice farmers from proceeds made from excess rice sold.

The results of the study revealed some components of the rice farming practices that need to be given special attention if increase in rice yield is a priority. Examining the results of this study, it has become clear that good land preparation, bund construction, and proper and accurate land area measurement contributes significantly to yield increase in rice in the Northern Region of Ghana. The study also unearths that agronomic practices such as good seed selection, proper planting, timely and adequate fertilizer application, proper weed management and pest and disease control all facilitates increase in rice yield in Northern Region. These findings, therefore, contribute to new and better ways that can lead to rise in rice yield in Northern Region.

5.4 Recommendations

From the results, the researcher wishes to make the following recommendations:

- The study recommends that the lessons learnt from the project should be mainstreamed into MoFA's mandate for rice farmers throughout the country. Mainstreaming the rain-fed lowland rice production technology nationwide would be beneficial to all rice farmers in Ghana and help increase rice production in fulfilment of government policy of being self-sufficient in rice production. This can be done through the Regional and District Departments of Agriculture by emphasising training of farmers on how to measure land accurately, construct

bunds and ensure that land ploughing is done properly. If farmers are able to ensure that their rice farm lands are prepared according to specified standard, increase in yield would be assured.

- All trainees in agricultural training institutions, especially the Agricultural Colleges in the country should be exposed to the JICA sustainable rain-fed lowland rice cultivation technology for it to be used in the training of students. These students after graduation would subsequently train rice farmers on the use of the JICA rain-fed lowland rice production technology. If JICA rice cultivation technology is made known to all AEAs and farmers, Ghana can be a net exporter of rice.

- In order to ensure timely and standardised land preparation, Government and development partners should incorporate mechanisms that would facilitate the provision of tractors and tractor services to rice farmers. Ready availability of tractors and tractor services to rice farmers would guarantee proper and timely land preparation and bund construction.
- It is recommended that government should provide other farming equipment such as planters, harrows, sprayers, tape measures and harvesters to serve rice farmers. These equipment can be imported and sold to rice farmers on hire purchase bases and or at subsidise prices. This would make farming much easier and enticing to many potential farmers especially the youth. Making farming capital intensive

with machinery available for use by rice farmers could go a long way to increase farm sizes, leading to increase in rice yield.

- It is recommended that JICA should secure more funding to extend the project to as many districts in the country as possible since the evidence of the project is clear that rice yield is increased through the JICA rice training technology.

- The farmers should also sustain the technology by practising and applying the knowledge gained through the project. This would help them sustain the food security gained as a result of increase in rice yield and their livelihoods assets would continue to increase.

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APPENDIX I

QUESTIONNAIRE FOR FARMERS

UNIVERSITY FOR DEVELOPMENT STUDIES
FACULTY OF AGRIBUSINESS AND APPLIED ECONOMICS

DEPARTMENT OF AGRICULTURAL EXTENSION, RURAL DEVELOPMENT AND GENDER STUDIES

PhD INNOVATION COMMUNICATION

Dear Respondent,

I am a PhD student with the University for Development Studies offering Innovation Communication. I am seeking your responses to enable me to carry out this thesis on the topic: **AN EVALUATION OF JAPAN INTERNATIONAL COOPERATION AGENCY TRAINING ON SUSTAINABLE RAIN-FED LOWLAND RICE PRODUCTION TECHNOLOGY ON FARMERS' LIVELIHOOD IN NORTHERN REGION, GHANA is** strictly for academic purpose. Please be assured that any response you give would be treated with utmost confidentiality and only for the purpose for which it was solicited. Your candid opinion or response is therefore appreciated. Thank you.

BIODATA

1. How old are you? …….
2. Sex Male [ ] Female [ ]
3. Marital status. Single [ ] Married [ ] Separated [ ] Divorced [ ]
4. Level of education. No formal education [ ] Primary [ ] Middle school [ ] JSS [ ] SSS or O/L [ ] A/L [ ] Diploma [ ] 1st Degree [ ] 2nd Degree [ ]
5. Do you earn some income? Yes [ ] No. [ ]
6. To what extent does this income influence your rice production output?

   very high [ ] high [ ] moderate [ ] low [ ] very low [ ]
7. For how long have you been cultivating rice? ……years
8. How was rice farming introduced to you? ……

9. What is the size of your rice farm? (in hectares equivalent) ……

10. How do you know the size of your rice farm? I measured [ ] Tractor operator measured [ ] AEA measured [ ] AEA helped me measured [ ]

Objective One:

Determine the Usefulness of the Training method used in Training Farmers.

11. What method(s) were used in training you during the programme? (Tick as many as are applicable)

    Workshops [ ] Seminar [ ] Practical Demonstration [ ] ToT [ ]

12. To what extent has the training helped in increasing your rice yield?

    Very High [ ] High [ ] Low [ ] Very Low [ ]

13. Which of the above training methods selected do you think helped in building your capacity to increase yield most and why?

    ……

    ……

14. From the scale of five, indicate your level of agreement to the statement on the reasons for the usefulness of the training. Where SA = 5, A = 4, NC = 3. D = and SD = 1

S/No	Response	SA	A	NC	D	SD
1	Now produce more rice tan before					
2	Now produce quality rice than before					
3	My knowledge in rice production is increased					
4	Now gain much income because of increase rice yield					
5	Now earned more profit from sale of rice than before					
6	Am now linked with many farmers and share ideas					

Objective Two

Examine the perceived capabilities gained by rice farmers from the training in the selected districts.

15. What were you able to do after the training that you could not do before the training? (Tick as many as applicable)

S/No	Perceived Farmers ability Acquired after the training	SA	A	NC	D	SD
1	I am now able to measure acre properly					
2	Ensure that the ploughing is properly done					
3	I am now able to select quality seeds for planting					
4	I now know the exactly time to start rice planting					
5	I can now control weeds properly					
6	I can now identify diseases and control them					
7	I now get more output from the same piece of land than before.					

Objective Three

Ascertain the extent to which the farmers and AEAs perceived that the training project has contributed to increase in rice yield (per hectare) of farmers in the selected districts.

16. Quantity of rice produced before and after the training project among rice farmers in the study areas.

	Before Training	After Training
Quantity in t/ha	**Frequency**	**Frequency**
100kg– 1 ton		
1.1 – 2 tons		
2.1 – 3 tons		
3.1+ tons		

17. To what extent do you perceive that the training provided by JICA led to increase in rice yield in your farm?

Very High [ ] High [ ] Moderate [ ] Low [ ] Very Low [ ]

Objective Four

Assess the relationship between the components (land development and rice cultivation) of the training project on rice yield in the selected districts.

18. Do you see the training on rice production useful? Yes [ ] No [ ]

19. If yes, how useful was the training? Very useful [ ] Useful [ ]
No idea [ ] Averagely Useful [ ] Not Useful [ ]

20. The training led to increase in rice yield on the same piece of farmland I cultivated rice after the training. **Please choose between 1 which is least agreement to 5 highest agreement to the statement. 1 = [ ] , 2 = [ ], 3 = [ ], 4 = [ ], 5 = [ ]**

21. To what extent do you agree with the following statements on areas of training of JICA rice production? Choose between 1, least agreement to 5 highest agreement

AREAS OF TRAINING		5	4	3	2	1
Land Development	Proper area measurement leads to increased rice yield.					
	Bund construction contributes positively to increase in rice yield					
	Good ploughing /land preparation leads to increase in rice yield					
Rice Cultivation	Selecting and planting good seed results in good yield.					
	Adopting good methods of planting (planting at the right time and using recommended seed rate) increases yield					
	Applying the recommended rates of fertilizer increases rice yield.					
	Timely application of fertilizer gives increase yield.					
	When weeds are controlled on time it increases rice yield					
	Timely control of pests and diseases using recommended chemicals increases yield.					

Objective Five:

To Determine the Effect of Increase in Rice Yield on the Status and Livelihood of Farmers in the Selected Districts

22. Do you see yourself different now after you implemented the JICA technology and if yes, how different are you in terms of socio-economic benefits you achieved from the training? Indicate your agreement to the under listed by ticking between 1, least agreement to 5 highest agreement.

S/No.	Socio=economic benefits	5	4	3	2	1
1	Able to pay Wards School fees					
2	Better in terms of wealth					
3	Able to solve personal problem					
4	Respect in the community					
5	Able to solve personal problem					
6	Living a healthier and happier life					

23. Have your assets increased after adopting practices of JICA? Yes [ ] No [ ]

24. Indicate the additional asset(s) you acquired as a result of the increase in rice yield after practicing JICA rain-fed lowland rice production technology. Please, you may tick more than one where applicable

S/No	Assets Acquired by Farmers after the Project	Yes	No
1	Bicycle		
2	Motor Bike		
3	Motor Tricycle (Motor King)		
4	Mobile Phone		
5	Goats/Sheep for Rearing		
6	Zinc (roofing sheet)		
7	Smock		
8	Mattress		
9	Standing/Ceiling fan		
10	Cooking utensils		
11	Solar Lantern		
12	Fridge		
13	Television Set		
14	Satellite Decoder		
15	Home theatre		

25. To what extent do you agree with the following statement regarding change(s) in your livelihood assets due to increase in rice yield which resulted from the training received under the rain-fed lowland rice development project? **Please tick from 1 to 5 with 1 been the least agreement and 5 highest agreement**.

Livelihood assets

Assets	**Specific assets for farmers**	**5**	**4**	**3**	**2**	**1**
Human Assets	My skills and ability in rice cultivation have improved					
	I am more knowledgeable in rice farming than before.					
	I maintain good cultural practice after the training I received.					
	I feel better educated on general farming practice.					
Social Assets	I am now connected/networked with others within and outside the community.					
	I am a member of farming groups/associations in the community					
	I have learnt how to trust, build trust and relate well with others.					
Natural Assets	I have acquired my own land for farming purpose.					
	I have protected my house and farm land against erosion.					
Physical Assets	I have purchased motor bike or bicycle as means of transport for my farm and family use.					
	I have extended or renovated my house to provide decent shelter for my family.					
	I now have access to portable drinking water (adequate supply) because I a able to afford as a result of increase in rice yield.					
	I am now connected to electricity for my domestic consumption or using generator or solar because I am able to pay.					
	I have been able to acquire TV, Radio, or Cell Phone because I get money from increased rice yield.					
	I have acquired bullocks for the purpose of ploughing my farm and					

	for others who need their service for a fee.					
	I have purchased a tractor (individual or as a group) for personal and commercial use as a result of the money I get from improved rice yield.					
	I am now using modern farming tools such as Wellington boots, knapsack and bird scaring net.					
	I am rearing livestock in addition the rice farming to supplement my income as a result of increase in rice yield.					
Financial Assets	I always have cash-in-hand to meet daily cash need.					
	I have current assets (assets capable of converting into cash easily and quickly).					
	I have opened Savings account with bank or formal or semi-formal micro-finance institutions.					
	I am credit worthy and can secure loan from any lender.					

26. Has your status changed after taking part in the project?

Yes [ ] No. [ ]

27. From the table, indicate the type of status change you experience as a result of increase in your rice yield.

S/No.	**Type of Status**	**Yes**	**NO**
1	Respect in the community		
2	New Position of power (Assembly member, Unit committee member or Chieftaincy title)		
3	Ability to solve personal problems		
4	Increase in wealth		

Objective Six

Examine the constraints faced by farmers in their use of the methods they were trained in.

28. From the table, please tick the constraints you think affected your smooth use and implementation of the JICA training programme.

S/No.	Constraints	SA	A	NC	D	SD
1	Farming systems is mostly labour intensive so it is difficult to increase output levels					
2	Erratic rainfall pattern making it difficult to predict when to plant.					
3	It is difficult getting tractors to prepare the land early.					
4	It is difficult getting equipment such as cutlasses, hoe, sickle, knapsack sprayer, bird scaring net, tarpaulin, etc.					
5	Difficulty in getting fertilizer in the require quantities for our farms					
6	Not difficult constructing or repairing bund on the rice farm					
7	The JICA variety attracts birds which required much effort on bird scaring and use of bird scaring nets.					
8	What we were taught during the training is difficult to practice.					
9	Because the training was done late I could not practice it.					
10	Difficult getting quality seeds					
11	AEAs are not enough to serves all farmers well					
12	Socio-cultural factors limits the extent to which women participate in rice production.					

29. Please list any other constraints that you face that are not stated in the table above.

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30. Please provide any comment you deem necessary that can aid the researcher in this research study.

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Thank you for your time and response.

APPENDIX II

INTERVIEW GUIDE FOR AEAs

UNIVERSITY FOR DEVELOPMENT STUDIES
FACULTY OF AGRIBUSINESS AND APPLIED ECONOMICS

DEPARTMENT OF AGRICULTURAL EXTENSION, RURAL DEVELOPMENT AND GENDER STUDIES

PhD INNOVATION COMMUNICATION

Dear Respondent,

I am a PhD candidate with the University for Development Studies offering Innovation Communication. I am seeking your responses to enable me to carry out this thesis strictly for academic purpose. Please be assured that any response you give will be treated with utmost confidentiality and only for the purpose for which it was solicited. Your candid opinion or response is therefore appreciated. Thank you.

1. Level of education. …….
2. How long have you worked as an AEA?
3. What is the name of your operational area?
4. What were the specific types of training methods employed in training farmers by JICA?
5. What is your general assessment of the methods of training?
6. Did this project make any difference to rice production in your operational area?
7. What is your perspective on the effects of the training on rice yield?
8. Were the project objectives achieved?
9. Any comment?

Thank you for your time.