The experiential learning process in farmer field school in rice production innovation; A case of Ruanda - Majenje irrigation scheme in Mbarali District, Tanzania.

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Dedication

This work is dedicated to my mother Molen Makwenzi and my late father Chilagula Talibo.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AESA	Agro -Ecosystem Analysis
CIP-UP WARD	International Potato Centre
DALDO	District Agricultural and Livestock Development Officer
DANIDA	Danish International Development Agency
FAO	Food Agriculture Organization
FEW	Field extension worker
FFS	Farmers Field Schools
FGD	Focus Group Discussion
JICA	Japan International Cooperation Agency
MATI	Ministry of Agriculture Training Institute
MBZIU	Mbeya Zonal Irrigation Unit
MoA	Ministry of Agriculture
SARO	Semi Aromatic Rice Observation
T& V	Training and Visit
TC-SDIA	Tanzania –Japan Technical Cooperation in Supporting Services Delivery System of Irrigated Agriculture
TOT	Transfer of Technology
URT	United republic of Tanzania
WWF	World Wildlife Foundation

ABSTRACT

This thesis sheds light on the study which was carried out in Mbarali District, in Farmer Field School (FFS) in Ruanda-Majenje irrigation scheme in Tanzania. The data and information were collected from mid July to mid August, 2011. The study aimed to investigate how the principles of experiential learning are applied in FFS in rice production innovation at Ruanda-Majenje irrigation scheme. A case study of 25 farmers out of 72 who received the FFS training since 2006 was used to understand the application of these principles. The data collection methods involved the development of a checklist of questions which were focused on: Individual farmers, Field Extension Workers (FEWs), Focus group discussions (FGDs), District FFS coordinator and Mbeya zonal irrigation engineer. Qualitative methods that included Focus Group Discussions, Individual interviews, key informants interviews, observations and review of documents and reports were used to gather information for the study. Two FGDs, each of 6 farmers, were conducted with men and women separately.

The FGDs provided a wide range of responses and helped to provide conclusion and validate various answers which emerged from other research methods. It also helped to clear doubts in some of the issues which I was not able to conclude by reading from various documents and reports. The issues that were asked covered their participation in FFS plot for land preparation, weeding, application of fertilizer, pests and diseases control and their general experience with FFS. Key informant interviews were also conducted to FEWs, District FFS coordinator and Mbeya zonal irrigation engineer. The aim was to cross check and confirm some issues which was explained by other participants. Not only that but also to understand the role of government in delivering FFS to farmers. FFS training schedule, different FFS records and plans were also reviewed. Field observation on FFS was being undertaken was also done. Individual rice farms were visited and observed. During the visit, face to face encounter with farm owners were also done. During this time push weeder, rice husk manure and individual line spacing farms were observed. Also observation was done in checking FFS plots, Farmers common practices and new innovation practices plots.

The empirical evidence of the case study indicates that experiential learning has taken place to a limited extent. This might have been influenced by the fact that extension workers still use the transfer of technology principles where they first demonstrate to farmers what is to be trained. Farmers were not allowed to make mistakes and to come up with their conclusion. The MoA had a philosophy that farmers should practice what they are trained from extension workers rather than using their own ideas and trying them in FFS plot. Also farmers were not fully involved in the discussion of the findings from field observations. Extension workers were found to give their own solution of the problems encountered by famers instead of letting farmers to critical analyze their problems, criticize, comments and give suggestions to their own problems. Lastly, few farmers applied the trained innovation on small plots with the reasons that they are still to test and try the trained innovation as they are not yet confident of the innovations trained. However, only the use of rice husk as manure was found to be practiced by the entire trained farmers. The rice husks were found to be from the farmers' experiences and it was also tried in the FFS plot. This suggested that famers learnt more from their own experiences and from other farmers.

From the findings it was recommended that the Ministry of Agriculture philosophy of FFS should change from transfer of technology principles to experiential learning principles where farmers are allowed to use their own experiences.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background information

Agriculture is the backbone of Tanzanian economy. About 80% of the population lives in rural areas where they directly depend on agriculture for their livelihoods. Rice is the second major food crop after maize for many households. However, rice yields are still low on smallholder farms. In order to boost rice production among the smallholder farmers, the Ministry of Agriculture (MoA) has used the Transfer of Technology (TOT) approaches such as the Training and Visit (T&V) to disseminate rice production innovations among them. But these approaches have proved ineffective. Following the failure, there has been a search for improved methodologies that respond better to farmers' demands and a shift towards more participatory and group focused approaches. Farmer-to-farmer extension, group extension methods, Participatory Rural Appraisal (PRA) and Farmer Field Schools (FFS) are some of the recent methodologies applied on large scale schemes (DANIDA 2004; Davies 2006 cited Duveskog, 2006). For instance, Mbeya Zonal irrigation unit (MBZIU) under the Ministry of Agriculture adopted the Farmer Field School extension approach that considered farmers' demands as well as their participation in the learning processes through setting of rice trials. The FFS extension approach was chosen because it uses experiential learning principles and a group approach to facilitate farmers and Field extension worker (FEW) to collaborate in decision-making, solving problems, and learning new technologies.

In 2006 MBZIU in collaboration with Mbarali District Agricultural and Livestock Development Office introduced the Farmer Field School approach at Ruanda-Majenje irrigation scheme. The MBZIU was an initiative of Tanzania-Japan Technical cooperation in a program namely supporting service Delivery Systems of Irrigated Agriculture (TC-SDIA) (MOA, 2009). Farmers formed FFS groups of 25–30 members each. The Project selected the FEW working in the project area and farmers who formerly received training course on FFS to become FFS facilitators. The training was about agronomic rice practices such as land preparation, use of different rice varieties with characteristics on farmers' preferences, diseases and pests control, water management, fertilizer applications, rice bunds making, harvesting and storage methods. Rice seed preparation and selection were also part of the training program. In addition, farmers learnt on nursery management, planting techniques such as timing on transplanting and line spacing. But there still rice yields are low despite all the training of farmers through FFS approach (MoA, 2009). MBZIU expected farmers who received such training to be able to practice in their farms the rice production innovation they learnt through FFS. This was anticipated to improve yield through the use of rice production innovations introduced in FFS. The overall aim of the MBZIU and Mbarali District Agricultural and Livestock development office was therefore to increase rice yield in small – scale farmers at Ruanda-Majenje irrigation scheme.

The FFS has several actors at various levels. Leaders, farmers and facilitators constitute the primary actors of FFS and are found at grassroots level. The secondary actors are the District coordinator who coordinates the training and the District Agricultural and Livestock Development Officer (DALDO) in Mbarali and the tertiary actor is the MBZIU under the Ministry of Agriculture. The MBZIU also works in close collaboration with Uyole research institution, Japan International cooperation Agency (JICA), Food Agricultural Organization (FAO), Uyole

and Igurusi agricultural training institutes (Uyole and Igurusi), World Wildlife Foundation (WWF) and local credit institutions (Mbarali DADP, 2011).

1.2 Research problem

Despite the efforts made by the MBZIU to use of FFS and employ experiential learning principles to increase rice productivity, rice yields are still low for most smallholder farmers. The majority of farmers in the irrigation scheme do not practice agronomic practices such as planting innovation early transplanting, varieties selection, weeding methods, pests and diseases control, seed preparation for sowing, line and planting in rows learnt from FFS (MoA, 2009). Reports also show that most farmers use local seed varieties retained from previous rice harvest which can be tried in the FFS plot to find out how famers practice these innovations. Farmers also use own local agronomic practices in planting rice such as broadcasting, randomly transplanting at certain times of the year (MoA, 2009). The learning process behind the FFS is the experiential learning in which the farmers learn from experience and replicate the process during the farming cycle. Though FFS is expected to bring better results than the previous transfer of technology approach yet it has not brought any changes towards the achievement of the desired goal which is to increase rice productivity to the farmers. It seems that experiential learning process has “gone wrong” which could be one of the major reasons for the poor performance of FFS extension approach. These observations triggered motivation to conduct this study.

1.3 Research objective

With this study, the MBZIU under the Ministry of Agriculture of Tanzania aims to investigate how the experiential learning process is taking place in farmer field school at Ruanda - Majenje irrigation scheme and to contribute to the improvement of the training process in FFS in rice production innovation.

1.3.1 Research questions

How are the principles of experiential learning applied in FFS at Ruanda - Majenje irrigation scheme in rice production innovation?
The following sub questions can be formulated:

- How does concrete experience take shape in the FFS?
- How are observations and reflection done in the FFS?
- How does the formation of abstract concepts and generalizations happen in the FFS?
- How is the active experimentation done in the FFS?

CHAPTER TWO

2.0 LIRETARUTE REVIEW

2.1 Definition of concepts

2.1.1 Farmer fields schools (FFS)

Duveskog (2006) defined Farmer Field School as a “school without wall” which gives the farmers a forum of sharing their experiences and knowledge through usual field observation and enables them to apply their experiences related to the crop management practices in making decision under the guidance of a skilled facilitator.

2.1.2 Experiential learning

Experiential learning is defined as a knowledge creation process through which new experience are being integrated into previous experiences and transformed into relevant, durable and retrievable knowledge which is suitable for use in the learners’ environment (Kolb 1984; Sheckley and Keeton 1997; cited by Ndoye, 2003). Experiential learning phenomenon undertaken in this study reflects on the experience of farmers and developing generalizations (Roberts, 2006). According to Kolb (1984), experiential learning is the process whereby knowledge is created through transformation of experiences. The past experiences need to be integrated to what one comes to learn.

2.2 Differences between Transfer of Technology and Experiential learning

Duveskog (2006) argued that the extension approach of transferring technologies to the farmers to directly transform their practices can brings contradiction to the current practices. In order to enhance sustainable agriculture, coordination of information exchange between researchers, extension workers and farmers is important. Innovations established by researchers with no involvement of the farmers are not sustainable. Furthermore, various innovations which are proposed by researcher do not make sense to the farmers because the role of farmers knowledge is overlooked (Leeuwis, 2004).

The FFS extension approach comes from another paradigm intended to assist farmers in problems solving so that they can become experts towards the developing agricultural innovation as indicated in Table 1. The conservative Transfer of Technology (TOT) focus on transferring technical methods which they assume are better than the farmers practices and disseminating to the farmers. The major FFS target is capacity building of the farmers through experiential learning through farmer research and experimental plots (Nederlof and Odonkor, 2006).This was supported by Kabir (2007) who stated people are known to say the following about the discovery-based learning, or farmers’ experimentation;

> “When we hear, we remember some,
> When we see, we remember more.
> When we do, we remember the most,
> But when we discover, we never forget’’.

The Nederlof and Odonkor (2006) argued that the FFS aims to allow integration of local knowledge and scientific knowledge to help building up farmer's better decision making in their farms.

Table 1: Difference in principles between the Transfer of technology and experiential learning

Issue	**Transfer of Technology**	**Experiential learning**
Trainer	FEW (Training and visit)	Facilitator (adult education)
Role of farmer	Receiver of new technology /end user	Co-learner /expert
Role of research	Primary source of information	Process and consequences of local testing and farmer learning /input curriculum
Learning	Individual practices of technology	Group of learning based on observation and experiments. Decision making process more important than the decision per se
Curriculum/ topic	Chosen by scientists (FEWs)	Chosen by farmers
Knowledge	Science based	Based on local knowledge and situation based on farm perspective
Needs	Based on scientists	Based on farms perspective
Participants	Developed by scientists	Negotiable with farmers
Locus of expertise	Researcher /FEW	Farmers
Decision making	Application of recommendation	Locality specific decision on observation
Pedagogy	Training (Demonstration and field examples)	Experiences, education (learning cycle)
Training site	Demonstration field training centered at home	Collective field

Source: Adapted from CIP-UPWARD (2003), Dilts (1998), Gallagher (1999) and van de Fliert *et al*. (1995) as cited by Nederlof and Odonkor, 2006)

2.3 General description of FFS

2.3.1 Curriculum development

In FFS there are conversations between farmers and FEWs, whereby farmers raise the problems that they face in crop or animal production and suggest possible solutions among themselves while the extension worker listens. After discussion farmers choose the topic to be covered in the learning. The learning activity chosen should build up farmer's experiences through discussions and sharing knowledge in order to gain insight to their local farming practices and recognize the technical gaps (Duveskog, 2006).The training topics covered in a session should correspond to the activities happening in FFS participant's field so that they put into practice what they have learnt immediately and therefore will not forget. Topics are chosen depending on the cropping calendar and include among others seed selection, rice transplanting, weeding, pests and diseases control, post -harvesting handling in their own crops (Gallagher, 2003).The training session of the crop management is carried out on a

common field for the farmer's participants. In the FFS the plots are sub divided into two, one part of the plot crops are grown using the farmers indigenous methods while on the other side recommended convectional crop management methods are applied. The two different parts of the plots are meant to provide comparison between farmer's indigenous methods and conventional methods and will help farmers to make decision through observation when making selection of the practices useful to them (Van de Fliert *et al.,* 1995 cited by Nederlof and Odonkor, 2006).

2.3.2 Facilitator

Facilitator of FFS in learning activities in most cases is an FEW who have got skills on FFS process or farmers who received training course from the FFS. This farmer facilitator guides the other farmers in the learning process. The main task of the facilitator is to guide the farmers and stimulates learning process but not lecturing and providing them with answers (Duveskog, 2006). McMorland and Piggot-Irvine (2000 cited by Duveskog, 2006) stated that "facilitator's task is linked to midwife-task of helping to bring forth new life, and birth of something new".

In many programs it is better for the facilitator to be a farmer rather than FEW because farmers know their community well and speak the same language and they are recognized by the members of their social group. It also has the advantage of saving transport cost and other financial assistance compared to having an FEW come to facilitate the group. The extension facilitators need trainings on facilitation skills, in management skills such as leaderships, record keeping, budgeting, use available local materials in training, preparation of the training and project proposals (Gallagher, 2003). Raelin (1997 cited by Duveskog, 2006) state that the farmers facilitators should show a good image to their fellow farmers so that they can be like a mirror to reflect good practices, which others can easily learn by observation. Schön (1983 cited by Duveskog, 2006) argued that in order to enhance sharing knowledge and trust the facilitators need to overcome his or her defensiveness favoring certain group of people, jealous and embarrassment. In most cases FEWs uses the elements of top-down extension approaches and it is difficult to switch off from the role of being an expert in the FFS training session. Most public extension systems are insensitive to farmer's needs, bureaucratic, and politically challenge (Anderson et al, 2004).

The facilitator is responsible for creating a trust, empathy, openness, integrity and mutual respect (Malinen, 2000; Percy 2005). The FFS learning should involve the practical learning activities over a longer time, and should create trust and solidarity. The facilitator in FFS provides a safe environment for farmers to make a critical reflection in the learning process in the FFS is the responsibility of the facilitator (Mezirow, 2000 cited by Duveskog, 2006).The persons who serve as facilitators should have completed a training program that lasts an entire crop cycle and provides them with first-hand experience in rice cultivation, while developing facilitation, leadership and administrative skills. Each facilitator is expected to guide at least three FFS per year (Braun *et al.*, 2000). The facilitator's role is to guide the farmers as they learn by doing (involvement on hands works). Each activity follows a certain procedures, in the training farmers observe, analyses, draw conclusions and making decision. The studies carried out by (Ndoye, 2003) shows that farmers need a competent facilitator who can guide them in learning process. This is supported by (Doebbert 1994 cited by Ndoye, 2003) who argued that experiential learning happen if it is facilitated by confident and competent facilitator whom farmers trust.

2.4 Experiential learning theory

2.4.1 General overview

In adult learning and professional development, experiential learning theory promotes their development of experiences and knowledge sharing. The theories of experiential learning involve continuous interaction among individuals and their surroundings (Kolb 1984, Sheckley and Allen, 1989; Sheckley and Keeton, 1997 as cited by Roberts, 2006). David Kolb (1984) developed Experiential Learning Theory also called “The Kolb Cycle” or “The Learning Cycle” or “The Experiential Learning Cycle”. Although Kolb’s theory was developed predominantly for use in adult education, the theory has been acknowledged by academicians, teachers, extension workers and trainers and has been used in their respective fields. Thus experiential learning has a broad range of application from classroom to laboratory learning and also from field level organized learning to coincidence teaching (Roberts, 2006).

For experiential learning to be effective an individual learn more if he/ she is involved in the learning process. Also there should be a relationship and link between what is the roles of the learner and the topic. This relationship happens because of the link between the experiences the learner has before and the new knowledge and skills acquired leading to greater level of knowledge in learning, people use the knowledge which is already available to create new knowledge. This means that learning depends on knowledge already available and the quality of also depends on the ability to transform new information into the body of experiences which already exists (Ndoye, 2003). Kolb (1984) cited by Roberts 2006) said that experiential learning has four stages which are concrete experience, reflection and observation, formulation of abstracts and concepts and active experimentation. In the current research Kolb’s experiential learning model was used as a tool for the study as shown in figure 1.

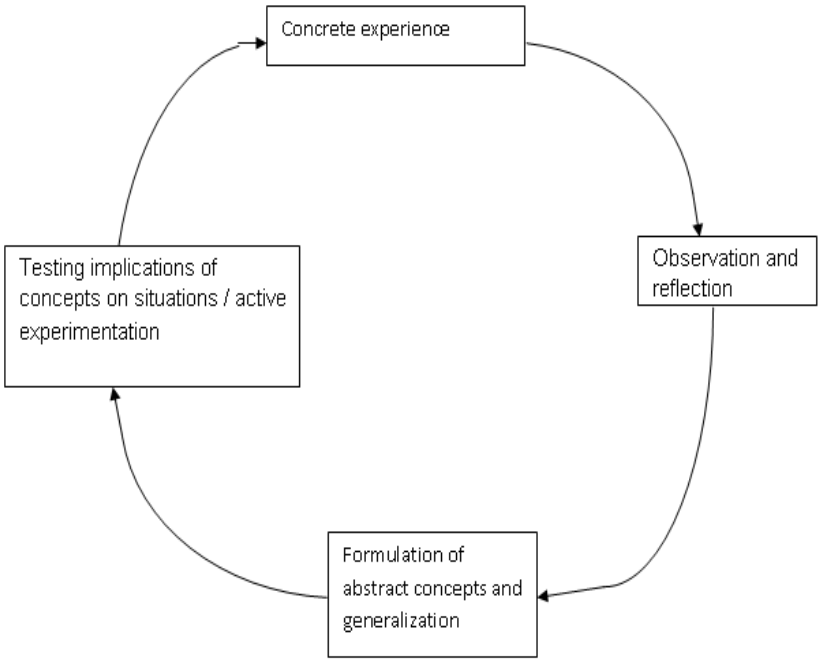

Figure 1*: A model of experiential learning modified from Jarvis et al (2003)*

2.5 Basic elements of experiential learning and its application in FFS

Farmer Field School (FFS) is a form of adult education which uses the experiential learning methods, aims at building farmers' decision making capacity and expertise (Nederlof and Odonkor, 2006). This is supported by Duveskog (2006) who states that experiential learning is typically related to agricultural extension which works with farmers, to find the ways of solving their problems through testing and experimentation of their ideas and practices. Leeuwis (2004) argued that farmers learn through their experiences and by doing which involves critical thinking, reflection, experience and action. Nederlof and Odonkor (2006) describe learning as 'the process whereby knowledge is created through the transformation of experience', and develops the idea. The four stages from experiential learning model were used as described below:

2.5.1 Concrete experience

Concrete experience is where the trainee will be interacting with the innovation being studied. The central point of experiential learning is concrete experience; however, the experience does not always have to be life experiences but it can be through a simulation which is developed from a learning environment. For example, a role plays case study or an exercise which puts the farmer in close reality with the actual situation on the ground (Fenwick, 2001). Concrete experience is the same as the knowledge received by acquaintance or direct practical experience. This is where the farmers get practical experiences by doing and involvement in the actual reality as individuals. Experience means active involvement or participating in the activities which leads to the buildup of knowledge and skills (Roberts, 2006).

Duveskog (2001) argued that farmers should be given chance to discover and the whole activity should be designed for practical discovery rather than only by seeing or hearing something. He also added that farmers should be guided to make up their own opinion through practical discovery. The FFS should allow farmers to come together to bring in new knowledge and technologies but also sharing of their previous experiences.

The facilitator is supposed to sub-divide farmers into 4-5 farmers to enhance participatory learning. Participation of farmers in FFS should lead towards building and improving farmer's capacity to analyze their farming system and practices, and to develop and test possible solutions that address their prioritized needs, combining local and scientific knowledge (Sones and Duveskog, 2003). Also Luther *et al.*, (2005) argued that, without an adequate training of trainer's program the subsequent FFS program will fall far of its potential aims of empowering farmers in decision-making on solving their problems related on crop production.

Concrete experience in FFS through active participation with hands-on activities forms the foundation of learning. According to Race (2010), learning by doing such as practices, farmers' experience, repetition, trial and error build up the concrete experience. Farmers are given opportunity to practice the innovation themselves on their farms or in group trials which leads farmers to stimulate other farmers by raising questions for discussion, difficulty real experiences which the farmer is experiencing in his or her own farm. Studies carried out in Senegal shows making trial and error enhances learning, farmers reported that they require to repeat for this will help them to capture what they have learnt, they learn through mistake and corrections (Ndoye, 2003).

Farmers through testing the new skill in small plot learn a lot about it (Ndoye, 2003).The role plays and case study are applied especially if the topic which has been selected by farmers is related to the issues where it is difficult to set up actual trials on the ground. Simulated experiences like group session, practical exercises and trial plots the facilitator in FFS helps the group make use of actual real life situations, all of these exercises apply Kolb's learning cycle (Kolb 1984), that farmers use concrete observations to reflect on experiences and from there conceptualize the learning points on which actions are defined. In the case of the season or enterprise-long trials farmers go into active experimentation which leads to another cycle of experiences and observations (Duveskog, 2006). Studies done on case studies, role plays, brainstorming and problem solving on FFS in Nigeria shows that they contribute to effective learning (Ajani and Onwubuya, 2010).

2.5.2 Observation and reflection

Observation and reflection are the next stage of the model of experiential learning. At this stage farmers reflect on what they experienced. At this stage the farmer learn through the four senses which are seeing, hearing, feeling and tasting the innovation (Roberts, 2006). Keogh et al, (2001) cited in Duveskog, 2006) argued that experiences alone cannot teach, learning occurs when there is reflective thinking and exchange of experiences by the farmers. The reflection facilitates farmers in making sense of the previous experiences by comparison with the new experiences which helps them to draw conclusions. The information is changed into use intentionally. Kolb cited by Roberts (2006) said that "intention is a cognitive process in which the learner mentally breaks apart the experience and internalizes the information". Studies in Senegal on experiential learning have shown that farmers can learn effectively through watching and observing other farmers (Ndoye, 2003). On the other hand field trips create conducive environment for farmers to learn comfortably through having visit to other successful FFS farmers. They can learn through sharing their experiences, they have the chance to discuss the learning points after come back from field visit (MATI, 2006).

In FFS farmers in groups can make observation of the field and crops and recording data of what will be happening in that field such as diseases, pests, soil characteristics, condition of crops, the number of tillers per plant, the insects and diseases affecting the crop and any other relevant information. The information collected can be presented in the discussion and drawn in flip charts for future references (Braun *et al,* 2000, Rivera; 2004). According to Roberts (2006), when necessary activities can be postponed until observation and judgment has occurred.

The basis of the FFS approach is the Agro-Ecosystem Analysis (AESA), which is based on field analysis. The aim of using AESA is for farmers to learn and make regular field observation, analyze problems and build up in decision making in regard to crop management. The analysis goes into the cycle of observation, analysis of action (Duveskog, 2006). Through frequent use of AESA, farmers develop as checklist of indicators for making observations during management of their farm practices, AESA is the main tool used in decision making in FFS (Gallagher, 2003).

Farmers enter in the field in small working groups for observation early in the morning prior to field activities; one or two FFS facilitators go along to supervise Agro-Ecosystem Analysis activity. Every group select one member to record all field data, the duty can be rotated among members so that everybody can have a fill of field data for his or her own use. Observations

are carried out diagonally across the field and randomly select the rice plant hills, mark them by pegging start making observations (MATI, 2006).

2.5.3 Formulation of Abstract concepts and generalization

Abstract conceptualization stage is where learners learnt through stages learners grasp the information through conceptualizing by forming the rules, generalizing and hypothesizing the innovation being studied. This stage is also cognitive in nature but it occurs even without the actual practice of the innovation. In this stage the farmers develop concepts (mental maps, models, concepts and framework) by logical analysis and/or in-depth reflection of experiences (Kayes, 2005). In FFS, farmers learn through discussion with other farmers. Farmers, who discuss with their counterparts about new innovations learnt, appear to seek more information more actively than those who use passive learning model (Ndoye, 2003). According to Russ (2007), farmers who work in groups to collect data from the field, generate analysis through discussion, present results and make group decision for field management have more confidence than groups who work alone with no one to discuss.

Farmers in smaller groups prepare presentations of their processed field observations in flip charts by writing words, drawings plants, putting agronomic information such as pest types and numbers, disease incidence and severity. Through this group discussion, questions comments, suggestions and criticism were carried out. The presentation of field findings must be rotated among FFS participants in each FFS. The FFS facilitator must play a great role in facilitating successful discussion (MATI, 2006; Gallagher, 2003). Duveskog (2006) suggested that the FFS facilitator is to probe deeper using questions but not giving answers most answers come from the farmers, this brings the farmers into critical thinking, problem solving and brainstorming.

According to Gallagher (2003), in this stage the training of farmers follow a certain pattern where they observe, analyze, draw conclusions and make decisions. To improve, the decision making comes from interactive process of situation analysis under different viewpoints, synthesizing the analyzed situation and implementing the decision. Also this stage farmer decide whether to accept or reject the practices they have learnt based on underlying reason, concepts and relationship. Race (2010) found that learning through quicker constructive feedback helps learners especially in the context of trial and error. If the learners feel that the derived concepts do seem to fit to reality or solve the existing problems, they go for active experimentation otherwise throw the concepts out and go for another round of gathering experiences, reflection and abstract conceptualization (Kayes, 2005). Also in this stage learning emphasis is not based on “how” but “Why” (Gallagher, 2003).

Field days in FFS are very crucial for other non-FFS participants to learn from their results and share their skills. Field days provide an opportunity for non-participants to be exposed to the FFS group’s lessons and the skills and knowledge gained in the process. Also it used as drawing conclusion of the learnt skills from FFS. Furthermore, field days provide the FFS group members with an opportunity to display and share their experiences to others, like the experimentation results and learning activities, including group dynamics. Also field days reinforce the FFS cohesion and raise awareness among the community members, the government and other organizations in the area, and finally will create support and new demand for FFS (MATI, 2006).

Experiential learning model assists learners to develop abilities to analyze issues, enhance critical thinking, and promote the ability to create conducive an environment for better

practicing the learnt new practices in their fields and hence to make better decisions (Kenmore, 1997; cited by Feder *et* al., 2004). FFS site for trials is a meeting point where the experimental matter is identified by farmers for farmers learning and where various technologies are practices for study and results are compared and shortcomings of various technologies are identified. In the experimentation different control treatment are used in plan, with the aim to provide standard in making comparison having the farmer's common practices and new innovation plot. In most cases the control treatment is farmers' common practices. This helps farmers to compare the new practices with their own practices in terms requirement, inputs, and complexity and yields (Friis-Hansen and Duveskog, 2008).

2.5.4 Active experimentation

Active experimentation is the last stage in experiential learning where the learners, test the concepts, generalizations and hypothesis formed in the previous stage. At this stage the information is changed by the extension who involves the interaction with the innovation (Roberts, 2006). Experimentation is a major component in the FFS learning process which gives farmers opportunities to build up their capacities to continuously adapt to change and improve way of managing their fields. The experimentation helps to generate the research outcome to the particular technologies. During Farmer Field School learning process focuses on experimentation and testing**.** Farmers also carry out a wide range of additional experiments on refining techniques learned in the FFS, as well as developing new technologies. In addition to acquisition of knowledge, FFS participants conduct a number of "experiments" after the FFS were completed. Majority of these experiments involve adaptations and uses of new technologies in their own farms (Rivera, 2004).

2.6 Indicators of the research

This section explains the indicators which have been used to verify how the experiential learning being applied in FFS through observations, asking the farmers, review of reports and key informants. Table 2 below shows indicators which explain the ideal situation of experiential learning and how this can be measured in FFS. These have been used as standard measures for this research.

Table 2: Indicators and means of verifications

Characteristics	**Indicators**	**Verification (source and method)**
Concrete experience	• Farmers in group carry out FFS activities such as land preparation, planting, weeding as part of the field work being done by the farmers and is wholly done by themselves without assistance from the FFS facilitator (s). They carry out the activities and make mistakes, do it well, and encounter what is difficult and what is easy. • Farmers work into small groups	-Ask and Observe what farmers have been doing in the field. -Check record books, what they have done, what mistakes they made and what corrections have been made -Check on the farmer's record book what activities they have done
	• Farmer set own field trial (s) without the supervision of the FEW/FFS facilitator. They work in the trials on their own.	-Ask and observe how trials are set and whether the farmers are doing it on their

		own
Reflection and observation	• Farmers are stimulated to watch and formulate what they observe and encountered when doing field activities such as observation of number of pests, different crop growth, number of plants affected by diseases, number of tillers per plant, field water levels. Verbally and in writing (recording data) • Decision made after reflection perhaps decisions are made more between the thinking and the trial stage.(feedback by observers or by individual facilitator)	-Observe whether farmers are stimulated to participate in observation -Observe field trials and ask farmers what they have observed so far. -Observe how reflection is done stimulated by the facilitator asking questions
	• Farmers get opportunity to visit other successful farmers as field visits and then they will discus and present what they have learnt during the trip	-Ask farmers what field they visited and what they learnt -check with the extension, district FFS facilitator and farmers books for records of past visits
	• Farmers set group field trials and allowed to check on certain characteristics such as resistance to disease, pest attacks.	-Check what observations have been made by farmers so far as recorded in their record books
Formulation of abstract concepts and generalisation	• In the field or afterwards in a room a group discussion takes place in which analysis of their findings is done, explanations are done with support of words or visuals by using flip chart or pieces of papers, pictures and drawings • The majority of farmers participate in the discussion: sub-divided into groups each group record and analyze data on piece of paper /flip chart then present to the plenary discussion	-Observed in minutes what discussed in progress and check the following: -what is discussed -how farmers participate -how the staff participate -how feedback is taken -how conclusions are drawn -Observe by attending the discussion group/ meeting or ask farmers questions about their findings
	• Farmers compare results among themselves, also drawing from earlier experiences/exchange experiences	-Observe by attending the discussion group
	• Field plot are set one with farmers' common practices and another with new innovation. These farmers they can observe and then compare such as the inputs used, labour and yield	-Ask farmers , FFS district coordinator, field observation and Mbeya zonal irrigation engineer
	• Conclusions are drawn collectively about the main learning points based on the experience	-Observed during training or group discussion or check minutes of the meeting and what was discussed
Active experimentation	• Farmers apply skills and practices learned into real rice fields to solve problems	-Check in the minutes and what was discussed and the decision taken.

		-Visit individual farms to see how the skills learnt are applied on individual farms -Talk to the farmers about their experience on their own farms

Source: Researcher own design, modified from Kolb (1984) experiential learning cycle.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of the study area

The study was conducted at Ruanda-Majenje irrigation scheme, located in Mbarali district, Mbeya region in Tanzania as shown in figure 2. The Mbarali district was selected purposefully; the district is endowed with large number of irrigation schemes where FFS has been introduced, which is covered by Mbeya zonal irrigation unit. Ruanda-Majenje irrigation scheme was chosen because from past experience other irrigation schemes in the same area like Igomelo, Ipatagwa and Uturo where FFS was also introduced the same time, the production of rice has increased whereas that of Ruanda-Majenjea irrigation scheme has not changed and yet they have the same type of soil and climate.

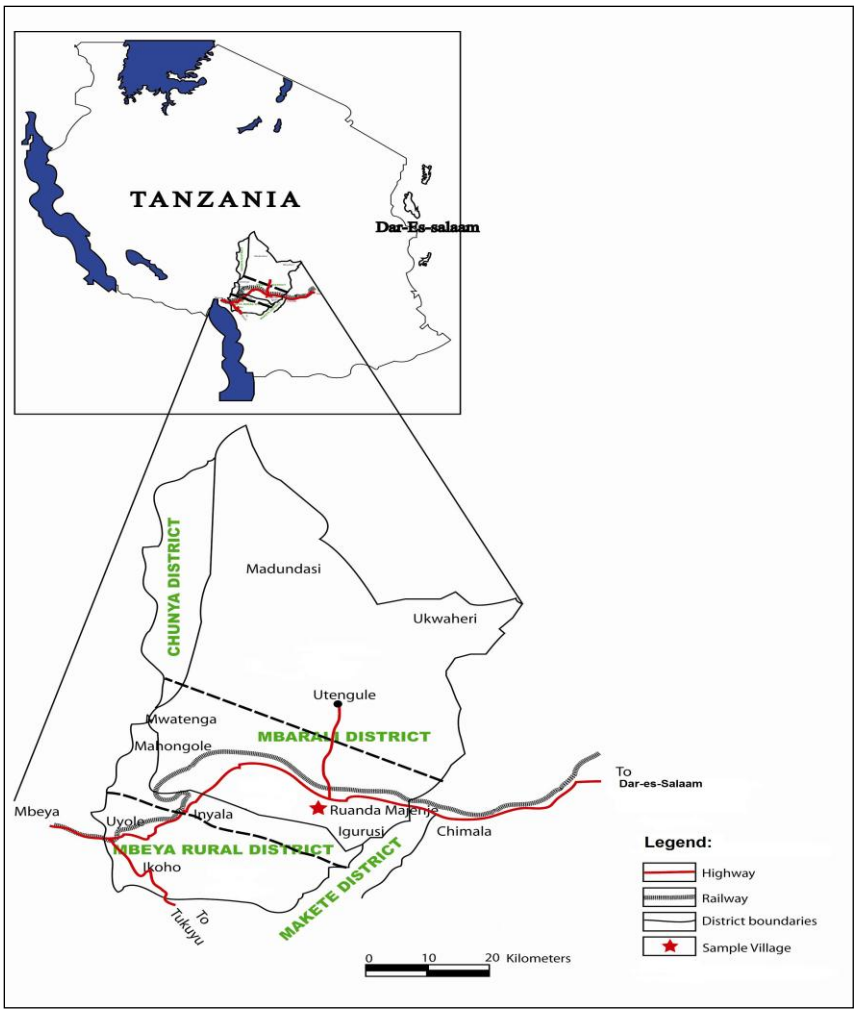

Figure 2*:* Map of Tanzania showing study area, Ruanda -Majenje irrigation scheme *(Source: SWMRG (2004).*

3.2 Research design and Sampling procedures

The nature of research approach is qualitative based on empirical data and desk review study. A case study was used to get the data and information. The qualitative approach included individual interviews, Key informants, Focus Group Discussions (FGDs) and observations. Twenty-five respondents (25) were selected randomly from a list of 72 farmers who have participated in FFS trainings since 2006. The list of farmers was obtained from the field extension worker office (FEW). Twenty five (25) participants were selected and interviewed because it was the minimum number of participants that was set for FFS training.

Figure 3: Researcher interviewing a farmer. *(Source: Field study, 2011)*

3.3 Data Collection Methods and Procedure

Field familiarization and introduction procedure: One day was spent at the field site to introduce myself to village leaders at Ruanda- Majenje, field extension workers and various farmers. The extension worker was the main host and later he was the one who took me to respective farmers for introduction. It was during this time, when the objective of the study was spelt out and I also requested them to provide their time and experience so that that I could learn from them.

The second stage was the pre-test of the checklist of my research questions. This process took one day and it involved three farmers participated in FFS training. The reason for pre-test was to refine my questions and to fit it to the local conditions for proper application. Thereafter, another day was spent to refine and finalize it. The key informant questions were pre-tested by talking to the field extension workers. Through the communication it was easy to identify issues which were needed to be corrected or modified for the final checklist of the questions. The following are the key methods applied during the field work:

(a) *Individual Interviews:* This was a face to face encounter between the researcher and respondent directed towards understanding perspectives of the issue under investigation (Kumar, 2005:124). This was administered to 25 farmers individually. They were farmers who owned farms within the irrigation scheme and had received the FFS training. Twenty five members were selected randomly out of 72 FFS participants since 2006. This was the minimum number of the group setting within the FFS process. In this method, three to four respondendents were interviewed per day. Interviews were conducted in their farms and sometimes in their homes and it took about 45 to 60 minutes per one respondent. Issues which were addressed were: participation in FFS activities, the FFS approaches, the use of manure, nursery management, planting, harvesting, weeding, number of FFS plots, application learnt skills in their own farms and field trips and lessons learning.

(b) *Key informant interviews:* These were people who have special position and were looked upon as representatives of the opinions and experience as suggested by Kumar (2005).

This type of interview was conducted with four respondents. These respondents were: Two Field extension workers, District FFS coordinator and Mbeya zonal irrigation engineer. Issues which were addressed in this method included: Farmers field trips; lesson learnt and feedback mechanisms, settings of field trials, opinion on FSS plots and farmers field days. This interview took about 30-60 minutes per respondents and it took three days to finalize the interviews.

(c*) Focus Group Discussions (FGDs):* This method of interview was conducted to a group of six people to ensure that the size of the group was not so large to preclude adequate participation by most members nor was small that is could fail to provide substantive coverage than that of an interview of one individual (Merton, *et al.,* 1990:45). Two groups were administered. The group had six members and both men and women were involved separately. This allowed much freedom for women to speak up without fear. The idea was suggested by field extension worker and it became useful to apply during the field work. The collected data from both groups is not gender related in data analysis. The members were purposively selected and they involved FFS leaders and some of individuals who were pro-active during the individual interviews. This interview took about one hour and thirty minutes (90 minutes). Participants had freedom to talk but I was managing the group by making sure each of them could participate actively. Not only that, I was also making sure the agenda was focused with minimal interference.

(*d) Observations:* This method involved field visit of the irrigation scheme and visit to respondents' farms were involved. Issues observed were: Farmers demonstration with push weeder to control rice weeds, rice husk manure processing and application of learnt FFS skills in their own farms; rice planted in rows and in line spacing, one FFS plot (see Fig., 4, Fig., 5, Fig., 6 and Fig., 9). This method enabled a lot of learning process and verification of the findings which were gathered through the other interview methods.

(e) Review of reports and documents: Reports and documents have been reviewed. Government documents and reports at the field level were reviewed. This helped to provide a lot of knowledge on how to undertake the study and also to understand how the research could be conducted in a proper manner (see Table 3, Table 4, Table 5 Fig. 6). It also provided additional information.

(f) Attending FFS farmers meetings: During the study I was able to attend one of farmers meeting (see Fig. 7). During the meeting different rice pests and diseases were presented by the group secretary. During this meeting I was an 'observant'. No interference to the meeting was made but I was quietly observing and taking note on key issues in the discussions and observing the proceedings.

Secondary data and information were also collected through different literature review. Literature search from journals, scientific books and internet by using key words of the research experiential learning in farmer field school have were investigated. The information basically focused on key concepts of experiential learning theory and farmer field school (FFS). Published and unpublished reports related to Ruanda -Majenje Irrigation Scheme, from Mbeya Zonal Irrigation Unit, Mbarali District Agricultural and Livestock development office, Uyole Research Institute and Ministry of Agriculture were used.

3.4 Limitation of the research

To a small extent the process of data collection was hampered by tight schedules of the farmers. The farmers were busy because it was the harvesting time and preparation for the National agricultural shows exhibition. However, community leaders and field extension workers played a great role to ensure my research was accomplished within the scheduled dates.

3.5 Data Analysis

The data collected from the field was sorted, edited, summarized and analyzed by using Microsoft Word and the findings were presented using descriptions, tables and figures. Findings from the field data were compared with the theory of experiential learning in FFS. From the findings conclusion were drawn and recommendations have been provided in chapter six.

CHAPTER FOUR

4.0 RESULTS

4.1 Application of concrete experience

Farmers interviewed 23 out 25 reported that; they participated (i) land preparation (ii) planting methods (iii) weeding (iv) rice bund making and (v) fertilizer application in rice FFS plot. However such field activities were first demonstrated to them by the Field Extension Worker (FEW). The farmers said that the FEW has a program on what should be done at every stage of the FFS and the demonstrations are prearranged and put in the program. They said that their role is to learn new practices as demonstrated and to follow what is trained. One farmer also complained that he was taught like student in school, on planting space (i.e. the distance between two consecutive seedlings), dosage rate of fertilizer and pesticides application.

Additionally, two Focus Group discussions (FGSs) was conducted which involved 12 farmers who were divided into 6 people each group. They also confirmed to have participated in the above mentioned activities (i)-(V). Moreover, they also added they participated in the following FFS activities such preparation of organic rice husk manure, sowing seeds in nursery and transplanting rice seedlings to the FFS plot. One farmer from the FGDs had this to say:

> *"In FFS plot we work harder than what we do in our own farms. This makes my back ache and I can't sleep well after working in a FFS plot"*

During the field study it was observed that, the FFS process involved demonstration by FEW and then the farmers were given an opportunity to practice themselves (Fig. 4, 5). This was observed in one of the trainings where the FEW demonstrated the operation of a push weeder in controlling weeds in rice field. The FEW first demonstrated (Fig, 4) and thereafter each farmer tried out the practice as the others watched (Fig. 5). If the farmers deviated from what was demonstrated and they did it differently, the FEW corrected them and instructed them to do it as they were shown.

Figure 4: FEW demonstrating the use push weeder (source:Field study, 2011)

Figure 5: farmers trying out the push weeder in of a turns

In this training it was observed that ideas are generated from one side only from the FEW. The farmers played a passive role as they simply got information and instruction from the FEW who seemed not to motivate them to open up and make contributions to what should be done in the FFS training and how it should be done as required in the experiential learning. On asking the FEW how FFS trainings are planned and the role of farmers in the training, the two FEWs said that they plan trainings and make program on what should be trained when it should be trained. This is necessary because they are required to make work plans at the beginning of the year so that the work plans can be used to solicit funds. When asked why they do not involve farmers at the training stage so that the training can be participatory they said that they did not see the need since the farmers needed to learn new things most of which they had no idea. One of the FEW said that:

> "*In setting out FFS activities we give farmers everything such as the plan to be used, seed to be used and other inputs as required".*

In the individual interviews with the farmers they kept referring to the FFS plot as the "agricultural plot," some referred to it as "MoA's plot"; others referred it as "Magomela plot" and others as "Ligonile plot"; Magomela and Ligonile are the names of the FEWs. The interviewed farmers did not own the plots or the activities taking place in the plot. To an extent it even appeared like some of the farmers seemed to view the activities they were doing in the FFS as an obligation to the MoA. The interviewed farmers said that they are not given an opportunity to try several methods including some of their practices alongside new practices for comparison. They are not given an opportunity to do what they know, on their own, to make mistake and correct them so that they can learn better. They are not given a chance to share methods that have been tested locally and proved effective instead only new practices are trained in the FFS. On the other hand the two FEWs kept talking about the FFS plot as their own or the MoA's. The FEW comes with a ready plan on what variety to be planted, and the agronomic practices to be used. He gives instructions to farmers on what they should do as shown in figure 4 and table 3 thereby denying farmer's opportunity to explore other ideas and methods. When asked what role the farmers play in planning activities in the FFS, the FEW said that it is him who plans the FFS field trials and demonstrates to farmers because they do not know how to do field trials so they cannot do it on their own. When asked whether this is the approach he has used since the first group he trained, he said that is what he has always done. To him the success of the FFS is when the farmers learn new ideas and innovations and replace the traditional ones in their own farms. The other indicator of success in his view is having all the farmers attend all the trainings that are what would please his supervisors. In one of the documents files the researcher observed the training schedule shown in Table 3 below. On asking for the current training schedule the FEW said this is the one he has been using since 2008 because the activities remain the same.

Table 3: Ruanda –Majenje schedule for Single group (25 farmers) Training for FFS field

Crop	Rice	Who performs the activity		
Season	2008/09			
Field area (ha)	(0.25ha)			
	Activity	Farmers	FEWs demonstration	Week
	Land preparation	v	v	Week 1
	Seed selection	v	v	Week 2
	Sowing in the nursery	v	v	Week 3
	Rice bund making	v	v	Week 4
	Harrowing	v	v	Week 5
	Transplanting	v	v	Week 6
	Irrigating	v	v	Week 7
	Top dressing fertilizer application	v	v	Week 8
	Weeding	v	v	Week 9
	Diseases and pest control	v	v	Week 10

Source: FEWs office at Ruanda-Majenje irrigation scheme.

This was also confirmed from the individual interviews of those who have been trained. All of them, regardless of the year of training, when asked what they were trained they mentioned activities and procedures similar to what is stated in above schedule shown in table. The table shows that farmers do not do anything without getting demonstrations first, a further indication that they play a passive role contrary to the experiential learning principles.

During the individual interview, 21 farmers said that they were not divided into small groups during FFS activities which would give each one of them a chance to actively participate and freely discuss in the small group. While 2 participants said they were divided in small groups and the remaining 2 said that it was not easy to be divided into groups because some farmers came to the FFS plot not on time (they delayed) and therefore it was difficult to divide them in small groups from the beginning of FFS activities. The large group limits individual participation especially building farmer's confidence. As a consequence, farmers continue to face problems in their farming activities due to the difficulty to share experiences among themselves during FFS training. Some of the problems that were reported included methods for pests and disease control, fertilizer applications, methods of weed control, use of different rice varieties and planting methods. The interviewed farmers said that they depend on the FEWs for solutions to these problems. Furthermore in one of the observed training session there were 27 farmers and these were all trained as one large group without separating them in small groups.

During one of the trainings it was found out that farmers were using organic manure made from rice husks. When it was asked where they got the idea of using the husks manure, one of them commented that;

> "We use this manure because it is cheap and we can afford it. It also improves our soil structure".

The heap of rice husk manure which the farmers were using can be seen in figure 6 below.

Figure 6: Rice husk manure used in the FFS plot *(source: Field study, 2011*)

4.2 Application of reflection and observation

During the individual interview with the 2006 former secretary of FFS group, showed the records of 2006 FFS field observations. Field observation is a field activity where the group of farmers move through the field looking at the plants characteristics like number of tillers per plant, pests and diseases and field water levels. The records showed that an average of 20 out of that year' 25 FFS participants regularly participated in field observations activity while 5 participants were could not participate due to various reasons which were given by individual. From the same records it was observed that 24 participants had made at least one visit to other successful FFS groups to see what agronomic practices the farmers in other schemes were practicing so as to compare the results with their own. When asked where else such a report could be found for clarification of some points that were not clear she said that she was the only one recording and the records were kept by her. Figure 7 below shows the book where the secretary had recorded. In the record book there were lists of farmers who participated in various activities like field observations, field trips to other irrigation schemes and the dates which they participated. The farmers used Kiswahili language which was the language familiar to them so the records are in Kiswahili. It also had details of pests and diseases that had been observed in the FFS plot. Table 4 show the summary of what was she reported and what was found in the book. This observation and the report from the individual farmer's interviews indicate that the farmers kept records and these records remained with them even after the end of the FFS. However the records were only found with the secretary and they seemed not to have been used since the end of the FFS. Thus their usefulness seems to have ended at the end of the training. This could be explained by the fact they were considered part of the FFS which the farmers did not ever own but considered as a Ministry's program. In the record there were descriptions of the insects and diseases they had observed on asking the secretary whether they ever referred to these records to help them identify the diseases and pests they faced, the secretary said no farmer had ever come to ask.

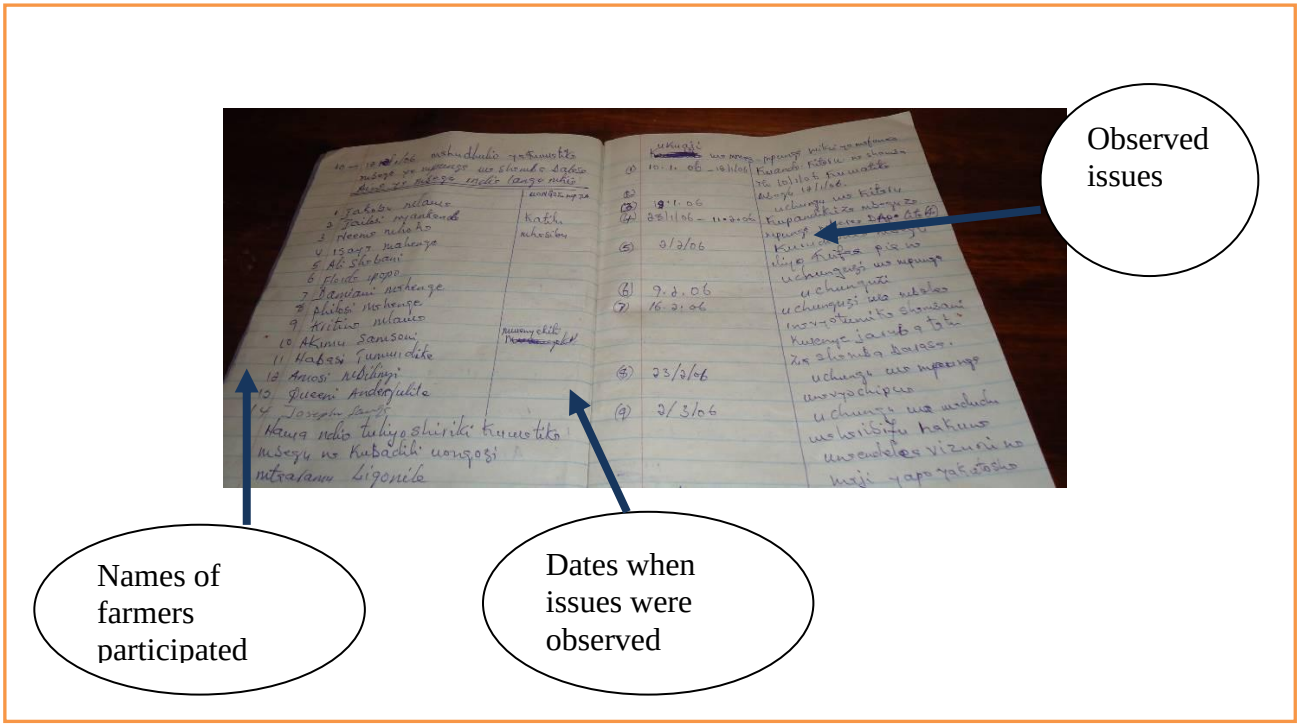

Figure 7: Record book with list of farmers who participated in field observation and what was observed *(Source: Field study, 2011)*

Table 4: Attendance of farmers in field observations, record keeping and field trips in FFS

Activity	Number of farmers who participated	Number of farmers who did not participate
Field observation	20	5
Record keeping and field observations	1	24
Field trip to visit other successfully FFS	24	1

During individual interview 24 out 25 farmers reported that they had not recorded anything during field observation except the group secretary who is the recorder. The same was confirmed during the FGDs it was generally confirmed that, farmers had not recorded anything during field observation except one who had been a secretary. One farmer said that:

> "*I have no exercise book for recording what was learnt and therefore whenever I am given the opportunity to practice by myself I cannot remember a single thing".*

Others said that they had observed that the new rice variety is tolerant to water logging. Plants of the new variety that were in marshy areas still showed a green colour. They compared this with their own varieties that change colour to yellow when they are water logged. Two farmers

in comparing what they observed in the FFS field and their own farms said that the new variety had more tillers than their own local varieties. The farmers remembered all these but they had not made any records of the observations like the description of the pests and diseases and the control the FEW had recommended. They could remember only general things like the new variety had more tillers and was tolerant to water logging but not the control of the diseases and pests. When the farmers who had been trained earlier were asked what they do when their crop get diseases they said that they call the FEW to give solution an indication that even after the training they were still dependent on him.

Apart from the past records from 2006 which was shown in figure 7. Individual interviews was conducted 24 out of 25 farmers interviewed reported that they had made field trips to successful FFS where they saw how fellow farmers were able to apply what they had learnt from FFS such as planting rice in rows, line spacing, proper water management and timely transplanting and use high yielding rice varieties. The places visited included Igomelo, Chimala, Ipatagwa and Majengo irrigation schemes all in Mbarali district, Mbeya region. This was also confirmed in the records of one key informant the Mbarali district FFS coordinator. The coordinator had records of the places visited, the date, the number of farmers who attended and the purpose of the visits. FFS coordinator also provided other reports which indicated other performance in other FFS fields which were visited. He was also able to tell other trained innovation like use of rice transplanters, use of inorganic fertilizer, use of improved rice varieties. The coordinator also reported that they were not able to distribute reading materials to farmers because they had no sufficient funds to do so, and if they did was not timely.

It was also found out, even after the field visit that farmers do not come together to discuss and exchange observations made, instead they disperse to their homes. This was supported by 5 farmers during FGDs who said that after the visit no meeting is organized to discuss what was observed from field trip. One farmer said that:

> *"After the visit we had no chance to discuss what we observed in visit, instead some farmers practiced the observed skills and technologies individually*".

This was also confirmed by the two FEWs, one of them said;

> *"Soon after field visits farmer would want to go back to their own farms to do other duties".*

Also it was found out that in the meeting following the visit the observed issues during the field visit are not discussed since they are not planned for.

4.3 Application of formulation of abstract, concepts and generalization

Group discussion and presentation

During the study it was observed that after the field observations the farmers gathered and sat as one large group. The group secretary presented the findings from a piece of paper and there was no use of visual aids which would help the farmers to visualize, reflect and remember what they had seen. He presented the recorded field findings by reading them to the group. After the presentation by the secretary, farmers had the chance to ask questions for more clarification. The farmers were not fully involved in the discussion of the field findings. The farmers asked the FEWs for clarifications of the problems that they observed in the field.

Some farmers wanted to know what they can use to control the diseases and pests they observed. The FEW provided the types of chemical to use for every disease and pest they asked. The farmers did not give any suggestion of various ways that from their own personal experience can be used to control the diseases and pests. This was observed by the researcher in one of the meeting (see figure 8 below). During individual interview all 25 farmers reported that, after field observation they gather and FFS group secretary reads the field findings from piece of paper or from exercise book. There was no use of visual aids drawings, flip charts.

In the FGDs farmers said that, the FEW gives them solution on how to control diseases they observed from the field. One farmer said that:

> "*The secretary read all the observation made in the field and FEW advices us what chemical to use".*

Figure 8: Photograph showing secretary making presentation in one of the group discussion (*Source: Field study, 2011*)

When going through the documents, the researcher found data collection sheets among the FEW FFS training files. The sheets had records of the problems encountered during the field observations. These had been filled by farmers and sent to FEW for solution. In one of the sheet the farmers had recorded the diseases they had observed as rice rust and the pests observed as rice stalk borers. The form has space where the FEW recommended the solutions (see table 5). When asked how the forms get back to the farmers the FEW said that the forms are later sent to the FFS group secretary who reads the solutions written on the sheet to the group. After that the recommended pesticides were bought by group leaders. A sample of the form is attached below as table 5. However, the initial language was Kiswahili but has been translated to English. The form is in Table 5 below.

Name of the FFS: Ruanda -Majenje irrigation scheme
Farm: Rice FFS
Date of investigation of pests and diseases: 23.2.2010
Investigation number: 3

Table 5: Data collection sheet for Agro-Ecosystem Analysis (AESA)

Crop	Farmers field observation	Total
Rice	Number of rice stalk borer seen	12
	Number of plants infected by rice rust	15
FEW recommendation : Apply sumithion to control rice stalk borers. Also use blue copper (fungicides) to control rice rust		

Comparison of FFS plots

Observation revealed that there was only one plot for the new practices, there were no farmer's common practices plot for comparisons. In an individual interview with the Mbeya zonal irrigation engineer he said that there should be only one plot where new innovation is trained. In individual interview all 25 farmers reported that there were no two plots in FFS for comparison of farmers' common practices and new innovation practices there is only one plot for new innovation practices, to make comparison farmers were asked by FEWs to compare their findings with a nearby farm that has been planted by farmers' common practices. In another interview with the district FFS coordinator he said that there should be only one plot where farmers learn new technologies, there is no need for a plot of their practices because if farmers are given a chance to choose between their own practices and what they are trained by MoA they are likely to chose their own practices because they are familiar and affordable. Moreover they can compare what is happening in the FFS plot with what is happening on their own farms. When asked whether in his view some farmers practices are valuable and worthy discussions he said that farmers should learn better technologies which the MoA is training. According to him the number of people receiving the trainings and graduating every year is important, when asked whether follow up is made to find out whether those who graduate practice what they have learnt, he said that it is not planned for because of budget constraints.

In FGDs the farmers were asked whether they compare what they see in the FFS plot with what is happening in their own farms the farmers reported that they are occasionally asked to do so but they hesitate to do it because they feel that their practices are subordinate to those trained by the MoA. One farmer said that*:*

> *"Our common practices are not used for comparison as most of us think that they are worse than the new innovations".*

Drawing of conclusions of FFS training for entire cropping season

In an interview with the FEWs they both said that at the end cropping season the FFS comes to an end. It concludes with a field day where farmers who did not participate in the FFS trainings are invited to see the results. The FFS plot is strategically put near a busy road where many people pass and therefore see the plot. In this plot farmers gather, the FEW places a board on which he records the process the crop has gone through from planting unit the current stage.

On the board he writes the planting date, seed rate, fertilizer applied, name of the variety, spacing and estimated yield. Farmers move through the plot observing the crop, the number of tillers, the size of the head, incidents of pests and diseases, any logging of the plants and uniformity in maturity.

In FGDs, farmers said that they had ended their FFS with field days. They also said that this was when the FEW explains all the operations and activities which had been done throughout the year such as the date of planting and how they controlled diseases and fertilizers used. They also said that during field days farmers are encouraged to practice the new innovations on own fields. One farmer said that;

"During field days we are told the best rice variety to plant in our own fields and different chemicals to use for disease and pest control by FEWs".

4.4 Application of active experimentation

Data in this area was obtained by individual interviews and visiting individual farms for observation. Through field observations and interviews with individual farmers, it was discovered that only 8 out of 25 farmers were able to apply some of learned skills in their farms. When asked why they applied what they learnt, they said that they wanted to achieve the high yields like what they had seen on the FFS plot. Observations showed that all the 8 had small plots in their own farms where they had planted rice in rows and line spacing as shown in figure 9 below. Six out of the 8 had planted the improved rice variety SARO and others used local varieties. All the 8 said that they soak seeds in salty water to separate the viable seeds from the unviable seeds. All the 8 were using sumithion chemical that was recommended during the training to control rice stalk borers. Five were using blue copper to control rice rust. The following table provides the summary of the findings:

Table 6: Activities carried out by 8 farmers who applied learned FFS skills in their own farms

Number of farmers	Technique
6	Planted new rice variety (SARO)
8	Soak seeds in salty water
8	Use recommended pesticide (sumithion chemical) to control rice rust
5	Use the recommended pesticide ,blue copper to control rice rust
8	Small plots in their own farms planted rice rows

(Source: Field study, 2011)

On visiting all the eight farms of those who were partially practicing the trained skills, observations showed that the farmers only followed the recommended practices on the small plot while in the rest of the farm they continued to follow their own practices. Figure 9 below shows the researcher visiting farms to see application of learnt practices on the farmers' own farms.

Figure 9*:* Application of learnt practices on the farmers' own farms (*Source: Field study 2011)*

Individual interviews and field observations revealed that 17 out of the 25 farmers did not apply any of the new skills trained at the FFS. The reason given by these farmers were that they are unable apply the new skill by themselves as they were not confident, they still required the support of the FEW. The farmer's said that during FFS sessions the FEW gives instructions on what should be done and this makes them to be dependent on him. Other farmers complained that what they learnt in the FFS was completely new to them and they were not sure if it can work on their farms so, they wait until they see other farmers practicing. At the same the 8 who had applied the trained skills in the small plots continued with their own practices in the main field. All the farmers were using rice husks manure similar to what is shown in figure 6 above to plant rice. This was the only practice trained at the FFS that was applied by all the farmers in their own farms. Farmers planted the local variety "India rangi mkia" seedlings in a random way. They use neem tree powder to control the stalk borers and Mexican marigold extract to control rice rust. All the farmers said they had not written the chemicals recommended by the FEW and they could not remember what was recommended. In FGDs one aged farmer said:

> *"I learnt this from my parents when I was young and I have practiced it since then, I am confident it works so I will not stop it".*

In the FGDs 8 farmers said they didn't trust the chemicals used to control the diseases and pests. All the 12 farmers said they did not use the recommended fertilizers because they had heard from other farmers that the fertilizers "poison" the soil.

CHAPTER FIVE

5.0 DISCUSSIONS

5. 1 Application of concrete experience

Results show that farmers participate in activities like planting and weeding in the FFS plot however the FEW demonstrates first and then they follow. Whereas the farmers are involved in carrying out the activities yet they are not given an opportunity to do what they know first, on their own, to make mistake and correct them so that they can learn better. Instead the FEW comes with a ready plan on what to be done and how it should be done. He demonstrates first and ensures that the farmers follow the instructions without deviation. If they deviate they are quickly corrected. This goes against what (Race 2010 and Ndoye 2003) say that farmers should be allowed to use their own experience, make trial and error so that they can enhance their learning. Duveskog (2001) also says that farmers should be given a chance to discover on their own so the trained should be designed to encourage farmers discovering on their own. The result of the failure of involving the farmers in the planning of the FFS activities is the dependency of the farmers on the FEW even after the training an indication that apart from accomplishing the targeted activities and fulfilling the FEWs work plan the FFS leaves little impact in the community. This contradicts the principles of FFS because concrete learning requires active involvement or participating of farmers in the planning as well as carrying out the activities. This explains why the rice yield does not go up even after the FFS training.

The study shows that the FEW are the ones who come up with ideas on what to be tried in the FFS plot. The farmers are not involved in the planning stage and for this reason they never really own the plot but always keep referring to it as the extension worker's plot and not their own plot. The fact that they are not given an opportunity to try several methods including some of their practices alongside new practices for comparison makes them disassociate themselves even more with the plot. This goes against the principles of experiential learning which states that the farmers practice and ideas should be the starting point and any new ideas should build on what the farmers are already practicing giving the farmers a chance to try out their ideas and exchange their past experiences builds their confidence and empowers them to experiment on their own farms. According to Duveskog (2001) the FFS should allow farmers to come together to share their past experiences, identify the gaps and try new ideas.

Results show the FFS training is a rigid plan set by MoA. The FEW training schedule was made in 2008 and it has been used since then without revision. The FEW did not find anything wrong with this because it is what is expected by his supervisors and possibly the MoA. The trainings are mainly one sided, Transfer of Technology (TOT) from the "experts" the MoA staff to the farmers. However this shows that the farmers do not have any input in the planning of the FFS training. It also shows that even if the performance of the FFS is poor things continue as usual, the MoA remains contented with achievements of all the targeted trainings and not the impact of the trainings. As a result the farmers do not own the trainings instead they participate like outsiders who come listen and go away. This denies the farmers an opportunity to bring out their training needs which would then make the training demand driven and relevant to the farmers need. The MoA also misses the opportunity to discover cheap rice production methods that have been tested by farmers and found to work at the local conditions. According to Duveskog (2006) the facilitator should guide the farmers and stimulate learning but not giving instructions. They should play the midwives role of bringing forth new life; they should bring in new ideas from the farmers.

The study shows that the farmers work in large groups which make it difficult for each farmer to actively participate and practice. When farmers actively participate they are likely to remember what they have learnt long after they graduate from the FFS training and they are also confident in applying the skills in their own farms. Duveskog (2006), states that the foundation of learning is through active participation and learning with hands on. The ideal number of the farmers group is 4- 5. This small number provides a safe environment for farmers to openly speak and freely participate in FFS group activities.

The results show that the only practice trained at the FFS that was applied by all the farmers is the use of rice husks manure. This was also the only practice which was an idea from the farmers. This shows the importance of using the farmer's ideas and building on them; it makes the technologies acceptable to farmers and increases the chance of its application. According to the farmers, rice husks manure is cheaper than inorganic fertilizers which most of them could not afford. This shows that trying to pass technologies that are beyond the farmer's capacity will not succeed no matter how long the training takes. It also shows that farmers hold their practices dearly and they are not willing to replace them so easily. The farmers who brought in the idea of using rice husks manure said that from experience rice husk manure improve soil structure. These results shows that farmers accept the ideas from other farmers more readily that they accept from extension workers. The interviewed farmers included some who were trained in 2006 and up to now they have not put to practice some of the things they were trained. However this has not stopped the MoA from training the same things to new groups of farmers

5.2 Application of reflection and observation

The results show that farmers participate in field observations in FFS plot. They use some senses like touch, see, hear and feel. They can see the numbers of tillers per plant in the new variety and compare them with those in their local varieties, they listen to each other as they exchange experiences, they touch the soil to feel the moisture content, the count the pests and the number of plants infested by pests and infected by diseases. This enhances learning because according Roberts (2006) in the second stage of the experiential learning farmers learn through the four senses**.** Keogh *et al* 2001 cited in Duveskog (2006) says learning occurs when there is reflective thinking and exchanging of experiences by the farmers. However, this happens only on small scale and not to an extent that can help the farmers to build confidence and carry out the same practice on their own in their farms.

Recording of field observation is done by only the secretary of the group and this has been the case since 2006. This indicates that farmers' participation is limited, but MATI (2006) says that in experiential learning every group should select one member to record data and this should be done on rotational basis among the members so that every farmer gets a feel of what data recording is. This encourages them to make records in their own farms. It also makes the farmers attentive and helps them to take note of the various characteristic of diseases and pests and they can easily identify them on their own farms. The failure of farmers to record makes them unable to identify problems on their own and therefore have to call the FEW every time they have a problem. Moreover the farmers do not seem to appreciate the importance of the recorded observations, this is reflected by the fact that the secretary of the 2006 group never referred to the records after the training and neither did the farmers in that group ever come to her to ask for the recorded information.

The study revealed that Mbarali district agricultural and livestock office with collaboration with MBZIU organizes field trips for the farmers to visit successful irrigation schemes so that they can learn from them. The field trips are important because they give farmers an opportunity to meet other farmers whose FFS trainings have brought a difference in their rice production. This helps the farmers to learn things that they were not doing well in their trials from those who were successfully doing them. It was also provides them an opportunity to reflect on areas that would need improvement and possible ways of improving. According to Ndoye (2003) farmers can learn effectively through watching and observing the practices of other farmers. However after the visits the farmers do not come together to discuss their observations and lessons learnt. This does not match with what is suggested in (MATI, 2006) that after field trip farmers should discuss their learning points. The failure of farmers to meet denies them the opportunities to share and exchange what each of them learnt during the field trip, so that they can learn what one missed they can learn from others who observed it. It also denies them opportunity to reflect on what they saw and heard; discussion would make them remember it for a longer time.

5.3 Application of formulation of abstract concepts and generalization

The result show that after every field observation farmers meet and the secretary reads through what he has recorded. After this farmers ask questions about what they have observed like the name of diseases and the control. The FEW provides all the answers and does not encourage farmers to share their experience on what diseases they have observed on their own farms in the past and how they have controlled them. The results indicate that instead of the FEW playing the role of a facilitator he plays the role of an instructor while the farmers play a passive role. But in this stage the farmers are supposed to develop concepts by logical analysis or in-depth reflection of experience (Kayes, 2005) suggested that in FFS learning through discussion with other farmers, through group discussions, comments, suggestions and criticism are carried out. Farmers who discuss seek more information more actively than those who use passive learning model (Ndoye, 2003). In Ruanda-Majenje farmers these elements of experiential learning are missing making the trainings less effective.

At this stage the findings of the field observation should be process and presented in various visual aids like drawing plants, putting agronomic information like pest types and numbers in flips charts. This should be done by small groups of farmers who later present the processed findings to the whole group. Farmers are expected to hear, to see, critically analyze what they have observed and draw conclusions. However in Ruanda-Majenje the farmers are not sub-divided into smaller groups the findings are read to them from exercises books or Agro-Ecosystem Analysis forms (AESA)/ small piece of paper. They are expected to remember what is they hear, both the interviews and observation revealed that farmers do not carry books to record what is discussed and the conclusions drawn for future reference. This does not agree with what the (MATI, 2006; Gallagher, 2003) suggests that all members of the small groups are supposed to be involved in the creation of the drawings that illustrate their field findings in flip chart or posters which makes it easy for participant to see it. While making drawings in the small groups farmers discuss and analyze the data they have collected giving each of them an opportunity to say what he/she observed, the discussion also helps them to remember what is discussed later and apply. Also according to FFS coordinator reported that they do not able to distribute reading materials to farmers because they had no sufficient funds to do so, and if they did was not timely this affect the learning process in FFS due to lack of training materials such as flip chart, marker pens.

Results show that farmers fill the Agro-Ecosystem Analysis forms for pests and disease incidences; they give them to the FEW for solution basing on the information put on the forms. This goes against the experiential learning principles that say that farmers should interact and analyze situations under different viewpoints, synthesize the analyzed situations and implement the decision (Gallagher, 2003).

In FFS field there was only one plot for the new innovation practices, there were no farmer's common practices plot for comparisons. According to FFS coordinator there should be only one plot where farmers learn new technologies because farmers need to learn new and "better" technologies so that they can replace their own subordinate practices. In the FFS the MoA is promoting the recommended practices without acknowledging the farmer's common practices. It is a linear model of transferring innovations "Transfer of Technology" to farmers. In experiential learning farmers should identify the experimental matter and various technologies should be practiced for study, results are compared and shortcomings of various technologies are identified (Friis-Hansen and Duveskog, 2008). But in Ruanda-Majenje all these decisions are made by FEW, for example the FEW decides what variety to grow, what technologies to be trained, what field trips to make and the places to be visited.

Results show that the MoA is more concerned with producing large number of FFS graduate and resources are invested towards this end. According to the FFS coordinator the number of people receiving the trainings and graduating every year is important. The coordinator also said that after the trainings no follow up is made to find out whether those who graduate practice what they learnt on their farms or not because of budget constraints. Since limited resource are normally spent on priority areas , the practice of the learnt skills by the farmers on their farms is not a priority , the mission is considered complete after the training.FFS trainings conclude with a field day where farmers who did not participate in the FFS trainings are invited to see the results. Field days provide the FFS members opportunity to display and share their experiences to others like the experimentation results and learning activities (MATI, 2006).

5.4 Application of active experimentation

Only 8 out of 25 farmers interviewed applied some of learned skills in their farms because they were impressed by the high yield however they only did it on small plots in their farms. This indicates that they were motivated by the results and not the process of learning. They apply it only on a small plot because they need to test it on their own. Some of those who didn't practice said they didn't do it because they had not written down the recommended agronomic practices such as dosage of pesticide so they could not remember. This shows they were looking at the chemicals as what the MoA recommends and not what they had observed and appreciated. Others still held on to the their own practices like use of Neem extracts to control pests, use of Mexican Marigold to control rice rust because they were familiar, this indicates that farmers still value their practices and have confidence in them even though the FFS coordinator assumed they were subordinate and failed to let the farmers try them in the FFS plot.

The use of the rice husk manure was practiced by all the farmers because the idea came some of the farmers and it was tested on the FFS plot. This shows that farmers trust information that comes from other farmers. Some of the farmers said they want to see others practice it before they apply it an indication that they would still want the information to come from other farmers whom they trust more than the MoA staff. It shows that they have not learnt from the FFS enough to appreciate and apply it on their farm. Also farmers had fears that the inorganic

fertilizers poison the soils but since they were not given the chance to openly discuss their fears so that they can be cleared. Since they never spoke up the MoA staff did not get to know the real reason as to why farmers do not take up the new technology but assume other reasons for the low uptake of technologies.

5.5 Ministry of Agriculture philosophy and Approach on farmer field school

The MoA introduced FFS as a better and different approach to transfer of technology in order to achieve better results in rice production to small-scale farmers. But it becomes very apparent here that the MoA have seen FFS as just another way of transferring technologies to farmers. The MoA still attitude is that they are the experts whose modern technologies should replace the farmers' primitive methods of rice cultivation. MoA uses FFS to convince farmers to adopt and use the new innovations that are being developed and decided by experts. Such innovations include the use of new rice varieties, recommended planting space, and fertilizer application; weed control, pests and diseases control.

The MoA views their technologies as superior to the farmers practices and for that reason the farmers practice have no place in the FFS training. Even in setting FFS plots is only one plot (new innovation practices plot) where farmers learn new technologies because farmers need to learn new and "better" technologies so that they can replace their own subordinate practices. The MBZIU and Mbarali district Agricultural and livestock office do not consult or involve the farmers in planning the trainings because they imagine that farmers cannot have valuable input but rather everything should be planned for them and their role is to listen, learnt and change. This approach has ignored farmers' knowledge and their experiences in their local practices of rice production. This indicates that MoA is using the Transfer of Technology (TOT) under the name of FFS process because the ideas and experience of the farmers have not been included. The MoA has set FFS concept without considering the value of farmers in their own practices at the local level and how issues can be imparted in their locality. MoA has been seen FFS as just another way of making the farmers do what they want, that is adopt technologies. Instead of using FFS approach to support farmers to learn from their own experiences and make decisions on problem solving at their own farm level. However, the implementation of FFS has resulted into the failure to achieve the goal by the MoA to increase rice productivity to small-scale farmers.

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the conclusions drawn from the study and recommendations made from it. The conclusions will mainly try to answer the research question on how the principles of experiential learning applied in FFS at Ruanda- Majenje irrigation scheme in rice production innovation.

6.1 Conclusions

This study revealed the current approach of the learning approach of the FFS at Ruanda-Majenje irrigation scheme. From the study, concrete experience in the FFS at this irrigation scheme does not take fully place because even though farmers carry out field activities, the FEW first demonstrates what should be done and when famers deviate from the instructions they are corrected. The farmers work in large a group that makes it difficult for every person to participate.

On reflection and observation, farmers participated in field observation but by the FFS group secretary. Thus, other farmers do not have the opportunity to keep records. Farmers also had a chance to visit other successful FFS irrigation schemes but they did not get together after the visit to reflect on their visit. Therefore reflection and observations were not properly done.

In addition, the formulation of abstract concepts and generalization stage did not take place as it should be. Data processing did not take place since the presentation was done by the group secretary to the whole group and discussions did not take place. Instead the FEW also draw the conclusions from the findings and provided all the solutions to the farmers. Farmers did not use visuals by making use of flip charts or pictures and drawings. There was no comparison of farmer's practices and the new innovation practices; rather there was an emphasis on the promotion and the transfer of new innovations. Farmers past experiences were not considered in the conclusion.

Considering active experimentation, only some few farmers applied what they learnt from the FFS on their own farms. Even though, the knowledge was applied on small plots except the use of rice husks manure which was applied by all farmers who participated in the FFS. This indicates that the FFS trainings did not change the farmer's practices despite all the efforts and investment made by the MoA.

MoA had hoped that the FFS approach will bring better results in rice production than the former TOT unfortunately the FFS setting being done here is only TOT in a different name. For that reason the results have been as can be expected the same. The staff does not seem to know the difference between the two approaches and they are doing their best to achieve what is expected of them. This study therefore sheds some light on the reasons as to why rice production in Ruanda-Majenje irrigation scheme has not increased like in the neighboring irrigation scheme despite being in the same climate and geographical location and farmers going through the same training approach FFS.

6.2 Recommendations

Based on empirical findings and discussions the following recommendations are suggested:

- The MoA philosophy of FFS should change; it should clearly differentiate between TOT and FFS. There a need for change in attitude and practice to motive collaborative learning process where farmers and experts could collaborate in decision making, problem solving and learning new innovations practices. The MOA should stop thinking of themselves as the experts and farmers as technology receiver rather they should appreciate and acknowledge what farmers already know through experience and practice.

- The MBZIU with collaboration with Mbarali District Agricultural and Livestock office should provide all the resources that make FFS training effective like flip charts, marker pens, notebooks, pens. But, besides providing these materials, trainings should follow the principals of experiential learning in order to be effective and to have impact in the community.

- Mbarali district agricultural and livestock office in setting FFS field, the comparison of two FFS plots (farmers' common practices and new innovation practices plots), is important and should be set next to each other. The close proximity will easy the observations and the results will help farmers to make comparison and adopt the various technologies.

- Mbarali district agricultural and livestock office must organize field trips program, at local level as much as possible for farmers and the entire community members to learn at a wider scale. This will benefit the present and future rice production.

- The extension workers should monitor the application of the practices learnt at the FFS which should include some farmers practices in the farmers own farms by visiting them regularly. This will provide an opportunity to get and give feedback (i.e. proper follow-up).

- Use of farmers' practices in rice production should be considered and embraced in the whole FFS learning process. The MoA should be able to learn from farmers in order to meet farmers' needs. The consideration of farmers' knowledge and experiences should be encouraged.

- MBZIU to fund further research this time on the successful FFS to find out why they have been successful in order to use the findings to help improve the less effective FFS.

7.0 REFERENCES

Ajan, E., and Ownwubuyu, E., (2010). Farmer Field Schools (FFS) and Junior Farmer Field and Life School (JFFLS) as challenges to agricultural extension development and practice in Nigeria .*Journal of Agricultural Extension*. pp 53-61.

Anderson, J.R., Feder, G., and Gangulf, S., (2004). The rise and fall of training and visit (T& V) system: an Asian mini –drama with an African epilogue. World Bank policy Research Working (3928), Wshington, DC: The World Bank.

Braun, A., Thiele G., and Fernandez, M., (2000) Farmer Field schools and Local Agricultural research committees: Complementary platforms for integrated decision-making in sustainable agriculture Network paper no 105.

Duveskog, D., (2001). A case study for Farmer Field Schools: Water harvesting and soil moisture retentension Nairobi, Kenya.

Duveskog, D., (2006).Theoretical perspective of the learning process in Farmer Field Schools, with reference to East African experiences. Working paper.

Feder , G., Murgai, R., and Quizon, J., (2004). The Acquisition and Diffusion of Knowledge: The Case of Pest Management Training in Farmer Field Schools, Indonesia. Journal of Agricultural Economics, 55 (2), pp 221-243.

Fenwick, T., (2001). Experiential learning: a theoretical critique from five perspectives. Columbus, The Ohio State University.

Friis-Hansen, E., and Duveskog, D., (2008). Linking the Learning process in Farmer Field Schools to impact of transformative change.

Gallagher, K., (2003). Fundamental elements of Farmer Filed Schools.

Jarvis, P., Holford, J., and Griffin., (2003). The theory and practice of learning. London: Routledge

Kabir, H., (2007). Adaptation and adoption of the System of Rice Intensification (SRI) in Myanmar using the Farmer Field Schools (FFS) approach, PhD thesis.

Kayes, D., (2005). Internal validity and Reliability of Kolb's learning style inventory Version 3. Journal of Business and psychology, 20 (2), pp 249 -257.

Kolb, D., (1984). Experiential Learning: Experience as the source of Learning and Development. Prentice-Hall Inc New Jorsey.

Kumar, R., (2005). Research methodology. A step-by-step guide for beginners. Second edition. SAGE Publications. London.

Leeuwis, C., (2004). Communication for Rural Innovation, Rethinking agricultural extension, 3rd edn.Backwell, Netherlands.

Luther, G.,Harris, S.,Sherwood, K, Ghallagher, J.,Mangan and Toure' G., (2005). Development and Innovations in Farmer Field Schools and Training of Trainers.

MATI. (2006). Unpublished FFS training manual used by staff from Ministry of Agriculture Training Institute, Uyole-Tanzania.

Mbarali DADP, (2011).Unpublished document, District Agricultural Development programme,-Tanzania.

Merton, R. K., Fiske, M., and Kendall, P.L., (1990). The Focused Interview. A manual of Problems and Procedures. Collier Macmillan Publishers. London.

Mezirow, J., (2000). Learning as transformation: critical perspectives on a theory in progress. San Francisco, Jossey Bass.

Ndoye, A., (2003). Experiential learning, self-beliefs and adult performance in Senegal Lifelong Education, 22 (4), pp 353–366.

Nederlof, E and Odonkor, E (2006). Lesson from an Experiential Learning process: The case of Cowpea Farmer Field Schools in Ghana, *Journal of Agricultural Education and Extension*, 12 (4), pp 249-271.

Race, P., (2010). Making learning happen. A guide for post compulsory education.2nd ed. Sage.

Rivera, W., (2004). Agriculture and Rural development discussion paper 10 Extension Reform for Rural development volume 3. Demand-Driven Approaches to Agriculture Extension case studies of internal initiative.

Roberts, T,. (2006). A Philosophical Examination of Experiential Learning Theory for Agricultural Educators, *Journal of Agricultural Education*, 47 (1), pp 17-29.

Russ, D., (2007). From Farmers' Field Schools to community IPM. Vol.17 (3):18.

Sones, K., and Duveskog, D., (2003). Farmer Field Schools: The Kenyan Experience. Report of the Farmer Field Schools stakeholder forum held at Nairobi. Kenya, FAO.

SWMRG, (2004).Comprehensive Assessment of Water Resources of the Mkoji sub-Catchment, its Uses and Productivity. A report submitted to the Comprehensive Assessment Competitive Grant International Water Management Institute by the Soil and Water Management Research Group (SWMRG), Sokoine University of Agriculture, Morogoro, Tanzania. pp 82

URT, (2009). Ministry of Agriculture, Tanzania, National Rice Development strategy.

Annex

Checklist: sources of information

Sub-questions	Farmers individual interview	FEW individual interview	Farmers focus group discussion	District FFS coordinator, Zonal Irrigation engineer	Observed during training and attend Farmers meetings	Observed in the field	Reports and documents from farmers and FEWs
Concrete experience	Farmers practicing land preparations, weeding, fertilizer applications, checking water levels, harvesting, pest and disease control. Farmers allowed making mistakes. Farmers setting their own trial, carry out FFS in small group	Setting of FFS trials. How farmers participate in FFS activities, planning of training	Participation in FFS activities Participation in FFS activities and the whole activities done by themselves without assistance from FFS facilitator.	Opinion in allowing famers to make mistakes. Opinion in allowing famers to set their own trials.	Check field operations during training such as weeding, fertilizer application	Farmers' practices tried in FFS plot such as planting methods randomly, rows, in line spacing, rice varieties	Check of training schedule. Check mistakes done and what corrections made.
Reflection and Observation	Observed activities such as the number of tillers per plant, diseases incidences, pest numbers and type, growth rate, size of plant panicles, water levels. Field trips, discussion of observed operations. Ask farmers what they have observed. Recording of field observations	Observed activities. Field trips and what is observed. Meetings and discussion after field trips. Presentations on what was observed.	Observed activities such as the number of tillers, diseases incidences, pest numbers and type, growth rate. Recording of observed data.	Field trips and discussion of observed operations. Check who gives solution to problems.	Meetings after field observations. Observe what is discussed. Questions asked criticism.		Check recorded information on what was observed. Discussion meetings and what was discussed. Check places visited from documents.
Formulation of Abstract concepts and generalizations	Ask farmers Meetings after field observations presentation of field findings, Ask farmers what are the two plots are for. Why they set the two plots? Performance differences between two plots.	Number of FFS plot. Technologies tried in FFS field. Drawing conclusions. How do they arrive at their conclusions of the FFS practiced concepts?	Sources of solutions to observed issues. Comparison of FFS practices. How do farmers end the FFS activities?	Opinion on number of FFS plots.	Visual aids used. Farmer discussions, comment, criticisms, suggestions, analysis. Observed during farmers meeting	Number of FFS plots.	Check documents on who gives solutions to the problems encountered.
Active Experimentation	Farmer practices on their own farms. Reasons of the practices	What skills are applied by farmers on their own field?	Source of information of the practiced activities by farmers.			Field observations on farmers practices	