THE ROLE OF FARMER FIELD SCHOOLS IN DISSEMINATION OF TECHNOLOGIES TO PADDY FARMERS IN MVOMERO DISTRICT TANZANIA

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN AGRICULTURAL EDUCATION AND EXTENSION OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

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ABSTRACT

Farmer Field School (FFS) approach is gaining prominence as an extension approach in most developing countries and its degree of effectiveness in influencing farmer's uptake of knowledge for future use is promising. This study was conducted to assess the role of FFS as an approach in disseminating technologies to paddy farmers in Mvomero District. Specifically, the study sought to determine perception of farmers on FFS approach in knowledge development and dissemination of technologies, socio-economic factors influencing farmers' participation in FFS, comparison of production between FFS and non-FFS farmers and factors facilitating the dissemination of agricultural technologies under FFS. A cross-sectional design was employed to collect data from a randomly selected sample of 60 FFS and 60 non-FFS farmers. A structured questionnaire was used to collect primary data and secondary data was collected from reports and documents. The Statistical Package for Social Sciences (SPSS) was employed in analyzing primary data. Findings show that FFS farmers had high level of knowledge than non FFS farmers. This translated itself into higher average annual paddy yields among FFS farmers. It indicate that FFS as an approach is effective in dissemination of improved paddy technologies in Mvomero District. However, challenges like little or no technical and financial support for farmers after they graduate from season-long training sessions and poor linkage to other agricultural service providers affected sustainability of FFS graduates. It is recommended that policy and strategic issues related to recruitment of more extension personnel, special funding for follow ups, more engagement with private actors in paddy production would strengthen FFS farmers to continue applying what they learn through FFS.

DECLARATION

I, Zainabu Faraji Mchomvudo hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

_____ _____

Zainabu Faraji Mchomvu Date

(MSc. Student)

The above declaration is confirmed

_____ _____

Dr. Kizito K. Mwajombe Date

(Supervisor)

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DEDICATION

To my beloved parents Mr and Mrs Kishaghiro Mchomvu who laid down a better foundation for my education.

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LIST OF ABBREVIATIONS AND ACRONYMS

AESA	Agro Ecological System Analysis
ASDP	Agriculture Sector Development Programme
DTC	District Training Coordinator
FAO	Food and Agriculture Organization of United Nations
FEW	Field Extension Workers
FFS	Farmer Field School
IFAD	International Fund for Agricultural Development
IPM	Integrated Pest Management
MAFC	Ministry of Agriculture Food Security and Cooperative
NGO	Non-governmental Organization
PES	Pluralistic Extension Services
PTD	Participatory Technology Development
SE	Standard Error
SHERFSP	Southern Highlands Extension and Rural Financial Services Project
SNAL	Sokoine National Agriculture Library
T&V	Training and Visit
ToT	Transfer of Technology
TDT	Technology Development Transfer
URT	United Republic of Tanzania
WB	World Bank

CHAPTER ONE

1.0 INTRODUCTION

1.1 Introduction and 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 (Talibo, 2011). The main food crops in Tanzania are maize, paddy, wheat, sorghum/millet, cassava and beans but so far Tanzania's agricultural potential is largely undeveloped (Temu, 2006; URT, 2006; World Bank, 2005). As a result crop productivity has been low and paddy is no exception (URT, 2006; Talibo, 2011). In order to boost paddy production among smallholder farmers, the Ministry of Agriculture Food Security and Cooperative (MAFC) has been implementing various farmers' capacity building programmes. One of them was Transfer of Technology (ToT) approach through Training and Visit (T&V) extension methodology to disseminate paddy production innovations among farmers. But these approaches have proved ineffective (URT, 2004). Following this failure, there has been a need for improved methodologies that respond better to farmers' demands and a shift towards more participatory and group focused approaches. Various approaches have been used with varying performance. Farmer Fiels Schools (FFS) is one of the model widely used in different countries, including Tanzania (Mwasyete, 2012).

FFS is a popular extension approach worldwide (Muhamad, 2012). The approach uses experiential learning and a group approach to facilitate farmers in making decisions, solving problems, and learning new techniques (Duveskog, 2013). In recent years, a number of development agencies, including the World Bank (WB) have promoted FFS as a more effective approach to extend practical based knowledge to farmers (Feder *et al*., 2003).

Farmer Field School extension is an approach that takes into account farmers' demands as well as their participation in the learning processes. It is regarded as school without walls where groups of farmers meet periodically with facilitators during the crop or animal cycle (Duveskog, 2013). According to FAO (2008), FFS is mainly concerned with improving decision-making capacity of farming communities and stimulating local innovation for sustainable agriculture. FFS focuses on building farmers' capacity to make well informed crop management decisions through increased knowledge and understanding of the agro ecosystem (Mweri, 2005). FFS participants make regular field observations and use their findings, combined with their own knowledge and experience, to judge for themselves, what, if any, action needs to be taken.

The aim of FFS is to build the farmers' capacity to analyze their production systems, to identify their main constraints, and to test possible solutions, eventually identifying and adopting the practices most suitable to their farming system (Muhamad, 2012). In this approach farmers go through a learning process in which they are presented with new technologies, new ideas, and new situations and ways of responding to problems. The knowledge acquired through this learning process is then used to build on the existing knowledge enabling farmers to adopt the technologies to the best advantage of their own situations (Davis, 2008).

FFS started in Indonesia in 1989 as a methodology for training farmers on Integrated Pest Management (IPM) project (Davis, 2008). Since then, FFS approach has been extended to several countries in Africa and Latin American (Bunyata *et al.,* 2011; Van den Berg, and Janice, 2007).

The FFS approach was introduced in East Africa in 1995 under the Food and Agricultural Organization (FAO) special programme for food security in Western Kenya (Babur, 2009). In Tanzania FFS was introduced in 1998 piloted in the Southern Highlands Extension and Rural Financial Services Project (SHERFS) funded by the International Fund for Agricultural Development (IFAD). In Morogoro Region and specifically Mvomero District, FFS was introduced in 1999 as a pilot study in Mkindo village where farmer groups namely “MwanzoMgumu and “Nguvukazi” were formed with a total of 51 members who were trained on improved practices in paddy production (Mvomero District Planning Report, 2012). From Mkindo village, FFS was scaled up to cover other areas in Mvomero District, such as Mlali, Hembeti and Wami Dakawa wards. Despite the spread of FFS in many villages in Mvomero District the average paddy production per farmers is still below the potential average per hectare.

1.2 Problem Statement and Justification of the Study

According to Duveskog (2013), FFS approach is widely applied in a range of contexts and often suggested to bridge the gap between the technological and social needs of farmers. Such schools use experiential learning and a group approach to facilitate farmers in making decisions, solving problems, and learning new techniques. Furthermore, David (2007) argue that as enthusiasm over FFS spreads in Africa and a growing number of donors and governments establish FFS programmes, it is important to have more empirical evidence from Africa on the effectiveness of FFS approach. Based on this argument it is important to have more context-relevant studies which will contribute to the existing body of knowledge on the influence of FFS in poverty reduction, particularly in developing countries.

Farmers training on improved paddy production practices in Mvomero District through FFS has been in progress for 14 years. Despite the efforts made by the District to use FFS as an approach to increase paddy productivity, overall paddy yields among farmers are still low. Recent reports show that FFS groups increased from two in 1999 to 124 in 2012 with a total of 2 739 trained farmers on paddy production through FFS (Mvomero District Planning Report, 2011). The extent to which FFS has contributed to dissemination of technologies on paddy production as well as the extent to which technology spread to other farmers in Mvomero District lacks empirical evidence and hence not well documented.

For example; the national potential paddy production is five tons per ha. But majority of paddy farmers in Mvomero District are still producing on average below 3.4 tons per ha although majority of them have been trained through FFS. This called for a need to investigate the role of FFS as an approach in disseminating knowledge to paddy growing farmers and make a comparison of paddy production between farmers who had attended FFS and farmers who did not. Findings from this study will be of great importance in formulating strategies to address situation in the study area and other areas where paddy is grown with similar socio- economic factors. Also the findings will help to inform various stakeholders on the current status of knowledge and production level in the study area.

1.3 Objectives of the Study

1.3.1 General objective

The overall objective of the study was to assess the role of FFS as an approach in disseminating paddy production technologies among paddy farmers in Mvomero District.

1.3.2 Specific objectives

The specific objectives of the study were;

i. To determine perception of farmers on FFS approach in knowledge developed and disseminated in the study area.
ii. To identify socio-economic factors influencing farmers' participation in FFS programme in the study area.
iii. To compare paddy production between FFS and non-FFS farmers in the study area.
iv. To identify factors facilitating the dissemination of agricultural technologies under FFS in the study area.

1.3.3 Research questions

i. What is the perception of farmers in knowledge developed and disseminated under FFS approach in the study area?
ii. What are the socio-economic factors influencing farmers participation in FFS programme in the study area?
iii. What are the differences in paddy production between FFS and non-FFS farmers in the study area?
iv. What are the factors facilitating the dissemination of agricultural technology under FFS in the study area?

1.4 The Conceptual Framework

The conceptual framework of this study is based on dissemination of agricultural technologies required by paddy farmers in order to meet high production level. It is therefore the roles of FFS to make sure that dissemination of technologies to farmers are in place.

In this study the independent variables are grouped into three categories namely; social factors, economic factors and institutional factors. Social factors include: age, level of education, marital status, size of land, and sex of respondent. Economic factors such as level of income, access to farm inputs and family labour. Others include institution factors such as source of information and extension service. Therefore, the above factors are thought to influence adoption of good agricultural practices by paddy farmers.

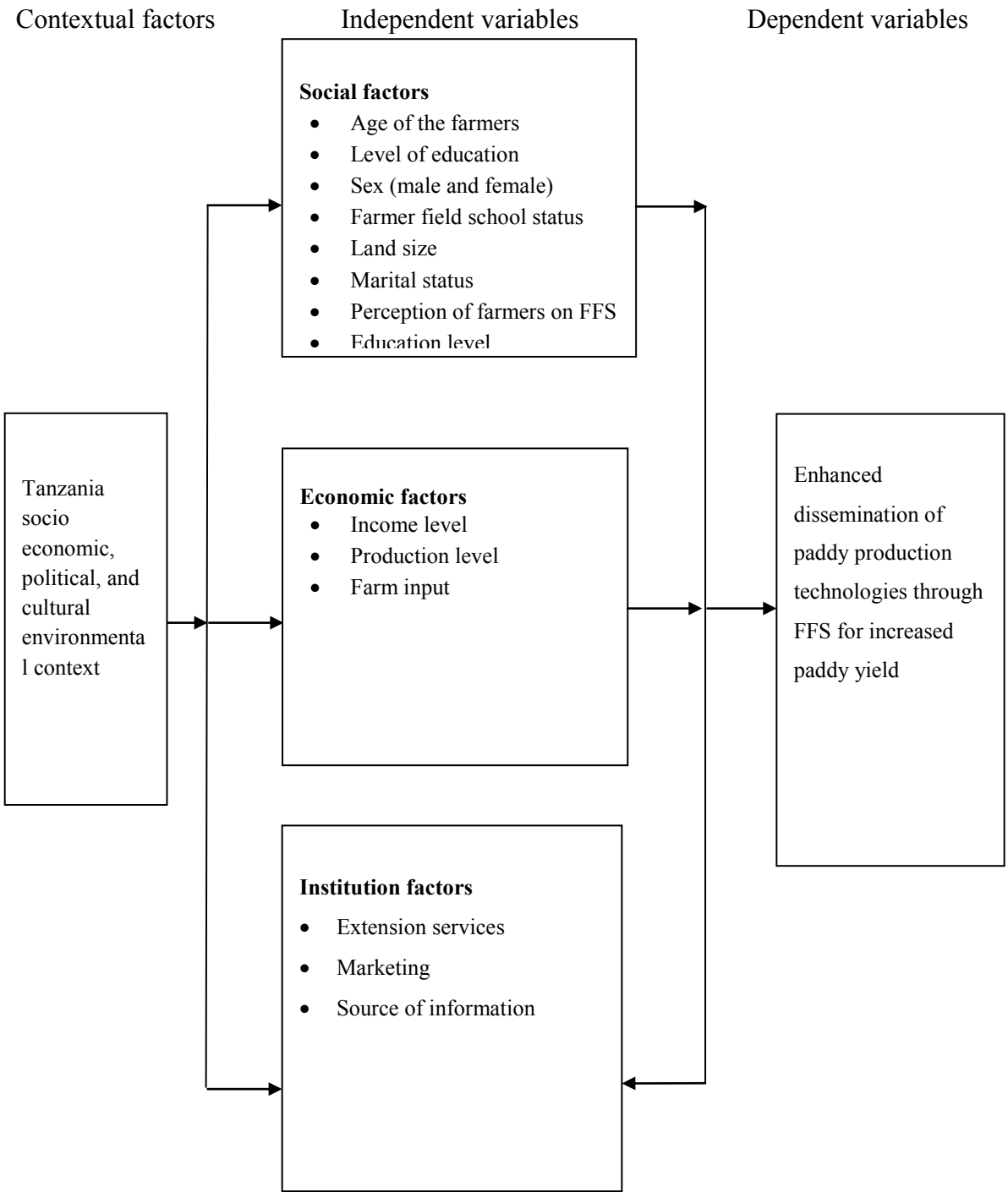

Figure 1: Conceptual framework on role the of FFS approach in dissemination of technologies to paddy farmers

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Role of FFS in Technology Transfer

The role of FFS is to deliver services and to speed up farmers' access to and adoption of new technology. The main role of FFS is to empower farmers and enable them to identify and analyze their agricultural problems and be able to make the right decisions (Kimaro, Mukandiwa and Mario, 2010). As described in the preceding sections, it is obvious that top-down approaches to extension message delivery like T&V preceded participatory models in the historical timeline in many parts of the world.

However, during the late 1980s and 1990s researchers and technology transfer agents started to be aware that farmers' non-adoption that was then rampant stemmed from the fact that most technologies did not fit their circumstances (Asiabaka, 2002). Thus improved adoption of technologies is only possible when technology developers and change agents take into account and implement the concept of learning from and about farmers.

Based on these insights, it has over time been clearly understood that contextualized solutions to farmers' problems and challenges require a multidisplinary and system approach. In this new orientation, various stakeholders are involved in the whole process of technology development, transfer, implementation and retention for sustainable benefits. The technology users who are practically the farmers should be considered central to any research and extension efforts.

As opposed to linear T & V extension model which assume that farmers are always ignorant, FFS is built on an understanding that farmers have formally and non-formally

acquired skills and knowledge emanating from their long experimentation and experience in agricultural activities. The FFS model therefore, capitalizes on the principles of experiential learning to guide farmers in developing better ways of improving their livelihoods through sustainable use of ecological resources.

The above argument is in line with the observation by Duveskog *et al.* (2002) that the spinal cord of the FFS approach is farmers' own knowledge and experience expressed though group experimentation and discussion. It is further asserted that Africa has an enormous resource of untapped traditional knowledge and promising innovations and initiatives that could bring substantial benefits for other smallholder farmers on a wider application (Duveskog *et al.,* 2002; Hakiaza *et al.,* 2004). In view of this fact, FFS as a group learning approach builds knowledge and capacity among farmers to enable them diagnose their problems, identify solutions and develop plans and implement them with or without support from outside.

The roles of FFS are basically founded on the need to do away with the traditional research and extension linkage system, where agricultural Technology Development and Transfer (TDT) have tended to be largely based on ineffective vertical one-way communication model with information flowing from research to extension and the role of extension was to transfer the information to the farmers (Asiabaka, 2002; Hakiaza *et al.,* 2004).

The general role of FFS therefore is the empowerment of farmers in all important socio-economic and environmental aspects. The individual roles of FFS include building social capital which is critically important in dealing with community challenges and deliverance of public goods, improvement of farm level (individual) technologies adoption through

participation and involvement, enhancement of aggregate (community level) technology adoption through farmer-to-farmer technology transfer and to offer opportunity to test and adapt research-developed technologies.

Furthermore, apart from technical innovations, FFS offer a platform for farmers as community members to learn and understand other topical socio-economic issues. Based on these roles, the effectiveness of an FFS varies over space and time depending on the objective of the programme, level of financial and technical support from the government (and other private actors), facilitation skills and commitment of extension officers. The effectiveness is therefore measured based on the degree to which the FFS programme meets the above roles, using pre and post programme situations or FFS and non-FFS farmers (Khatam *et al.,* 2013; Hakiaza *et al.,* 2004). Objectively verifiable indicators are used in this regard. They include, but not limited to increased uptake of technologies on offer, improved productivity, improved household incomes and reduced land degradation.

2.2 Description of Farmer Field Schools (FFS)

According to Duveskog (2006) Farmer Field School (FFS) is 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 or livestock management practices in making decision under the guidance of a skilled facilitator. The training programme utilizes participatory methods "to help farmers develop their analytical skills, critical thinking, creativity, and help them learn to make better decisions (Godtland *et al.,* 2004).

Furthermore, FFS is described as a Platform for improving decision making capacity of farming communities and stimulating local innovation for sustainable agriculture (Khisa,

2004, FAO, 2008). It is a participatory approach of extension, whereby farmers are given opportunity to make a choice in the methods of production through discovery based approach. Its main objective is to bring farmers together to carry out collective and collaborative inquiry with the purpose of initiating community action in solving community problems (Khisa, 2004).

FFS is a season-long training programme conducted in the field (Anandajayasekeram, 2007). It offers community-based, non-formal education to groups of 20-25 farmers through self-discovery and participatory learning principles. Some authors advocate for group sizes of 25-50. The learning process is based on agro ecological principles related to a given cropping cycle. The school brings together farmers who live in the same village/catchment.

The FFS model is an important institutional and organizational innovation that needs to be studied in depth in different agro-ecological zones, different institutional arrangements and over time. The FFS programme are common platform for group interaction among farmers, regular meetings, discovery-based-learning in the field and regular follow up encounters with individual farmers (Paredes, 2001).

In general the expected outputs of FFS approach are increased farmers' capacity for research, innovation and informed decision-making, development of farmers' capacity to define their own research agenda and follow-up activities, stimulation of farmers to become facilitators of their own research and learning processes increased responsiveness to farmer-client demands and needs by organizations in national research and extension and development systems (Ashby *et al*., 2000).

2.3 Historical Background of FFS

The FFS approach was developed by FAO project in South East Asia as a way for small-scale rice farmers to investigate, and learn for themselves the skills required in their paddy fields (Godtland *et al.,* 2004, Khisa, 2004; Bijlmakers, 2011). The term "Farmers' Field School" comes from an Indonesian term "Sekolah Lapangan" meaning simply "field school". The first Farmer Field Schools were established in 1989 in Central Java during the pilot phase of the FAO assisted national IPM Programme. These Programme was prompted by the devastating insecticide-induced outbreaks of brown plant hoppers (*Nilaparvatalugens*) that are estimated to have in 1986 destroyed 20000 hectares of rice in Java alone reference.

The Government of Indonesia's response was to launch an emergency training project aimed at providing 120 000 farmers with field training in IPM, focused mainly on recording on reducing the application of the pesticides that were destroying the natural insect predators of the brown plant hopper (*ibid*).Since then FFS methodology has spread in many parts of the world. The model has been adapted to suit various crops other than rice and also other fields such as environmental conservation (Dimelu and Okoro, 2011).

2.4 Principles of Farmer Field Schools

In the field school, emphasis is laid on growing crops or raising livestock with the least disruption on the agro-ecosystem. The training methodology is based on learning by doing, through discovery, comparison and a non-hierarchical relationship among the learners and trainers is carried out almost entirely in the field. Based on these facts there are four basic principles that guide FFS methodology (Bijlmakers, 2011, Khisa, 2004).

The four major principles within the FFS process are:

a) Grow a healthy crop

b) Observe fields regularly

c) Conserve natural enemies of crop pests

d) Farmers understand ecology and become experts in their own field

2.5 Essential Elements of FFS

Although FFS has been adapted to suit deferent circumstances and topics, there are six important elements that form the pillar of the model (Khisa, 2004 and Duveskog, 2008). These elements are described below.

2.5.1 The group

The group comprises of 20-25 individuals members who have a common interest, forming the core of a Farmer Field School. The FFS tends to strengthen existing groups or may lead to the formation of new groups (Matata *et al.,* 2001;Mweri, 2005).

2.5.2 The field

FFSs are about practical, hands-on topics. In FFS, the field is the teacher, and it provides most of the training materials such as plants. Farmers are usually much more comfortable in field situations than in classrooms. In most cases, communities can provide a study site with a shaded area for follow-up discussions and practical (Duveskog, 2008).

2.5.3 The Facilitator

FFS needs a technically competent facilitator to lead members through the hands-on exercises. There is no lecturing involved, so the facilitator can be an extension officer or a Farmer Field School graduate (Ajani and Onwubuya, 2010). Extension officers with different organizational backgrounds, for example government, Non-Government Organization (NGO) and private companies have all been involved in FFS as facilitators.

This arrangement is highly observable in places where there is Pluralistic Extension Services (PES).

2.5.4 Farmer field day/ visit

Farmers are given an opportunity to hold at least one day at field day for a learning cycle and have exchange visits and tours during the duration of FFS. During the field day farmers explain the technologies they had learned and also entertain visitors including their neighbor farmers (Duveskog, 2008).

2.5.5 Programme leader

Most FFS programmeexist within a larger programme, run by government or a civil socio organization. It is essential to have a good programme leader who can support the training of facilitators, get materials organized for the field, solve problems in participatory ways and nurture field staff facilitators (Davis, 2008). In Tanzania, most districts have programme leaders who are normally called the District Training Coordinators (DTCs).

2.5.6 Financing

This is an important element since Farmer Field Schools can be expensive or low-cost depending on who implements them and how they are conducted. A topic under study also dictates the amount of funds required to successfully support the learning process. One important issue in FFS is that of sustainability without outside funding (Ajani and Onwubuya, 2010).

2.6 Experiential Learning

Experiential learning is defined as a knowledge creation process through which new experience are being integrated into previous ones and transformed into relevant, durable

and retrievable knowledge which is suitable for use in the learners' environment (Talibo, 2011).

In addition, 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. The major FFS target is capacity building of the farmers through experiential learning through farmer research and experimental plots (Nederlof and Odonkor, 2006); cited by Talibo, (2011) who stated that, 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''

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

2.7 FFS Curriculum Development

In FFS there are conversations between farmers and Field Extension Workers (FEWs), whereby farmers raise the problems 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 on 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. One key factor in the success of the FFS has been that there are no lecture all activities are based on experiential (learning-by-doing), participatory, hands-on work (Duveskog, 2013). This builds on adult learning theory and practice. Each activity has a procedure for action, observation, analysis and decision-making.

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 (Nederlof and Odonkor, 2006). The conventional plot is used as a control while the plot where improved practices applied is considered the treatment plot. This section is related to this study where productivity on paddy production is compared between FFS and non FFS farmers in order to determine effectiveness of FFS methodology.

Additionally, FFS follows a curriculum where crops, livestock, socio-economic and education are integrated to form a holistic approach for addressing farmer's needs. The curriculum is based on local conditions, problems and needs of participating farmers. Although the emphasis on any particular discipline may differ, relationships between and among the various farm components and disciplines should not be ignored. Emphasis is

put on agro-ecosystem analysis that helps farmers gain ecological insight and integrated management principles with wider alternatives to choose (Talibo, 2011). Several elements of experiential learning are of particular relevance to development and extension including the role of higher order experiences, reflection and dialogue. Those facilitating development processes work with farmers to help them step back and analyze their situations and then together identify ways forward through experiential learning.

2 8 Participative group study/learning

FFS are organized for groups of about 25 farmers who meet together with common interest (Godtland *et al.,* 2004). The farmers discuss their problems and what they want to learn. The group of participants is roughly the quantity that can comfortably work together with a facilitator. The groups are often divided in smaller sub groups, so that members can better participate in field observations, analysis, discussion and presentations. The FFS participants can have different backgrounds.

A constructive learning process also reveals the opportunities for developing alternative actions, strategies, capacity and possibilities for working together. Schusler (2001) found that a social learning process can contribute to both common purpose and collaborative relationships. Besides finding common purposes in dealing with environmental problems, social learning also contribute to the development of appropriate structures, collaborative relationships and supportive policy development.

2.9 Agro-Ecological System Analysis

The corner stone of the FFS approach is the Agro Ecological System Analysis (AESA), which is a field, based analysis of the interactions observed between crop/livestock and other biotic and abiotic factors co-existing in the crop/livestock field (Khisa, 2004). The

purpose of using AESA is to learn and make regular field observations, analyze problems and opportunities encountered in the field and to improve decision making skills regarding farm management. The analysis follows a cycle of observation, analysis and action. By carrying out AESA regularly in the FFS, farmers develop a mental check list of indicators to be observed when monitoring their farm practices.

AESA involves regular (usually weekly) observations of the crop. Participants work in sub groups of 4 or 5, and learn how to make and record detailed observations including: growth stage of the crop, insect pest, weeds, disease levels, weather conditions, soil condition and overall plant health.

Using the framework of AESA, improved farmers decision-making emerges from an iterative process of analyzing problems and situations from multiple viewpoints, synthesizing the analysis, making decisions and implementing them accordingly.

It also involves observing the outcomes of the implemented decisions and evaluating their overall impact (Rola and Jamias, 2002). Feature learning in the field school is experiential and discovery based and AESA is done in small groups of 4-5 farmers on the activities being carried out in the central plot. Appropriate indicators are used to measure system health during the learning process. The analysis and proposals emanating from the small groups are presented in plenary session for discussion and for reaching a consensus on the next course of action. Since most relationships among agro ecosystem components are usually unknown to most farmers, mechanisms for identifying and filling such gaps need to be put in place. Special topics are included in FFS to cover unknown agro ecosystem relationships. The topics also develop farmer's research capacity by stimulating comparison of treated and non-treated plots and by providing regular opportunities for

data gathering and analysis through the testing, validation and evaluation of technologies through Participatory Technology Development (PTD).

During the learning cycle, participants' capacity for collective action is stimulated through group dynamic exercises. The exercises help to strengthen teamwork spirit and problem solving skills, promote creativity and awareness on the importance and role of collective action and the need for mutual support. They also help the group members to learn about individual's role and behaviour that makes teamwork successful in addition to establishing a conducive climate for learning.

2.10 Transfer of Technology

Duveskog (2006) argued that the extension approach of transferring technologies to the farmers to directly transform their practices can bring 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 (Duveskog, 2006).

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. 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.

2.11 Adult Non-formal Education

FFS assume that farmers already have a wealth of experience and knowledge (Rola and Jamias, 2002). FFS harnesses this knowledge through the process of participatory agro ecological analysis and learning by doing. The focus is on effective communication at field level and not marketing of extension packages. Field issues are dealt with-in dialogue with farmers. Therefore, FFS is oriented to providing basic agro ecological knowledge and skills, but in a participatory manner so that farmers' experience is integrated into the programme (FAO, 2008).

One key factor in the success of the FFS has been that there are no lectures since all activities are based on experiential (learning-by doing), participatory, hands-on work. This builds on adult learning theory and practice (Rizal, 2008). Each activity has a procedure for action, observation, analysis and decision making. The emphasis is not only on "how" but also on "why". Experience has shown that structured, hands-on activities provide a sound basis for continued innovation and local adaptation, after the FFS itself has been completed. It is also one of the main reasons that farmer facilitators can easily run FFS once they know how to facilitate an activity, the outcomes become obvious from the exercise itself. The group dynamics exercises are part of the non-formal education methods used in the field school to enhance learning and development of capacity for collective action. Khisa (2004) has underscored major non-formal education methods used in FFS as sharing, case study, role play, problem solving exercises, panel discussions, small group and large group discussions, brainstorming and simulation games.

2.12 Farmers Perception towards the FFS Implementation

Farmers' perception toward agriculture is probably positive in nature. However, there may be specific negative views, opinions and perceptions which will vary depending on the

farmer's personal circumstances and system of farming (Sadati *et al.,* 2010). Attitude plays a critical role in the innovation decision process. In order to adopt any technology farmers must first develop a positive perception towards such innovation (Helali, and Ahmadpour, 2013). Perception in any social system is based on culture and technology aspect that define individuals in such society. However these perceptions can be moderated or changed by external factors such as information transfer from change agent and other communication channels which impact on adoption and can eventually influence in developing either positive or negative perception towards newly introduced extension approach (David, 2007).

2.13 Factors Facilitating the Dissemination of Agricultural Technology under FFS

Use of farmers as extension agents to disseminate new technologies to others are increasingly being adapted in smallholder farming systems (Dinpanah *et al*., 2010) Information is therefore considered as one of the most important resources in agricultural and rural development that assists the farmers to take decisions and appropriate actions for further development related to farming.

Agricultural extension has a strong reliance to transfer agricultural knowledge generated through research with the aim of acquiring useful information and changing attitudes and practices by farmers (Feder, 2004). It is considered as a process of bringing desirable change in the behavior of the farmers to adopt innovations related to agriculture in such a way that they are clear and convinced of their utility. Thus agricultural extension organizations are entrusted with the primary task of educating farmers and disseminating the latest agricultural technologies through various extension teaching methods including printed material, audio visual, agriculture extension services, farmer to farmer, indigenous and knowledge from other neighbours in the community (Niyegela, 2007).

According to Van den Berg (2007), experience has shown that FFS graduates often require follow up to develop their acquired knowledge and skill in order to disseminate technical package according to their local circumstances. Specific training on field study skills helps farmers to conduct studies in an independent and sound manner.

2.14 Factors Influencing Farmers Participation in FFS Training

FFS is a model that advocates a situation where farmers are provided with an opportunity to actively participate in learning and achieve greater control over the conditions that they face every day in their fields. The model gives the farmers a forum for 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 (Duveskog, 2006).

In order to enhance sustainable agriculture, coordination of information exchange between researchers, extension workers and farmers is of paramount importance. Innovations established by researchers with no involvement of the farmers are not sustainable. Furthermore, it has been observed that various innovations which are proposed by researcher do not make sense to the farmers because the role of farmer's knowledge is overlooked. Nederlof and Odonkor (2006) argue that the FFS aim is to allow integration of local knowledge and scientific knowledge to help building up farmer's better decision making in their farms.

Talibo (2011) observed that in many programmes it is better for the facilitator to be a farmer rather than Field Extension Worker (FEW) because farmers know their community well and speak the same language and they are recognized by the members of their social group.

There are manifold factors which are known to influence the rate at which farmers participate in FFS training programmes. These factors may differ from one place to another depending on socio-economic, institutional, technological and environmental settings. Therefore, understanding of these factors would lead to proper planning, management and evaluation of most FFS programmes currently being funded and managed by public and private institutions.Furthermore, participation of farmer in FFS increase when they receive clear information of innovation delivered. Rogers (1995) asserted that awareness and knowledge of a new study is necessary before taking decision. However Van den Berg (2004) proves that some farmers may take decision in participating in technology development even if they have little information on that technologies.

Means of information are critically important in technology transfer especially in FFS approach. All innovations have two important aspects namely the source and the target adoption unit. The former involves technology development like research in other development institutions where as the later involves farmers or other consumer of technology. Therefore developed innovations have to be communicated to the consumer or user. Rogers (2003) categorizes communication channels into localities and cosmopolites. Localities involves mainly interposal communication such as visit by extension officer and farmer to farmer contact while cosmopolites may also include some of localities means that mainly deal with information transfer to a large social community at the same time. It includes radio, television and other printed materials.

Means of communication have a great influence on the rate of adoption of innovation. Each innovation is best suited to a given type of communication means. Therefore it’s critically important to identify means of communication that will result into improved rate

of adoption of a given technology. Also depending on the level of illiteracy of target group and infrastructure, some means of communication do not bring about effective communication in all communities. So it's important to ensure the means of communication selected are suitable to a given community, for example physical contact is a well suited to FFS farmers.

2.15 Comparison in Production between FFS and Non FFS Farmers

Comparison of productivity among FFS and non FFS members is one of the important aspects in determination efficiency of FFS methodology in improving farmer's productivity and income.Crop productivity is defined as the value of production per unit area (Davis *et al*., 2010; Nyamai *et al.,* 2012). FFS members are expected to excel non FFS production performance. This is because FFS members are expected to transfer knowledge and skills gained in seasonal long training sessions to their own main farm after graduation (Truong, 2008).However, there is limited or conflicting evidence as to their effect on productivity and poverty, especially in many places (Davis *et al*., 2010; Godtland *et al*. (2004). This study therefore aims at assessing the performance of FFS group in order to shed light on the role of FFS in dissemination of technologies.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Description of Study Location

This study was conducted in Mlali, Hembeti and Dakawa wards of Mvomero District, which is one of the six districts in Morogoro Region. Other districts include Morogoro Rural, Kilosa, Kilombero, Morogoro Municipality and Ulanga. The District lies at an altitude ranging from 400 to 2000 meters above sea level and in 2012 had a total area of 7 325 (km^2) with a potential arable land of 5 493.75 km^2 (Mvomero District Planning Report, 2012). The District had bimodal type of rainfall pattern namely short rains which start from October to December, and long rains starting from February to May/ June with average rainfall of 600-2000mm per annum.(Mvomero District Planning Report, 2011).The District is favorable for agricultural production of crops such as paddy, maize and other crops.

The choice of the area of study was due to its accessibility by roads to various villages, passable at all times. Again the areas are selected because farmers from these wards were trained on improved paddy production practices under FFS and FFS have been employed for a number of years in trying to disseminate paddy production in the District, (Mvomero District Planning Report, 2011). But the average paddy production per farmer is still below the potential average per hectare. The national potential paddy production is five tons per ha. Based on that report, majority of paddy farmers in Mvomero District are still producing an average of 3.4 tons per ha which is far below the national average (Mvomero District Planning Report, 2011).

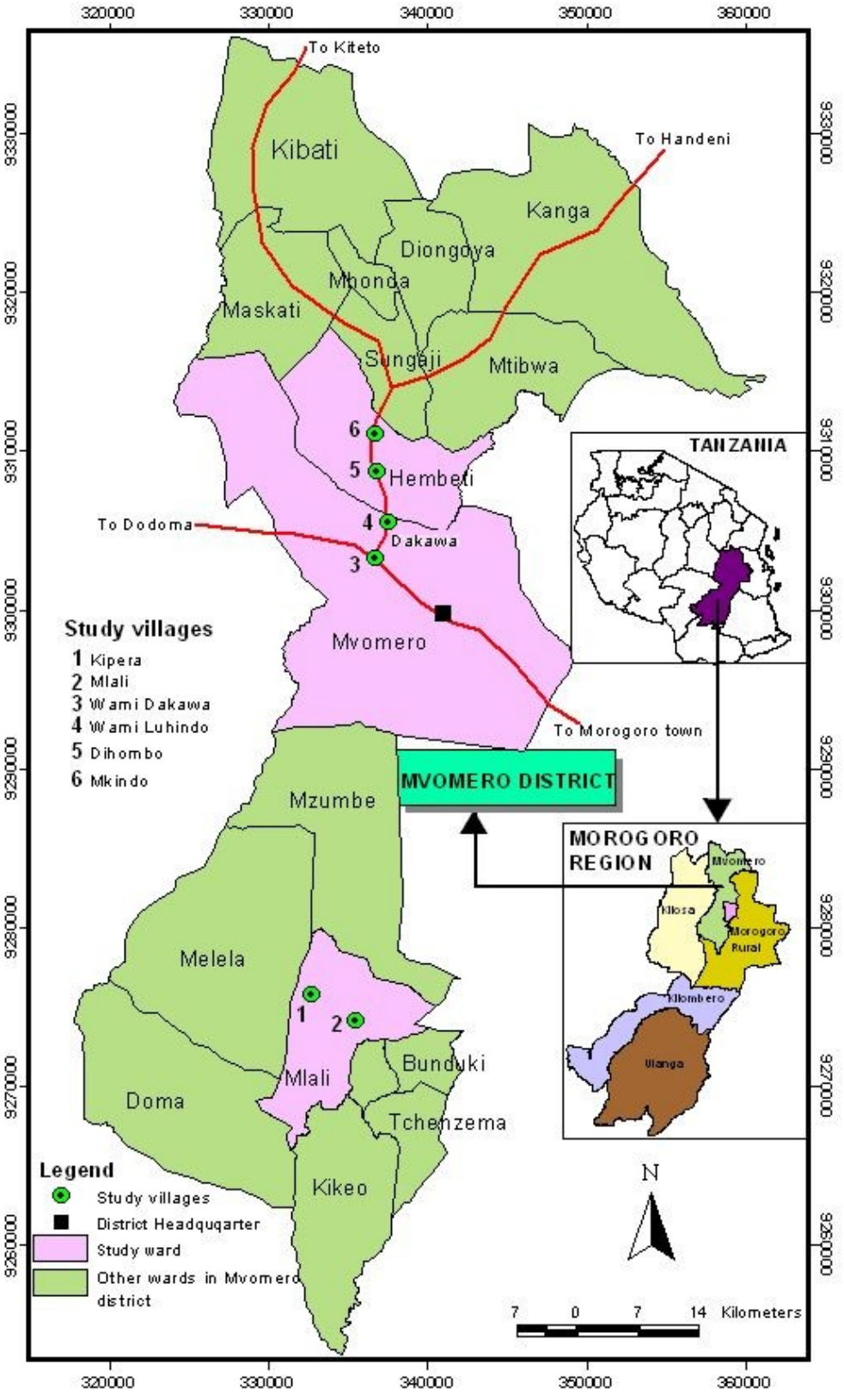

Figure 2: A map of Mvomero District showing study area

3.2 Research Design

This study employed a cross-sectional research design. According to Babbie (1990), it allows data to be collected at a single point in time from the sample selected to represent a large population. This design is considered appropriate because it is cost effective and it is less time consuming.

3.3 Sampling Frame and Sample Size Determination

3.3.1 Sampling frame

The sampling frame for this study was all paddy growing farmers in the study area covering 12 villages in Mvomero district.

3.3.2 Sampling procedure

Three wards namely Mlali, Hembeti and Dakawa were randomly selected and from each ward two villages were randomly picked to constitute a study area. From each village, all paddy growing farmers were stratified into FFS and Non-FFS farmers and from each group ten farmers were randomly picked to get a total of 20 respondents per village making a total of 120 farmers for the study.

3.3.3 Sample size

Bailey (1990) argued that the sample or sub sample of 30 respondents is bare minimum for a study in which statistical data analysis is to be done regardless of population size. Based on Yamane formula (1967) with a Confidence level of 95% and level of precision of 5%.which states that:

$n=\frac{N}{1+N(e)^2}$ Whereby,

N = Population size affected by the phenomenon under study (N = 2 739)

n= Sample size

e= Level of Precision level (sampling error) = 5% or 0.05

$$n=\frac{N}{1+N(0.05)^2}$$

$$n=\frac{2739}{1+2739(0.05)^2}$$

n= 349

Given the limitations of time, funding and support, this study involved 120 respondents from farmers who attended FFS training and farmers who did not attend FFS training in three selected wards in the study area which is reasonable for statistical analysis of this study.

3.4 Data Collection

3.4.1 Primary data collection

Primary data on socio economic characteristic of farmers, technologies taught under FFS, knowledge of farmers on paddy production and paddy production levels of farmers were collected. Also farmers' views on FFS as a training approach was measured based on their perception towards the approach and were scored using a likert scale ranging from one for agreed to three for strongly disagree. Data were collected using a structured questionnaire administered to 120 respondents. Structured questionnaire was designed in a set of open and close ended questions in respect to all three objectives. A checklist was administered to key informants on the extent on which FFS has addressed demand of needed technologies on paddy knowledge and to what extent FFS has influenced farmers to adopt and make use of knowledge.

3.4.2 Secondary data collection

Secondary data involved collection of information from different reports, books, village reports, Sokoine National Agriculture Library (SNAL) and web site.

3.5 Data Analysis

Data collected from the primary sources were organized, coded, processed and analysed using Statistical Package for Social Sciences (SPSS) version 12 computer programme.The quantitative primary data was analyzed to determine basic statistics as frequencies, percentages, mean and standard deviations. Descriptive statistics was used on the socio economic characteristic of respondents. Chi-square was used to compare knowledge acquisition on improved paddy production practices between FFS and non-FFS farmers.

Differences in production levels between the two groups were compared by t-test. General linear regression was to determine the influence of socio-economic factors on paddy production and paddy yield among respondents. Formula of General linear regression is as follows.

$Y_{ij} = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots, + \beta_6 X_6 + \varepsilon$

Where:

Y_i = observed paddy yield

$\beta_1, \beta_{2\ldots}, \beta_6$ = Coefficients of the independent variables showing how they influence Y

X_s = Independent variables

X_1=Age (years)

X_2=Sex (male or female, 1=Female, 0= otherwise)

X_3= Marital status

X_4 = Education level of the farmer

X_5= people involved in paddy production in household

X6= participation in FFS

0 = otherwise)

ε_i= Random error term showing the influence of other factors not explained in the model

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 Demographic Characteristics of the Respondents

The findings in Table 1 show socio-demographic characteristics of the respondents. Out of the 120 respondents from three wards 61 (50.8%) were males and 59 (49.2%) were females. Of the 120 respondents, 61 (50.8%) were married, 24 (20%) were divorced, 21 (17.5%) were single and 14 (11.7%) were widowed. Additionally, it was established that majority, 91 (75.8%) had primary school education while 27 (22.5%) had secondary school level of education and the remaining two (1.7%) had no formal education. On land ownership out of the 120 farmers, 56 (46.6%) acquired their land through inheritance, 35 (29.2%) through purchase and 29 (24.2%) rented the land.

Furthermore, findings show that out of the 120 respondents, 24 (20%) had their ages ranging between 18 and 24 years and 52 (43.3%) their ages ranged between 29 and 39 years. Also, 30 (25%) of the respondents their ages ranged from 40 to 50 years old, while 14 (11.71%) of the respondents had their ages ranging from 51 to 61years old.

Table 1: Distribution of respondents by demographic characteristics (n = 120)

Variable		Frequency	Percentage (%)
Sex	Male	61	51.8
	Female	59	49.2
	Total	**120**	**100**
Marital status of respondent	Married	61	50.8
	Single	21	17.5
	Widowed	14	11.7
	Divorced	24	20
	Total	**120**	**100**
Education level	Completed Primary education	91	75.8
	Completed secondary education form 1V	27	22.5
	No formal education	2	1.7
	Total	**120**	**100**
Land ownership	Inherent	56	46.6
	Bought	35	29.2
	Rented	29	24.2
	Total	**120**	**100**
Age of respondent	18-28	24	20
	29-39	52	43.3
	40-50	30	25
	51-61	14	11.7
	Total	**120**	**100**

4.2 Perceptions of Farmers on FFS Approach in Disseminating Paddy Production Knowledge

Farmers tend to have different perception towards some aspects of FFS as an approach for participatory knowledge development and dissemination. These perceptions are to a large extent dependent on individual characteristics of farmers, geographical location, economic activities and level of external support (Concern, 2010).

Respondents who had attended FFS were asked to indicate their perceptions towards FFS as an approach in disseminating paddy production knowledge and skills. Respondents were required to provide their opinions based on a likert scale ranging from one for agree to three for disagree on the various predefined aspects. 'Agree' indicates the relative strength of FFS and hence its role in contributing to the improvement of farmers' incomes through paddy production. On the other hand, 'disagree' indicated areas in which farmers identified weakness of FFS while a 'neutral' position indicated that FFS that neither positively nor negatively impacted on the economic welfare of the paddy farmers. In this study, an aspect is considered to have been agreed or disagreed when it was shown by at least 60% of respondents (See Table 2).

The findings in Table 2 show that 86.7 % of respondents agreed that FFS training helped in providing knowledge on paddy production while 85 % agreed that FFS increased contact with extension agents. Also 86.7 % agreed that FFS increased access of knowledge disseminated on paddy while 90 % agreed that FFS made farmer more competent in practicing knowledge on paddy production. More than 91% agreed that knowledge gained through FFS improved paddy management, while 80% were of the opinion that the knowledge gained through FFS made them to teach other farmers on good paddy production practices gained through FFS while 75% said that they usually learn from other

trained farmers on good paddy production practices, 91.7% maintained that they usually followed what they were trained during FFS.

On the contrary, it was noted in some cases that FFS groups could not remain coherent for a long time as shown by 75% of respondents. Probably this could be due to withdrawal of funding and facilitation extended during training that is not continued after farmers have graduated. Also, 95% of the respondents maintained that FFS did not continue receiving significant support from the government after graduation and 75% said that extension officers did not continue with their efforts to provide services to FFS members after graduation, reasons that could also have lead to disintegration of FFS group. These findings show that FFS, as an extension methodology has generally proved to be effective in participatory knowledge development and dissemination among paddy farmers in the study area. However there are challenges that should be addressed in order to maintain and further achieve positive and sustainable benefits. For example small financial and technical supports provided to FFS groups are only capable of maintaining them to graduation.

This implies that there was no institutional arrangement that was put in place and which could prepare conducive environment in enhancing long term achievement of FFS through follow ups as a means of technological reinforcement. This observation is consistent with results from a related study by Mvena *et al*. (2013) that one of the challenges in the FFS approach is sustainability of the activity once outside support comes to an end. Furthermore, results from key informant interviews supported this observation by asserting that farmers' groups disbanded immediately after graduation due to lack of funds and technical support.

Table 2: Perceptions of trained farmers on FFS approach in disseminating paddy production knowledge (n = 60)

Selected aspects of FFS	Responses					
	Agree	%	Neutral	%	Disagree	%
FFS training helps provide knowledge on paddy production	52	86.7	7	11.6	1	1.7
FFS increase contact with extension agents	51	85	8	13.3	1	1.7
FFS increase access of knowledge disseminated on paddy production	52	86.7	7	11.7	1	1.7
FFS makes farmer more competent in delivery of the knowledge on paddy production	54	90	4	6.7	2	3.3
Knowledge gained through FFS helps in increasing paddy production	54	90	4	6.7	2	3.3
Knowledge gained through FFS improve paddy management	55	91.7	3	5	2	3.3
Usually teach other farmers on good paddy production practices gained through FFS	48	80	8	13.3	4	6.7
Usually I learn from other trained farmers on good paddy production practices	45	75	12	20	3	5
Usually I follow what I learn during FFS session	55	91.7	0	0	5	8.3
FFS groups remain coherent for a long time after graduation	15	25	-	-	45	75
FFS continue receiving significant support from the government after graduation	3	5	7	11.7	50	83.3
Extension officer continues with their efforts to provide services to FFS members after graduation	15	25	-	-	45	75

4.3 Socio-economic Factors Influencing Farmers Participation in FFS Training

The influence of socio-economic factors of respondents on participation in FFS training was determined by measuring their level of satisfaction on knowledge obtained through FFS to the smallholder's socio-economic attributes.

4.3.1 Satisfaction on knowledge dissemination through FFS by sex

From FFS farmers out of 60 respondents 25 male. Out of 25 farmers 21 said were satisfied with knowledge disseminated on paddy production and 4 said were not satisfied with knowledge disseminated on paddy production and women farmers out of 35 farmers 29 said were satisfied with knowledge disseminated on paddy production and 6 said were satisfied with knowledge disseminated on paddy production. While from non FFS farmers there are 60. Out of 60 farmers 40 are male farmers, 15 said were satisfied with knowledge disseminated on paddy production and 25 said were not satisfied with knowledge disseminated on paddy production and female farmers out of 20 farmers 13 said were satisfied with knowledge disseminated on paddy production and 7 said were satisfied with knowledge disseminated on paddy production, and the differences in satisfaction in knowledge transfer between men and women was found not to be statistically significantly different, p= 0.097.

These findings are similar to a study conducted in Philippines. For example it is argued that FFS graduates had higher knowledge scores about IPM than the non-FFS control group (Rola and Jamias, 2002 cited by Mwasyete, 2012). It is further established in the same study that women farmers are good participants of FFS programmes than male farmers because they have both the time and patience to attend the weekly class for the whole season despite the fact that they are not chief decision makers in typical rural villages.

Table 3: Satisfaction of respondents on knowledge disseminated through FFS by sex (n=120)

Farmer status	Sex of respondents	Satisfied	Not satisfied	n	df	χ^2	P - Value
Non FFS farmers	Male	15	25	40	1	1.661	0.097ns
	Female	13	7	20			
	Total			60			
FFS farmers	Male	21	4	25			
	Female	29	6	35			
	Total			**60**			

ns= Not statistically significant at p< 0.05

4.3.2 Satisfaction of knowledge dissemination through FFS by education level of respondents

Table 4 Show satisfaction of knowledge disseminated through FFS by education level of the respondents. Of the 60 FFS farmers 39 (65%) acquired primary education and 21(35%) acquired secondary education. While 60 non FFS farmers 2 (3.3%) acquired non formal education, 52 (86.7%) acquire primary education and 6 (10%) acquired secondary education. Those who had no formal education indicated that they were not satisfied with the knowledge disseminated through FFS. This could be due to not showing practically during practice and training of farmers but using only documented materials which might limit those with no education to learn comfortably the skills imparted through FFS. The result from chi-square test, shows that there was significant association between education and satisfaction of extension services at ($p<0.02$). This implies that majority of the respondents can read and write in Kiswahili, the language mostly used in primary schools.

They can read magazines, newspapers, leaflets, agriculture reports and other written documents.

Table 4: Satisfaction of respondents on knowledge disseminated through FFS by education (n =120)

Farmers status	Education category	N	%	χ^2	P - Value
Farmers who did not attend FFS.	No formal education	2	3.3	7.881	0.002**
	Primary education	52	86.7		
	Secondary education	6	10		
	Total	**60**	**100**		
Farmer attended FFS	No formal education	-	-		
	Primary education	39	65		
	Secondary education	21	35		
	Total	**60**	**100**		

** Statistically significant at p< 0.02

4.3.3 Satisfaction of knowledge disseminated through FFS by age of respondents

Table 5 shows satisfaction of knowledge disseminated to farmers by age of respondents through extension services. The result from chi-square test shows that there was no significant association between age and satisfaction of extension services at ($p<0.05$). Rogers (2003) indicated that there is inconsistence about the relationship of age and innovativeness found that earlier adopters of agricultural innovations were younger. In this study the dominant age of paddy production in both wards ranged between 29-39 years farmers and 40-50 years. This study is in line with Matata *et al*. (2010) who found that the dominant age group among respondents participating in improved fallow practice among smallholder farmers in western Tanzania was composed of members with age ranging 20 to 40 years.

Table 5: Distribution of respondent on satisfaction of knowledge disseminated through FFS by age (n=120)

Variables	Farmers status	Age categories	N	df	χ^2	ρ– Value
Satisfaction on knowledge disseminated	Farmer attended FFS	14-24	14	1	1.941	0.246ns
		29-39	26			
		40-50	11			
	Total	51-61	9			
			60			
	Non FFS	14-24	14			
		29-39	20			
		40-50	21			
		51-61	5			
	Total		**60**			

ns= Not statistically significant at p< 0.05

4.4 The Regression Analysis on Influence of Socioeconomic Factors Influencing Paddy Yield

According to Kothari (2004) regression refers to the statistical determination of a statistical relationship between two or more variables. Beta values (β) which are the partial regression coefficients (as the optimal linear estimates of the dependent variables) reflects the weight to be applied to an in dependent variable when one or more specified independent variables are included in the equation. And the Standard Error (SE) is an estimator of magnitude of error that can be expected in estimating future values of the dependent variables. The t- value signifies the departure of the partial regression coefficients of independent variables. All t- values are compared to the standardizes regression beta (β) value**.** Results are presented in Table 6.

Table 6 shows findings of regression analysis on the annual paddy yield and socio-economic factors of respondents. The regression modal of annual paddy yield and socio-economic factors was statistically significant at (p = 0.002). Results show that age of the respondents, marital status, and farmers participation in FFS had statistically significant negative (+ β) influence on the annual paddy yield (at $p \leq 0.05$: t = -3212, -2.185, and -3.757 respectively). In other words, they were positively correlated with paddy yield. On the other hand, sex of the respondent, their education level and total number of people in household had no statistical significance effect on the level of paddy yield (at $p \leq 0.05$, t= -1281, 1.581 and -211 respectively).

Table 6: Regression analysis on socio-economic factors influencing paddy yield (n=120)

Predictors	**Un-standardized Coefficients**		**Standardized Coefficients**	**t**	**ρ–Value**
	B	**Std. Error**	**Beta**		
Age of Respondent	-3599.463	1120.803	-.400	-3.212	.002**
Participation in FFS	3033.753	807.461	.403	3.757	.000**
Sex of Respondent	-1019.909	796.351	-.137	-1.281	.203ns
Marital status	3486.377	1595.661	.274	2.185	.031**
Education level	2983.302	1886.880	.488	1.581	.117ns
Total number of people in household	-38.022	180.391	-.042	-.211	.833ns

NB: ** = Statistically significant at p< 0.05; ns=Not statistically significant at p<0.05

$R^2 = 51.2$.

4.5 Comparison of Production Levels between FFS and non FFS Farmers

Result in Table 7 show distribution of the respondent to their views on production levels between FFS farmers and non FFS farmers on paddy yield. Three factors namely reasons for increased production, paddy farm size (in hector) and annual paddy yield (in Kgs).

Table 7 considered the opinion of both FFS and non FFS farmers in the trend of their paddy production. Among the FFS farmers, 50 (80.3%) indicated that production level had generally increased, 6 (10 %) observed that production remained the same whereas 4 (6.5%) observed that production had increased. For non FFS farmers, 11 (18.3%) indicated production had decreased 33 (55%) indicated that their production remained the same and 16 (26.7%) felt that production level had decreased. In this case, the results implied that FFS farmers had realized more production compared to non FFS farmers. This might be due to the application of knowledge acquired during training.

Table 7: Views on trend in paddy production by attendance in FFS (n=120)

Variables	Responses	Frequency	%
Farmers attended FFS	Increasing	50	83.5
	Remained the same	6	10
	Decreasing	4	6.5
	Total	**60**	**100**
Farmers who did not attend FFS	Increasing	11	18.3
	Remained the same	33	55
	Decreasing	16	26.7
	Total	**60**	**100**

4.5.1 Reasons for increase in paddy yield

Findings in Fig. 3 below show the reasons given by both FFS and non FFS farmers. For FFS farmers out of 60 respondents 42 (70%) indicated that paddy production had increased due to application of knowledge gained through FFS training, 8 (13.3%) of the respondents felt that the production were increased due to improved practices and 10 (16.7%) of the respondents production increase due to coincidences of good weather.

While For FFS farmers out of 60 respondents 3 (5%) indicated that paddy production had increased due to application of knowledge gained through FFS training, 39(65%) of the respondents felt that the production were increased due to improved practices and 18 (30%) of the respondents production increase due to coincidences of good weather. This implies that FFS contributed significantly to the increased productivity in paddy production in the three wards.

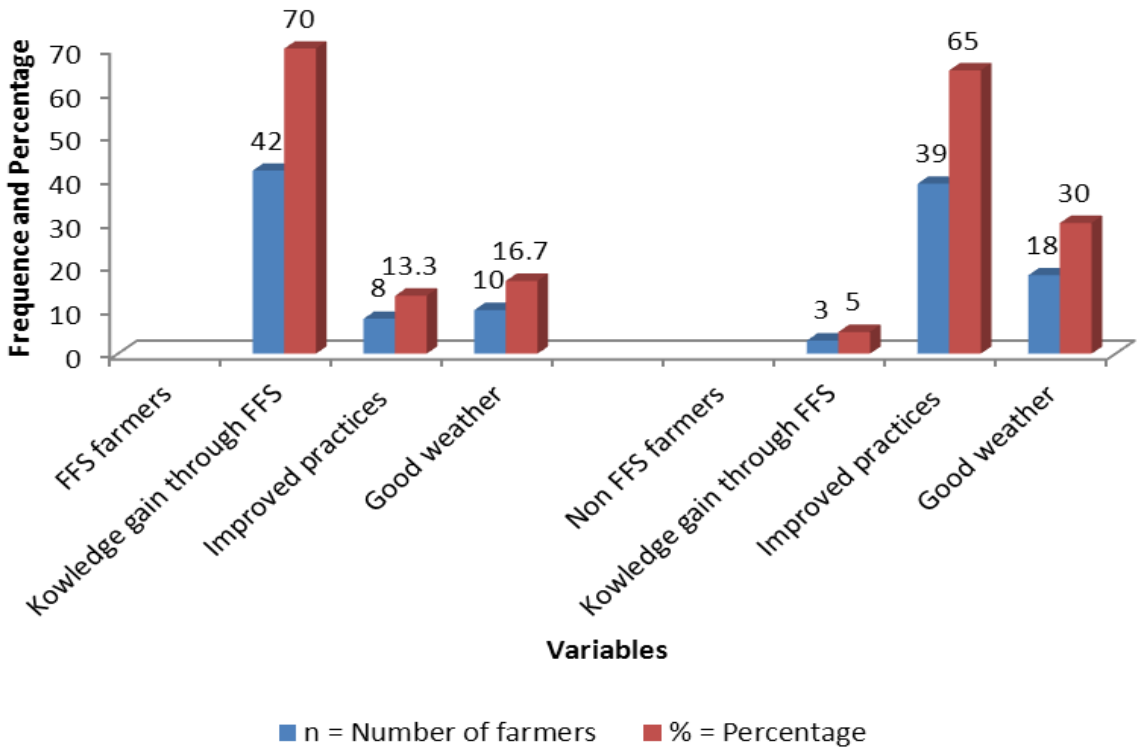

Figure 3: Distribution of respondent according to the reasons for increase of paddy production (n=60)

4.5.2 Size of paddy farms, average paddy yields and cost of production

Findings in Table 8 show that, size of paddy farms for FFS farmers ranged from a minimum of .50 to 12 hectare. While findings of non FFS farmer' shows that the size of paddy farm ranged from a minimum of .25 to 10 hectare. Findings from t- test shows

that there is no statistical significant difference in size of land between FFS and non FFS respondents (p= 0.321).

Implication of this result presented in Table 8 is that there were no statistically significant differences between FFS farmers and non FFS farmers on size of paddy farm. This furthermore implies that farm size did not influence paddy productivity. This is true because productivity depends on technology and improved practices applied in a given field rather than the size of the field.

Furthermore, findings from Table 8 show that the annual paddy yield ranged from 210 kgs to 25 200kgs with an average of 3187.05kgs. From the findings, yield for FFS respondents ranged from 650 to 25 200kgs whereas yield for non FFS respondents production ranged from 210 to 10 500 kgs. Findings from t- test shows that there is statistical significant difference in paddy production between FFS and non FFS respondents (p= 0.01).

The implication of this difference is that farmers who attended the FFS had benefited knowledge and skills gained in season-long training sessions for improved paddy practices compared to those who did not attend FFS training. It further implies that FFS was effective in improving paddy production in the study area.

These findings concur with those of some related studies conducted elsewhere. For example study conducted in Peru showed that FFS has been indicated to bring about improved agricultural production and productivity (Godtland *et al*., 2004). Additionally study conducted in Kenya showed that FFS participants were significantly better disseminators of technologies compared to non-FFS participants (Bunyatta *et al.,* 2011).

However, these finding were not inconsistent with those of Feder *et al.*(2004) who found that FFSs had no significant impact on crop yield in Indonesia. These differences in performance of FFS are possibly due to socio economic and physical situation in different parts in the world.

Addition finding from focus group discussion and key informants interviews supported findings from this study that paddy productivity for farmers who attended FFS training was higher than those who did not. This implies that farmers really benefit from knowledge and skill gained from season-long training through FFS.

Furthermore, findings from Table 8 show that the cost of paddy yields for the respondents who attended FFS training and those who did not attend the FFS. The findings show there is statistically significant difference in cost of production between farmers attended FFS training and farmers who did not attended FFS training ($p=0.003$).

This implies that economic power of farmers as measured by individual farmer's total annual income is of critical importance in influencing the level of paddy yield. This is because the more farmers improve their financial positions the more they are able to timely purchase inputs in the required quantity and quality, including acquisition of hired labour at peak periods. Findings from this study are consistent with Singha *et al.* (2011) with a study conducted in India where it was found that cost of production differ significantly between FFS group and non FFS group by show the same observation.

Table 8: Distribution of farms size, average paddy yields and cost of production between FFS and Non-FFS farmers (n=120)

Variables	Categories	n	Df	Mean	f	Sig
Paddy farm size in hectare	Farmers who did not attended FFS	60	1	2.5	.995	.321 ns
	Farmers attended FFS	60		2.9		
	Total	**120**		**2.7**		
Annual paddy yield in kgs	Farmers who did not attended FFS	60		1945	10.959	.001**
	Farmer attended FFS	60		4428		
	Total	**120**		**3187**		
Total income earned after selling paddy	Farmers who did not attended FFS	60	1	789 466	6.107	0.05**
	Farmers attended FFS	60		302 0616		
	Total	**120**		**1 905 041**		

ns= Not statistically significant at p< 0.05

**= Statistically significant at p< 0.05

4.6 Factors Facilitating Dissemination of Information to Paddy Farmers

4.6.1 Access to extension services by categories of farmers

The findings in Table 9 indicate that in FFS group 24 (40%), were visited every week, 17 (28.3%) were visited once per month and 19 (31.7%) were visited twice per month. While for non FFS farmers findings show that 9 (15%) of the respondents were visited by

extension staff once per week, 31 (51.7%) visited by extension worker once per month and 20 (33.3%) were visited twice per month. The findings show that there is significant difference in number of visits by extension workers between the two groups at 95% level of significant, p=0.04, thus p< 0.05. The chi-square results, however, reveal that there is significant difference in respondents' contact with extension officers between FFS farmers and non FFS farmers. These results support findings by Concern (2010) who reported that participation and adoption of innovation by farmers in FFS is high, when farmers are frequently visited by extension staff. Thus routine extension services are inadequate except where there are funded project.

Findings from focus group discussion and key informant interviews show that non-FFS farmers were inadequately covered with extension services compared to FFS members. It was revealed that extension officers were not motivated to attend non-FFS farmers because there were no funds to support them.

Table 9: Distribution of respondents by access to extension service (n =120)

Access to extension service	Number of contact	Frequency	Percentage	χ^2	ρ– Value
Farmers who did not attend FFS	Every weekly	9	15	10.927	.004**
	Once per month	31	51.7		
	Twice per month	20	33.3		
Total		**60**	**100**		
Farmers attended FFS	Every weekly	24	40		
	Once per month	17	28.3		
	Twice per month	19	31.7		
Total		**60**	**100**		

**= Statistically significant at p< 0.05

4.6.2 Information acquisition from other farmers

Findings in Fig. 4 show distribution of respondents based on access to agriculture information. For FFS farmers out of 60 respondents 57 (95%) access information of agriculture through farmer to farmer contact and 3 (5%) access information of agriculture through media. While for non FFS farmers out of 60 respondents 35(79%) acquire information through other farmers and 25 (21%) access information of agriculture through media. This implies that farmer to farmer contact was practiced by farmers within and without FFS groups. Moreover, FFS farmers practiced within group farmer to farmer contacts. Informal contacts with neighbours and friends were regarded as important source of information dissemination (Hulls, 1975 as cited by Niyegila, 2007).

This result indicates that major means of communicating technological information in paddy production was through farmer to farmer. These findings are also in accordance with those of Adong *et al.* (2013) about Factors to Determine

Membership to Farmer Groups in Uganda who found that farmer to farmer was important source of information on crop varieties and agriculture practices.

Other studies report that farmers show a higher level of adoption when new technology options are introduced by other farmers. Additionally, locally developed or adapted technologies increases the possibility for sustainable farmer-to-farmer extension services delivery (Duveskog *et al*., 2002).

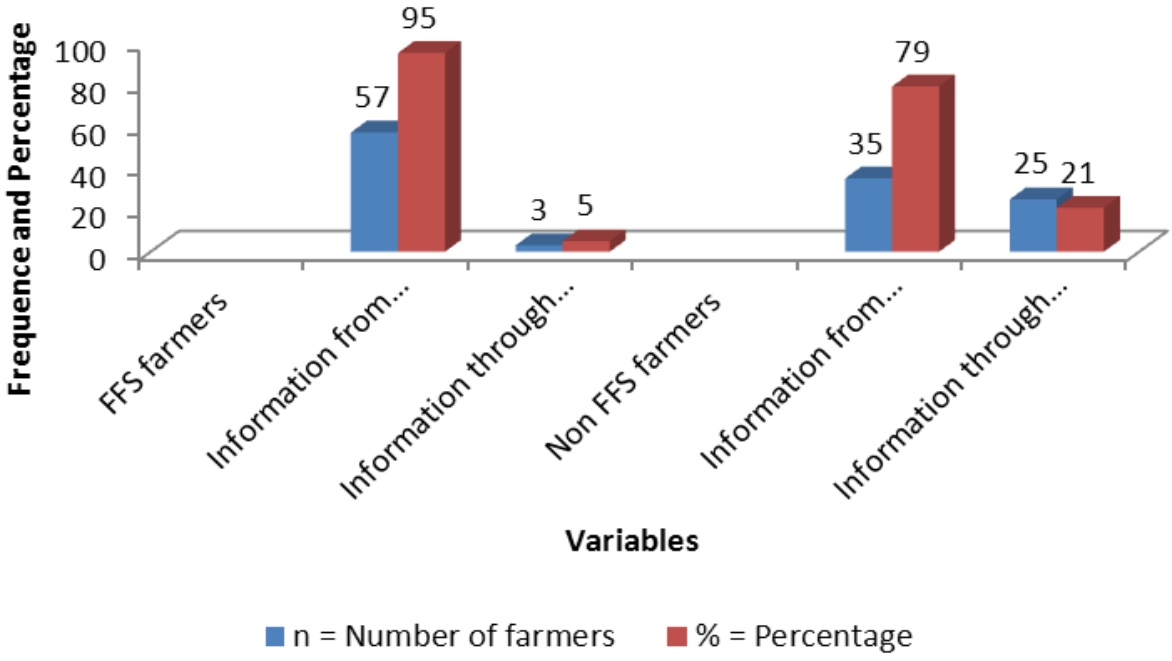

Figure 4: **Distribution of respondents based on access to agriculture information (n=120)**

4.6.3 Printed materials as a source of information to FFS and non FFS farmers

Findings in Fig. 5 show distribution of respondents based on access to agricultural information through printed materials. Of the 60 respondents, 52(86.7%) from FFS group access information through leaflets, books/booklets and posters. While 8 (13.3%) farmers access information through newspaper. Majority of the respondents acknowledged that using printed materials like news papers, magazine, leaflets and other type of written materials in agriculture. With respect to printed material, the findings of the study are in accordance with those of Sarhad (2011) who found that printed materials are the most preferred and useful sources of information. The findings from the present study are similar to those of Sarhad (2011) who found that the most effective forms of printed media were magazines followed by books/booklets, newspapers and posters. Findings imply that printed materials are some of most important source of information to farmers.

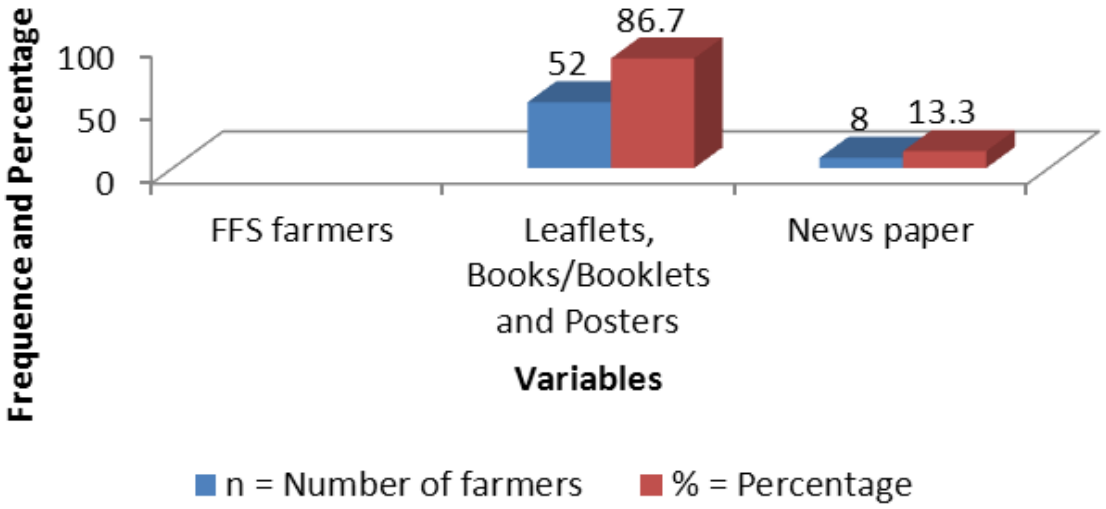

Figure 5: Distribution of respondent based on printed materials as a source of information

4.7 Motivation to Participate in the FFS Approach

Findings in Table 10 show distribution of respondents based on encouragement to participate in FFS approach. Of the 60 respondents from FFS group, 21 (34.9%) said that were encouraged to participate in FFS in order to improve productivity. Another 15 (25.3%) aspired to join FFS due to technology disseminated through FFS. While 14 (23.3 %) of the respondents were encouraged to participate after seeing good result from fellow farmers who FFS graduates. and 10 (16.6%) said were encouraged to participate in FFS through farmer to farmer interaction facilitated through FFS.

From the Findings, it can be seen that major reason for participation in FFS is the desire for improved productivity which leads to improved farm-based incomes. This is consistent with argument by Kasirye (2013) that a key determinant of sustained. participation of extension programmes and consequent adoption of improved technologies is the expected profitability of agricultural enterprises a result of such technologies.

The findings are related to what was reported by Van den Berg (2004), that smallholder farmers develop and apply their criteria in the context of their own goals and strategies for achieving family welfare through management of limited resources. Therefore participation of paddy farmers in FFS on production is related to the extent to which the programme fits the perceived characteristics of innovations as described by Rogers (2003), namely profitability, observability, trialability, compatibility and complexity. This is why the only 'acquisition of more technology' was not a popular response from respondents.

Also, successful farmers are a potential inspiration to other farmers who would as well like to excel in various agricultural aspects by learning from fellow farmers and pursuing the same ways which are thought to have brought the perceived benefits. In underscoring these observations, (Oster and Thornton 2009) assert that in any technology development and adoption process, peer effects is highly important in bringing about aggregate adoption of innovations over time and space. This was also in line with findings from focus group discussion and key informant interviews that showed that major reason to join FFS was the desired to improve productivity. The Findings are presented in Table 11.

Table 10: Farmers' encouragement/motivation to participate in the FFS approach (n=60)

Variables	Frequency	Percentage
Farmer to farmer interaction facilitated through FFS	10	16.6
To improve productivity enabled by FFS	21	34.9
Technology disseminated through FFS	15	25.3
Good result from fellow farmers who were previous FFS graduates	14	23.3
Total	**60**	**100**

4.8 Constrain to Participate in FFS Approach

Findings in Table 11 shows distribution of respondents based on constrain to participate in FFS approach. Of the 60 respondents from non FFS group, 22 (37.2%) said they did not participate due to lack of time and socio economic commitments, 20 (332%) did not participate due to the learning priorities are being imposed from out sides the group,13 (21.66%) did not participate due to lack of observable benefit from FFS while5 (8.33) did not participate due to inefficient of extension services to manage FFS.

Furthermore imposition of the learning topic from outside the group seems to be one of the constraints in the participation in FFS programmes. Sometimes learning topic are imposed from the district level in response to political reasons, interest of district agriculture officials or a requirement higher government authorities.

This situation is contrary to principle of FFS which advocates full participation and involvement of farmers in the whole learning season (Duveskog, 2006). This is because imposed topic does not capture farmers' interests there by leading to poor participation and consequent low uptake of technologies developed thereof.

Table 11: Farmers' constrain to participate in the FFS approach (n=60)

Variables	Frequency	Percentage
Lack of time due to socio economic commitments	22	37.2
Learning priorities are sometimes imposed from out sides the group	20	33.7
No observable benefit from FFS	13	21.7
Inefficient extension services	5	8.3
Total	**60**	**100**

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Based on the findings of the study, the following conclusions can be drawn:

i. FFS have positive impact in disseminating knowledge to paddy farmers and influence them to have positive perception on FFS as a model for technology transfer.

ii. Socio-economic factors like age of respondents, education level, income and marital status had influence on farmers' participation in FFS programmes.

iii. Farmer groups were found to disintegrate following the withdrawal of funding and facilitation that is not continued after farmers have graduated. Lack of institutional arrangement that are put in place limits the continuation and sustainability of FFS programmes as an approach for farmer to farmer exchange of knowledge.

iv. FFS have a positive impact on the productivity of paddy yield as evidenced by productivity variation between FFS and Non-FFS farmers. Paddy yields were relatively higher for the FFS trained farmers than those non FFS farmers. Farmers have positive perception towards FFS programmes as an approach for dissemination of knowledge to paddy farmers in the study area.

5.2 Recommendations

Based on the conclusions drawn from the findings, the following recommendations are made:

i. Mvomero District should maintain FFS training as a model for technology transfer by assist financial and technical supports in order for FFS to be sustainable.

ii. FFs initiated programmes should taken board understanding of socio-economic factors that impact on participation of smallholder farmers in the programme

iii. The government should continue supporting FFS by setting aside funds for follow up to improve and develop farmer's knowledge and skills gained through FFS programmes.

iv. Mvomero District Council and Central Government should enhance public-private partnership to ensure farmers access to the necessary agricultural services to enhance crop productivity through FFS.

v. There is need for extension agents to promote producer groups so that they could be trained under FFS approach to enhance crop knowledge and technologies dissemination among smallholder farmers

vi. The government, NGOs and other stakeholder should work together to help farmers to access information on agriculture through their FFS groups. In view of this the use of FFS groups, news papers, leaflet and other written materials as a source of information to other farmers will enable farmers to know more about FFS.

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APPENDICIES

Appendix 1: **Questionnaire: The role of Farmer Field Schools (FFS) in dissemination of technologies to paddy farmers in Mvomero District**

A. Respondent general information

1. Respondent's name:……
2. Name of village:……...
3. Ward:……
4. District:…….
5. Farmer attended Farmer Field School (FFS):…….
6. Farmer who did not attended Farmer Field School (FFS):……..
7. Date of interview:…….

SECTION B: Background information

1. Age of respondent in years

i.	18-28	
ii.	29-39	
iii.	40-50	
iv.	51 and above	

2. Sex of respondent

i. Male

ii. Female

3. Marital status of respondent

i. Single ii.

ii. Married

iii. Widowed

iv. Divorced

4. Size of household

i. Children of below7 years of age, Total ……...

ii. Children above 7 years of age but below 18 years of age Total ……

iii. With 18 years and above Total ……

5. Education level of respondent

i. No formal education

ii. Primary education

iii. Secondary education

6. Do you own land

i. Yes

ii. No

8. What type of land ownership

i. Inherent

ii. ii. Bought

iii. iii. Rented

9.What is your paddy annual yield per ha.

10. What was the total income after selling paddy

12 Do you afford to buy agriculture inputs?

i. Yes

ii. No

13. If no, where do you get income for buying agriculture inputs?

i. ……

ii. ……

SECTION C: FARMER'S PERCEPTION ON FFS APPROACH

1. Are you member of Farmer Field Schools (FFS) group?

i. Yes

ii. No

2. How often do you meet in FFS training?

i. Once per month

ii. Twice per month

iii. More than twice

iv. Not at all

3. Suppose the schedule of meeting changes, will you adhere to it?

i. Yes

ii. No

4. If no, give reasons …….

5. If yes, give reasons ……

6. Perception of trained farmers on FFS approach in disseminating paddy production knowledge

Selected aspects of FFS	Responses					
	Agree	%	Neutral	%	Disagree	%
FFS training helps provide knowledge on paddy production						
FFS increase contact with extension agents						
FFS increase access of knowledge disseminated on paddy						
FFS makes farmer more competent in delivery of the knowledge on paddy production						
Knowledge gained through FFS helps in increasing paddy production						
Knowledge gained through FFS improve paddy management						
Usually teach other farmers on good paddy production practices gained through FFS						
Usually I learn from other trained farmers on good paddy production practices						
Usually I follow what I learn during FFS session						
FFS groups remain coherent for a long time after graduation						
FFS continue receiving significant support from the government after graduation						
Extension officer continues with their efforts to provide services to FFS members after graduation						

SECTION D: Paddy production level of farmers

1. How many bags of paddy do harvest per ha.----- (number of bags)

2. What is the trend of paddy production have you experienced for the past three years

   i. Increasing

   ii. Decreasing

   iii. Remaining the same

3. If production increasing what do you think are the reasons?

   i. Coincidence of good weather

   ii. Improved practices (e.g. improved seeds, fertilizer, Weeding, pest and diseases control)

   iii. Others specify

4. Give the observed production trend do you think you will continue with application of gained Knowledge and skills in paddy production?

   i. Yes

   ii. No

5. If yes give reason/s

   i. ……

   ii. ……

6. What is your recommendation in order to improve technology transfer through FFS approach?

   i. ……

   ii. ……

SECTION E: Factors facilitating the dissemination of agricultural technologies under FFS.

1. Do you use Printed materials as a source of information?

   i. Yes

   ii. No

2. Where do you acquire paddy information?

   i. newspaper

   ii. Agricultural reports

   iii. farmers attended FFS training

   iv. Others (specify)

3. How often do you access extension service?

   i. Once per month

   ii. Twice per month

   iii. More than twice

   iv. Others (specify)

4. What motivate/encouragement you to join FFS?

   i. Farmer to farmer interaction facilitated through FFS

   ii. To improve productivity enabled by FFS

   iii. Technology disseminated through FFS

   iv. Good result from fellow farmers who were previous FFS graduates

5. What constrain hinder to participate in the FFS approach?

   i. Lack of time due to socio economic commitments

ii. Learning priorities are sometimes imposed from out sides the group

iii. No observable benefit from FFS

iv. Inefficient of extension services

THANK YOU FOR YOUR COOPERATION

Appendix 2: Checklist for key informants

1. Are you a member of FFS group?
2. How do you understand FFS approach?
3. How do you rank FFS as training methodology compared to other extension approaches?
4. Do FFS participant farmers share the knowledge with the non-FFS participating farmers?
5. If yes, how?
6. What is the situation on paddy improved technologies practices between FFS and non-FFS participating farmers?
7. Is there any difference in paddy productivity between the FFS and non-FFS participating farmers?
8. What are your opinions of FFS effectiveness on adoption of improved paddy technologies?

THANK YOU FOR YOUR COOPERATION

Appendix 3: Checklist for Village/Ward extension officers

1. Did you attend any FFS training?
2. What paddy technologies have you disseminated to farmers during FFS sessions?
3. Which technologies in paddy are mostly adopted?
4. Is there any change in productivity since farmers stated practicing in FFS? Give records for at least three years back.
5. How many non-FFS farmers have been reached by FFS members?
6. How many exchange visits do you perform and what farmers share amongst them?
7. How many field days do you perform in one crop cycle?
8. What did participants learn during those occasions?
9. What other support and motivations do you get from the District council/NGOs?
10. What needs to be improved?

THANK YOU FOR YOUR COOPERATION