SUSTAINABILITY OF HIMA PROJECT AGRICULTURAL TECHNOLOGIES IN IRINGA DISTRICT, TANZANIA

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ABSTRACT

Sustainability of Agricultural technologies in Iringa Rural has been questionable inspite of the introduction of several agricutural projects to conserve environment in Tanzania. This study aimed to assess the sustainability of HIMA project agricultural technologies in Iringa where: existence, performance, socio-economic and institutional factors that contributed to sustainability of agricultural technologies was studied. Cross sectional research design was used, Purposive sampling of 4 villages was done, 30 respondents in each village were randomly selected, 120 total respondents were interviewed. Results showed existence of technologies but some were poorly performed due to different socio-economic factors. Logistic regression and general linear model identified education level, Occupation, and Household size were statistically significant thus significaintly influenced factors on existence of agricultural technologies in the study area. The findings show that most respondents employed in agriculture are aware that key issues on agricultural policies are well addressed but implementation of By-laws are weak. However, some benefited with available financial institutions including SACCOS and trainings during agriculture shows. It was concluded that, most technologies still exist inspite of some performing poorly due to high management cost, incompatibility, financial constraints, inadequate extension for monitoring and evaluation and weak By-laws implementation. It was recommended that, the District should improve efficiency of extension services, farmers partcipation, trainings, seminars, certificates for better parformance as incentives to farmers, Financial empowerment to farmers to be important factors to consider during project introduction and implementation stage for technologies sustainability.

DECLARATION

I, **Yoakim Temelagos Kiyeyeu**, do hereby declare to the Senate of Sokoine University of Agriculture, that this dissertation is my original work done within the period of registration and that it has neither been submitted nor being concurrently submitted for degree award in any other institution.

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3/12/2014

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Date

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DEDICATION

This dissertation is dedicated to my Mother the late Elizabeth Utenga and my lovely Daughter Lydia whom I remember their words that education is open for people who want to study. However, they could not live to reap the fruit of my work; God's work has no mistakes.

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LIST OF ABBREVIATIONS AND ACRONYMS

CBFM	Community Based Forest management
CBNRM	Community Based Natural Resources Management
DALDO	District Agricultural and Livestock Development Officer
DANIDA	Danish International Development Agency
DCDO	District Community Development Officer
DED	District Executive Officer
EMA	Environmental Management Act
GDP	Gross Domestic Product
FGD	Focus Group Discussion
GLM	General Linear Model
FSN	Food Security and Nutrition
FFS	Farmers Field School
NGO	Non Governmental Organization
HIMA	Hifadhi ya Mazingira
IDP	Iringa District Council
IRSEP	Iringa Rural Socio-Economic Profile
ISNAR	International Service for National Agricultural Research
KIDAU	Kikundi Darasa Uhominyi
KPI	Key Performance Indicator
MAC	Ministry of Agriculture and Cooperatives
MAFS	Ministry of Agriculture and Food Security

MNRSA	Management of Natural Resources for Sustainable Agriculture
MSc	Masters of Science
NSGRP	National Strategies for Growth and Reduction of Poverty
OPV	Open Pollination Varieties
PCA	Principal Component Anaysis
SACCOS	Savings and Accounts Cooperatives Organizations
SPSS	Statistical Package for Social science
Std	Standard deviation
SUA	Sokoine University of Agricilture
TAPP	Tanzania Agricultural Productivity Progarmme
UNEP	United National Environmental Programme
URT	United Republic of Tanzania
USA	United States of America
VEC	Village Environmental Committee
VEO	Village Executive Officer
WEO	Ward Executive Officer

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Tanzania agricultural sector provides employment to 74% of the rural population (URT, 2011a). In 2006, it contributed about 75% of the total employment and 26.5% of the Gross Domestic Product (GDP) (URT, 2008). Between 1999 and 2006 the crop and livestock sub-sectors contributed approximately 35% of foreign exchange earnings. URT (2012) reported that livestock sector plays multiple roles in the livelihood strategies of the rural communities such as risk mitigation, food security and improved nutrition through food supply (meat, milk and eggs). It facilitates income generation, employment, provision of manure and draught power; and is also used for cultural purposes.

However, livestock and agriculture sector facing challenges on extension services delivery include decreasing number of extension staff, knowledge and skills among livestock stakeholders, including farmers', poor storage of crops, low level of production and land degradation due to poor farming methods (URT, 2011b). Technologies play an essential role in agricultural production and impact upon the life of farmers everywhere. Technical innovations such as the use of plough, crop rotations, fertilizers and much more have shaped the history of mankind, especially in our modern age where technologies are readily available and innovations plentiful agricultural activities expanded and production also have increased (FSN, 2010). A conservation programme, popularly known in Kiswahili as Hifadhi ya Mazingira

(HIMA) was introduced by Danish International Development Agency (DANIDA); in collaboration with Iringa Region in 1990. The head quarter of the project was in Iringa town, despite that the project concentrated mainly in Iringa Rural including Kilolo District, where implementation started before expanding to other districts of Njombe, Makete Mufindi and Ludewa (Orbicon, 2007; Minja and East 1996).

The purpose of HIMA was to promote sustainable agricultural production, natural resource management, and forestry production among farmers in Iringa Region of Tanzania. The pursuit of sustainability is motivated by dissatisfaction with the existing state of affairs. While many economists are concerned at the degradation of environmental quality associated with modern agriculture, others are concerned with the destructive impact that science-based technologies and modernization have had on lifestyle and culture (Zilberman *et al.*, 2004).

Sustainable agriculture is prescribed as a policy approach that maximizes economic benefits while maintaining environmental quality. It is argued that this approach is human capital-intensive and encourages new scientific developments. To attain sustainability, economic incentives for the development and adoption of precision technologies (with minimal residues that cause environmental damage) have to be developed (Zilberman *et al.*, 2004).

HIMA followed a participatory approach that involved the local population and tapped into relevant "indigenous knowledge". HIMA was integrated with and implemented through, local government structures, with the various district councils acting as executing agencies. Institutional sustainability was emphasized throughout planning and implementation (Orbicon and Gossgilroy, 2007).

Technology according to Peterson *et al.* (2003) is any idea, object or practice that is perceived as new by the members of a social system. The project had objectives of improving the productivity and sustainability of agriculture and natural resource management; catchments protection and soil erosion reduction (HIMA, 2007; Minja and East 1996). Therefore intervention areas were on soil and water conservation, agriculture, forestry, fisheries, participation and institutional arrangements (HIMA, 2007; Minja and East 1996). To achieve these objectives HIMA introduced various agricultural technologies such as contouring, home gardens, improved seed production, local chicken improvement and offspring Pass on, water sources protection, tree planting campaign, Organic farming, Improved storage organs, (granaries) and establishment of pasture plots for goats. These services and technologies were either given free to farmers or some cost sharing with agreement of proper management. The project lasted for thirtin (13) years and ended in 2003 where the farmers were left to continue with the technologies.

1.2 Problem Statement and Study Justification

Different agricultural projects and researchers have introduced agricultural technologies to help farmers to improve production (Orbicon, 2007). Byakugila *et al.,* (2008) explained that, currently technologies that would improve productivity were not sustained at all, or ceased to continue soon after project has stopped funding. Research experience from Zimbabwe showed that not all technologies were adopted, due to bio-physical factors (Soils, climate, and topography), institutional and technology characteristics (Baudeon *et al.*, 2007; Chiputwa, *et al.*, 2011).

Research carried out in tanzania by Orbicon (2007) in Kilolo District recognized that, technologies introduced by HIMA were highly accepted by farmers. The research concentrated on the impacts of the project to the community livelihood and poverty situation for people affected by HIMA, but did not report anything on the progress of the agricultural technologies that were introduced by the project. Many researchers focus on agricultural technological change and improvements to achieve the goals of reducing poverty by raising the welfare of poor farmers who adopt the technological innovations for present, productivity maximization, discover inputs including fertilizers and improved seeds, chemicals and machines (Uaiene, 2006; Orbicon, 2007).

Among many factors that contributed to growth in agricultural productivity, sustainability of the technology was the most important (Earles and Williams, 2005). Sustainable agriculture is one that produces abundant food without depleting the earth's resources or polluting its environment (Barungi *et al.*, 2013). It is agriculture that follows the principles of nature to develop systems for raising crops and livestock that are, like nature, self-sustaining. Sustainability of the technologies remains the main challenge for improving agricultural productivity (D'souza *et al.*, 2002). According to Wambura (2004) there are different socio-economic factors influencing existence of agricultural technologies, depending on farmers' characteristics, nature of technologies and a number of social factors. Thus, it should not extrapolate results from one location to another; hence need a specific location. The adopted technologies if well sustained can dramatically improve the well-being of agricultural households, but many questions about the determinants adopting sustainable technologies remain unanswered (Allahyari, 2009; Besley and Case, 1993). Sustainability of a technology according to Busiinge, (2010); Dietmar, (1989) is the ability of a technology or system to persist or donor aided programs to create systems that continue to connect and impact on the beneficiaries even after the programs are wound up. Allahyari (2009) evidenced that; agricultural extension services could play a key role in fostering sustainability through its educational programs. HIMA incurred costs to train extension staffs, farmers, Purchase some agricultural materials and good sub-centre offices and transport facilities as incentives with the expectation of meeting the objectives (Orbicon, 2007).

Despite the efforts that were invested by Iringa District and the phased out HIMA project, less was known on the sustainability of agricultural technologies that were introduced by the project in the district. The study was expected to bridge the information gap and the obtained results expected to be useful to other researchers and relevant staff of the district as well as assist governments, Projects in planning and other development partners involved in the development and promotion of sustainable agricultural technologies in Tanzania including other places with similar ecologies.

1.3 Objectives of the Study

1.3.1 Overall objective

The overall objective of this study was to assess the sustainability of agricultural technologies that were introduced by HIMA project in Iringa District, Tanzania.

1.3.2 Specific objectives

i. To assess the existence of agricultural technologies that were introduced by HIMA project in Iringa District
ii. To assess the performance of the existing agricultural technologies in Iringa Disrict
iii. To assess socio-economic and institutional factors influencing the sustainability of the introduced agricultural technologies

1.3.3 Research questions

i. Which agricultural technologies that were introduced by HIMA project still existing in Iringa District?
ii. What are the performance level of the existed HIMA project agricultural technologies
iii. What are the socio-economic and Institutional factors that influence sustainability of agricultural technologies?

1.4 Conceptual Framework

Research performed without the guidance of theoretical framework is usually sterile for the reason that the researcher does not know quite well what data to collect and when to have them and he or she put them to use (Chiemeke and Evwiekpaefe, (2011). For these reasons, the conceptual framework model about technology sustainability was developed. The modefied model was about acceptance of technologies which described that, the attitude towards accepting new technologies was of two sides; Negative or positive (Butt, 2004). From the conceptual framework, sustainability of Agricultural technologies was the dependend variable explained by the existence of the agricultural technologies and performance of the technologies which depend on technologies characteristics. The socio-economic and Institutional factors which also influenced by variables of age, sex, education level, marital status and Household size was cntributing factor towards sustainability of agricultural technologies. Institutional factors were identified to be government Policies, Acts, guidelines, Strategies, agriculture extension services, NGOs, CBOs, By-laws and financial constraints. Compatibility, Management cost, topography and climate were other biophysical factors that those factors may affect performance of the agricultural technologies to continue or cease (Chiemeke and Evwiekpaefe, 2011). Likewise, technologies characteristics such as acceptability, management costs, compatibility, relative advantage and complexity, bio-physical factors; soil, climate and topography was found to affect the existence and performance of agricultural technologies (Barungi *et al.*, 2013; Brey, 2010).

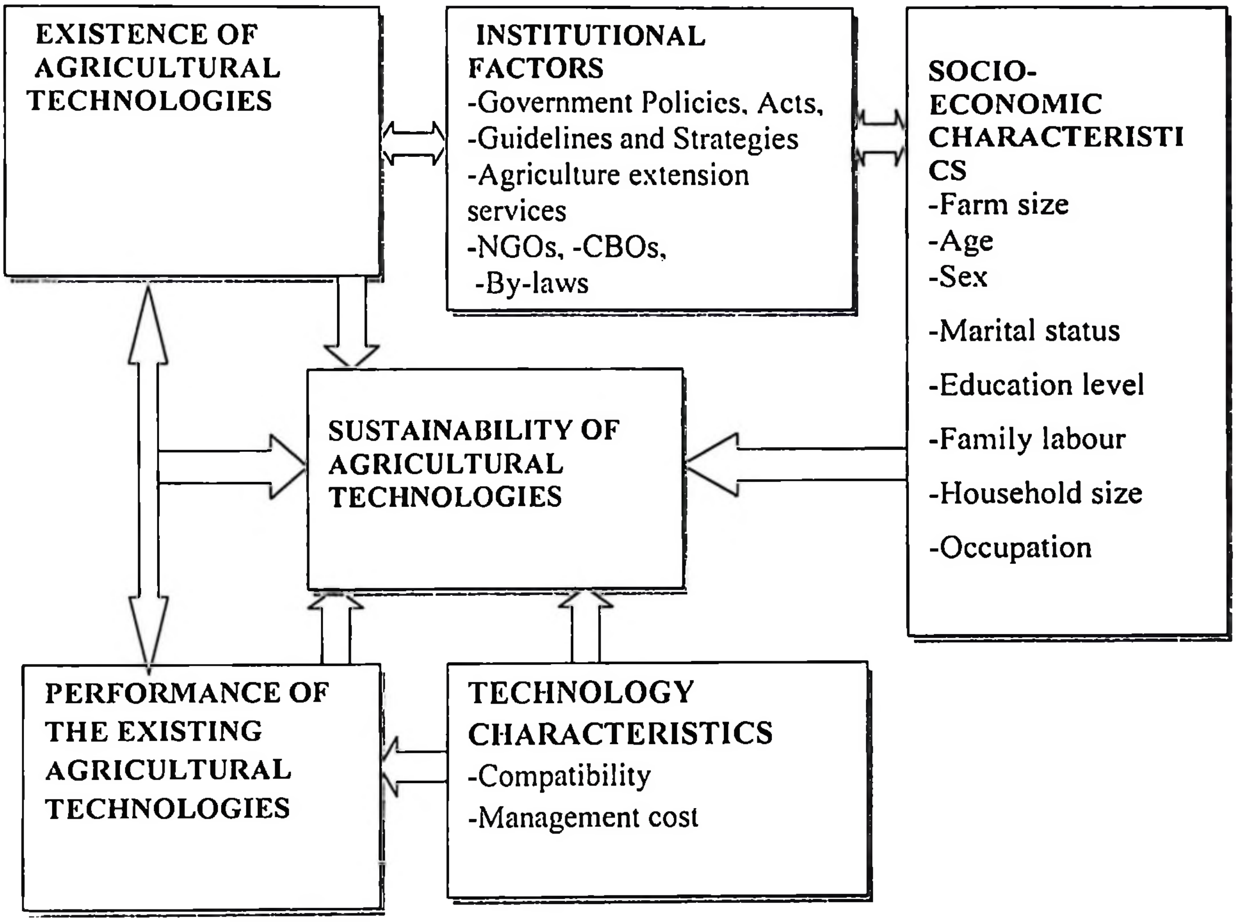

Figure 1: Conceptual framework of sustainability of agricultural technologies

(Modified from Butt, 2004)

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Existence of Agricultural Technologies

Sustainability according to Busiinge, (2010); Dietmar, (1989) is the ability of an activity or system to persist or donor aided programs to create systems that continue to connect and impact on the beneficiaries even after the programs are wound up. It refers to the capability and capacity of technologies to exist and maintained beyond the life of the project, particularly after the specific project funds are exhausted (Brey, 2010; Uaiene *et al.*, 2009).

In this context Sustainability of Agricultural technology considers the existence of the technologies to farmers after project phased out. Social aspect of Farmers, knowledge and awareness of resource conservation responses has agreed as one type of indicator by researches to measure the sustainability of agricultural technologies to a particular area (Manyong *et al.*, 2005; Peterson *et at.*, 2003). Due to variation in socio-economic factors, Institutional and technologies characteristics criteria used in one country are not necessarily applied to other countries Rasul and Thapa, (2003) cited by Brey, (2010). Therefore, indicators should be location specific, constructed within the context of contemporary socioeconomic situation (Berg, 2013; Brey, 2010; Mensah, 2000).

2.2 Factors Influencing Existence of the Introduced Agricultural Technologies

Research experience as observed by Sulo *et al.* (2012) revealed that, incompatibility of some agricultural technologies affect positively or negatively sustainability of other technologies. Management costs of some technologies beyond ability of farmers are said to influence the technologies sustainability. Ajay *et al.* (2006) explained that, some agricultural technologies require high management cost beyond farmer's capacity where eventually are left un developed due to farmes inability to pay running costs as a result the technologies ceased, other technologies require attention during manaement especiaaly during younger stage of hte life in case of plants and animals (Brey, 2010; Uaiene *et al.*, 2009).

2.3 Performance of the Existing Agricultural Technologies

Performance is a measurable value that demonstrates how effectively a company or project was achieved key business objectives (Peterson *et al.*, 2003). Performance refers to the need for technologies to be efficient producers of outputs that are relevant to the needs of stakeholders this is the principal measure of their effectiveness and before the technologies are measured their future performance, it needs to be able to measure and evaluate its present performance (Peterson *et al.*, 2003).

Peterson *et al.* (2003) added that, Key Performance Indicator may be of any value but should be a way to accurately define and measure it. For assessing the existence of agricultural technologies, two kinds of approaches are relevant: Those that assess organization in general and those that focus on assessing technologies performance

Lusthaus *et al.,* (2002) cited by Peterson *et al* (2003). More researchers argued that only through assessing the performance of the technologies a project can evaluate if the set objectives reached or requires extra monitoring strategies (Jabbar, 2003; Pretty, 2007).

2.4 Socio-economic and Institutional Charcteristics

Institutions may be defined as any form of constraint that human beings devise to shape human interaction (Foxon, 2002). Differences in socio-economic characteristics: Age, gender, education level of the respondents, occupation households size and marital status can be used to explain the difference between those who continue with and those who failed to continue with agricultural technologies (Ebojei, *et al.,* 2012). Subsistence farmers are more likely to sustain systems, techniques which seem familiar (Mead and Willey, 1980). Researches show that failure to exist of innovations could also be due to the socio-cultural outskirts of beliefs, values and traditional practices (Mvena and Mattee, 1988). Farmers' socio-economic characteristics can explain variables which includes: Age, sex, education, land size that may predispose a farmer to take an interest in an innovation (Nkonoki, 1994; Sulo *et al.,* 2012). The inevitable implication that measuring the influence of household characteristics in itself may provide insufficient explanations and thus there is a need for different approaches (Ajayi *et al.,* 2006). The informantin above should include changing behaviour and develop interest of environmental conservation and management of agricultural technologies. Extension and training are among the core functions of the Ministry of Agriculture and Cooperatives (MAC) and the agricultural sector as a whole, extension services, government policies, NGOs and any other social groups play part in continuous education provision and By-laws formulation. UNEP, (2003) explained extension services as an institution that encourages people's participation. Rantala *et al.* (2011) argues on rights and responsibilities in natural resource management based on national legislation and policies, as well as their perceptions of their ability to control natural resource use, legitimacy and interests regarding decision-making. Many of our environmental problems are not the result of 'bad' science but, rather, Inadequate policies, institutional and management systems (Zilberman *et al.*, 2004).

This is evidenced in different areas in Tanzania including Iringa Rural whereby despite the known scientific effect of deforestation, people still practice charcoal making in a commercial basis due to poor supervision of the policy of land management and finding alternative source of heat to reduce environmental degradation, to maintain environmental sustainability.

On improving Institutions strategies HIMA as reported by Orbicon (2007) shows that, even though many of the staff has taken up other employment, the district offices estimated that more than half of the Iringa District staff had received HIMA training. While HIMA attempted to improve staff capacity, most notably at the individual level, this initiative appears to have a more limited impact on the establishment of systematic changes, directed towards a more integrated decentralized planning within the districts (Rudebjer *et al.*, 2001). A number of donor agencies that have supported the United Republic of Tanzania's agriculture have had disappointing experiences due to: poor project design, a legal institutional and policy environment not conducive to the achievement of results and impact, failure to provide technically and commercially sound solutions (Hrubovcak, *et al.*, 1999). Ragasa (2012) literature, looks at factors affecting the various kinds of existed technologies explained that; many of them include institutions like farmer-based organizations, community-based organizations, cooperatives, self-help groups, informal networks and various forms of collective action including poor access to financial services by farmers or lack access to credits. Moreover, research show that, lack of capital and credits, incompatibility of the agricultural technologies to local norms, financial constraints, non membership of socio groups influence the sustainability of the technologies (Ebojei *et al.*, 2012; Sulo *et al.*, 2012).

Access to financial resources is important factor for technology existence, where financial capital is required to obtain the technologies and associated inputs (Baumüller, 2012; Ragasa 2012). Farmers are more willing to bear the financial risk in case the technology does not perform well. Financial resources may be available through institutional loans (URT, 2011a). In particular in the case of smallholder farmers, limited access to credit may provide an important constraint to technology existence (Poulton *et al.*, 2006; Baumüller, 2012).

Poor policy in utilization of academic researches done by researchers and motivations to farmers with self initiatives of environmental conservations, as well as empowering farmers to maintain introduced agricultural technologies. Research on impact evaluation of HIMA in Iringa Region that was done by Orbicon (2007) shows that, soil erosion was still a problem in different areas in the Region. Survey indicates some significant shifts in the use of different technologies. Assumption made by Limbu (1999) was that, often there was adequate profitable technologies on the shelf in which farmers can use to increase productivity and income hence reduce the level of poverty, but the assessment of these technologies have not been sufficiently integrated with the process of agricultural development.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Study Area

The study was conducted in Iringa District which has 5 divisions, 25 wards, 123 villages and 718 subvillages. Isimani was the only division that was under HIMA project in the District, where different agricultural technologies were introduced.

3.1.1 Location

Iringa Rural district is located between Latitudes 6^0 55' and 10^0 30' South of the Equator and between longitudes 33^0 45' and 36^0 55' East of Greenwich. To the North borders by Singida and Dodoma regions, Kilolo District to the East, Mufindi District and Njombe region to the south, West bordered by Mbeya region. Isimani is one of the five divisions of Iringa Rural in the north part of the District along Dodoma road.

3.1.2 Biophysical factors

Soils are red/yellow, well drained and highly weathered and leached clay soils in high altitude areas. Midlands areas are occupied by intermediate clay soils which are characterized by being moderately drained and leached. The lowlands are occupied dominantly by red brown loams and are highly fertile while Iringa dominated by the Kipengere and Livingstone mountain ranges in the southern part of the region and the Udzungwa Mountains separating Iringa and Morogoro regions in the east (IRSEP, 2008). The climate average annual temperature ranges from 15°C-20°C, with annual rainfall ranges from 500mm-1 000mm. The District has an areas of 20576sq km, of which only 9857.5sq km are habitable, while the rest is occupied by the National Parks, forests, mountains and bodies of water. The District has 480 158 hectares of arable land, which comprises 78% of the District's total land, yet only 34.1% (163 887 ha) is utilized for agricultural activities.

3.1.3 Socio-economic characteristics

The District population is 266 444 people comprising mainly of four major tribes as follows: Hehe 43%, Bena 37%, Kinga and Pangwa 11% and the rest tribes are 3% (IRSEP, 2008). Administratively Iringa District has 6 division, 20 wards and 199 villages, average households are 56 682, while agriculture is the main economic activities, followed by livestock keeping and fishing (URT, 2008).

3.1.4 Choice of the study area

The reason of carrying the study in Isimani Division Iringa District was that, it was the only division that was under HIMA project out of five divisions in Iringa District. Also the division had experienced problems of soil and water conservation, where soil erosion and deforestation due to poor farming methods were the main problems. Therefore the solution acoording to the district plan was introduction of Agricultural technologies as management measures to address those problems, hence it was a proper place for research to asseess the agricultural technologies sustainability.

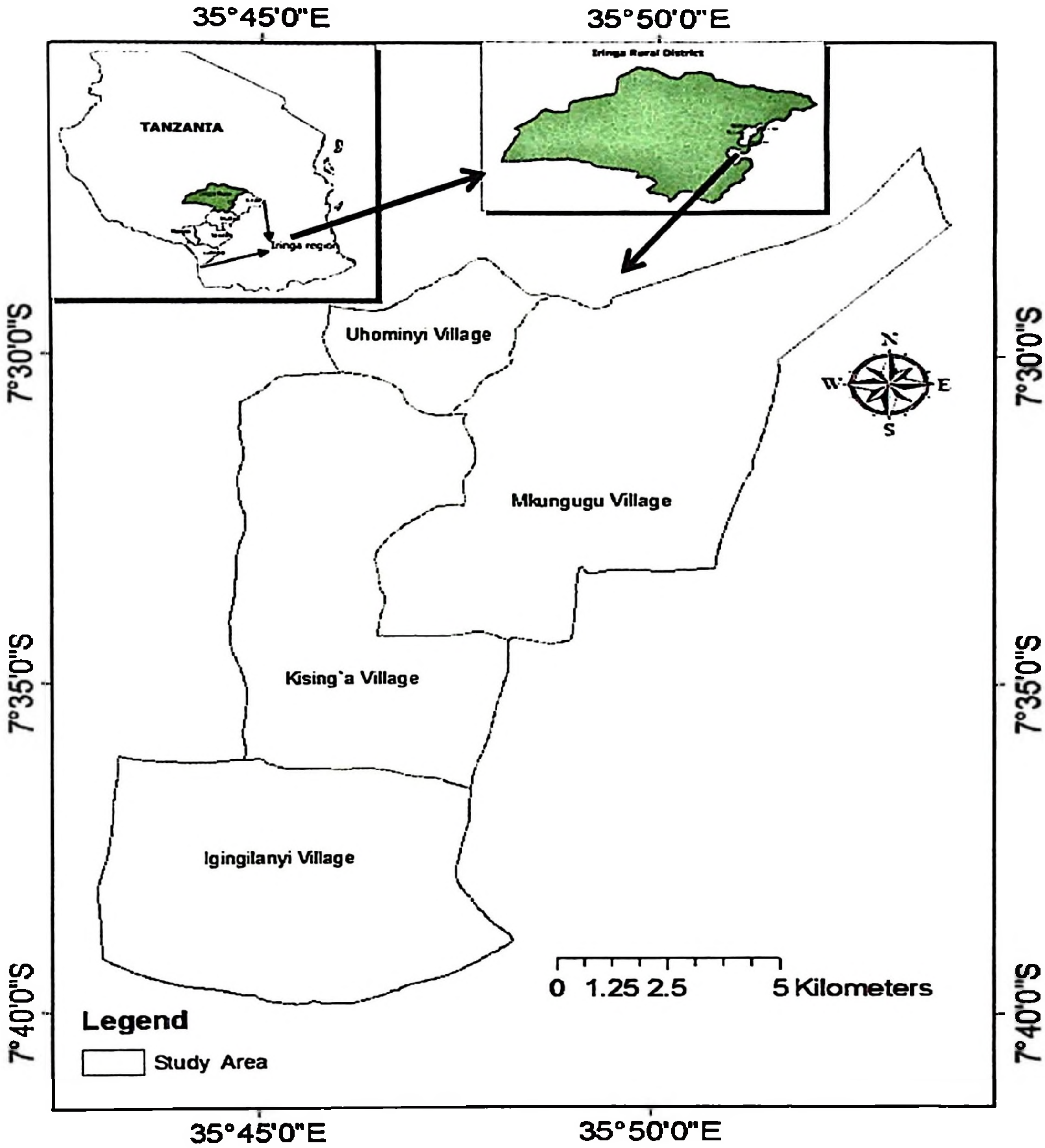

Figure 2: Location of study villages in Iringa District, Iringa Region, Tanzania

3.2 Data Collection

3.2.1 Research design

A cross sectional research design was used which allows data collection to be done at a single point in time; it was economical, accuracy and mostly commonly designs in social studies (Kothari, 2004). Data collection was assisted by other two staff who were trained for two days on how to perform interviews to farmers untill when they were sutsfactory. The staff were from village agricultural extension officers in the respective villages, for this case respondents were given information in the agreed time where by structured questionnaire was used and there was an arrangements for key informants interview and discussion with focus group.

3.2.2 Sampling and sample size

Purposive sampling was done where by two wards out of four wards that were covered by HIMA project, basing on villages that were adopted more different agricultural technologies where four villages out of 11 were also purposively selected. By using the existing list of household, 120 households 30 respondents each village was randomly selected. Procedure was adopted from Kombo and Tromp (2006) who argued that, significant population representation was achieved when a random sample of at least five percent of the total population was taken for the study, where each member within the population has an equal chance of being selected as a member of a sample (Table 1). All four villages were listed with their respectively names of all people involved in different technologies. Then names for each village was written on small pieces of paper and put on a basket and shake vigorously. One Village executive Officer (VEO) requested to pick thirty piece of paper from the basket then those names were given respectively numbers to qualify as the respondents for that village.

Table 1: Proportions of the sampled population per village

Division	Ward	Villages	House holds	Sample	Percentage
Isimani	Nduli	Mkungugu	353	30	**8.0**
Isimani	Nduli	Kising'a	345	30	9.0
Isimani	Nduli	Igingilanyi	459	30	6.0
Isimani	Kihorogota	Uhominyi	261	30	11
			1418	**120**	**8.0**

3.3 Existence of Agricultural Technologies

The interview method, by using structured questionnaire with open and closed end questions were used to collect primary data. Two enumerators were trained to get the assistant of collecting data. After understanding the procedure, pre testing of questionnaire to see the validity and ability of enumerators was carried out before start the actual work where five respondents were interviewed but data were not included, untill when it was clear. The direct observation method of the conditions for some technologies such as Fodder and pasture plots, Contours bands, animal housing and granaries, were observed directly from the field (plate 1,2,3,and 4). Respondents were asked to state the technologies that were introduced and if the technologies were existed or ceased during interview.

Plate 1: Contour bands stabilized by Vertiva grasses at Mkungugu Village Iringa District

Plate 2: Fodder cut for dairy goats at Kising'a Village Iringa District

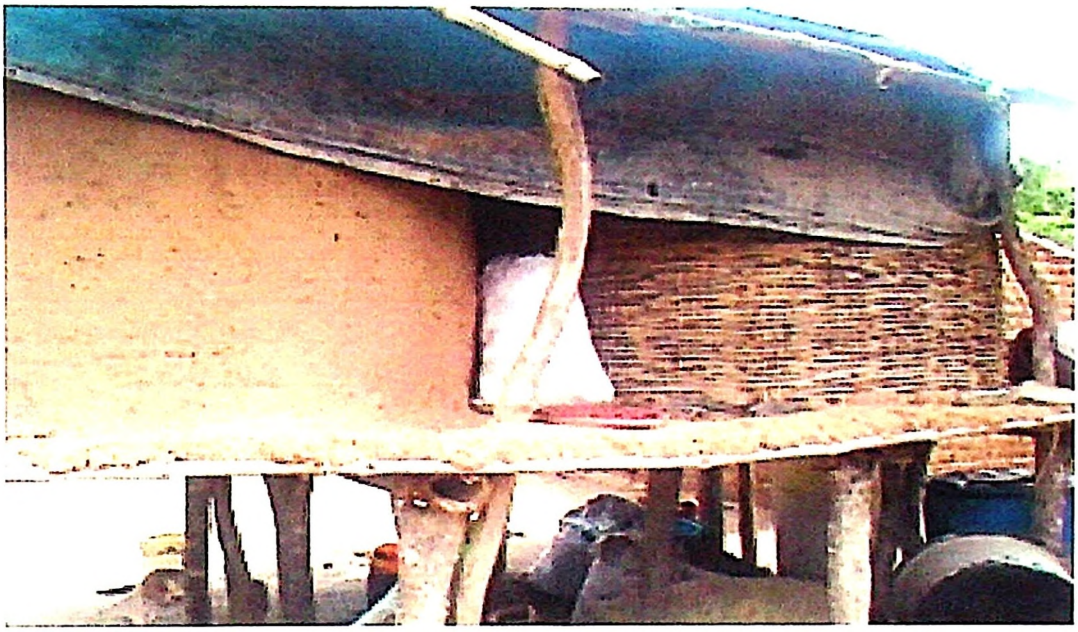

Plate 3: Improved granaries with grains at Kising'a Village Iringa District

Plate 4: Dairy goat husbandry at Kising'a Village Iringa District

3.4 Performance of the Existing Agricultural Technologies

Questionnaire was used to interview respondents. Repondents were asked to rate technologies that were existing to tell their condition and how they were performing according to their perception.They were required to rate in a form of four-point Likert scale 1=Very good 2=Good 3= Fair 4=Poor (Nyenza *et al.,* 2013; Oloko and Ogutu, 2012). The response were recorded by the researcher according to numbers coded in a questionnaire. Observation method was also used to see some of the technologies.

3.5 Socio-economic and Institutional Factors Influencing Sustainability of Agricultural Technologies

Data on socio-economic factors were obtained by interviewing the respondents on their households characteristics which were; age, sex, marital status, Household size, livestock keeping and grazing systems, land ownerships and all about households. General information of the respondents are collected by the use of household's questionnaires (Ebojei *et al.*, 2012). Closed and open ended questions were asked and also checklist for key informants at villages, wards and district levels was used. Focus group discussion (FGD) was also used, where different representative groups were selected, based on interested group one group of four women in each village and one groups of three livestock keeper's association, seven respondents were involved in discussion in each village as source of information. Research found that, a group of 6-12 people was ideal number as recommended by Onwuegbuzie *et al.*, (2009). Respondents were asked to state the different socio-economic factors influencing the sustainability of the agricultural technologies by the use of questionnaires and discussion as all ideas were regarded and recorded to make the respondents free enough to air out their views during discussion. Data from government offices were the main source of information for this objective, where secondary data from DALDO'S office about the type of technologies that were introduced by HIMA project were obtained.

Secondary data were collected from Government offices (DALDO's office and DCDO) who were involved directly during HIMA project implementation and available changes since the introduction of the project up to when it phased out by 2003. Topographic, soil characteristics and planned activities to sustain agricultural technologies were also obtained from the district, while data on climate, was obtained from Nduli airport metrological unit. WEOs/VEOs extension officer's reports and By-laws were used to get more information on consideration of agricultural technologies in their yearly plan. Journals, Books and researches from SNAL, internet were used to obtain data.

3.6 Data Analysis

3.6.1 Existence of HIMA project agricultural technologies

Data collected through questionnaires on the existence of the agricultural technologies were compiled, coded, entered into computer programme. Logistic regression analysis was employed to address the objective of existence of agricultural technologies where the dependent variables were binary that were used to determine the socio-economic factors influence on the sustainability of agricultural technologies (Katenka, 2012). The choice of binary logistic regression was because it allows modeling the event probability for a categorical response variable with two outcomes. A logistic regression was performed to assess the effects of socio-economic characteristics which were Age, Sex, Education level, Household size, Occupation and Marital status of the respondents if had influence to sustainability of agricultural technologies where by binary was existence of the technologies or not exist =Y. If the technology existed score (1) and if technology ceased scored (0). Socio-economic factors included in the analysis were X_1= Age, X_2=Sex X_3=Education X_4=Household size X_5= OcccupationX$_6$= Marital status. Statistical analysis was performed using statistical package for social science, by analyzing on the SPSS menu, Regression and binary where the result was automatically. Equation summary was $(Y) = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + ... + \beta kXk$............................(1)

Where: Y=the dependent variable, β_0 = Constant of the equation, β_1 to βk= Regression coefficients, (X_1 - Xk) = Explanatory variables.

All socio-economic variable were tested at p ($p<0.05$) to test its significance and correlations with the agricultural technologies.

3.6.2 Performance of the existing agricultural technologies in Iringa Disrict

Data collected through questionnaires on rate of performance of agricultural technologies, were compiled, coded and loaded into Statistical Package for Social Science version SPSS 16.0 computer programme, where four-points Likert scale that were coded, were used to rank the responses if were performed Very good, good, fair or if were poor and the number of responses were calculated. Variables with higher frequencies were regarded as higher performance and with less frequency, were regarded as low performed technologies. Regression analysis was used to analyze data and gave output to show the extent of data relationships existed between variables where also, results in standard deviation,means Frequencies and percentages were shown in form of tables (Beaumont, 2012). Multivariate analysis of variance (MANOVA) with Anova was used to test each technologies individually to see how were influenced by socio-economic factors. Is a type of multivariate analysis used to analyze data that involves more than one dependent variable at a time. Acccording to Grice, (2007) MANOVA allows us to test hypotheses regarding the effect of one or more independent variables on two or more dependent variables.

Research by Grice, (2007) pointed out that, if the overall multivariate test is significant; we conclude that the respective effect is significant. If only one dependent vriable, customarily we would examine the univariate *F* tests for each variable to interpret the respective effect. In other words, we would identify the specific dependent variables that contributed to the significant overall effect

Principal component analysis was used to reduce the complexity of agricultural technologies to a more manageable number, The analysis was performed after testing for linearity relationships and was described by four factors. PCA is a variable-reduction technique that aims to reduce a larger set of variables into a smaller set of 'artificial' variables, called 'Principal components which account for most of the variance in the original variables (Beaumont, 2012; Dariush and Mahshid, 2009; Nyenza *et al.*, 2013). PCA is a statistical technique used to discover which statements form independent of one another. Statements that are correlated with one another but are largely independent of other responses are combined into factors

(Nyenza., *et al.*, 2013). It is based on the assumption that certain underlying factors, which are smaller in number than the original number of statements, are responsible for the co-variation among the responses. The Scree plot, which the graph of the Eigen values against all the factors, was used to determine number of factors to retain. According to Beaumont (2012) the criteria used were the point where the sreeplot curve starts to flatten where Eigen value above 1, so only that factors have been retained, while variables below 1 was left. General linear model (GLM) univariate analysis of variance was used to assess the influence of age, household size, sex, marital status, level of education and occupation the univariate approach was chosen rather than the multivariate approach because the four principal components are statistically independent of each other.

3.6.3 Institutional factors that affect sustainability of agricultural technologies

Policies, By-laws and trainings were analyzed by comparing the extent of implementation given through response (Sanyal and Babu 2010). They were asked the extent of agricultural extension do incorporate the agricultural technologies issues in their trainings, financial facilitation, By-laws implementations, the available organization that are facilitating the communities. Content analysis was used to data collected by checklist for key informants including views on contribution of government to sustainability of technologies, views on the contribution of the institutions to sustainability of the technologies that eventually supported answers obtained from questionnaires. Roles of institutions and their relationships in supporting sustainability of agricultural technologies (Rantala *et al.,* 2011). Respondents were asked to tell the extent of agricultural technologies incorperated in extension programme, the knowledge on By-laws and if there are other organizations that support the respondents financially. The responses were coded and descriptive statistics analysis was used to analyze data and output were given out in a form of frequencies, means and percentages.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Existence of HIMA Project Agricultural Technologies

Table 2: Response of sampled farmers asked to tell existence of technologies

Technology	Number of respondents	Percentage
Contouring technology	49	40.8
Animal husbandry technology	76	63.3
Pasture /fodder plots technology	18	15.0
Organic farming technology	25	20.8
Improved Granaries technology	44	36.7
Compost making technology	88	73.3
Home gardens technology	60	50.0
Improved seeds technology	52	43.3
Passing- on of offspring programs	42	35.0

Note: Total number of respondents = 120

The Agricultural technologies that were introduce by HIMA project were: Contour technology, Animal husbandry and production, Pasture/fodder plots technology, Organic farming technology, Improved Granaries, Compost making technology, Home garden technology, Improved seeds technology and Passing off spring to other farmers technology. Research findings show that, most technologies were existing although most of them scored less response depending on the rate of development (Table 2). During discussion some respondents said that they were continuing with technologies that was not requiring high cost of management but if the technologies were not benefiting them directly they left un developed. Majority of the farmers out of 120 respondents 88 (73.3%) responded that compost making technology was existing, while Animal husbandry technology response were 76 (63.3%) and home gardening technology 60 (50%) (Table 2). The rest of the technologies were present but scored less response on compared to other technologies. Research results revealed that variation of technologies existence were due to different socio economic factors that were tested at $p<0.05$ which were: Education level of the respondents, Occupation and householdsize of farmers as showing direct statistically significant to the existence of organic farming, Improved seeds and the existence of Passing on offsprings within farmers (Table 3).

Technology that required high cost in management was left or developed by few farmers. Experience from other researches show that, majority of the farmers who were economically depending on agriculture, expected profitability was the driving factor (Keelan *et al.*, 2009). It was also added that, maintaining technologies always was not smooth, judging from trends observed in other areas that, agricultural technology existence was uneven not only for economical, but also temporarily (Kariyasa and Devi, 2012; Lowenberg-DeBoer, 2006).

Table 3: Respondents' responses on the existence of agricultural technologies and their significance

	Variable						
Technologies	Age	Sex	Households	Occupation	Marital tat	Education	Constant
Contouring							
B (SE)	.170	-175	.785	-2.011	-444	1.764	-1.651
	(0.322)	(0.430)	(0.445)	(1.009)	(0.578)	(0.731)	(2.116)
WALD	0.279	0.165	3.111	3.976	0.590	5.823	0.609
Df	2	1	2	1	1	2	2
P	0.598	0.684	0.78	**0.046**	0.443	**0.016**	0.435
Exp(B)	1.186	839	2.190	0.134	0.642	5.836	0.192
Animalhusbandry							
B (SE)	0.898	0.897	0.255	-.562	0.411	1.499	-4.350
	(.489)	(0.653)	(0.633)	(1.246)	(.835)	(.873)	(3.051)
WALD	3.380	1.888	0.163	.204	0.242	2.947	2.033
Df	2	1	2	1	1	2	2
P	0.066	0.169	0.687	0.652	0.623	0.086	0.154
Exp(B)	2.456	2.452	1.291	0.570	1.508	4.475	0.013
Pasture plots							
B (SE)	1.483	-0.347	-0.769	-19.27	18.39	1.412	-24.33
	(0.977)	(1.10	(1.179)	(1.29E4)	(8.286E3	(1.760)	(2.105E4)
WALD	2.305	0.099	0.425	0.000	0.000	0.644	0.000
Df	2	1	2	1	1	2	2
P	0.129	0.753	0.514	0.999	0.998	0.422	0.999
Exp(B)	4.406	0.707	0.463	0.000	9.702E7	4.104	0.000
Organicfarming							
B (SE)	-.286	-0.081	1.998	-18.565	17.715(8..32	.244	2.101E4
	(0.666)	(.923	(.909)	(1.281E4)	6E3)	(1.923)	(.000)
WALD	0.184	0.008	4.831	.000	0.000	0.016	0.000
Df	2	1	2	1	1	2	2
P	0.668	0.930	0.028	0.999	0.998	0.899	0.999
Exp(B)	0.751	0.923	7.371	0.000	4.937E7	1.277	0.000
Improved Granaries							
B (SE)	0.093	-0.353	1.166	-.627	-1.537	-.536	4.931
	(0.493)	(.659	(.628)	(1.151)	(1.151)	(1.036)	(3.449)
WALD	0.036	0.287	3.441	.297	1.782	0.268	2.044
Df	2	1	2	1	1	2	2
P	0.850	0.592	0.064	0.586	0.182	0.605	0.153
Exp(B)	1.097	0.702	3.208	0.534	0.215	0.585	138.535
Improved seeds							
B (SE)	0.119	-0.140	0.627	-2.081	-.345	1.780	-1.417
	(0.321)	(.430)	(.437)	(1.003)	(0.574)	(.731)	(2.101)
WALD	0.138	0.107	2.065	4.299	0.361	5.933	0.455
Df	2	1	2	1	1	2	2
P	0.710	0.744	0.151	0.038	0.548	**0.015**	0.500
Exp(B)	1.127	0.869	1.872	0.125	0.708	5.929	0.243
Pass-on offsprings							
B (SE)	.305	0.343	0.347	.964	-0.052	2.779	-9.565
	(0.388)	(.525)	(.528)	(1.038)	(.677)	(1.175)	(3.235)
WALD	0.618	0.427	0.431	0.863	0.006	5.592	8.740
Df	2	1	2	1	1	2	2
P	0.432	0.514	0.512	.353	0.938	**0.018**	0.003
Exp(B)	1.356	1.410	1.414	2.623	0.949	16.104	0.000

Note; Bold number are significant at $P < 0.05$, -2 log likelihood = 146.758a; Cox and Snell R2 = 0.116; Nagelkerke R2 = 0.157 Numbers in parenthesis denote Standard Error (SE) and those outside indicate standardized regression Coefficient (B)

4.1.1 Existence of contour technology

Research revealed that, education level had statistically significant influence on contour technology p=0.016, (Table 3) this implies that existence of agricultural technologies is influenced by the education level of the respondents in study area. The findings is in line with Ambali *et al.*, (2012); Manalled *et al.*, (2008) who found that, education increases the level of awareness of the farmers on the importance of innovation of the improved technology. Highly educated farmers could produce far more efficiently than they were able to in earlier times; the same amount of land could produce more food with less work (Nimoh, *et al.*, 2013). People were able to understand the benefit of the innovation at a faster speed than the uneducated. Generally, education is thought to create a favorable mental attitude for the acceptance of new practices especially of information-intensive and management-intensive practices (Wabibi; 2002; Makame, 2007; Rollins, 2009).

It was also revealed that there was a statistically significant influece in occupation of the respondents at p=0.046 (Table 3). This means that contour technology is influenced by occupation of the farmer in the study area. Occupation characterized by more income, knowledge, possession and authority. If you want to farm sustainably, there are certain measures you need to undertake in order to move toward that goal (Zilberman *et al.*, 2004; Ambali *et al.*, 2012). Research revealed that majority of farmers in the study area who had ability in terms of financial and knowledge were more practising contour farming. This was identified during field discussion with farmers. It was also observed that, respondents who were employed in an organization in the study area some belonged to farmer-based organization in

KIDAU and SACCOS. Research experience by Nimoh, *et al.* (2013) found that occupation and farmer-based organization membership positively influenced access to credit.

4.1.2 Existence of organic farming technology

Household size of the respondents show statistically significant where p=0.028 and the Research findings regarding the relationship between household size and existence of organic farming technology was higher than other socio-economic factors, despite of not being developed by the farmers. According to Zilberman *et al.*, (2004) organic farming aimed at using more ecologically sensible practices with requires labour and skills. This implied that, the existence of organic farming technology was influenced by number of people in households. This findings was in line with research by Hazali, (2013) which showed that there is significant relationship between households size and agriculture production in most rural areas where farmers depend much on their family labour for farm work especially when there is no mechanization and the use of hazardous chemical such as herbicides which are not environmentally friendly. Labour Constrain therefore: inhibits farm size, reduces farm out put as there will be no surplus produce to sell and hence reduced household income obtained from agricultural activities (Din, 2011).

4.1.3 Existence of improved seeds technology

Findings show that, only occupation and education level are statistically significant p=0.038 and p=0.015 (Table 3). Majority of the respondents argued that the number of people who used improved seeds were higher compared to previous due to government provision of subsidies. They also complained on high price of inputs in agricultural shops where farmers with low income were not able to purchase, People with employment and different sources of income were able to purchase improved seeds from agricultural inputs shops. This implying that farmers with low earnings in their occupation, purchasing power of improved seeds is low while farmers with employment in organization and other sources of income have higher purchasing power, therefore were able to purchase improved seeds even without government subsidies. Education level of respondents showed statistically significant influence at P=0.015 on the existence of improved seeds technology (Table 3). Other researchers supported that farmers with higher education possess higher abilities and are able to adjust faster to farm and technologies sustainability (Crook *et al.,* 2011). It was more observed that, effect of socio-economic factors on existence of technologies was greater in the area which has more access to outside information and off-farm activities (Kebede *et al*., 1990). Farmers with formal education their attitudes and thoughts were usually more open, rational and able to analyze the benefits or advantages of the technology so that made much easier to respond to innovations (Kariyasa and Devi, 2012). This implies that education level o the respondents has influence on the existence of improved seeds technology and hence the existence of agricultural technologies in the study area.

4.1.4 Existence of passing offspring of small stocks to neighbour farmers

The findings showed that education level of farmers was statistically significant to Passing offsprings at $p<0.018$ (Table 3) implying that education level of the respondents influenced the existence of passing off springs of goats and piglets to other farmers in the study area. This technologies was aimed to circulate small stocks of goats and pigs to majority of farmers in the study area through giving each other the young animals of dairy goats and pigs to neighbour famers. Research found that majority of the farmers completed primary school level, but received more training before HIMA project phased out. Farmers said that the technology phased problems as some farmers were not ready to give animals to neighbouring farmers and speed of passing animals to other farmers in the study area was slow but farmers who received knowledge on passing on were ready to release animals to other farmers.

Keelan *et al.* (2009) findings realized that, farming experience and education from extension services was an opportunity to support in promoting of technologies to farmers. During focus group discussion, a group of livestock keepers were able to tell that, she was give dairy goat from HIMA project and was multiplied to seven where it be came so helpful to her family as she got money by selling milk to neighbours, exposure to other farmers from outside when selected to attend such as Nane nane show, where some attend with their animals and train other farmers, learn themselves from others. Others said that farmers who use manure to grow their crops, the production were increased even if they were not able to tell the increased amount. This went in line with research by Jackson *et al.* (2012) who found that, Goats have faster reproductive rate, shorter generation interval, are cheaper to buy and require fewer facilities for up keep and maintenance than cattle. Goat enterprises make quick returns on invested capital, due to the importance of goat as source of food and in reducing poverty to small scale farmers. This implies that education level of the respondents had an influence on the existence of passing offsprings of small stocks within farmers, inspite of the technology shows less score in assessing the existence of the technologies. Research revealed that all other technologies: Animal husbandry technology, Pasture/fodder plots technology and improved granaries technology, were not statistically significant to all socio-economic factors of age, sex, Household size, Occupation, marital status and education level of the respondents. $p>0.05$ (Table 3). This implies that the existence of those technologies in the study area were not due to socio-economic factors.

4.2 Performance of the existing agricultural technologies in Iringa Disrict

Findings in (Table 4) show that, Compost making technology performed well 94 (78.3%) (Table 4) while Organic farming performed poorly whereby out of 120 respondents 93 (71.5%) said that, the technology was poorly performed Contour technology was the next poorly performed whereby the respondents were 91 (75.8%) Pasture plots 86 (71.7%), passing offspring to other farmers 84 (70%) (Table 4). This finding indicates that presence or the existence of the technologies were not depend on the performance of the technologies.

During discussion some respondents said that farmers failed to practise zero grazing due to its tedious work which requires cutting fodder and pasturing for their goats, when the number of animals increased therefore opted to practise free range system to satisfy their animals. Some farmers in the study area keep large number of livestock especially cattle and goats, these animals graze under free range system causing big destruction of the agricultural technologies such as contour bands. Poor performance of some agricultural technologies was due to less information of available By-laws and weak implementation of By-laws that are known by farmers as it was observed through farmer's response. However, contour bands that were stabilized by vertiva grasses were performing very well.

Table 4: Performance of agricultural technologies

Agricultural technologies	Scores on the performances							
	Very good		Good		Fair		Poor	
	n*	%	n*	%	n*	%	n*	%
Contour technology	3	2.5	26	21.7	0	0	91	75.8
Animal husbandry	10	6.3	60	50	7	5.8	43	35.8
Pasture plots technology	4	3.3	27	22.5	3	2.5	86	71.7
Organic farming technology	0	0	20	16.7	7	5.8	93	77.5
Improved Granaries technology	10	8.3	59	49.2	1	0.8	50	41.7
Compost making	0	0	94	78.3	13	10.8	13	10.8
Home garden technology	0	0	67	55.8	7	5.8	46	38.3
Improved seeds	10	8.3	63	52.5	2.7	1.7	45	37.5
Passing offsprings	3	2.5	31	25.8	2	1.7	84	70

n*=Number of Respondents, % their percentages.

The findings show that granaries technology was used by farmers with high production. However, during discussion respondents showed to shift to the technology slowly by storing their produce in sacks, stores or into their rooms where they suggested was safer. Compatibility of some technologies was another issue, considering their grazing systems to be free range grazing systems, it was difficult to maintain contour technoloy and established pasture/fodder plots.

By using MANOVA, analysis was performed and the findings of the model show a significant influence of occupation on the performance of the technologies. It is significant for all multivariate tests which are Pillai's Trace, Wilks' Lambda, Hotelling's Trace and Roy's Largest Root (Table 5).

Table 5: Results for multivariate analysis of variance (MANOVA)

Effect	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept						
Pillai's Trace	0.982	5.782E2[a]	9.000	98.000	0.000	0.982
Wilks' Lambda	0.018	5.782E2[a]	9.000	98.000	0.000	0.982
Hotelling's Trace	53.105	5.782E2[a]	9.000	98.000	0.000	0.982
Roy's Largest Root	53.105	5.782E2[a]	9.000	98.000	0.000	0.982
Age						
Pillai's Trace	0.174	1.050	18.000	198.000	0.406	0.087
Wilks' Lambda	0.831	1.056[a]	18.000	196.000	0.400	0.088
Hotelling's Trace	0.197	1.061	18.000	194.000	0.395	0.090
Roy's Largest Root	0.156	1.712[b]	9.000	99.000	0.096	0.135
Sex						
Pillai's Trace	0.057	0.664[a]	9.000	98.000	0.740	0.057
Wilks' Lambda	0.943	0.664[a]	9.000	98.000	0.740	0.057
Hotelling's Trace	0.061	0.664[a]	9.000	98.000	0.740	0.057
Roy's Largest Root	0.061	0.664[a]	9.000	98.000	0.740	0.057
Marital status						
Pillai's Trace	0.215	0.637	36.000	404.000	0.951	0.054
Wilks' Lambda	0.800	0.628	36.000	368.989	0.955	0.054
Hotelling's Trace	0.232	0.621	36.000	386.000	0.959	0.055
Roy's Largest Root	0.094	1.056[b]	9.000	101.000	0.402	0.086
Household size						
Pillai's Trace	0.231	1.434	18.000	198.000	0.119	0.115
Wilks' Lambda	0.782	1.426[a]	18.000	196.000	0.122	0.116
Hotelling's Trace	0.263	1.418	18.000	194.000	0.126	0.116
Roy's Largest Root	0.169	1.858[b]	9.000	99.000	0.067	0.145
Education						
Pillai's Trace	0.231	0.927	27.000	300.000	0.574	0.077
Wilks' Lambda	0.784	0.925	27.000	286.853	0.576	0.078
Hotelling's Trace	0.258	0.923	27.000	290.000	0.579	0.079
Roy's Largest Root	0.156	1.732[b]	9.000	100.000	0.091	0.135
Occupation						
Pillai's Trace	0.219	3.061[a]	9.000	98.000	**0.003**	0.219
Wilks' Lambda	0.781	3.061[a]	9.000	98.000	**0.003**	0.219
Hotelling's Trace	0.281	3.061[a]	9.000	98.000	**0.003**	0.219
Roy's Largest Root	0.281	3.061[a]	9.000	98.000	**0.003**	0.219

Bolded titles are socio-economic factors

The occupation of the respondents was statistically significant at p=0.032, where only contour technology shows to have influenced by occupation of the respondents in the study area. The other agricultural technologieswere of animal husbandry, pasture/foddes, Organic farming, Improvrd granaries, Compost making, Homegardening, Improvrd seeds and passing offsprings technologies were not influenced by occupation of the respondents in the study area.

Table 6: Univariate tests for the effects of occupation on the performance of technologies (p values)

Source of variation	T1	T2	T3	T4	T5	T6	T7	T8	T9
Corrected Model	0.412	0.220	0.318	0.168	0.189	0.032	0.079	0.388	0.477
Intercept	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Occupation	0.412	0.220	0.318	0.168	0.189	0.032	0.079	0.388	0.477

T1=Contour technology, T2=Animal husbandry, T3=Pasture/Fodder plots technology, T4= Organic farming technology, T5= Improved granaries, T6= Compost making, T7= Home gardening, T8= Improved seeds, T9= Passing animal offsprings.

Technologies performance differed according to farmer's ability to manage the technology. Research findings during discussion show that, technologies that required high cost of management and less direct benefits were not interested by farmers with low income. Occupation of the respondents has influence to the technologies performance in the study area. Occupation refers to the type of jobs people perform by virtue of their skills, experiences or choices. You may be self-employed or work as an employee of an individual or organizational entity. The different types of occupation dictate the income earned by people in the society

(Gadar and Yunus 2009; Lowenberg-DeBoer, 2006). High-salaried individuals are normally associated with skilled occupations such as doctors, engineers, lawyers and accountants. Self-employed individuals owning successful businesses also generate huge amounts of income. Unskilled occupations such as menial labor do not pay much. Therefore, the ability of customers to afford the different products you offer in your business depends on types of their occupation. (Gadar and Yunus 2009; Rudebjer *et al.*, 2001).

Contour technology requires skills and labour during construction including payments of the people employed during construction and material required to stabilize the contour bands (Vertiva grasses). This findings indicates that, self employed in agriculture may perform better contour technology when have enough labour or farmers employed in other organization are able to employ labourers.

Table 7: Values of performance score associated with a category of socio-economic variable which are statistically significant influence on the technology

Technology	Socio economic factor		Mean	Std
Compost making technology	Occupation	Self employed in agriculture	2.41	0.97
		Organization	1.63	1.19

Self employed in agriculture mean=2.41, Organization=1.63 (Mean score range=0.78)

Research by Lambert *et al.* (2012) shows that majority of developing countries in rural areas are dependant on agriculture occupation toearn their livelihood. In the study area compost making technology was adopted by most farmers due to that were cheaper compared to other sources of fertilizer in homegardening. Agriculture and related businesses continue to be a major force in national employment and productivity (Lambert *et al.*, 2012).

4.2.1 Principal components of performance of agricultural technologies

The Principal Components Analysis revealed that the responses to the statements were best described by four factors. The factors were represented by 58.99% of the variance (Table 8).

Table 8: Principal components analysis matrix showing response of the people towards statements describing performance of agricultural technologies

Variables	PC1 (18.37%)	PC2 (15.96%)	PC3 (13.22)%	PC4 (11.44%)
Improved granaries technology performance	-.691			
Improved seeds technology performance	.499			
Contour technology performance		.532		
Animal husbandry technology performance		-.702		
Home gardening technology performance		.602		
Organic farming technology performance			.735	
Compost making			-.787	
Pasture plots technology performance				.886

PC1: Technologies that require scientific knowledge of storage characteristics PC2: Special arrangement or management requirement, PC3: Local technologies related (technology that do not require in organic materials) PC4: Climate dependant technology.

The first principal component (PC1) represents 18.37% of the total variance, Technologies that require scientific knowledge of storage characteristics. It consists Improved granaries and Improved seeds technology. It was found that, different from traditional granaries that were used by most farmers in villages the modern had raised one metre high and fixed with rat guards to prevent rats from entering inside the grains. At the side of the structure there was a door for outlet for the grains when required them for food that improvement qualified them to be a technology different form the traditional one. It was also revealed that improved granaries have the mean less than 2. This implied that the technology performance was poor compared to the technology on the first component.

The second Principal component (PC2) represented 15.96% of the variance (Table 8). They represented agricultural technologies that require special arrangement or management. These technologies included contours making, animal husbandry, granaries and home garden. The mean for contour technology on the second principal component, Animal husbandry technology and Home gardening were more than 2 implying that was just fair but not very good. Special arrangements were due to compatibility of the technologies for example, free range grazing system that was reported, it was difficult to have both home gardening and Contour bands technology if special land use planning was not taken care of. During discussion farmers said that, the main grazing system used in their livestock especially cattle are free range system, there were no fences and most contours bands, pasture plots and home gardens were destructed in the study area. Research on Negative effect of free range system to the environment by Blanchet *et al.* (2003) outlined to be increased soil erosion, adverse water quality impacts from increased runoff and loss of biodiversity, roads damage and other agricultural crops and infrastructures. When arranged properly livestock and other components in the land they benefit one another sustainably (Keelan *et al.* 2009; Blanchet *et al.* 2003).

The third Principal component (PC3) the technology that is local oriented, using locally available materials to sustain agriculture. These factors represented 13.22% of the variance (Table 8). These technologies included compost making and organic farming. The mean for the technologies on the third principal component was less than 2 (Table 8) implied that, technology poorly performed, while Compost making technology was just good but not very good. During discussion respondents argued that effectiveness of using organic chemical to control animal parasites was poor there fore livestock keepers opted to use acaricides that was more effective.

Research experience show that In these times of rapid change and increased competition for scarce resources, it has become essential for agricultural research organizations to periodically evaluate their performance and take the necessary steps to address problems and weaknesses (Peterson *et al.*, 2003; Zilberman *et al.*, 1997). It should be realized that Farmers have experience and are sources of experience as respondent. The fourth principal components (PC4) was about Climate dependant technology was represented by 11.44% of the variance. Under this component technologies were pasture/fodder plots that were established by farmers so as to be given animals by project. Cimate is a condition of the atmosphere at a particular location over a long period of time from one month to many millions of years, but generally 30 years (Nikolov and Zeller, 2011). Technologies depending on climate seemed to be vulnerable to sustainability as was observed by research in the study area. During discussion respondents explained the failure of fodder and pasture plots that was contributed by prolonged drought. Pasture estabblishment and improvement enougph rainfall or water was required.Research experince show that Effect of climate was including wilting of plants which had direct effect to communotics (Nikolov and Zeller, 2011). Pasture as a crop requires water to survive like other plants (Nikolov and Zeller, 2011; Peterson *et al.*, 2003).

4.2.2 General linear model (GLM) univariate analysis results for principal components of performance of agricultural technologies

General linear Model univariate analysis was used to give results for components underlying people response towards performance of technologies where socio-economic characteristics of age, Sex, Marital status, Household size, education level of the respondents and respondents occupation were used to show if were statistically influenced the agricultural technologies components to the study area (Table 9).

Table 9: General linear model (GLM) univariate analysis for components underlying people response towards performance of the technologies

Component	Source	Type I Sum Square	Df	Mean	F	P
(C1)	Age	1.634	3	0.545	0.535	0.659
	Sex	0.014	1	0.014	0.013	0.908
	Marital status	1.106	4	0.277	0.272	0.896
	Household size	0.853	2	0.427	0.419	0.659
	Education level	5.767	3	1.922	1.889	0.136
	Occupation	0.037	3	0.012	0.012	0.998
(C2)	Age	0.711	1	0.711	0.707	0.402
	Sex	1.460	4	0.365	0.363	0.835
	Marital status	5.928	2	2.964	2.946	0.057
	Household size	3.005	3	1.002	0.996	0.398
	Education level	1.202	1	1.202	1.195	0.277
	Occupation	0.037	3	0.012	0.012	0.998
(C3)	Age	4.899	3	1.633	1.784	0.155
	Sex	0.361	1	0.361	0.394	0.531
	Marital status	3.168	4	0.792	0.865	0.487
	Household size	0.240	2	0.120	0.131	0.877
	Education level	1.934	3	0.645	0.704	0.551
	Occupation	11.393	1	11.393	12.449	**0.001**
PC4	Age	1.564	3	0.521	0.525	0.666
	Sex	0.336	1	0.336	.338	0.562
	Marital status	0.311	4	0.078	.078	0.989
	Household size	8.103	2	4.052	4.076	**0.020**
	Education level	3.036	3	1.012	1.018	0.388
	Occupation	0.280	1	0.280	0.282	0.597

Note: Bold figures are significant at P< 0.05.

Occupation shows statistically significant at p<0.001 (Table 9). Research findings show that, locally technologies related (technology that do not require inorganic materials) which were: Organic farming and compost making technology were influenced by occupation in the study area. Researchers argue that occupation related with income of the respondents (Mariani *et al.*, 2012; Bulg, 2003). In the study area farmers performed well compost making technology. During discussion they said the technology was easy and did not require high cost to prepare as required locally available materials and experince. This evidenced by Parwan, (2009) ; Kebede *et al.* (1990) who found that a person based on farmer experience has more cofidence and ability to implement agricultural technologie. From the study area, all respondents had more than ten (10) farming years which showed enough knowledge and experience to perform better that technology. Farming experience could be an opportunity to support a new technology (Kariyasa and Devi, 2012). However, some farmers were supported by available SACCOS and TAAP, NGO in financial and material support although it was claimed that was not to majority.

The findigs show that, Household size was statistically significant influenced the agricultural technologies under component of Agricultural technologies that were Climate dependent at p=0.020. (Table 6). Research experience show that, majority of the farmers use their own household labour to perform their daily activities in rural areas (Keelan *et al.*, 2009; Swinton and Lowenberg-deboer, 2001).

Therefore households with large number of family members are likely to perform more the technologies compared to households with few number of people. In the study area the technology was said to perform poorly due to climate effect and managerial problems but this implies that the number of people in a household were able to solve the problems as some pasture plots at erly satges required to be watered therefore, number of people in a households who were able to work were capable to fetch water and irrigate the pasture plots during dry season. Components of the technologies that were categorized as requiring scientific knowledge of storage characteristics which were improved granaries and improved seeds technologies were not significantly influenced by socio-economic factors of Age, Sex, Marital status, Household size, Education level and Occupation. Likewise Components that were categorized as required Special arrangement or management require arrangements due to their incompatibility in nature, which were; Contour technology, home gardening and Animal husbandry were also not significantly influenced by socio-economic factors (Table 9).

Table 10: Summary statistics of the values of principal component associated with a category of socio-economic variable which are statistically significant influence performance of the local technologies

Socio-economic factors	Response	Mean	Std
Occupation	Self employed in farming	-0.05	0.95
	Employed in government	0.75	1.45
Household size	1-3	-0.54	0.51
	4-7	0.08	1.05
	Above 7	0.34	0.96

4.3 Institutional factors that affect sustainability of agricultural technologies

4.3.1 Agricultural and livestock policies

It was observed from the policy that, the government promised to strengthen field extension services to enhance its effectiveness in direction, management, improve linkages and put in place an effective monitoring and evaluation system, the extension services delivery was said not be a monopoly of the Government (URT, 1997a). Equally, the training of farmers and livestock keepers continue to take place in Farmer Training Centres, the Government ensured that extension programmes developed are well planned and systematic (URT, 1997b). Tanzania acknowledges that increased use of modern inputs (fertilizers, agrochemicals, seeds, farm implements etc) is a pre-requisite for achieving sufficient agricultural productivity and growth to meet economic development, poverty reduction and food security goals (URT, 2013). Research revealed that, the promise of government on extension services number are increased but effective monitoring were still not sufficient this was realized during discussion where by respondents argued that the inclusion of technologies in extension daily activities were just to some extent and not sufficiently. Orbicon, (2007) reported this during HIMA evaluation report and surgested support to the government extension services in rural areas.

Public and private sector agricultural financing in Tanzania was low because of unavailability of long term financing for investment in the sector for medium and large-scale farming. Tanzanian agriculture is characterized by smallholder producers who lack the ability to borrow from financial institutions (URT, 2012). Moreover, the Government in collaboration with other actors facilitated accessibility of finance to farmers and other actors in the agricultural sector, The Government shall strengthen financial intermediaries (rural banks, SACCOS) to make them responsive to agricultural development financial needs; and Mechanisms for creating awareness on loans and loans repayment terms shall be strengthened (URT, 2012). These policy statements concur with HIMA project objectives of empowering extension, introduction of agricultural technologies and improve productivity in the study area (Orbicon, 2007).

However, the availability of long term financing sectors in the study area was not observed except only one NGO in two villages was supported few farmers. SACCOS was helpful to farmers who were able to join as members and ask loans some were said were able to purchase Tractor though SACCOS loans (Table 10).

4.3.2 Environmental management Act (EMA) 2004

The act was clearly stipulated that, Sensitive area such as area prone to soil, air or water erosion attention should be taken care of basing on environmental conditions to village lands Act No. 5 of. 1999 Apart from the term and conditions prescribed by section 29 of the Village Land Act 1999 on village lands or on land sharing arrangement between pastoralists and agriculturalists in terms of section 58 of the Village Land Act, 1999, the Minister may prescribe any other additional environmental protection conditions to be complied with by the grantees of customary rights of occupancy (URT, 2004). Regarding the policy statement, Research revealed to have some implementations to some extent as was reported during discussion some respondents were having land ownership certifacates. How ever, there were no report on deliberately effort to take measures to control soil erosion prone areas after HIMA project phased ouut. During discussion with pastoralist the arrngements of areas for pastoralist were done but there was observed topersist policy weakneses of imlpementation due to the fact that some conlicts were reported by farmers between them and pastoralist also, the system of freerange grazing systems were dominated to all areas without restriction that caused some of agricultural technologies to be distroyed by animals in the study area (Table 10). The study by explaine experiece that, the risks and uncertainties that are associated with new precision technologies should be investigated and studied, and their implications for policy design must be explicitly recognized and planned (Zilberman *et al.*, 2004).

4.3.3 National land policy 1997/human settlement policy 1995/ CBFM guidelines 2007

The Village Land Act (1999), The Local Government Act (1982), The Forest Act (2002) and the Forest Regulations (2004) provide the legal basis for villages to own and manage forest resources on village land in ways that are both sustainable and profitable. The village must prepare By-laws that support the management plan (fines, sanctions, etc) and these must be approved by the village assembly (Forest Act: Section 34 (4) (CBFM, 2007). Village land use plan will be used as a tool for implementing policies for better land use and management. Furthermore, village land use plans will provide a basis for guiding extension service packages including techniques in forestry, Wildlife and Environmental conservation. Research revealed tohave implemented to a large extent these promise as it was realised during discussion that villages own forest through CBFM in the study area (Table 10).

4.3.4 Village land Act, 1999

This act empowers village governments with devolution management rights over land. It enables villages to draft and enforce By-laws (but not to collect fines). It allows for the creation of Certificates of Village Land and the Right of Occupancy to Forest Land for both communities and individuals. Finally it established management institutions for CBNRM and Community-Based Forestry at village level, like Village Assembly, Village Council, Village Environment Committee (VEC) or Village Natural Resource Management Committee (VNRC) and Village scouts or guards. The act makes legal provision for common property and ability to be registered as statutory entitlements in Customary Lands including registration of all commons. Research revealed to have implementation on that, as was reported during discussion with respondents in the study area.

4.3.5 National strategy for growth and reduction of poverty NSGRP 2005

The strategy is committed to ensuring the development activities today do not adversely affect development needs of future generation. Emphasis is on the sustainable use of the country's Natural resources and avoiding harmful effect on the environment and on people's livelihoods. It also advocates for people-centered development (NSGRP, 2005).

4.3.6 National environmental policy 1997

The primary policy objectives was the promotion of the environmental sound technologies that is the technologies that protect the environment, less polluting, use resources in a more sustainable manner. To ensure sustainability, security and equitable use of the resources for meeting the basic needs of the present and future generation without degrading the environment or risk health or safety, to prevent or and control degradation of land, water and air which contribute our life support system. Research revealed that this policy statement was received to the study area as one of the objective of HIMA project in the study area, to implement this the project introduced contour technology to prevent soilerosion and land degradation to the study area as was pointed out by (Orbicon, 2007). However, toachieve the objective the district policy after phased out of the project was to plan and organize how to be done to ensure continuation of the technologies to the community.

Experience shows that the ability of an organization to produce useful and relevant outputs largely depends on internal policies, strategies, and management practices and the context in which these are applied. By examining and evaluating these critical aspects of an organization, managers can identify problems and constraints that are contributing to poor performance and, more important, take action to address them (Peterson *et al.*, 2003; Pretty, 2007). This implies that Iringa District requires deliberately effort to formulate policies for technology follow-ups and monitoring so as to achieve the National environmental and phased out project policy, to better the environment and community livelihood.

Table 11: Key issues addressed on the existing policies, acts, guide lines and strategies for sustainability of agricultural technologies

Key issues	Contribute to sustainability	Policies/Guidelines/Acts/Strategies
Transfer agricultural knowledge from expert to farmers	Through Research and extension	Agricultural and livestock policy 1997
Land sharing arrangement between pastoralists and agriculturalists	Land use planning	Environmental management Act 2004
Right of Occupancy for both Communities and individuals	Sense of ownership	Village land act 1999
Community based forest management	Sense of ownership Sharing resources	CBFM-Guideline 2007
Provide financial support to the agricultural sector	Empowerment	National Agriculture policy 2013
The use of technologies that protect the environment	Environmental management	National Environmental policy 1997
Conflict resolution and better land use management	Community security	National Land policy 1997
Sustainable use of country's Natural resources	Self sustainance	National strategy for growth and reduction of Poverty NSGRP 2005

Findings show that, policy issues have influence to sustainability of the agricultural technologies through extension services, land use planning, sense of ownership of the resources, empowermente and community security and satisfaction. Experience from other research show that extension as an institution has an input to improve farmers' performance (Okuthe, 2014). This implied that extension services equip farmers with new knowledge and skills from research to farmers. If a farmer has no skill and technical know-how about certain technology, he/she may have less probability of managing agricultural technologies sustainably. It was also shown by the district, during discussion with key informants when they were asked if the district has planned to sustain HIMA project agricultural technologies the response were that, The District had no plan due to financial constraints. Only activities that were given a budget were considered. Research pointed out by Okuthe, (2014) shows that, economic inability of the institutions to assist farmers is a part of the farmers fail to afford cost of developing innovations and mitigate risks.

Findings show that through interview, farmers show awareness on availability of By-laws that supports sustainability of agricultural technologies in the study area, as results showed that, 61 (50.8%), agreed to be aware, while 59 (49.2%) responded to be not aware of the by-laws if support the sustainability of agricultural technologies in the study area. However, according to (Table 12) the number do not differ much. This implies that the By-laws are not very clear to farmers as it was shown during discussion that even if there are By-laws but do not functioning because the rate of destruction of some technologies were still high. The study revealed that enforcement of agricultural technologies By-laws by the responsible organs was weak despite government explained that there are ward tribunals who take care of people deviating their agreed environmental regulations. This observation are similar to that by Mowo *et al.*, (2007) who outlined that, weak leadership was found to be an important factor influencing the enforcement of Agricultural technologies By-laws. Weak leadership contributed to infectiveness of By-laws because some of the village leaders are not daring enough and would like to be seen as ‘good people’. This way, most offenders are left free leading to more degradation of natural resources. In

Tanzania, among the reasons advanced for this were; Limited involvement of communities in enforcement of By-laws, limited understanding of the law enforcement process and weak leadership (Mowo *et al.*, 2007).

Moreover 88 (73.3%) of the respondents said that there were other organizations that supported the sustainability of agricultural technologies in different aspects. 32 (26.7%) did not show awareness of the presence of the organizations that dealt with agricultural technologies. The identified organizations during field work were one NGOs Tanzania Agricultural Productivity Progamme (TAPP) US AID that facilitates farmers' groups in garden crops production and seeds production in Mkungugu and igingilanyi villages. Kising'a and Kihorogota SACCOS, Facilitate farmers. One farmer's field school (FFS) groups known in Kiswahili as Kikundi Darasa Uhominyi (KIDAU) was observed at Uhominyi village. The aids was on financial, technical and material services such as seeds production small animals support and trainings. During discussion out of 120 respondents who were asked if they were financially assisted in implementations of agricultural technologies, 79 (65.8) not received any financial while only 41(34.2%) were aided by government 24 (20%), NGOs 12 (10%) and 5 (4.2%) by SACCOS (Table 12). The findings show that majority of the respondents were not financially assisted. However, farmers who were assisted by organizations their technologies progressed very well. This implied that, financial aids had positive effect on agricultural technologies growth. The results are similar to the study by Butt, (2004); Wabibi (2002); Sanyal and Babu (2010). who found that, access to credit is one way to improve farmer access to new technology and increased productivity.

Table 12: Institutional factors that affect the sustainability of technologies

Institutional factor	Response	Frequency	Percentage
Extent of extension service to incorporate	Sufficiently	32	27.7
	To some extent	88	73.3
Knowledge on By-laws supporting sustainability of technologies	Yes	61	50.8
	No	59	49.2
Any other organization support after HIMA	Yes	88	73.3
	No	32	26.7
The organizations that Support Respondents	Other farmers	3	2.5
	Extension esrvice	79	65.8
	NGOs	6	5
	Not supported	32	26.7
Any financial aids	Yes	41	34.2
	No	79	65.8
Financial aid providers	Government	24	20
	NGOs	12	10
	SACCOS	5	4.2
	Not financed	79	65.8

The finding show that most respondents were engaged in small animals production such as dairy goats, pigs and some keep drought animals that were mostly supplied by HIMA project to assist farmers economically and reduce workloads especially women. The livestock keeping activity were 74 (61%) while those who do not keep livestock were 46 (38%). 88 (73%) responded tohave assisted by other organizations as were mentioned as NGOs (TAAP) and Extension services as well as financial support of loans through SACCOS and CBO (KIDAU). A serious issue in livestock keeping was the un restricted free range grazing system that was adopted by farmers as identified during discussion to be the contributed factor to performance of some agricultural technologies of: Contour, home gardening, pasture plots and survival rate of trees that were planted, because free range grazing systems if not properly arranged has negative impacts to the environment. During discussion livestock keepers were given rules and boundaries to graze their animals out from forest reserves and community farms. But due to shortagre of land some farmers extend farming by clearing new agricultural area where pastoralist were given to graze, and the pastorslist face shortage of pasture as the number of livestock increased, eventually they graze to restricted areas. However, the study area show weaknesess of By-laws implementation in villages.

Research experience show that, excessive livestock grazing also causes soil compaction, erosion, decreased soil fertility, water infiltration and water storage capacity, while Unrestricted access to resources can result in overexploitation and degradation of the resource (Benina and Penderb, 2002; Blanchet *et al.* 2003).

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Based on the findings from the study the following conclusion are made: The findings from existence of agricultural technologies show that most technologies are still existing inspite of the variations in its present situation. Passing on young animals within farmers (Offsprings) was a significantly influenced by education level of the respondents. However, the some few farmers were retaining young animal from passing to other neighbouring farmers. Majority of the farmers completed primary school level of education with more experience obtained from HIMA project.

The technologies that were still existing were highly benefiting farmers in terms of income, nutrition and exposure to other farmers when were selected as farmers exchange visit, crop production were inreased as a result of environmental management. Findings showed that other technologies were not statistically significant to all socio-economic factors.

Performance of most technologies were poor in the study aread with exception of some technologies of compost making which performed verywell, while other were differing in performance for reasons of incompatibility of some technologies and management cost to some technologies. Technologies that were poorly performing were Contour farming organic farming and fodder/ pasture plots due to unrestricted grazing system (free range grazing system) as the technologies are not compatible.

However, socio-economic factors: Occupation, household size and education level of the respondents were significantly influenced performance of agricultural technologies in the study area.

Socio-economic and Institutional factors of Extension services were found not incorporated in HIMA project technologies in their daily trainings, while By-laws were not implemented and majority of the farmers were less informed of the By-laws and financial aids to the farmers were not enough although of some few farmers said to have benefited from SACCOS, CGO (KIDAU) and (NGO) TAAP which were available in the study area.

5.2 Recommendations

i. The existence of agricultural technologies in the study area require emphasis on extension services; to put into programmes of trainings and follow-ups the implementation of HIMA project introduced technologies during their routine works to monitor the weaknesses, on going evaluation and monitoring of the technologie to ensure their sustainability.

ii. Performance of the technologies will be better if projects involve farmers from the start and motivations to farmers, whose technologies perform well. The District should give them more assistance, such as seminars, field tours working gears, certifacates of technology performance and financial empowerment as incentives so as to speed up performance and development of the technologies.

iii. The District should make followups of the implementation of By-laws on the grazing and farming to the community. By-laws supervision, financial support to villages that implement well the technologies. The District should arrange trainings to farmers on policies objectives and evaluation of the implementation of the policy, plans, acts, and strategies as part of institutional empowerments to the community in the study area.

iv. The District should maintain the technologies that were introduced by the the phased out HIMA project as this will be a baseline to other projects that will be introduced in order that they will know how the approaches required, the community needs for the sustainability of the technologies, poverty elevation, and rising income to the communities in their respectively house holds.

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APPENDICES

Appendix 1: General household informations

A. Assessment of sustainability of hima project agricultural technologies in Iringa Rural District, tanzania.

Date............... Respondent number/name (household head)......................

Village.................Ward..............................District.............................

Age and Sex

1. Age of the respondent.................... (Years)
2. Sex. 1. Male [ ] 2. Female [ ] *Tick*

Marital status

1. Single [ ] 2. Married [ ] 3. Widowed [ ] 4. Separated [ ]

5. Divorced [ ] 6. Other, specify............[ ]

Education level

3. What is the level of education of the household head in years?

1. No formal education [ ] 2. Adult education [ ] 3. Primary education [ ]

4. Secondary education [ ] 5. Others specify [ ]

4. Age category in a household of the respondent

1=25-45 [ ]

2=46-456 [ ]

3=Above 56 [ ]

5. What is your occupation? 1. Self employed in agric.[ ] 2. Organization [ ]

3.Not employed [ ]

B: To assess the performance of agricultural technologies and their characteristics that contributes to sustainability.

6. In the table below rate the score of performance of the adopted I agricultural technologies (As very good, Good, Fair, Poor)

Agricultural technologies	1=Very good	2=Good	3=Fair	4=Poor
1. Contouring (Functions/working)				
2. Animal husbandry and production				
3.Pasture plots (Establishment)				
4.Organic farming (use)				
5.Granaries (number and use)				
6.Compost making (number & use)				
7. Home gardens size/number/				
8.Improved seeds to farmers (Production and use)				
9.Training systems (seminar, Farmers field days)				
10 Tree planting campaign/HIMA-day (Campaign)				
11.Passing- on of offspring programs				

(i) Factors Influencing Sustainability of the Agricultural Technologies

7. In the bellow agricultural technologies that were introduced by HIMA project.

State if they exist or Ceased for each one. 1=Existing 2= Ceased [ ]

Agricultural technologies	1.Exist	2.Ceased
1. Contouring technology		
2.Animal husbandry and production		
3.Pasture /Fodder plots technology		
4.Organic farming (use)		
5.Improved Granaries		
6.Compost making (number & use)		
7. Home gardens size/number/		
8.Improved seeds technology		
9.Training systems		
10 Tree planting campaign/HIMA-day (Campaign)		
11.Passing- on of offspring programs		

7 (a). If are existing, which of the following might be the main reason?

1=Less cost 2=acceptable 3= 1 and 2 4= Good management [ ]

7 (b) If are Ceased what is the main reason among the following?

1=High cost 2=Not acceptable 3=1 and 2 4=Poor management [ ]

8. For how long have you involved in farming activities (Years) 1=5-10 [ ] 2= 11-15 [ ] 3=16-20 [ ] 4= Above 20

9. Do you own land? 1. YES [ ] 2. NO [ ]

10. If answered 'YES' in above question, what is the total size of your farm? [ ]

(Acreage)

11. How did you acquire your land? 1= Inherited from ancestors [ ]

2= Bought from other people [ ]

3=given free [ ]

4=other means (specify) [ ]

12. What types of crops do you grow in you plot? (List)

Food crops 1=Maize[ ] 2=Sorghum [ ] 3=Beans/Cow p.[ ]

Cash crops 4=Sunflower [ ]6=Sim sim [ ]7= Ground nuts[ ] 8=Tomatoes[ ]

13. What is the source of your labour?

1=Household labour [ ] 2= Hired labour [ ]

3=Associations with neighbors [ ] 4=Others specify [ ]

14. What influenced you to adopt agricultural technologies you are using?

1. Income and food [ ] 2. Influenced by others [ ] 3. Prestige [ ] 4.Others [ ]

specify

15. Do you keep livestock? 1=Yes [ ] 2=No [ ] If YES

16. What grazing system practiced for (Cattle, Goats/Ship and Donkeys?) 1= Zero grazing [ ] 2= Semi intensive [ ] 3=Free range [ ]

17. How do you manage Pests of crops and Parasites from livestock?

1. Organic. [ ] 2. (Integrated Pests and Parasites Management (IPPM) [ ] 3. In organic [ ]

(ii) Institutional Factors that Affects the Sustainability of the Agricultural Technologies

18. Did you receive any type of training on agricultural technologies after HIMA has phased out?

1=YES 2= NO [ ]

19. Who facilitated the training 1=government [ ] 2=NGOs [ ] 3=Private organization [ ] 4=Not facilitated

20. What extent the agricultural extension do incorporate the agricultural technologies issues in their trainings? 1=not at all [ ] 2= to some extent [ ] 3= Sufficiently [ ] 4= Moderate [ ] 5=high[ ]

21. Are there any by-laws governing the sustainability of technologies?

1= Yes 2=No [ ]

22. Do you receive any advise from outside? 1=YES 2= NO [ ]

23. If answered YES in item above, where do you get those advices?

1=Other farmers [ ] 2. Extension officers [ ] 3. NGOs [ ] 4. Not advised [ ]

24. Did you receive any financial aids in Agricultural inputs (Improved seeds)?

1=Yes 2=No [ ]

25. If Yes who provide them 1= government subsidies [ ] 2=NGOs [ ] 3=private companies [ ] 4=Others..[ ]

26. In reference to Tanzania agricultural policy objectives on agricultural technologies what is your opinion for the following table below?

Policy objectives	1=Increasing	2=Constant	3=Decreasing
Food supply productivity			
Nutritional status of people			
Inputs allocation(Improved seeds, Fertilizers, Chemicals)			
Household income			

THANK YOU FOR YOUR COOPERATION

Appendix 2: Checklist for District /Ward and Village Key Informants

Date....................Name of Officer/position /

Designation............District/Ward/Village......

1.How is the situation of HIMA project Agricultural technologies in your area?------

----

2.What other factors that influencing sustainability of agricultural technologies (list factor)-------------

Negatives--

Positives--

3. What are the District / ward/villages strategies on continuing support for sustainability of HIMA project Agricultural technologies? ------------------------------

4. What are the challenges facing the agricultural technologies development? --------

5. What are the general observations on sustainability of HIMA project agricultural technologies after phasing out?---

6. What are the policies you know that influence HIMA project Agricultural technologies?------------

THANK YOU FOR YOUR COOPERATION