

**ASSESSMENT OF THE FACTORS INFLUENCING SUSTAINABILITY OF  
IMPROVED PINEAPPLE PRODUCTION TECHNOLOGIES IN GEITA  
DISTRICT, TANZANIA**

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

## **ABSTRACT**

This study was conducted within Geita District Council to find out factors influencing sustainability of improved technologies for pineapple production. Sustainability is the ability to maintain a certain status or process in existing systems, there are four types of sustainability human, social, economic and environmental. The overall objective was to establish factors influencing sustainability of improved pineapple production technologies by small scale farmers in Geita district. Specific objectives of the study were to identify indigenous technologies that are in use, to determine the improved technologies and to compare indigenous and improved technologies. The population consisted of smallholder farmers in four wards drawing a sample size of 120 respondents with each ward contributing 30 respondents. Data were collected using a questionnaire, focus group discussions, key informants interviews and observations. Sustainability technology is important in this study in spreading new technologies of pineapple production and hence increases productivity. There are two types of technologies used in pineapples production such as improved and indigenous technologies. Indigenous technologies are generally low capital intensive, environment and ecology friendly. Improved technologies are those technologies which have the modern agricultural inputs such as improved varieties and fertilizers. Main approach to increasing productivity among farmers by most sub-Saharan African countries was through government controlled distribution of fertilizers and improved varieties at subsidized prices. The study recommends that Geita District Council should promote the use and sustained with technologies.

**DECLARATION**

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

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Date

The above declaration is confirmed by;

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Date

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## **ACKNOWLEDGEMENTS**

First of all, I thank God for lightening the way and allowing me to successfully complete my studies at Sokoine University of Agriculture in Tanzania as planned.

I wish to express my sincere gratitude to the Department of Agriculture, Irrigation and Cooperatives Office in Geita District for allowing me to pursue my studies. I wish to express my heart felt gratitude to my supervisor Professor Z. S. K. Mvena for his guidance and constructive support during the whole period of the study. Special thanks go to extensionists in Nzera, Kakubilo, Kagu and Katoma wards who helped me during data collection. I would like to express my sincere thanks to farmers who accepted to give their time to be interviewed thus allowing me to complete my studies. Finally special thanks to my family for their patience and tolerance during my absence.

## **DEDICATION**

I dedicate this dissertation to my Mother AMINA IDD OMARY and my husband MHANDO BAKARI MHANDO who paid the fees for my education.

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**LIST OF ABBREVIATIONS**

ACORD	Agency for Cooperation and Research in Development
ASDP	Agricultural Sector Development Programme
CODERT	Community Development and Relief Trust
DADPS	District Agricultural Development Plans
DAICO	District Agricultural Irrigation and Cooperatives Office
FAO	Food and Agriculture Organization
FGDs	Focus Group Discussions
HYV	High Yield Varieties
KIIs	Key Informant Interviews
NBS	National Bureau of Statistics
NGOs	Non-Governmental Organizations
SNAL	Sokoine University National Agricultural Library
SPSS	Statistical Package for Social Sciences
TACCIA	Tanzania Chamber of Commerce, Industry and Agriculture
URT	United Public of Tanzania
VEOs	Village Executive Officers
WEO	Ward Executive Officer

## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 Background Information

Pineapple (*Ananas comosus*) is among the widely cultivated crop in Sub-Saharan Africa. In East and Central Africa, the crop is produced in Uganda (1%), Kenya (40%), Tanzania (19%) and Rwanda (40%) (Fit Uganda ltd, 2007). Annual pineapple consumption demand for Tanzania is approximately 214 840 tons (Fit Uganda ltd, 2007). Main producing areas in Tanzania include Morogoro, Tanga, Pwani, Mwanza Geita, and Ruvuma regions.

The crop is transplanted by new vegetative growth (sucker), among other different technologies for production of pineapple (Ubi *et al.*, 2005). Improvement of agricultural productivity and sustainability is through the introduction of improved agricultural technologies and management practices. Examples of improved agricultural technologies include, among others, appropriate spacing and use of fertilizers, use of wood boxes, timely planting, and use of improved varieties, and use of tractor for land preparation. On other hand indigenous technologies include use of local varieties, local transport facilities from the field to the market, use of local facilities in land preparation such as the hand hoe.

Sustainability is defined as a practice that meets current and long-term needs for food, fiber and other related needs of a society. The net benefit of sustainability of agricultural technologies includes conservation of resources that maintain other ecosystem services and functions including long-term human development (Rao and Rogers, 2006). Feder *et al.* (1985), state that adoption of technologies provides opportunities for increasing agricultural productivity, sustainability, improvement of farmers' agricultural practices and sustainability of the crop.

Pineapples a major cash crop grown in Geita district after abandonment of cotton due to losing its importance and value as the land for its production declined. The price of cotton also slumped in the world market the condition that contributed to poor production. The current area under pineapple production in Geita district is 1 450 ha (DAICO, 2014). The crop is mainly produced in Bugando, Butundwe, Busanda, and Kasamwa divisions within the district.

In Geita district, pineapples have the potential to be good and a reliable source of income for small scale farmers as it generates high earnings per unit area. Such high potential made many projects like Agency for Cooperation and Research in Development (ACORD) and Community Development and Relief Trust (CODERT) to introduce different improved technologies namely, improved crop varieties, wooden boxes for transportation, but also build skills of small producers on primary processing techniques by training farmers on site.

Pineapples also generate more revenue per unit weight compared to other crops available for sale in the district (DAICO, 2013). In this regard, pineapples have the potential of improving the livelihood of the farmers including small-scale farmers, since 40% of households in these divisions depend on pineapple enterprises for their livelihoods. For that reason the district is consistently strengthening its own capability to provide people centered sustainable services towards realization of livelihood and reduction of poverty within the district by 2025. The main concern in agricultural development is the sustainability of the technologies in use. Very often technologies introduced through projects usually cease as soon as the project comes to an end. Thus the current technology use in the production of pineapples in Geita needs to be closely monitored in order to sustain the improved technologies.



## **1.2 Problem Statement and Justification**

Despite the important role pineapples play in the economy in Geita district as a fruit for consumption and income generation its sustainability is faced by a number of challenges. Demort (2007), for example, innovations are often adopted slowly by farmers and several aspects of adoption remain poorly understood, this could be due to lack of awareness and understanding on how and when improved technologies are to be used. In Geita district for instance institutions which deliver extension services were considered as important for the distribution of improved technologies. This causes various agricultural services to be given to farmers mainly through development projects (CATAD, 1989 cited by Rutatora, 2002).

Apart from these efforts of extension service delivery to farmers, the sustainability of pineapple production improved technologies by smallholder farmers in Geita district is largely unknown. Furthermore, the Agricultural Sector Development Programme (ASDP) through the Geita District Agricultural Development Plans (DADPS) support and trained pineapple producers in area such as improved fruits production, processing and marketing. Additionally NGO's like Agency for Cooperation and Research in Development (ACORD) support good technologies of addition to value chain, yet production of pineapple in the study area is getting less (DAICO, 2014). Samson (2007) argues that there is need for the application of appropriate technologies in post harvesting, marketing and sustenance of improved technologies of pineapple in the study area for good realization of pineapple production. Although technologies play an important role in increasing productivity of the crops (Morton, 1987), the sustainability of these technologies is not known. This is especially relevant when such technologies introduced through projects and the projects come to an end; farmers also cease to use such technologies due to a number of factors such as financing (Muffui, 2007). This study will

therefore unlock the factors that influence the sustainability of technologies used in production of pineapples using Geita district as a case study.

The results for this study are expected to generate information on factors influencing the sustainability of new technology of pineapple production by small scale farmers in the district. This information will be of vital use to both the development agents and farmers in Geita district and beyond. Once the development agents understand the source and nature of the problems hence will act as a bridge among farmers and stakeholders for pineapples producers. The empirical results of the study will also support other similar detailed and comprehensive studies in the region.

### **1.3 Objectives**

#### **1.3.1 Overall objective**

To establish factors influencing sustainability of improved pineapple production technologies by small scale farmers in Geita district.

#### **1.3.2 Specific objectives**

1. To identify current practices for production of pineapples at farm level.
2. To identify improved technologies that has been introduced in pineapple production.
3. To examine factors contributing to sustainability between the indigenous and newly introduced agricultural innovations related to pineapple production.

### **1.4 Research Questions**

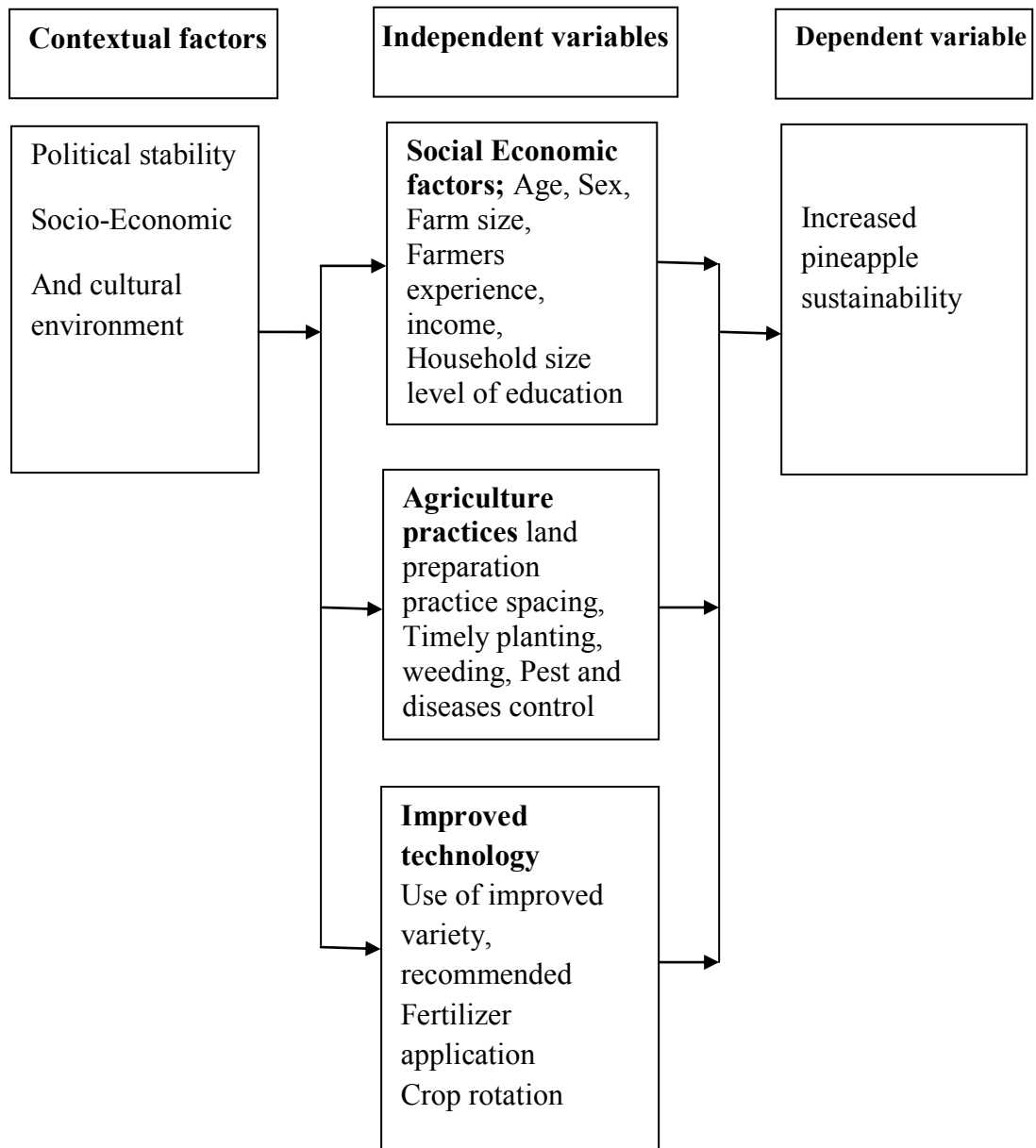
1. What are the technologies used by house hold?

2. What are the improved technologies that have been introduced in pineapple production?
3. What are the factors contributing to sustainability between the indigenous and improved technologies?

### **1.5 Conceptual Framework**

In this study conceptual framework assumption was based on that sustainability to smallholder farmers in improved technology of pineapple production intends to increase as well as increase farmers' income. Farmers and farm characteristics are first category, variables such as farmer's age, farm size, and experiences.

Another category is agricultural practices such as land preparation, proper spacing, and crop rotation, weeding together with pest and diseases control. Also use of improved variety, application of fertilizer, good transplanting in rows and recommended spacing is another category. Economic efficiency can be achieved if prosperity is preserved, income and employment are maintained or increased, and competitiveness and innovation capacity is maintained. The development of social solidarity is considered sustainable if people are able to live their lives and develop their capabilities in conditions of solidarity and well-being.



**Figure 1: Conceptual framework**

## CHAPTER TWO

### 2.0 LITERATURE REVIEW

#### 2.1 Definition of Key Concepts

Sustainability is the study of how natural systems function, remain diverse and produce everything it needs for the ecology to remain in balance. Sustainability is one of the newest degree subjects that attempts to bridge social science with civic engineering and environmental science with the technology of the future.

Sustainability is development processes that needs to integrate ecological and societal knowledge through changes in policy, institutions and behavior (Mohamadi *et al.*, 2011) Senanayak (1991) proposed that agricultural systems have varying degrees of sustainability according to the level of external inputs required to maintain the system that the state of the biotic community within a system operates. According to Sustainability Education Center (2002) sustainability cannot be achieved without addressing social justice issues.

Social sustainability often is broadly defined to include community impacts, general human rights, social justice, labor rights and treatment (Bitsch, 2010). Sustainability defined by the Committee on Twenty-First Century Systems Agriculture (2010) that sustainable agriculture as a progress with respect to four goals: (a) producing enough to satisfy human needs, (b) enhancing environmental quality, (c) protecting the natural resource base and (d) being profitable, increasing the quality of life for farmers, farm workers, and society as a whole. Sustainability defined as a socio-ecological process characterized by the pursuit of a common ideal. Sustainability prompted major

adjustments in conventional agriculture to make it more environmentally, socially and economically viable.

### **2.1.1 Types of sustainability**

The four main types of sustainability are human, social, economic and environmental. These are defined and contrasted. It is important to specify which type of sustainability one is dealing with as they are all so different and should not be fused together, although some overlap to some certain extent (James, 2015). Specialists in each field best deal with these four types of sustainability. For example, social scientists have a lot to say about social sustainability; economists deal with economic sustainability and biophysical specialists deal with environmental sustainability (Amao *et al.*, 2011).

#### **2.1.1.1 Human sustainability**

The very basic need of human sustainability is good reproductive health and safe childbearing (Goodland, 2002). Those that reproduce have the responsibility of caring for their children, giving them access to proper education, and promoting their health and wellness (Goodland, 2002). At some point, the children should have enough skills and knowledge such that they can sustain their own way of life. It is at this point that they become considered as productive human capital as well as individuals that can go through the process of reproduction and rearing.

#### **2.1.1.2 Social sustainability**

Social sustainability means maintaining social capital. Social capital is investments and services that create the basic framework for society (Goodland, 2002). It lowers the cost of working together and facilitates cooperation: trust lowers transaction costs. Only systematic community participation and strong civil society, including government can

achieve this. Cohesion of community for mutual benefit, connectedness between groups of people, reciprocity, tolerance, compassion, patience, forbearance, fellowship, love, commonly accepted standards of honesty, discipline and ethics. Commonly shared rules, laws, and information (libraries, film, and diskettes) promote social sustainability (Goodland, 2002). Shared values constitute the part of social capital least subject to rigorous measurement, but essential for social sustainability (Hepu et al 2013). Social capital is undercapitalized, hence the high levels of violence and mistrust Social (sometimes called moral) capital requires maintenance and replenishment by shared values and equal rights, and by community, religious and cultural interactions.

#### **2.1.1.3 Economic sustainability**

Economic sustainability is having a set amount of capital for a certain period. Those who consume that capital must also conserve it so that they will continue to enjoy it towards the end of the specified period (UNFCCC, 2014). This means that we must preserve all our resources as we consume them so that human beings in the future can enjoy them as well. To achieve this, we must regenerate our resources at a rate that is equal to or faster than our consumption (Goodland, 2002).

#### **2.1.1.4 Environmental sustainability**

Environmental sustainability is important because it involves natural resources that human beings need for economic or manufactured capital. Materials taken from nature are used for solutions that address human needs. If nature is depleted faster than it can regenerate, human beings will be left without raw materials (Morelli *et al.*, 2011). It is intended to help operationalize the concept of sustainability by providing more clarity of purpose and direction, particularly regarding the importance of valuing ecological services and recognizing our interconnectedness. It is intended as an articulation of the professional

goal of the environmental manager and other environmental professionals (Goodland, 2002). Geita district is also mindful of the importance of resource conservation, especially to biologically rich areas of Rubondo Island and Natural forests available. It recognizes that promoting these areas will bring about social, economic and cultural benefits as well as in turn complement and strengthen conservation efforts.

## **2.2 Types of Technologies in Pineapple Production**

There are two types of technologies in pineapple production which are indigenous and improved technologies.

### **2.2.1 Indigenous technologies**

Dayanatha (2006) identified five major characteristics of indigenous technologies which are generally low capital intensive and since they are usually environmentally and ecologically friendly, they are also sustainable. Thirdly, they are generally location and site specific and have limited adaptability, they also diffuse over small homogenous zones mainly by farmers to farmers interaction and finally, that they generate only small increments in output.

Indigenous technologies have historically made and will continue to make a valuable contribution to world of science and technology and cultural heritage. According to Labe (2008), indigenous technologies are an important resource not only for the communities who developed it but also for the scientist and technologist since they have the potential to promote social and economic development by improving the understanding local conditions. Labe (2008) further stressed that indigenous technology provide alternative to western know-how, thereby giving more options for solving problems. Indigenous technologies are part of the lives of rural poor, their livelihood depends almost entirely on



specific skills and knowledge essential for their survival. Example of indigenous technologies of pineapples production in Geita district are using local varieties during transplanting, using local facilities during the land preparation, poor pest and diseases control, using local facilities during transporting pineapples from field to the market.

### **2.2.2 Improved technologies**

Improved technology refers to new inputs, methods, new process or new innovation to increase the production and productivity in agriculture. Those technologies which have the modern agricultural inputs such as seeds, agro-chemicals, and fertilizers can dramatically increase yield but also reduce losses. Improved technologies are largely products of modern science.

Conley and Udry (2002) looked at pineapple cultivation in Ghana and analyzed how fertilizer use can make a marked difference in productivity between a farmer using it and the one who does not. They found that a farmer increases or decreases his fertilizer use when a neighbor experienced higher than expected profit using more or less fertilizer than he did. This is supported by Bandiera and Rasul (2006) who examined the link between social networks and technology adoption in Northern Mozambique and noted that a farmer who discussed agriculture with others had a higher propensity to adopt new technologies.

Conkey and Udry (2003) found that, social learning is important in the spread of the new technologies for farmers with poor farming technology as they would learn from progressive farmers and hence improve their method of farming. Farmers adopt improved farming technologies if information of such technologies is at their disposal. Also Conley and Udry (2002) studied application of fertilizer in pineapple cultivation in Ghana. These authors concluded that initial adoption may be low due to imperfect information on

management and profitability of the new technology but as this becomes clearer from the experiences of their neighbours and their own experiences.

### **2.3 Sustainability of Technology**

The Sustainability Technologies program is a unique and flexible curriculum designed to meet the challenges of the new energy economy. The program done in pineapples production area such as Kagu, Kakubilo, Igate, Nzera, and Katoma where small holders farmers learned different improved agriculture technologies. It runs by NGOS especially ACORD, CODERT and government such as department of agriculture. Atala (2002) defined technology as an organized capacity for some purposive activity. The definition above suggests that sustainability technology includes both components and processes of agricultural production. These processes may include; production of plant, the introduction of new crops, livestock and fisheries, mechanization, infrastructural development, inputs, and land tenure. Merrian (2013) revealed that technology is the application of knowledge to the practical aims of human life or to changing and manipulating the human environment. This includes the use of material tools, techniques and sources of power to make life easier or more pleasant and work more productively. Also involve identification and assessment of agricultural practices and technologies that enhance productivity, food security and resilience in specific agro-ecological zones and farming systems (Adofu *et al.*, 2013 and Abahl *et al.*, 2015).

Foster and Rosenzweig (1995) found that, initially farmers may not adopt improved technology because of imperfect knowledge about management of the technology. The effects of a technology depend on: The way a technology is perceived and used in a social context, the way in which it affects or even transforms this context, the way it interacts

with technological systems and its physical context, the time frame of analysis and the quantity of use.

#### **2.4 Sustainability of Improved Pineapples Production Technologies**

There are many reasons which make the sustainability of improved pineapple production after introduced technologies cease soon after the project comes to an end. One of them is because of lack of the financial resources (Muffui, 2007). The sustainability of technologies discontinue after external support ceases as farmers failed to realize the profitability of the new technology. Foster and Rosenzweig (1995), and Conley and Udry (2002) found similar results. Rubas (2004) tested the universality of age, education, outreach, and farm size in influencing adoption of agricultural technologies he found the technologies cease as if there no external supporter's example extension services.

Conley *et al.* (2000) also studied pineapple output as a result of the combination of two most important inputs in pineapple production. They looked at output related to fertilizer and labour. They indicated that there was agronomic evidence that pineapple yields increase if there are applications of fertilizer. Tschirley *et al.* (2013) noted that the main approach to increasing productivity among farmers by most sub-Saharan African countries was through state controlled distribution of fertilizers and improved varieties at subsidized prices. Information as to the depth of the labor market would suggest whether or not households could work off-farm to earn funds to invest in agriculture (Nanai, 1993)

Saili *et al.* (2005) conducted a research on the factors affecting the performance of pineapples of smallholders in Kampung Meranek. In their study they looked at the production (output) against a number of factors which included labour, pineapple cultivation practice, land size, knowledge and farm record keeping. They also focused on a

number of qualitative factors that influenced output as against most of the variables or characteristics that can be quantified. The qualitative variables included education, race, and gender, and status, number of farmers children involved in pineapple farming, pineapple cultivation practice, and farm recording.

Successful agricultural transformation, the world over, has been largely attributed to improved farm technologies such as fertilizer, improved seeds, soil and water conservation (Johnston and Kilby, 1975; Mellor, 1976; Gabre-Madhin and Johnston, 2002). For developing countries, the contribution of improved technologies to agricultural productivity is well documented (Sunding and Zilberman, 2001; and Doss, 2006). Many studies focused on measuring of the awareness of innovation and on various kind of innovation by using new varieties of cassava (Mkamilo and Jeremiah, 2005). They looked at Africa and Tanzania second most important food crop after maize providing over half of the dietary calories to over half total rural and urban population in sub-Sahara Africa. The varieties code-named Pwani, Mkumba, Makutupora and Dodoma, have doubled cassava production in the country with their potentially high yield ranging from 2-51t/ha against the current average yield of 10t/ha. Productivity of cassava production in many areas had doubled by planting new cassava varieties and high yield cultivation (Hoang Kim, Nguyen Van Bo *et al.*, 2010).

Chalamila and Madulu (2007) conducted a study on the ‘potential’ and constraints of fruit trees in Coast region in Tanzania. In their constraint analysis it was found out that farmers’ major constraints were sustainability of reliable markets, sustainability of improved varieties, lack of improved production, processing know how and pests and diseases. The most important problem was lack of reliable market.

In Geita District Council, Agency for Cooperation and Research in Development (ACORD) (2014) examined the issues related to post-harvest handling and prevailing improved technologies in pineapple production. They found small scale producers are affected by limited knowledge and use of good agricultural practices by the small produces themselves. The opportunity remains that there is significant proportion of farmers within productive age group (35-45) engaged pineapple production in Geita and that most farmers produce on own land with considerable farm size but due to limited use of good agricultural practices productivity remains low. The current challenges to production call for the need for stakeholders to support small horticultural producers to adapt to climate change by supporting them to get training on good agricultural production and also to access improved pineapples varieties that could sustain their productivity.

## **CHAPTER THREE**

### **3.0 RESEARCH METHODOLOGY**

#### **3.1 Description of the Study Area**

Geita Region was created in March 2012 out of the former Shinyanga and Mwanza regions. Geita District had a total population of 807 619 (400 475 male and 407 144 female) (URT, 2012). The district is well endowed with arable land, water resources, and most of the economic infrastructure to improve the quality of rural and urban life as well as to support the envisaged investment. These include road services, navigation services, airport, electricity supply, railway, postal services, banking and telecommunication. The Geita District Council plays a major role in providing agricultural extension services to the small-scale farmers (Sicilima, 2005). Since the district is a major pineapple producing area, it is thus ideal for this study (Anderson and Feder, 2007).



Figure 2: A map of Geita District showing study areas

### **3.2 Research Design**

The study adopted a cross – sectional research survey design that allows sufficient data to be collected at once in time from a sample selected to describe the larger population (Babbie and Mouton, 2005).

### **3.3 Sampling Procedures**

The study employed a multistage sampling technique. Small producers of pineapples were the target population. Multistage sampling refers to a sampling technique carried out through various stages. Simple random sampling technique was used in selecting four out of the 37 existing wards. One village was selected randomly from each ward, to have a total of four villages. From each village 30 pineapple producing household heads were selected randomly from the existing village registers. According to ( Matata et al 2001), 120 respondents are adequate for most socio-economic studies in Sub-Sahara Africa.

Multistage sampling technique was used; small producers of pineapples were the population. Four wards were selected, namely, Kakubilo, Nzera, Katoma, Kagu; eight villages were selected in this study, namely, Kagu, Igate, Sungusira, Rwezera, Nyabalasana, Katoma, Kakubilo and Chanika where pineapples are produced.

A sample of 120 households (pineapple producers) were interviewed using a questionnaire. A total of 10 Key informants were drawn from the District Agriculture, Irrigation and Cooperatives department (DAICO), Tanzania Chamber of Commerce, Industry and Agriculture (TCCIA) Community Development and Relief Trust (CODET) and Agency for Cooperation and Research in Development (ACORD) across the four wards were interviewed.



### **3.4 Data Collection**

#### **3.4.1 Data collection instrument**

Both quantitative and qualitative data were used in the study. Structured questionnaires with open and close-ended questions were used to collect the quantitative data from the respondents. Key informant interviews were used to collect qualitative data from extension officers, NGOs and village leaders. Focus Group Discussions (FGDs) were also conducted with total of 12 participants (7 male and 5 female) in four wards. The Key Informant interviews and the FGDs used checklists which are attached as Appendix 1.

#### **3.4.2 Data collection procedures**

Pre-testing of the questionnaire

A pilot survey was done before the actual study to test the questionnaire for its accuracy, adequacy of the time allocated and for the researchers to familiarize him/her. De vaus (1993) stated that do not take the risk, pilot test first. Twenty (20) randomly selected farmers outside the study area participated in the exercise but were not included in the actual study.

#### **3.4.3 Primary data collection**

Primary data collection was done by administering structured questionnaires to the 120 respondents and a checklist to key informant interviews including extension workers and opinion leaders.

#### **3.4.4 Secondary data collection**

Secondary data were collected from published reports from different sources such as Sokoine University National Agricultural Library (SNAL), District Agriculture, Irrigation

and Cooperatives Office (DAICO), together with Ward Executive Officers (WEO), Village Executive Officers (VEOs), from electronic sources.

#### **3.4.5 Data process and analysis**

Data from the respondents was summarized, coded, analyzed using Statistical Package for Social Sciences (SPSS) version 16.0. Descriptive statistics such as frequencies, percentages and means were determined on the socio-economic characteristics variables. Chi-square used to identify and find the relationship between dependent and some variables and between the variables themselves. Also qualitative data used content analysis such as to measure requirement of farmers for adoption the new technologies where farmers' opinions were tabulated and descriptive statistics of frequencies and percentages were used to summarize the data.

## **CHAPTER FOUR**

### **4.0 RESULTS AND DISCUSSION**

#### **4.1 Socio-economic Characteristics of the Respondents**

Socio-economic and demographic characteristics of the respondents have some influence on farmers' production decisions (Sulo *et al.*, 2012). Because of this reason, socio-economic and demographic characteristics of the respondents were also focused in this study with the aim of determining how such characteristics influenced farmer's decisions in responding to the sustainability of improved pineapple production technologies. The characteristics described in this section include age, education level, sex, marital status, household size and farm size. The socio-economic and demographic characteristics of the respondents are presented in Table 1.

**Table 1: Distribution of respondents according to age, sex, marital status, education level, household size and farm size (n=120)**

<b>Variable</b>	<b>Categories</b>	<b>Frequency</b>	<b>Percentage</b>
Age	20-35 years	25	20.8
	36-51 years	63	52.5
	Above 52	32	26.7
	<b>Total</b>	<b>120</b>	<b>100.0</b>
Sex	Male	107	89.2
	Female	13	10.8
	<b>Total</b>	<b>120</b>	<b>100.0</b>
Marital status	Single	12	10.0
	Married	93	77.5
	Separated	14	11.7
	Widow	1	0.8
	<b>Total</b>	<b>120</b>	<b>100.0</b>
Education level	No formal education	16	13.3
	Primary education	66	55.0
	Secondary education	29	24.2
	Post-secondary education	9	7.5
	<b>Total</b>	<b>120</b>	<b>100.0</b>
Household size	1-5 members	17	28.2
	6-10members	98	60.8
	>11 members	15	11.0
	<b>Total</b>	<b>120</b>	<b>100.0</b>
Farm size (Ha)	0-10 ha	19	15.5
	11-21 ha	49	40.8
	22-32ha	50	41.8
	33 above	2	1.7
	<b>Total</b>	<b>120</b>	<b>100.0</b>

#### 4.1.1 Age

Table 1 shows the distribution of the respondents according to age. Age is one of the most important demographic variables and is the primary basis of demographic classification in vital statistics, census and surveys (NBS, 2005). According to CIMMYT and Nanai (1993) age has considerable influence on either use or no use of any technology introduced in any particular area. John (1995) further argues that older people have more experience but their receptivity to new ideas and technologies decrease with age. The age of the farmer has an impact on experience, wealth and decision making in all matters which affect the rate and extent of sustainable use of a new technology. Farmers in the younger age groups may easily switch over the use of a certain technology to using more recent technologies.

The findings in Table 1 reveal that 20.8% of the farmers fell within 20-35 years, 52.5% fell within the age group of 36-51 years, and 26.7% were above 52 years. These findings indicate that majority of farmers are within the active age range, and because younger farmers are more likely to adopt new technologies, improved technologies in pineapple production are likely to be widely adopted in the study area. Similar findings were reported by Esiobu *et al.* (2014a) who revealed that farmers within the age range of 41 to 50 years are still in their active age, more receptive to innovation more technically efficient, effective and could withstand the stress and strain involved in making decisions on new ideas and therefore contributing significantly to the adoption of new technologies.

The number of respondents in the age group of farmers above 52 years was few (26.7%). Focus Group Discussions and informal interviews revealed that the category of farmers in the age group of above 52 years use their land as capital; they work together with those who had no land on condition that during farming the farming partner must use improved technologies during land preparation, transplanting, weeding and harvesting. Then the land

owners would rent out everything carried out by the farming partner, after harvesting the first produce of the crop in every harvest would belong to the landlord as a payment in kind, the subsequent harvests would go to the farming partner in every farming season (Chineke *et al.*, 2011).

#### **4.1.2 Sex**

Table 1 shows that 89.2% of the respondents were male headed households and 10.2% were female headed households. The findings imply that the study area is more likely to have faster adoption to improved technologies because as Ndawaita (2001) observes male farmers dominate valued household resources such as land, oxen plough, improved varieties directed to farming. Due to these reasons the speed of adoption of improved technologies of pineapples production is likely to be lower among female headed households than is likely to be the case with the male headed households, who have access to assets to improved pineapple production technologies. Shortages of assets like land among women may have direct influence on discontinuation of new technologies in pineapple production in the study area.

#### **4.1.3 Marital status**

Table 1 presents results on marital status of the respondents. The results show that 77.5% of the respondents were married, 10% were single, and about 11.7% were separated. These findings concur with those by Kidagho (2009) who found that, majority (95%) of the respondents were married, and only few (3%) were single.

The high percentage of married couples implies majority of farmers had permanent residence and household responsibilities, and only a few farmers, being single and separated. Married groups have the advantage of sharing managerial skills within the

family and access to more labour force which can be employed in improved technologies for pineapple production activities. The high percentage of married couples implies majority of farmers had permanent residence and household responsibilities, and only a few farmers, being single and separated. This finding is similar to Damisa and Yohana (2007) who observed that, Married farmers are likely to be under pressure to produce more, not only for family consumption but also for sale. The desire to produce more could lead to agricultural information seeking and use. Similarly, the availability of family labour could be an incentive to the married farmer to cultivate more crops and to use agricultural information.

#### **4.1.4 Education level**

Education is a key determinant of the life style and status an individual enjoys in the society (NBS, 2005). The results in Table 1 show that 55% of the respondents have primary education, 24.2% have secondary education, and 7.5% have post-secondary education. This means 86.7% of the respondents were able to read and write and 13.3% were not able to read and write. The explanation to these findings is that agricultural activities need someone with basic education. The level of education is one of the most important variable social factors. The education variable might be attributed to the high level of knowledge and experience about improved farm practices acquired by the educated farmer. This helps her/his to influence major decisions being taken in the home, farm management inclusive (Damisa and Yohana, 2007).

Similar findings were reported by other researchers such Urio 1996 cited by Ndawaita, (2001) who found that only educated people participate in agricultural experimentation. In this study educated people mean a farmer who can impart or acquire general knowledge, developing the powers of reasoning and judgment, and generally of preparing oneself or

others intellectually for mature life. This finding is contrary to Robert Chambers (2007) who found that a number of researchers had established convincing evidence that indigenous knowledge held by rural people had value and could play a role in technology development. This implies that most farmers who benefit from agricultural programme which require skills are literate, because they can read, write information and be able to keep records.

In the study area, the majority (86%) of farmers have formal education which contributes to their level of understanding of different improved technologies. Also the findings show that 7.5% of the respondents had post-secondary education. During FGDs it was reported that these learned groups were the ones who introduced pineapple producers who practice improved technologies with the aim of having sustainable method of production. The findings are consistent with the findings in a study by Okoli *et al.* (2014) who reported that exposure to high level of education is an added advantage in terms of achieving huge income and running efficient agribusiness enterprise.

Education levels have a corresponding impact in the adoption of improved technologies and enhancing high productivity of agricultural production over time (Mtoi *et al.*, 1982). Hence, education is a vital determinant in reflecting the success in the sustainability of improved technologies as well as controlling and mitigating of such factors as diseases, insect pests, credits inaccessibility and poor infrastructure. It is thus expected that the fact that majority of farmers had primary education, will have a bearing on the adoption of improved technologies of pineapples production in the study area. That being the case, regular farmers group training by DAICO, NGOs and researchers will have a positive impact on sustainability of improved technologies and developments in improving pineapple production and management techniques.



#### 4.1.5 Household size

On household size, the findings (Table 1) indicate that many (60.8%) households had between 6 and 10 household members, while very few (28.2%) households had between 1-5 household members. The large size of households implies that, the amount of family labour available for household activities was high, although, in some households, the number of household members included even the children, very old aged people and physically disabled individuals who do not participate in income generating activities; in this respect therefore, large families provide labour for farm activities, and as observed in rural areas, extended families live in separate homesteads in relatively close proximity to each other engaging in farming activities hence being sustainable farming.

The average number of household members from this study area was eight persons. This is above the Tanzanian national average household size of 4.6 (URT, 2013). The findings of this study on household size are similar to what was found by Kwai (2013) in the study on the contribution of savings and credit cooperative societies to income poverty reduction conducted in Mbozi District of Tanzania. In Kwai (2013) study, the average household size was between 6-10 household members. Elsewhere, Onaiwu (2011) and Oluwatayo *et al.* (2008) reported that large household size compliment labour to enhance production and reduce the cost of hired labour. Thus an increase in household size equals to an increase in household labour and hence it ensures an expansion of farmland. Pineapple farmers who had large household sizes realized more yield/income than their counterparts with smaller household sizes. Also according to Martey *et al.* (2013), household size serves as a form of family labour and compliments the effort of the household heads on the farm. Availability of family labour provides the household head in assessing the performance of existing and potential farm activities and systems family labour by providing farmers with the potential for more profit while at the same time protecting the environment (Tegegne

*et al.*, 2001). On the other hand, lack of adequate farm labour supply could be a barrier to the adoption of a more sustainable farming system.

#### **4.1.6 Farm size**

Table 1 shows that 40.8% of the respondents had a farm size ranging from 11-21ha. About 42% of the respondents had a farm size ranging from 22-24ha. During FGDs the respondents said that many people own land through purchasing and others had inherited their lands from their ancestors. The findings revealed further that having a large farm size had a big impact on influencing sustainability of improved technologies. It is frequently argued that farmers with larger farms size were more likely to sustain an improved technology than those with smaller farm sizes; as they can afford to devote part of their field for use with improved technologies (Alene *et al.*, 2000). As reported by Adeyemo (2009), large farm size increases farmers' productivity, improves their technical knowhow, and makes efficient use of resources.

## **4.2 Pineapple Production in Geita District**

### **(a) Crops grown**

Pineapples are a major cash crop grown in Geita district after abandoning (DAICO, 2010) cotton due to losing its importance and value due to diminishing of land sizes for cotton production. Dixon *et al.* (2004) observed that decline in prices of traditional export commodities has caused smallholders to reduce areas under crop cultivation and to shift to new cash crops or other food crops. This was also punctuated by the decrease of the price of cotton in the world market (Kilima, 2006). Nowadays, the main crops grown as reported by the respondents (Table 2) are pineapples (grown by 42.5% of the respondents), vegetables, maize and beans (grown by 32.5%), cassava and rice (grown only by 17.5%) and lastly, cotton (grown by 7.5% only). This trend compelled farmers in the study area to

shift from cotton to pineapple production because such crops earn farmers an income two to three times per year. Due to putting much of effort to the cultivation of the cited major crops, many farmers have limited time to grow or look after cotton. As observed in this study, pineapples were the main crop grown by almost all respondents in the study area as the demand of the product is very high.

**Table 2: Crops grown in the study area (n=120)**

<b>Category</b>	<b>Response</b>	<b>Frequency</b>	<b>Percentage</b>
Crops grown	Pineapple	51	42.5
	Maize and beans	39	32.5
	Cassava and rice	21	21
	Cotton	9	9
	<b>Total</b>	<b>120</b>	<b>100</b>

### **(b) Practices of pineapple production**

The findings reveal that 44.2% of the respondents reported to have farms located at a distance of between 22 and 32 km, 39.2% of the respondents had their farms located at a distance of between 11 and 21 km, and 16.7% of the respondents had their farms located between 0-10 km. This implies that as the distance increases from the farms to the market so is the production costs. It also implies that the likelihood of a farmer to adopt an agricultural improved technology decreases with distance from the road and from home. This means that a long distance of the farms from the road makes it difficult for farmers to access information on improved technologies.

Studies suggest that a farmer is likely to continue using an agricultural technology if frequency of contacts with trained extension workers is increased, especially for technically complex technologies. Contact with neighbouring farmers who possess

knowledge of the proposed technology also increases the likelihood of farmers' sustained use of improved technologies. These constraints force farmers into selling their produce at farm gate prices after harvest thereby losing greater proportion of their fruits to exploitative and dubious middlemen in the area. Sometimes, farmers are forced into selling their fruits at very low prices to avoid huge wastage and losses; and this reduces their production efficiency. Also Table 3 shows that 68.2% of the respondents were selling their crops in the farm and 25% were selling their crops in other towns. This implies that many fruits were sold in the farm. Also during FGDs and key informant interviews, it was reported that farmers sell pineapples at the farm gate to avoid transportation costs and hiring of casual labour for harvesting and transporting the crops from the farm to the market place.

**Table 3: Distance from home to pineapple farm and marketing place (n=120)**

<b>Distance of pineapples farm</b>	<b>Frequency</b>	<b>Percentage</b>
0-10km	20	16.7
11-21km	47	39.2
22-32km	53	44.2
<b>Total</b>	<b>120</b>	<b>100.0</b>
<b>Marketing place</b>		
Within the village	8	6.7
Other town	30	25.0
Within the farm	82	68.3
<b>Total</b>	<b>120</b>	<b>100.0</b>

### **(c) Indigenous technologies in use in the study area**

The respondents explained different indigenous technologies such as use of local varieties use of local transport facilities from the field to the market, use of local facilities in land preparation such as the hand hoe.

#### 4.2.1 Sustainability related to technologies of pineapples production

The respondents who adopted the technologies cited a number of reasons for their participation and eventually sustaining them: the reasons are as follows,

1. Knowledge gained from the training through DAICO and NGOS encouraged them to use improved technologies
2. New ideas and facilitation they got on finding the market
3. High crop yields realized by using improved technologies.
4. Because of improved income and the ease of accessing the market

The respondents reported to have experienced good yield from pineapple crops as opposed to other crops such as cotton, paddy and cassava after using improved technologies in the study area. The study findings reveal that 70% of the respondents reported that the use of improved technologies in the farm could have a long life span of 10 to 12 years and 26.7% said that improved technologies help to have high quality pineapple production thus the products could be sold in high price.

During key informants interviews and FGDs it was revealed that technologies reach the farmer not in the appropriate time. Thus agricultural research and technology development (R & D) programs should aim at incorporating the needs of farmers in the various crop productions. This will facilitate the sustainability of such modern production technologies after being introduced and also the yields from pineapple production would increase.

**Table 4: The reasons of continued used improved technologies**

Improved technologies	Frequency	Percentage
Good production	4	3.3
High quality pineapples production	32	26.7
The farm can have long life span 10yearsto 12years	84	70.0
<b>Total</b>	<b>120</b>	<b>100</b>

#### 4.2.2 Number of years in pineapple production

Findings in Table 5 show that 49.2% of the respondents were involved in pineapple production between 12 to 17 years and 24% were involved between 18-and 24years of production. These findings concur with the findings by Onubuogu and Esiobu (2014a) who reported that farmers with more years of experience would be more efficient have better knowledge of climatic conditions, better knowledge of efficient allocation of resources and market situation and are thus, expected to make more efficient use of improved technologies in pineapple production. The implication of the findings is that more experienced farmers would set good time and cost of field management, allocate the resources which combine and utilize a better approach to pineapple production in the study area.

**Table 5: Years of pineapple production**

Years of farmers growing pineapples	Frequency	Percentage
0-5 years	10	8.3
6-11 years	7	5.8
12-17 years	59	49.2
18-23 years	43	35.8
Above 24 years	1	.8
<b>Total</b>	<b>120</b>	<b>100</b>

#### 4.2.2 Indigenous technologies and their limitation

In various occasions respondents reported to be using indigenous technologies such as, local varieties from fellow farmers, untimely weeding, no use of inputs such as fertilizers and herbicides, the use of traditional means such as local bucket use of transportation from the field to the market place, and untimely application of various inputs such as pesticides.

Studies have indicated that lack of extension services can hamper intensification as well as production levels of crops (Gockowski and Ndoumbé, 2004). Smallholder farmers need extension services, especially for crops that require knowledge on crop diseases and appropriate application of pesticide. Also the respondents reported not to have skills and knowledge on how to identify different pests and diseases and their control. Also postharvest losses, lack of market information on price trends and packaging techniques were other reasons cited for having limited indigenous technologies in the study area. This was because when farmers produce without market information they might produce what is not in line with what is required by the market in terms of quality and quantity especially where consumers are interested in product quality. In this way, they might incur a loss and as a result they may fail to invest in pineapples production.

**Table 6: Indigenous technologies used in study area (n=120)**

Category	Response	Frequency	Percentage
Indigenous technologies			
	Use local varieties	50	41.6
	Traditional weeding methods	42	35
	Little or no use of inputs	8	6.6
	Use local facilities	20	17
	<b>Total</b>	<b>120</b>	<b>100</b>

During group discussion, it was reported that improved technologies were not readily available in the study area. This finding echoes similar observation by Conley and Christopher (2000), on new technology on pineapple production in Ghana; they observed that relevant improved technology is complicated not only because of the relatively poor and heterogeneous environment in which the farmers operate (Walker and Ryan, 1990), but also because of the social and economic factors. Foster and Rosenzweig (1995), and Conley and Udry (2002) reported similar results. Foster and Rosenzweig (1995) studied

the adoption of HYVs in India while Conley and Udry (2002) studied the application of fertilizer in pineapple cultivation in Ghana. These authors concluded that sustainability may be low due to imperfect information on management. Generally, the respondents interviewed reported that availability of improved technologies is poor because of poor availability of information. They depend on NGOs and the government for some support, but not all of these get access to the little help provided. They further stated that the rate of using technology and sustained as a proxy for any desirable change in resource use by a farming population would depend on the characteristics of individual's production circumstances, characteristics of the technology itself, socio-cultural characteristics of individual farmers and the speed (Quizon *et al.*, 2001).

According to the respondents, applicability of indigenous technologies for pineapple production is difficult for the following reasons, first land needs to be well prepared, the soil should be treated before transplanting, making of trenchers of 60cm deep and then planting is done manually in small plots using traditional short-handled narrow-bladed hoe. Weeding is difficult and expensive therefore it requires protective clothing. There are problems of pests especially mole rats, which eat away the growing shoot leading to a reduction of farmers' output. During focus group discussion and key informants interviews it was reported that it is difficult to judge when the pineapple is ready to be harvested, farmers depend on experience, size, and colour as indicators of harvesting. Indigenous technologies in pineapple production used traditional transport facilities such as bicycles and traditional buckets.

#### **4.2.3 Sustainability of improved technologies in the study area**

As for sustainability of improved technologies, it was observed that the simpler the technology, the better its chance of being in use over a long period of time. If farmers can make more money by adopting a simple practice, then the use of a technology or



technology package will be sustainable. Improved technologies in pineapples production such as the use of improved varieties, the use of mixed cropping, the use of improved containers to protect the fruits from damage during handling and transport, and the provision of training have been generally successful adopted in the study area. Accordingly, the following observations are made.

1. Improved practices are sustainable if they fit well into the existing value chain and marketing system.
2. The simpler the technology, the better its chance of being in use over a long period of time. If farmers can make more money by adopting a simple practice, then the use of a technology or technology package will be sustainable.
3. Pineapples producers practices such as the use of improved varieties, identification of proper harvest timing, the use of improved containers to protect the produce from getting damaged during handling and transport, and the provision of training have been generally successful in the study area.
4. Sustainability of a technological innovations depended mostly upon their profitability in the local setting.
5. If subsidies are provided for investing in some technologies (examples: wooden crate and fertilizers) such technologies are likely to flourish.

Therefore improved technologies are sustainable because of the reasons above.

#### **4.2.4 Improved technologies and indigenous technologies: a comparison**

The study findings indicate that 27.5% of the respondents use all improved technologies while 25% of the respondents use mulching in their pineapple farms in order to conserve moisture in the soil and add nutrients. Twenty four point four percentage (24.2%) use improved technology on good seedling selection; 17.5% use improved technology such as

timely planting, 3.3% use good land preparation and 2.5% of the respondents use the technology of making trenches.

The study findings reveal further due to the use of indigenous technology 49.2% of the respondents make poor seedling selection, 46.7% make improper spacing and 4.2% farmers do poor weeding. This implies that weeding, mulching, seedling selection and timely planting are important in pineapple production in order to increase production.

Also respondents reported to have been discouraged from engaging in land management practices by input and output price variation, poor accessibility to output and input market, and poor flow of information (e.g. on technologies, markets and cropping practices) as a result of poor infrastructure.

**Table 7: Use of improved technologies and indigenous technologies**

<b>Improved technology</b>	<b>Frequency</b>	<b>Percentage</b>	<b>Indigenous technology</b>	<b>Frequency</b>	<b>Percentage</b>
Good land preparation	4	3.3	Poor seedling selection	59	49.2
Making trenchers	3	2.5	Improper spacing	56	46.7
Good seedling selection	29	24.2	Poor weeding	5	4.2
Mulching	30	25.0			
All of them (weeding)	33	27.5			
Timely planting	21	17.5			
<b>Total</b>	<b>120</b>	<b>100</b>		<b>120</b>	<b>100</b>

#### **4.2.5 Strategies for ensuring the sustainability of improved technologies**

The respondents were asked to indicate strategies if any that were put in place to sustain the improved technologies. About 13% of the respondents indicated that they plan to increase acreage to sustain improved technologies because of the marketing infrastructure and institutional support services example ease of market, good price and good transport, 52% indicated to continue using improved varieties, 30% indicated to continue using

wooden boxes for transporting pineapples from the field to the market and 8% indicated to continue planting early. Others, 10% indicated to encourage other farmers to use mixed crops farming, 5% indicated to start early land preparation, 2% indicated to prefer receiving extension services to sustain improved technologies. Generally, the interviewed respondents reported to have been encouraged using improved technologies because of the increase in production and high prices of pineapples. The respondents reported to have experienced good yields of pineapple crops as opposed to other crops such as cotton, paddy and cassava when using improved technologies.

**Table 8: Strategies for ensuring the sustainability of improved technologies**

<b>Category</b>	<b>Frequency</b>	<b>Percentage</b>
Increase acreage	14	13
Using improved varieties	59	52
Using wooden box	30	30
Early planting	6	8
Mixed crops	8	10
Early land preparation	4	5
Extension services	3	2
<b>Total</b>	<b>120</b>	<b>100</b>

#### **4.3 The Use of Modern Pineapple Production Technologies**

The use modern of technologies on pineapple production are as presented in Table 9. The chi square test was performed as a statistical test to see whether or not there were any significance differences between the use of indigenous technology and the use of improved technology in pineapple production.

The findings presented in Table 9 show that there were significant differences in production between the uses of two technologies at  $p < 0.05$  (Table9). This implies that

indigenous technology and improved technologies would result to differences in pineapple production.

**Table 9: Indigenous and improved technologies application**

Indigenous technologies	Reasons for using it		Reasons for not using it	
	$\chi^2$	$\rho$ - value	$\chi^2$	$\rho$ - value
Land preparation	21.4	0.000	77.8	0.000
Transplanting	82.4	0.000	50.7	0.000
Weeding	14.7	0.000	58.8	0.000
Harvesting	64.5	0.000	73.6	0.000
<b>Improved technologies</b>				
Land preparation	76.2	0.000	72.2	0.000
Transplanting	12.0	0.000	41.5	0.000
Weeding	51.0	0.000	7.5	0.000
Harvesting	32.0	0.000	10.5	0.000

#### 4.3.1 Introduction of new pineapple production technologies

The poor production methods and hence low productivity has led to the introduction of improved technologies through the District Agriculture, Irrigation and Cooperatives Office (DAICO) and NGOS like Community Development and Relief Trust (CODET) and the Agency for Cooperation and Research in Development (ACORD). Pineapple producers were the ones involved in the use of technologies introduced such as improved varieties, introduction of market information, new packaging techniques, knowledge of identifying different pests and diseases for sustained pineapple production in the study area. FAO (2009) contended that in many developing countries farmers access to quality seed of a diverse range of adapted varieties has been impeded by financial constraints and where to get good information. Pineapple producers were supported through training on good agricultural practices, how to find the market and provision of subsidies in pineapple production.

The factors that contribute to sustainability of newly introduced technologies among pineapple farmers include the use of mixed cropping for maximizing productivity, an increase of crop yields and raising farmers. Again, the influence from trained farmers played a role in the sustainability of improved technologies among other farmers. Availability of road for the transport commodities also influenced farmers in the sustained use of improved technologies Abahl *et al.* (2015). In addition, availability of extension services and relatively affordable costs also prompted them to adopt improved technologies. Similarly, according to the respondents improved technologies also produced better quality products that lead to increased income.

Out of 120 respondents, 16.6% indicated that they need to adopt mixed cropping system, 38% indicated that they were in need of using improved varieties; 14% said they needed extension agents, while 19.2% said they needed to use improved transport facilities; and the remaining 13% said they got information from researchers, DAICO, office and NGOS.

**Table 10: Requirement of farmers in improved technologies and number of training (n=120)**

<b>Category</b>	<b>Frequency</b>	<b>Percentage</b>
Mixed cropping	20	16.6
Improved varieties	46	38.2
Extension agent and training	17	14
Improved facilities for transport	23	19.2
<b>Total</b>	<b>120</b>	<b>100</b>

#### **4.3.2 Cropping system on pineapple**

On cropping system on pineapple production the findings in Table 6 show that 41.7% of the respondents use mono-cropping system so as to avoid competition for soil nutrients between pineapple and other crops and for ease of management. Also 30.8% of the respondents reported to be practicing mixed cropping system such as mixing banana with

cassava, maize, and beans. This finding is similar to the one reported by Onubuogu *et al.* (2014) who revealed that farmers adopt mixed cropping practice for many reasons which include; efficient management of land, coping with climate change, ensuring food security and food availability all year round, increasing income and reducing incidences of pests and diseases. Also the system is used as a means of maximizing productivity, diversification of crops on their small land holdings. Twenty seven point five percent (27.5%) of the respondents use intercropping with trees like pine. During FGDs and key informants it was reported that intercropping is used by farmers for ten years of growing pineapples; after that in the subsequent years farmers leave the farm for the trees and that becomes the end of the lifespan of pineapple production leaving pine trees in the fields.



**Plate 1: Pines and Pineapple in Nzera ward**



**Plate 2: Mono cropping system in Nzera ward**

**Table 11: Cropping system of pineapple production**

<b>Cropping system</b>	<b>Frequency</b>	<b>Percentage</b>
Monocropping	50	41.7
Mixed cropping	37	30.8
Intercropping	33	27.5
<b>Total</b>	<b>120</b>	<b>100.0</b>

### **4.3.3 The use of modern pineapple production technologies**

The findings in Table10 show that 66.7% of the respondents use improved technologies during land preparation. The findings reveal further that farmers use improved technologies during transplanting since pineapple production requires a lot of weeding especially during the rainy season. And it follows that labour-saving techniques are often adopted in areas of labour-shortage, but not in areas of labour-surplus. Table 15 shows that 75.8% of the respondents admitted that they used improved technologies in good handling of the produce, and 24.2% reported that pineapples stay for a long time in the market. These findings imply that farmers are more encouraged to use improved technologies during harvesting. Also Sampson (1980) make similar observations that farmers use field

containers for transporting the fruits to storage houses, do trimming of fruit stalk, do the cleaning of pre-cooling systems, do the sorting of fruits to remove the defective ones, do the waxing, size grading, packing in containers (use of dividers) storing (in low temperature), loading on the transit vehicles (Sampson, 1980).

**Table 12: Use of improved technologies (n=120)**

<b>Improved technologies</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Land preparation</b>		
Reasons for using		
Have facilities oxen	38	31.7
High production	80	66.7
Destroy pest	2	1.7
<b>Total</b>	<b>120</b>	<b>100</b>
Reason for not using		
Operation very expensive	8	6.7
It takes time	82	68.3
Problem of lab our	30	25.0
<b>Total</b>	<b>120</b>	<b>100</b>
Transplanting		
Improved technologies	118	98.3
Indigenous technologies	2	1.7
<b>Total</b>	<b>120</b>	<b>100</b>
<b>Weeding</b>		
Improved technologies of weeding	117	97.5
Indigenous technologies	3	2.5
<b>Total</b>	<b>120</b>	<b>100</b>
Reasons for using improved technologies		
Good sanitation	4	3.3
Control pest and diseases	51	42.5
Allow good aeration of the soil	65	54.2
<b>Total</b>	<b>120</b>	<b>100</b>
Harvesting		
Reasons for using improved technologies		
Stay for long time in market	29	24.2
Good handling	91	75.8
<b>Total</b>	<b>120</b>	<b>100</b>



#### 4.3.4 Usage of new agrochemicals (fertilizers)

Out of 120 respondents who indicated that they 115 (97.8%) said they participated in training on fertilizer use. However, with time 114(93.3%) indicated that they were not using fertilizers in pineapple production meaning that some of those who participated during training finally not adopted the use of it. Those who indicated that they abandoned using fertilizers claimed that fertilizers were expensive and others said they had no enough capital to buy fertilizers.

**Table 13: Percentage distribution of respondents by use of fertilizers (n=120)**

Variable	Responses	Freq.	%
Training on fertilizer application (n=120)	Yes	115	96.7
	No	5	3.3
	<b>Total</b>	<b>120</b>	<b>100.0</b>
Still using fertilizers (n=115)	No	114	93.3
	Yes	6	6.7
	<b>Total</b>	<b>120</b>	<b>100.0</b>
Reasons for not using fertilizers (n=3)	Expensive	38	33.3
	Lack of capital	76	66.7
	<b>Total</b>	<b>114</b>	<b>100.0</b>

#### 4.4 Sustainability of Improved Technologies, Availability of Market and Training

As for sustainability of improved technologies, it was observed that the simpler the technology, the better its chance of being in use over a long period of time. If farmers can make more money by adopting a simple practice, then the use of a technology or technology package will be sustainable. Improved technologies in pineapples production such as the use of improved varieties, the use of mixed cropping, the use of improved containers to protect the fruits from damage during handling and transport to the market and the provision of training have been generally successful adopted in the study area. Accordingly, the following observations are made.

1. Improved practices are sustainable if they fit well into the existing value chain and marketing system.
2. The simpler the technology, the better its chance of being in use over a long period of time. If farmers can make more money by adopting a simple practice, then the use of a technology or technology package will be sustainable.
3. Pineapples producers practices such as the use of improved varieties, identification of proper harvest timing, the use of improved containers to protect the produce from getting damaged during handling and transport to the market, and the provision of training have been generally successful in the study area.
4. Sustainability of a technological innovations depended mostly upon their profitability in the local setting for example to have good market and training.
5. If subsidies are provided for investing in some technologies (examples: wooden crate and fertilizers) such technologies are likely to flourish.

#### **4.4.1 Factors contributing sustainability of technologies**

Availability of herbicides, improved varieties, weeding and pesticides

The factors that contributing sustainability of technologies mentioned were the use of herbicides need low labour costs involved and the fact that herbicides use raised income and resulted into high crop yield harvested. Adoption of improved varieties resulted into relatively higher crop yields, raised income and resulted into high quality produced crops. Again, trained to farmers played a role in other farmers to have sustainability in technologies. The availability of the market for produced commodities influenced them to adopt use of improved varieties, factors contributing in sustainability of pineapples production according to FGD are; used of improved varieties, used of herbicide to control pest and diseases and good market.

#### 4.4.2 Farm production factors

However, out of 120 respondents interviewed, 40% reported to be trained two times per year; 32.5% reported to be trained four times per year; and 27.5% said they were trained more than 6 times per year. This implies that many people in the study area lack training on improved technology on pineapple production. The farmer who receives a lot of training is exposed to more technologies than his/her counterpart with low or no training from an extension expert on pineapple production. It looks apparent that those who have more training acquire more new farming techniques than farmers who grow pineapples without training. FGD explained more about the stable supply of the technologies is another important factor for pineapples production for example good practices of pineapples production, uses of good spacing.

**Table 14: Requirement of farmers in improved technologies and number of training (n=120)**

Category	Frequency	Percentage
<b>Number of training of improved technology</b>		
Two times per year	48	40
Four times per year	39	32.5
Above 6 per year	33	27.5
<b>Total</b>	<b>120</b>	<b>100</b>

#### 4.4.3 Marketing infrastructure and instructional support services

The findings revealed that majority 81.7% of the respondents were not satisfied with the market price while 18.4% of the respondents were satisfied. This implies that farmers sustain losses instead of earning profit after selling pineapples. Poor satisfaction is a result of low prices vis-a-vis high costs of production. Farmers in Geita district sell their pineapples at a price that ranges from TZS 50 to TZS 1 000 depending on the harvest season. During peak harvest season the price can be as low as TZS50 per fruit. Farmers

sell pineapples in such regions as Mwanza, Kagera, Shinyanga, and Simiyu. But farmers have become more of price takers than price makers in Geita district because there are no organizations which help them to find good markets; therefore, farmers prefer to sell the fruits at the market place rather than at the farm-gate. They would sell at extremely low prices in the farm than is the case in the market; they are afraid were of paying for transport and casual labour. The farmers sell pineapples to people within the villages at the same price they sell along the roadside points in places such as Kakubilo Centre, Sungusila, Igate, Nzera and Bugurula.



**Plate 3: Market place at Igate village**

**Table 15: Distribution of respondents according to satisfaction of the market**

Satisfaction	Frequency	Percentage
Yes	23	18.4
No	98	81.7
<b>Total</b>	<b>120</b>	<b>100.0</b>

#### 4.4.4 Institutional support services

The findings in Table 15 reveal that 46.7% of the respondents reported that the technology is supported by NGOs; 30% said the technology is supported by farmers; 17.5% said the

technology is supported by the District Extension Officers while few (5.8%) said the technology is supported by researchers. During Focus Group discussions and Key Informants Interviews it was reported that there was cost sharing of the improved technologies of pineapples production in the study area. According to Van den Ban and Bawkins (1996) farmer get knowledge and information they needed from other farmers, government extension organization, private companies, other government agencies, marketing boards, and other mass media. This finding is similar to the one reported by Bandiera and Rasul (2006) who examined the link between social networks and technology adoption in Northern Mozambique and noted that a farmer who discussed agriculture with others had a higher propensity to use new technologies.

**Table 16: Distribution of respondents according to source of support services**

Source of support services	Frequency	Percentage
District Extension Officers	21	17.5
Researchers	7	5.8
NGOs	56	46.7
Farmers	36	30.0
Total	120	100.0

#### **4.4.5 Political factors hindering adoption of improved technologies**

Political issues were reported to have been hindering the adoption of improved technologies in the production of pineapple in the study area. Out of the 120 respondents 65.8% said that there was no subsidies in pineapple production as, 26.7% reported of there being conflict of interests between NGOs and Village leaders (CADP, 2012). According to key informants interviews and FGD years back the government use to collect local revenue from cotton produce for use in the district and supported improved technologies for other crops. But nowadays because of the fluctuation of the cotton market farmers shifted from cotton to the production of food crops such as paddy and pineapple. This led

to an increase of the number of pineapple producers at the district level and which were not given any support to promote pineapple production. Farmers were also not getting any information on good technologies because some of the NGOs leaders were not giving actual information concerning improved technologies in pineapple production project.

**Table 17: Distribution of respondents according to political factors (n=120)**

<b>Political issue in pineapple production</b>	<b>Frequency</b>	<b>Percentage</b>
No subsidies in production	79	65.8
Conflict between NGOs and village leaders	32	26.7
none	9	7.5
<b>Total</b>	<b>120</b>	<b>100</b>

#### **4.6 Summary of Chapter**

Socio-economic and demographic characteristics of the respondents focused in this study with the aim of determining how such characteristics influenced farmer's decisions in responding to improved pineapple production technologies. The characteristics include age, education level, sex, marital status, household size and farm size. The age of the farmer has an impact on experience, wealth and decision making in all matters which affect the rate and extent of sustainable use of a new technology.

The explanation to these findings is that agricultural activities need someone with basic education. The education variable might be attributed to the high level of knowledge and experience about improved farm practices acquired by the educated farmer. Knowledge gained from the training through DAICO and NGOS encouraged them to use improved technologies.

Pineapples are a major cash crop grown in Geita district after abandoning (DAICO, 2010) cotton due to losing its importance and value due to diminishing of land sizes for cotton production. Sustainability of improved technologies, it was observed that the simpler the

technology, the better its chance of being in use over a long period of time. If farmers can make more money by adopting a simple practice, then the use of a technology or technology package will be sustainable.

The poor production methods and hence low productivity has led to the introduction of improved technologies through the District Agriculture, Irrigation and Cooperatives Office (DAICO) and NGOs like Community Development and Relief Trust (CODET) and the Agency for Cooperation and Research in Development (ACORD). Pineapple producers were the ones involved in the use of technologies introduced such as improved varieties, introduction of market information, new packaging techniques, knowledge of identifying different pests and diseases for sustained pineapple production in the study area.

Fertilizer is among the production factor of pineapples production. But majority of farmers 97.8% they participated in training on fertilizer use. However, with time (93.3%) indicated that they were not using fertilizers in pineapple production meaning that some of those did not use fertilizers. They claimed that fertilizers were expensive and others said they had not enough capital to buy fertilizers.

Farmers in Geita district sell their pineapples at a price that ranges from TZS 50 to TZS 1000 depending on the harvest season. During peak harvest season the price can be as low as TZS 50 per fruit. Farmers sell pineapples in such regions as Mwanza, Kagera, Shinyanga, and Simiyu.

During Focus Group discussions and Key Informants interviews it was reported that there was cost sharing of the improved technologies of pineapples production in the study area. Also political issues were reported to have been hindering the adoption of improved technologies in the production of pineapple in the study area.

## CHAPTER FIVE

### 5.0 CONCLUSIONS AND RECOMENDATIONS

#### 5.1 Conclusions

From the word “sustainability” being a complex concept as it was declared by different authors. The complexities of this concept contributed to many researchers make use of several different aspects in studying sustainability of improved technologies to the small holder farmers.

In this study, it was found out that, the factors which may influence the farmer to use improved technologies include, the Socio-economic and demographic characteristics of farmer, indigenous technologies that have been introduced in pineapples production, improved technologies that have been introduced in pineapple production and factors contributing to sustainability between the indigenous and newly introduced agricultural innovations related to pineapples production.

These aspects individually might contribute to influencing sustainability of improved technologies of pineapples production, close related socio-economic characteristics such as age, sex, education level; marital status, house hold size and farm size are among the factors which might contribute to sustainability of improved technologies of pineapples production in study area. The results showed that pineapples are major cash crop grown in Geita district after abandoning cotton due to losing its importance and value due to diminishing of land sizes for cotton production.

The result showed that farms located at a far distance from farmers residences increase production costs which result adopt an agricultural technology decreases with distance



from the road and from home. Study found that a farmer is likely to continue using an agricultural technology if frequency of contacts with trained extension workers is increased, especially for technically complex technologies.

The result shown that factors contributing in sustainability of pineapples production according to FGD are use of improved varieties, use of herbicide to control pest and diseases and good market, improved practices are sustainable if they fit well into the existing value chain and marketing system.

The simpler the technology, the better its chance of being in use over a long period of time. If farmers can make more money by adopting a simple practice, then the use of a technology or technology package will be sustainable. Also many people in the study area lacked training on improved technology on pineapple production. The farmer who receives a lot of training is exposed to more technologies. It looks apparent that those who have more training acquire more new farming techniques than farmers who grow pineapples without training. FGD explained more about the stable supply of the technologies is another important factor for pineapples production for example good practices of pineapples production, uses of good spacing.

Study found out that the technology is supported by NGOs, farmers, District Extension Officers and researchers. During Focus Group discussions and Key Informants Interviews it was reported that there was cost sharing of the improved technologies of pineapples production in the study area. Political issues were reported to have been hindering the adoption of improved technologies in the production of pineapple in the study area. Farmers were not getting any information on good technologies because some of the

NGOs leaders were not giving actual information concerning improved technologies in pineapple production project.

## **5.2 Recommendations**

In a view of the findings of this study, the following recommendations are put forward.

1. Project activity must involve the District Council which will eventually take over the overseeing the technology in question.
2. Due to long distance from the home to the farms being one of the factors affecting the adoption of improved technologies, the study recommends local government through district commission to construct and improve feeder roads so that farmers will easily access to their farms, reduce cost of transportation of inputs and outputs from the farm and hence make them be in a position to adopt the technologies and also extension agents will easily access to farmers production areas and extend the technologies to farmers.
3. The local government should ensure that improved varieties herbicides for controlling pests and diseases and good market should be continuously available so that farmers can sustainably adopt the improved technologies.
4. Stable supply of the technologies for pineapples production for example good practices of pineapples production, use of good spacing should be maintained so that farmers can produce high quantity and quality pineapples...
5. The study recommends that NGOs, farmers, District Extension Officers and researchers should continue to support farmers in cost sharing of improved technologies of pineapple production in the study area so that they can sustainably produce the crop.

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## APPENDICES

### Appendix 1: Questionnaire

Questionnaire of household

**TITLE: FACTORS INFLUENCING SUSTAINABILITY OF IMPROVED PINEAPPLE PRODUCTION TECHNOLOGIES IN GEITA DISTRICT**

Good morning/afternoon/evening, my name is PILL IDD MAUYA. I am working at Geita district council department of agriculture. I would like to study the sustainability of pineapple production in your area. In order to do this, I have a few questions to ask you. Your households have been randomly chosen to participate in this study and you are one of the household members chosen to give detailed information.

The purpose of this study is to establish factors influencing sustainability of improved pineapple production technologies by small scale farmers in Geita. The results are expected to generate information on factors influencing the sustainability of new technology of pineapple production by small scale farmers in the district. This information will be of vital use to both the development agents and farmers in Geita district. Once the development agents understand the source and nature of the problems and realize them, they will be more likely to have cohesiveness in finding the alternative solutions against those problems.

I would like to assure you that your information will be used for the intended purpose only and your identity will never be disclosed when such information is presented. Please feel free to answer the questions that will be asked. Would you be willing to have a discussion with me?

If NO, put a tick in the bracket ( ), end interview and find a replacement household;

If YES, put a tick in the bracket ( ), to acknowledge that the respondent consented.

Name of the Interviewer \_\_\_\_\_

Date of Interview \_\_\_\_\_

Time taken to complete interview \_\_\_\_\_

#### A. HOUSEHOLD IDENTIFICATION VARIABLES

1. Name of the Interviewee \_\_\_\_\_

2. Village name \_\_\_\_\_

3. Home let name \_\_\_\_\_

3. Ward name \_\_\_\_\_

4. Division name \_\_\_\_\_

#### B. INTERVIEWEE CHARACTERISTICS

5. Sex: \_\_\_\_\_ Male \_\_\_\_\_ Female

6. Age of Interviewee (years) \_\_\_\_\_

7. Educational level:

(a) \_\_\_\_\_ No formal education

(b) \_\_\_\_\_ Primary school education

(c) \_\_\_\_\_ Secondary School education

(d) \_\_\_\_\_ Post-secondary education

(e) \_\_\_\_\_ other, specify \_\_\_\_\_

8. Marital status

1. \_\_\_\_\_ Single

2. \_\_\_\_ Married
3. \_\_\_\_ Divorced
4. \_\_\_\_ Separated
5. \_\_\_\_ Widowed

9. Household composition (include only those who live within this house, exclude those who have permanently migrated to other areas, e.g. town)

Household member	Relation to HH	Age in years	Sex	
			Male	Female
Household's head				
Spouse				
Other members, mention names and provide all other relevant information				

HH –House hold head

### C. Farming activities

10. What is your total farm size \_\_\_\_\_ acres?

11. What kind of technologies do you use in production of pineapple?

Indigenous technologies ( )

Improved technologies ( )

Both ( )

12. Are these technologies easily available?

Yes ( )

No ( )



13. If yes, which of the technologies are more readily available?

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14. Is there any sharing cost of technology you use? \_\_\_\_\_

15. Who supporting the technologies you use?

District extension officers ( )

Researchers ( )

NGO's ( )

Farmers ( )

#### **D. Pineapple production**

**Objective1. To identify indigenous technologies used in the production of pineapples**

16. What is the size of the farm used for pineapple production? \_\_\_\_\_

17. What indigenous technologies do you use in your farm?

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18. Which one of these cropping systems do you use in pineapple farm?

Monocropping ( )

Mixed cropping ( )

Inter-cropping ( )

19. How do you see practicability of Indigenous technologies for pineapple production?

Easy to use ( )

Difficult to use ( )

20. Is this technology cost effective?

Yes ( )

No ( )

21. If yes who pay the cost

Yes ( )

No ( )

22. How many years have you been engaged in pineapple production?

2years ( )

8years ( )

14years ( )

22above ( )

23. Where are pineapples grown in relation to other crops items of the distance from farm to home

Crops	Far from home	Close to home
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Pineapples

Other crops

23. Where do you market your pineapples?

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24. Are you satisfied with the market?

Yes ( )

No ( )

25. If not satisfied with the market what are the reasons?

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**Objective 2. To identify improved technologies that has been introduced in pineapple production**

26. Are you using improved technologies of pineapple production?

Yes ( )

No ( )

27. If your answer is yes, list the improved technologies you use

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28. How many times per year do you have training of improved technologies?

2 times per year ( )

4 times per year ( )

5times and above ( )

29. Who incurs the cost of improved technologies pineapple production during training?

Gorvement ( )

NGO's ( )

Farmers ( )

30. Is there any culture or political issue hindering the improved technologies of pineapple production?

Yes ( )

No ( )

31. If yes, list them

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**E. Technology in use**

**Objective 3. To examine factors contributing to sustainability between the indigenous and newly introduced agricultural innovations related to pineapple production**

## 32. Indigenous technology

Stage	Technology used	Reasons for using it	Reasons for not using it
Land preparation			
Transplanting			
Weeding			
Insecticide application			
Fertilizer application			
Harvesting			

33. Why do you use indigenous technologies?

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34. Other indigenous technologies for pineapples production?

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35. Where do you get indigenous technologies for pineapple production?

From extension agent ( )

From fellow farmers ( )

## 36. Improved technologies

Stage	Technology used	Reasons for using it	Reasons for not using it
Land preparation			
Transplanting			
Weeding			
Insecticides application			
Fertilizer application			
Harvesting			

37. What are the reasons that make you to continue using the technologies mentioned in Qn.37 above?

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38. Is there any training on improved technologies from researchers to the farmers?

Yes ( )

No ( )

39. Who sponsors the training?

Government ( )

NGO's ( )

Farmers ( )

40. Is there any changes in yield?

Yes ( )

No ( )

41. If yes what is the nature of change in yield

Yield has decreased \_\_\_\_\_

Yield has increased \_\_\_\_\_

42. Which is more economically profitable between indigenous and improved technologies? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

43. What is make you continue or stop using the technologies?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Appendix 2: Checklist for focus Group discussion with Pineapple farmer informants**

1. What kinds of technologies are used in pineapple production?
2. What is the importance's of technologies which you mentioned above?
3. Is there any support of the technologies used?
- 4 Are pineapple producers still continue to use those technologies?
5. Give the reasons for using or not using the technologies?

**Appendix 3: Checklist for NGO'S /Extension officers**

1. What kind of agriculture technologies you offer to farmers?
2. Are there any cultural /beliefs or taboos hindering sustainability of agriculture technology?
3. Are there any incentives provided to the pineapple producers?
4. Please indicate the range of improved technologies that focusing in pineapple production?
5. Can you identify at least 5 success indigenous technologies of pineapple production?



**Appendix 4: Checklist for District agricultural officer**

1. What technologies provided to small scale farmers in Pineapple Production?
2. Is there any microfinance institutional which work together with pineapple producers?
3. What other supports of agricultural activities especially for pineapple production is provided to farmers?
4. Please explain what do you think there is a contributing factors of practice indigenous technologies?