INCOME EFFECT OF AGRICULTURAL INTENSIFICATION ON SMALLHOLDER COTTON FARMER'S IN MISUNGWI DISTRICT

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ABSTRACT

Cotton is a vital cash crop in Tanzania and is mostly produced in the Western Cotton Growing Area (WCGA). About 99 percent of the total cotton is produced from this area which comprises Mwanza, Shinyanga, Simiyu, Mara, Geita, Kagera, Tabora, Singida and Kigoma regions. The remaining percentage is produced in the Eastern Cotton Growing Area (ECGA) which comprises the regions of Morogoro, Coast, Tanga and Kilimanjaro. Due to low cotton yield, agricultural intensification was important in cotton to increase yield to attain income. The average production in the study area is 238 kg per acre which is below by 562 kg as per recommended productivity of 800 kg for UK 91 cotton seed variety. This study was conducted in Misungwi District which is in Mwanza region. The general objective of the present study was to assess the contribution of intensification on cotton production and its implication on smallholder farmer's income. The specific objectives were to examine the state/forms of agricultural intensification in the area, to determine the level of input efficiency, and to analyze the income effect of intensification on cotton. Data was obtained through structured questionnaire survey administered to 120 respondents selected from six villages. Descriptive statistics; stochastic frontier and GM analysis in the methodology were used. The results showed that eighty (80) percent of the respondents had primary level of education and were on the mid active age with an average of 40 years and average land size was 2.14 acres per household. Furthermore the results showed high variation of efficiency input used and difference gross margin for intensifies and non intensifies farmers, were intensified farmer has 310 kg while non intensified has 194 kg.

Intensification in cotton was found important in increasing yield for smallholder farmers if the government increases its efforts in provision of training, subsidy to input, good market price for cotton seed and employ extensional agents.

DECLARATION

I, NANCIETY MICHAEL MULASHANI, 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 degree award in any other institution**.**

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The declaration is confirmed

_________________________ _________________________

Dr. Adam Akyoo Date

(Supervisor)

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DEDICATION

This dissertation is dedicated to Michael Mulashani's family and all who had trust in my education.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATION AND ACRONYMS

CDT	Commutative Distribution Foundation
CDT	Cotton Development Fund
CDTF	Cotton Development Trust Fund
CIP	Crop Intensification Program
CRE	Correlated Random Effects
CSDP	Cotton Sector Development Program
CSRT	Cotton Subsector Reforms in Tanzania
ECGA	Eastern Cotton Growing Area
FAO	Food and Agricultural Organization
FAOSTAT	Food and Agricultural Organization Statistics
GDP	Gross Development Product
GM	Gross Margin
ICTSD	International Centre for Trade and Sustainable Development
IFAD	International Food and Agricultural Development
LZARDI	Lake Zone Agricultural Research and Development Institute
MLE	Maximum Likelihood Estimation
OLS	Ordinary Least Square
RCU	Regional Cooperative Union
SEACF	Southern Eastern Asia Collectors Forum
SNAL	Sokoine University of Agricultural library
SRI	System of Rice Intensification
TCA	Tanzania Cotton Authority
TCB	Tanzania Cotton Board

TCLSB	Tanzania Cotton Lint and Seed Board
TCMB	Tanzania Cotton Marketing Board
TGT	Tanzania Gatsby Trust
URT	United Republic of Tanzania
USA	United State of America
USD	United State Dollar
WCGA	Western Cotton Growing Area
WCGZ	Western Cotton Growing Zone

CHAPTER ONE

1.0 Background and Problem Statement

1.1 Background Information

Cotton is an important cash crop for many countries in the world. Over the last 5 years United State of America (USA) has been leading in cotton exports in the world (about one third of all global cotton exports) followed by India 19%, Central Asia 16%, Brazil 12% (ICTSD, 2013). China is the leading producer (about 31%) of cotton production, importer and consumer of cotton in the world followed by India and USA (Cotton Incorporated, 2014).

In Africa, cotton is among the few crops that accounts for significant share of the world exports. African cotton producers[1] contribute about 5% of global production, 11% of exports where C-4[2] countries contribute 6% and 5% is from the rest (Jales, 2010; ICTSD, 2013). The production of cotton subsector is uncertain, though production in Africa has been improving over time due to the efforts made by some African countries in supporting cotton farmers. Cotton is a valuable cash crop for many smallholder farmers' income and plays a vital role in the economies of many developing countries that are growing cotton. In Sub Saharan African countries, more than two million rural households depend on it for their source of income, which is a proportion of 40% of the population in Tanzania (George, 2012; SEACF, 2010).

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[1] These countries are Egypt, Mali, BurkinaFaso, Benin, Coted'Ivoire, Zimbabwe, Cameroon, Nigeria, Sudan, Togo, Tanzania, Chad, Zambia, South Africa, Mozambique, Uganda, Ethiopia, Senegal, Madagascar, Ghana and Kenya.

[2] Leading countries in cotton production in Africa c-4 countries (Benin, Chad, BurkinaFaso, and Mali).

1.1.1Cotton production in Tanzania

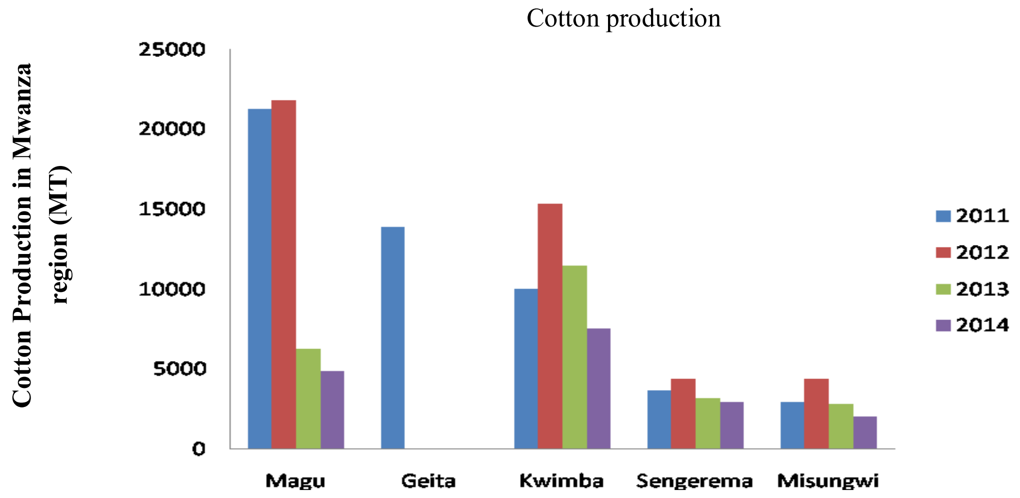
Cotton is one of the major traditional export crops in Tanzania after coffee, tobacco and sisal (Tanzania Gatsby, 2007). It is crucially important for income generation, foreign exchange earner (earned the country about USD 90.3 million in 2004/05 season) and a significant employer (about 500 000 employment opportunities to the rural households during 2011) (CDTF, 2011; Poulton and Maro, 2009). Rural cotton farming households own farm sizes averaging 1.5 hectares and use minimal purchased inputs such as agro-chemicals, fertilizer and seed. In Tanzania, cotton farming is 100% rain-fed and produced in two zones; Western Cotton Growing Area (WCGA[3]) contributing 99% of production with 1% of total production coming from the Eastern Cotton Growing Area (ECGA[4]). Cotton is grown in 42 districts from 13 regions with 90% of the produce coming from Mwanza, Shinyanga, Singida, Mara, and Tabora regions (TCB, 2010).

While production continued to expand in response to reformation changes in the cotton subsector for the zones growing cotton in Tanzania, WCGA accounts as the leader in cotton production. During production season of 2004/05 to 2010/11, Shinyanga produced 62 percent of total seed cotton in the country, followed by Mwanza (23 percent), Mara (8 percent), Tabora (4 percent) and communally Kagera, Kigoma and Singida (2 percent) where farmers were able to receive an average income of USD 226 per acre (TCB, 2010).

Mwanza Region is among the leading regions in cotton production from the WCGA. It produces 74 744 metric tons annually after Shinyanga which produces 220 808 metric tons. The economy of Mwanza Region is dominated by smallholder farmers and employs about 85% of the region's population (URT, 2012; TCB, 2010). The cultivated land for

[3] WCGA includes Shinyanga, Mwanza, Tabora, Mara, Kigoma, Kagera and Singida.
[4] ECGA includes Morogoro, Kilimanjaro, Tanga, Iringa and Manyara.

cotton differs between districts in the Region. Misungwi District produces 22 423.2MT which accounted for 30% of all cotton output from the region in 2008/09 season (Hanna, 2008). In 2014, Misungwi district produced 2 046.369 metric tons of cotton equivalent to 11.7% of total Mwanza Regional production for the year as shown in the trend of production for 2010/11 to 2014 in Fig. 1.



Source: Tanzania Cotton Board (2015).

Figure 1: Cotton Production in Mwanza Region in (Metric Tons) 2011 to 2014

1.1.2 Agricultural intensification

Agricultural intensification is an increase in the productivity of existing land and water resources in the production of food and cash crops, livestock, forestry and aquaculture. Agricultural intensification is concerned with social, political, environmental and economic aspects in meeting future global and industrial food demand under sustainable land use. It is defined technically as an increase in agricultural production per unit of land (Barney and Low, 2010).

It is associated with the increase use of external inputs. The need to intensify agriculture has been stimulated by the increase in demand for agricultural product due to population growth (Jacob *et al*., 2014; Muyaga and Jayne, 2014).

Agricultural intensification may occur as a result of an increase in the gross output due to input expanding proportionately without technological change or a shift towards more valuable output as well as technical progress that raises land productivity. The processes associated with agricultural intensification include an increase (per fixed unit of land) frequency of cultivation, an increase of labour inputs and a change in technology (Garnett and Godfray, 2012).

Intensification can also be described as the more efficient use of production inputs. Increased productivity comes from the use of improved variety and breeds, more efficient use of labour and better farm management (Dixon *et al*., 2001). According to the World Bank (2007), intensification exists on farm production pattern through increased use of input or better quality input. It performs more on diversification as among the option to sustainable intensification which represents a change in farm enterprise pattern to increase profitability and income to farmers.

Worldwide, the system of agricultural intensification has led to the increase in food production and spared non-agricultural land use. Since 1950, global grain production has doubled and arable agricultural land has increased by 9% (Nicole, 2011). In Africa, sustainable intensification has led to doubling of yield and enhancement of agricultural development since it increases the value of output per hectare. Assegai *et al.* (2014) asserts that agricultural intensification leads to increase in yield and profit to farmers.

Most intensification studies have been focused much on food crops in order to increase food security (Garnett and Godfray, 2012; Nicola, 2010). In Rwanda, crop intensification (through Crop Intensification Program (CIP) is done on maize, Soya bean and wheat in order to increase national agricultural productivity and food security. The CIP has raised wheat yield by over 100% and maize yields by about 90% in Rwanda during 2009 (Nicola, 2010).

1.1.3 Agricultural intensification in Tanzania

Tanzania is among Sub-Saharan African countries where most of the poor rural smallholder farmers are faced with food insecurity. About 80% of Tanzanian population depends on agriculture for their livelihood (Raymond and Emmanuel, 2010), yet the sector is the least renumerative in the economy. Agricultural growth has been the overriding policy concern in the effort to reduce poverty and hunger. Intensification in agriculture has been given much effort by Tanzania government to meet the demand for population growth. It has led to improvement of agricultural sector, where the sector has been contributing 31.7 percent of the country's Gross Domestic Product (GDP) (URT, 2014).

In Tanzania, intensification is done on various staple food[5] and cash crops[6] where more efficient use of production inputs matters. It is well known on rice through the System of Rice Intensification (SRI) which was adopted from Madagascar and put into practice in 2009. The process is suitable and produces health grain and increase productivity (Katambala *et al.*, 2013). High productivity, nutritional factors, environmental management and economic growth has been the main focus to improve availability and

[5] Food crops include Maize, sorghum, wheat, pulses, cassava, potatoes, plantains and millet.
[6] Cash crops include coffee, cotton, cashew nuts, tobacco, sisal, tea, cloves, horticultural crops, oil seeds, spices and flowers.

access to staple food (that account for 85% of food produce) and cash crops in Tanzania (URT, 2008).

The need for land for different agricultural activities has made the concept of intensification to be more viable in improving agricultural output to the farmers. Cotton is among the cash crops characterized by higher levels of competition for land in Tanzania (Tschirley *et al*., 2010). The cotton subsector has been an important sector providing income to cotton growers. The use of sustainable input for high output has been encouraged to cotton farmers where contract farming and organic farming has been encouraged as the means towards increasing output per area in producing cotton (ICTSD, 2013).

1.1.4 Reasons for Intensification on Cotton in Tanzania

Cotton is a cash crop that brings substantial wage employment opportunities to the smallholder farmers. Most of cotton farmers are smallholder farmers, majority growing less than 1.5 hectares while few grow more than 5 hectares (TCB, 2008). Their objective is to generate cash income from cotton. Intensification is imperative on cotton since it leads to agricultural innovation by rising capital for agricultural investment in cotton. It enables farmers to increase their standard of living and contributes to food security. For the cotton production to be successful, measures or efforts towards its improvement should be made. According to Achterbosch *et al*. (2014), management of cash crops is part of intensification as communities will experience drops in income if cash crops are not managed.

Intensification on cotton is essential in scaling up farming practices that maintain resource base on which smallholder farmer depends on to bring competitive economic returns.

Nicole (2011) demonstrated the positive effects of intensification productivity and income of smallholder farmers in Africa. The increase in productivity or output in crop production leads to higher income and improves welfare of smallholder farmers.

1.2 Problem Statement and Justification

The Tanzania Government has been trying hard to initiate different agricultural strategies to increase cotton productivity through interventions like contract farming and input subsidy. Nonetheless there has been a persistent low yield averaging 300kg/ha compared to established potential yield of 1000kg/ha in the cotton growing areas (TCB, 2010; Mwangulumba and Buluma, 2012). Despite the initiatives taken by different stakeholders[7] in providing subsidized inputs, improved agronomic practices as well as introduction of high yielding varieties, cotton sector is still faced with challenges such as inadequate input use, low price of cotton seed, and led to shifting of farmers to food crops instead of producing cotton (Nicola, 2010; Poulton, 2009).

Agriculture sector is an important sector in the growth economics of the country but it was given less concern in the past in Tanzanian government, the emerged concern on improving agricultural sector through intensification has helped the sector to increase its GDP contribution to 31.7 percent. Intensification has been practiced in different forms among stakeholders to include distribution of inputs, provision of education and knowledge to farmers on agricultural practices and marketing of agricultural produce among others (IFAD, 2013; URT, 2014). Cotton subsector is among the contributing industry in the growth of agricultural sector. The production of cotton needs high efficient

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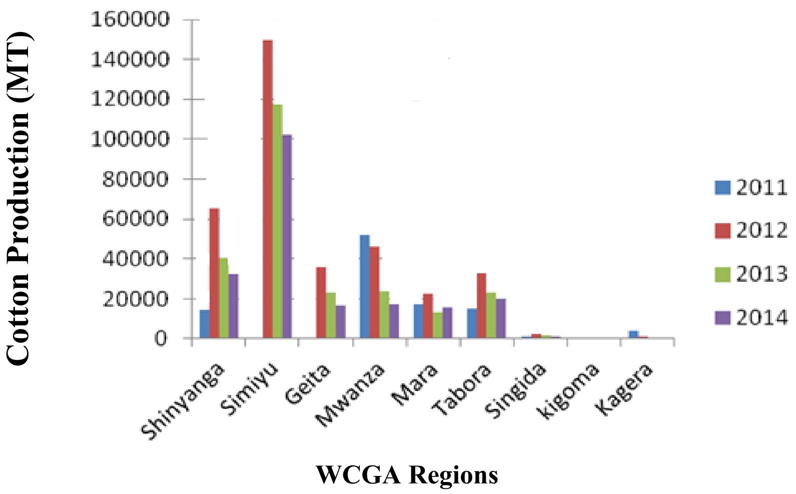
[7] Stakeholders are Research institutions, Quton, CDTF, TCB, Ginners, textile mills, cotton traders, cotton farmers, cooperative unions and societies, and the relevant ministries (Ministry of Agriculture, Livestock and Fisheries, Ministries of Industry, Trade and Investment).

use of input in order to increase productivity. Intensification being the concern in cotton production growing zones in Tanzania, has been practiced in various ways by using improved technologies, modern farming practices and the use of new seed varieties such as UK91 fuzzy and delinted as well as UKM08 (TCB, 2013). Despite these intensification efforts in the cotton growing zones, production of cotton is still undefined. For instance in WCGA, production is declining as depicted by the trend (2011-2014) of cotton production which has been contributed by low productivity. Production is also erratic over the areas; in some regions it is substantially high while in others it is very low. For instance in Fig. 2 below cotton production in Simiyu region is high followed by Shinyanga, Mwanza, Geita, Tabora, Mara, while Kagera, Singida and Kigoma production is very low. Cotton production in Mwanza where Misungwi is has been varying with the available data showing the declining trend per annually from 2011 season to 2014 season.



Source: Tanzania Cotton Board (2015).

Figure 2: Cotton Production in WCGA Region in (Metric Tons) 2011 to 2014

The role of intensification in cotton as defined was to ensure efficient use of inputs for increasinge productivity with a possible positive implication for smallholder cotton farmers' income. (Valelian, 2012; Sonda *et al*., 2011; Mwangulumba and Buluma, 2012; Itika and Makauki, 2007) have not dully accounted for the dwindling productivity amid intensification effort emphasized in place. The studies have particularly made reference to Misungwi district in their observation.

The state of intensification on cotton production in Misungwi District has been initiated by different ginneries, research institute and the government. It has been initiated by supplying seed cotton, subsidized pesticide and fertilizer as well as extension services. In the area productivity has been declining and a variety of challenges have been recorded ranging from produce price, difficult transportation, poor farming facilities, inadequate extension services, pesticides used and high cost of inputs as well biasness of cotton buyers in buying cotton was a challenge to farmers with small quantities of cotton (Hanna, 2008).

The state of intensification on cotton production has been experienced by farmers and other stakeholders in the cotton sector. Famers are being introduced to new technologies of production in various areas and stakeholders have tried their efforts in supplying seed, fertilizer and pesticides. For instance contract farming is a good example of drivers of intensification in the study area. It helps farmers to be informed about production method and market opportunities.

In the cotton sub sector intensification was introduced in 2006/07 by the government and Tanzania Gatsby trust. Cotton Sector Development Program (CSDP) was introduced in 2007 aiming at increasing cotton production from 300kg/ha up to 1000kg/ha, mainly focusing at improving contract farming and research programmers'. Lately the Tanzania Cotton Board (TCB) embarked on promoting contract farming in the Western Cotton Growing Zone (WCGZ) to solve the problem of inefficiency in the cotton subsector (Naluyaga, 2011).

Currently, farmers are allowed to grow cotton independently or in contract. Private ginning companies were allowed to participate in cotton production with farmers who are organized (George, 2012). With intensification in the cotton sector input use is said to have risen and the average yield has increased from 161kg of seed cotton per ha in 2001 to 760 kg of seed cotton per ha in 2009 in Bariadi District (TCB, 2010). This increment is contrary to Misungwi district which its productivity is still declining. The increase in average yield of seed cotton per hectare in Bariadi has been encouraging: implying that intensification has been recouping the intended role toward improving cotton production.

Assessing the implication of intensification on cotton smallholder farmers as implemented by different stakeholders is necessary to determine whether cotton productivity can be improved in the district. It will help in increasing the income of the smallholder cotton farmers and will help to improve the economic growth of the nation. The Results from this study will be beneficial to the government and other stakeholders in the cotton sub-sector in Tanzania, especially in creating awareness regarding areas for intervention toward improving cotton productivity and production among smallholder cotton farmers through intensification.

1.3 Objective

1.3.1 General objective

The general objective of the study is to assess the contribution of agricultural intensification on cotton and its implication for production and income to smallholder farmers in Misungwi District.

1.3.2 Specific objectives

The study's specific objectives were

i. To examine the status/forms of agricultural intensification for smallholder cotton farmers in the study area.
ii. To determine the level of input use efficiency for cotton smallholder farmers in the study area.
iii. To determine the effect of intensification on smallholder cotton farmers' income in the study area.

1.3.2 Research hypotheses

i. H_0: There is no significant variation in technical efficiency for intensified and non intensified cotton farmers in the study area.
ii. H_0: There is no significant difference in income between farmers who intensify and those who does not intensify.

1.4 Research Questions

i. What is the form of intensification on cotton production in Misungwi district?
ii. What are the effects of agriculture intensification to smallholder cotton farmers in Misungwi district?

iii. What are the differences in farm income between intensification and non-intensifying small holder cotton farmers in the study area

1.5 Organization of the Study

This study is organized in five chapters including the introduction. Chapter Two is a review of the body of literature on the study's subject matter. Chapter three describes the theoretical and methodological framework of the study, while chapter four gives the major findings and their discussion. Finally, chapter five concludes and presents the police implications of the study to the cotton sub sector in the country.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Theoretical Literature Review

2.1.1Agricultural intensification and productivity

Agricultural intensification is an increase in productivity of accessible land and water resources in food and cash crops production. Generally, it is associated with increased use of external inputs. Intensification is more on efficient use of input in production (increase in output per input used) and especially on improved variety and breeds, efficient use of labour and better farm management (Dixon *et al*., 2001). Inspite of intensification in agriculture to be perceived better in making efficient use of inputs, it becomes more critical when environmental problem or social issues are involved (FAO, 2004).

Although the concept of intensification has been good in increasing output, its contrary perceived by utilitarian to be subjected to vulnerability of pest and diseases especially to the fast growing improved variety that increase short term yield (FAO, 2004). In this approach intensification is the efficient use of inputs. It aims at producing outputs per all unit of inputs and raise productivity as well as income of smallholder farmer per unit of land grown cotton.

Furthermore, intensification deals with improvement of physical relationship between input and output per area and income per unit of land by investing capital and labour. The use of improved inputs and mechanisms has helped to increase productivity and minimize externality when applied sustainably (Assgoba *et al.,* 2014). According to Oluyende (2000) agricultural intensification has been an important measurement of marginal productivity of cotton and appropriate for increasing cotton output. It has been applicable for economic or technical analysis on specific cases. For instance, change in productivities of one input is likely to be accompanied in adjustment in the amount of other input. Thus it gives a little doubt that agricultural intensification has been perquisite to human civilization.

The positive effect of intensification on productivity has been associated with access to extension services, farmers' age which regarded as experience, education, access to credit, family size, access to fertilizers, agrochemicals and efficient use of improved seeds (Hannah, 2008; Garnett *et al*., 2012; Nicole, 2010; Aye and Mungatana, 2010). The positive relationship between landholding size, technical assistance, access to input, credit and the functioning institutional system was found to be efficient in increasing productivity. According to Tscharley (2013), although land was not an issue to the developing country in ensuring intensification and increased productivity, the 10 percent decline of hectors of land for cotton growing in Tanzania due to unfolding economic crises led to the decline in output for 27 percent (TBC, 2010).

2.1.2 Theory behind Intensification

The scenario of agricultural intensification evolved from the modernization and development theory basing on the experience from economic intervention. According to Macrus and Maria (2014), modernization theory evolved from development studies in the 1950s and 1960s aiming to transform the traditional society of the south to become industrialized. One of the influential theories was Walt Rostows model for economic growth. According to Rostow for any countries to be developed should struggle through five stages of development and argued that it was possible through investment from industrialized country. Economic development in the context of modernization theory aimed for developing country to restructure the goals, institution and culture from developed country. The development theory was criticized during 1960s Goran *et al.* (2005). Rostows model was criticized for suggesting the same method and goals for all nations due to inconsideration of diversification of different nations natural, social, and pre capitalist history. Although it was criticized it gave the rise of competitiveness within the existing structure in the international market due the presence of pre capitalist history.

Most of economic development revolutionalist (academician and politician) regard the issue of agricultural intensification and development method on increase food production to meet the consumption late of every mass (Boserup, 1993). Although Goran *et al.* (2005) argued that in less developed countries agricultural intensification does not only occur when there is population growth or scarce land for cultivation, it can happen due to commercial force in the combination of anti state bias and market orientation in community development.

During modernization theory, the issue of agricultural development was a debate on whether population growth contributes to food insecurity. The view of agricultural innovation was dominating during Malthus theory basing on agricultural productivity that affects size of population. Peet and Hertwick (2009) in modernization theory contend that agricultural improvement would lead to the development and that was more emphased by Malthus, Malthus was opposed by Ester Boserup view that population as a factor affects agriculture. She argued for improving agricultural practices first when population increases it lead to the scarcity of land and were population concentrate on using land for other activities apart from agriculture. Ungrowing small population does not find it necessity to improve agricultural methods while large and growing population has to face issues on higher productivity and investing in agricultural productivities. Buserup continue by argue that short maturity varieties by combining with other crop husbandry like fertilizer use will increase productivity but without following agronomic practice will leads to decrease crop output (Boserup, 1993).

According to the World Bank (2007), increase in agricultural productivity does not trigger food security only but also increases income for individual as well as household. The issue of agricultural intensification was essential in the second World Development Report on agriculture in 2008 (Marcus and Marie, 2014). It is seen as one way of bringing smallholders farmers out of poverty is by entering higher agricultural output. Most developing countries due to lack of intensification it produce staple foods which are unattractive to the global markets, the world bank emphasizes more on increasing agricultural intensification (productivity efficiency) in the market oriented cash crops (World Bank, 2007).

2.1.3 Theory behind the Study

The study lies under production theory. The theory of production addresses efficiency issues on the use of input in attaining higher possible output across the production. It also takes into account the production per given area of land (Fallel, 1957). Input use efficiency in production is the basic key in addressing agricultural intensification. Maximum satisfaction that individual gains in opting for using agricultural practices in production from the choices available helps farmers to improve productivity and raise income.

2.2 Empirical Literature Review

2.2.1 Approaches and Methods for Measuring Efficiency in Production

Efficiency in production is the ability of a firm to produce the greatest possible amount of output from a fixed amount of input. It can be the technical use of resources available to produce a given quantity of goods from least quantity of input. The concept of efficiency is derived from particular interpretation of production frontier, which in its classical sense is the relationship between output and the quantity of the input used (Farrell, 1957).

Efficiency in production per unit can be categorized in two components, allocative efficiency and technical efficiency. Allocative efficiency refers to the ability of a firm to use inputs in optimal proportions, given their respective prices while technical efficiency is the ability of a firm to minimize input use in the production of a given unit of output or to obtain maximum output from given unit of input. The product of technical efficiency and allocative efficiency gives the economic efficiency. Efficiency can be measured in four major approaches (Coelli *et al*., 1998). These include the stochastic frontier, the parametric programming approach, the deterministic statistic approach and productivity indices based on growth accounting and index theory principle. According to Baten *et al*. (2009) and Philip (2007), stochastic frontier and non-parametric programming (also known as Data Envelope Analysis (DEA) are the most popular approaches used among the four measures of efficiency.

According to Battese and Coelli (1995), the advantages of stochastic frontier approach over other approaches is that; it allows stochastic noise because it assumes that firms may deviate from the frontier not only because of technical inefficiency but also because of measurement errors. The approach also permits statistical tests of hypotheses pertaining to the structure and degree of inefficiency. Model in the first step of stochastic production frontier; the error term (inefficiency effects) are assumed to be identically independently distributed and the technical efficiency scores obtained are said to be depend on a number of firm's specific characteristics, implying that the inefficiency effects are not equally distributed.

The approach can use standard statistical approach to test for hypothesis of the model specification and significance variables included in the model. Also, it is more amenable to modeling effects of variables like land, fertilizer, seed, and pesticides. Stochastic frontier has been used in many studies in Tanzania. For instance Msuya (2009) used stochastic frontier as technical efficiency measurement of errors and other noise in the data and modified it to account for panel data. Akyoo and Mpenda (2014) as well as Wickedzi and Akyoo (2014) used a similar model to analyze production efficiency for smallholder cashew farmers and dairy farmers in Tanga City respectively.

Kiani (2008) determined the relationship between different farm size and productivity of various crops (Wheat, cotton, Maize and Sugar cane) whereby Cobb-Douglas production function model as efficiency measure was used. The result showed smallest and largest farm size has the highest land productivities, while the middle farm size had less productivity due to inefficient combinations of inputs that yield lower marginal productivities.

In the light of above mentioned studies stochastic frontier approach is the good approach in analyzing production efficiency the same applies to productivity. In another way Cobb-Douglas production function was used for estimation, the strong point being the ability to account for measurement errors and other noise in the data influencing the shape and position of the production frontier (Bourguignon, 1998; Msuya, 2009).

2.2.2 Profitability from Cotton Production

While TE is an important factor in production, rational economic agents are driven by the profit motive to engage in various economic activities. Using intensification in cotton production has the promise of higher net returns but also the uncertain of loss in case not used as required. Profit generally is gain making in business activity for the benefit of the owner of the business (Ebbeden, 2004). The levels of attaining profit from cotton production have been triggered by the levels of cotton farmers to adapt the use of technological practices in cotton farming. There are many factors that may have an effect on profitability of any enterprise.

In crop production most of the factors that affect profitability are the production costs, farm gate price, fertilizer usage, seed variety, tillage methods, labor, land tenure, power sources, extension services, remittances and farmer characteristics. Most of these factors have been considered in many studies on profitability. Some studies find some of these factors to have significant effect on profitability were as other studies find that these factors have insignificant on the profitability. For instance a study that was done on the profitability of sorghum Erbaugh, (2008) as cited by Ester, (2011) found that the farm size, production costs, farm location, interaction between production costs and farm gate price as well as the interaction between the varieties used and fertilizer applied were significant. Surprisingly, farm size was negatively influencing the gross margin contrary to the literature. However, the interaction between Production cost and farm gate price was positive and significant while farm gate price alone was not significant. In addition, the variety used, application of fertilizer and tillage method were not significant but the interaction between variety used and fertilizer application was positive and significant (Ebbeden, 2004).

In determining the levels of firms profit various methods have been used. One of the mostly used procedures is Profit margin that takes into account the variable cost and fixed cost, Profit margin as said previously measures the profit of a firm by summing the fixed and variable cost items and subtracting it from gross returns obtained from the sale of the crop and or livestock. In most cases farmers do not deduct the opportunity cost for their own money invested in farming. Moreover, they often ignore the cost of family labor in their budget as an expense. Debertin (1992) argued that the profit figure that often appears on farming enterprises is more of return against operational expenses excluding family labour cost.

Another method is Gross margin unlike profit margin it takes into account only the variable costs. Unlike profit margin, Gross margin analysis does not take into account the fixed cost pertaining to a given firm. Chamdimba, (2007) said Gross margin is determined by deducting variable costs from the gross income of a given crop and or livestock within a given period of time. Output and costs vary with the scale of enterprises, it is therefore expected that if an enterprise grow its Gross margin per hectare does not remain the same. Johnson (1982) defines gross margin as the difference between the value of an enterprise's gross output and variable cost of production. Gross margins are used to evaluate economic viability of an enterprise. They are used in agriculture for farm planning and comparing different farms with similar characteristics or different enterprises on the same farm (Chamdimba, 2007).

Chindime (2007) applied the gross margin analysis to estimate returns from smallholder dairy among borrowers and non borrowers of in kind credit in central and northern milk shed areas of Malawi. The results revealed that smallholder dairy farming was profitable for both borrowers and non borrowers with borrowers reporting higher gross margins than non borrowers.

Sonda *et al*. (2005) analyzed the economic viability of milk production in smallholder farming systems in Gambia. In a study involving 90 smallholder dairy farms, the gross margin analysis was used to assess the profitability and viability of smallholder dairy production. The results showed that smallholder dairy farming in Gambia was indeed viable. The study also established that profitability varies across groups based on the scale i.e. medium-resource group and resource poor farmers. Viability was higher in resource medium group than in resource poor group. This implies that smallholder dairy farmers have different resource endowments which affect profitability. Overall a dairy technology that requires more resources is likely to be less preferred by resource-poor farmers.

Also Mukwenda (2005) adopted gross margin analysis to measure the profitability of the warehouse system for cotton, coffee and maize. The system observed to be more profitable for the crops measured. Therefore this study adopted the tool to look for the income profit earned by smallholder cotton farmers using intensified method and for those who are not intensifying.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of the Study Area

The study was conducted in Misungwi District in Mwanza Region. Mwanza Region lies on the lake zone area in Tanzania, Misungwi is one of eight districts of Mwanza Region among the WCGA whereby residents depends on cotton production as the source of income for their livelihood, the study focused in Misungwi because the crop is in danger of losing its value to the smallholder cotton farmers income. Misungwi lies on the west of Mwanza city bordered by Kwimba District to the East, Magu District to the North, Shinyanga District on Southern part, Geita and Sengerema districts to the South West. Misungwi district is subdivided into 4 divisions, 20 wards and 78 villages (Fig. 3).

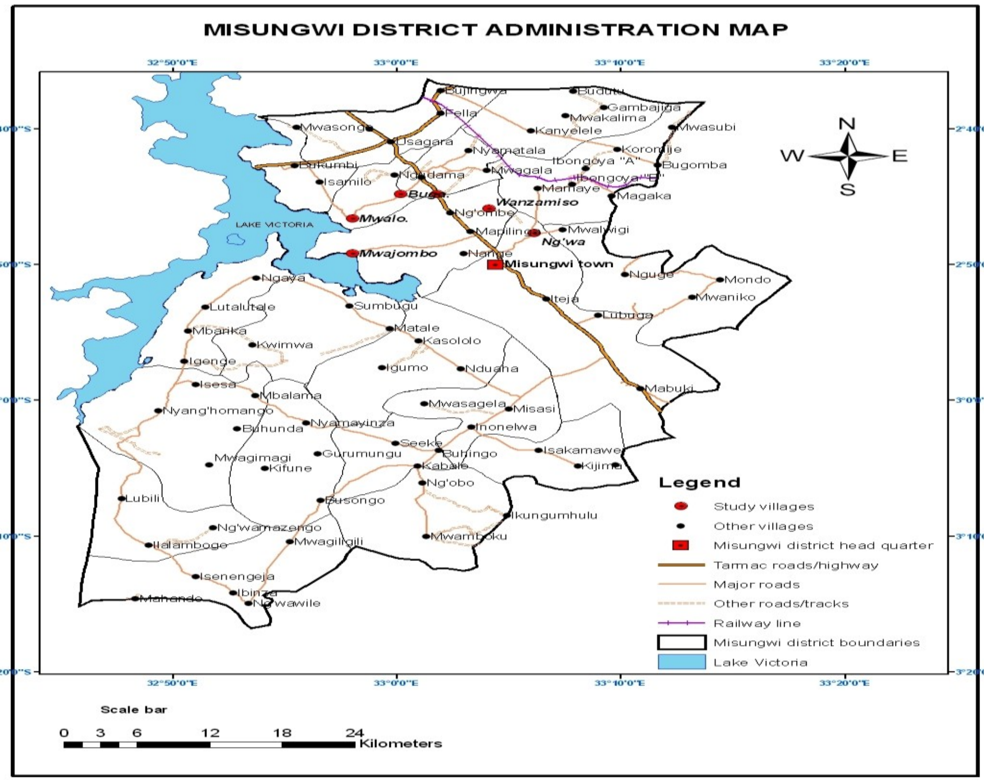


Figure 3: An administrative map of Misungwi District showing the study area

3.1.1 Climate

Generally, Misungwi district experiences short rains season from October to December and long rain season from February to May. Temperature and rainfall are influenced by the region's proximity to equator and the Lake Victoria. Maximum temperature ranges between 25°C to 28°C from June to August and it is highly affected by variation of weather due to climatic changes. Rainfall is reliable and bimodal ranging between 750mm in dry areas and 1200mm in wet areas. Misungwi district is found on low rainfall areas in the region, it is a semi-arid area characterized by bimodal rainfall ranging from 650mm to 1000mm per annum (URT, 2008; Mahoo, 2005). The soil in Misungwi district has high potential for agricultural activities and good for cotton farming.

3.1.2 Economic activities

The economy of Mwanza Region depends on industrial activities, business and agricultural activities (for example fishing livestock keeping and cotton production). Cotton production is among the prominent activities in the cotton growing districts in Mwanza as a result of the efforts made by the government under the Tanzania Cotton Board (TCB) in undertaking small scale cotton farming. Most of small scale cotton farmers are aware of improved cotton seed varieties and the use of agronomic practices.

3.2 Conceptual Framework

The Conceptual framework for this study depicted in Figure 4, is an essential guideline for identifying important variables for effective and efficient data collection. Technical efficiency was used to measure input use efficiency of smallholder cotton farmers in Misungwi district. Technical efficiency determination is based on the theory of production. The production theory used productivity as an average measure of agricultural intensification. Technical efficiency deals with proper allocation of resources along the production function in attaining high output (Farrell, 1957). Productivity is explained as the ratio of output per inputs used in the production process (Nicholson and Snyder, 2008). When all outputs and inputs are included in the productivity measure it is called total productivity. Outputs and inputs are defined in the total productivity measure as their economic values, thus total productivity is the measure of economic values that determines the income of individual (smallholder cotton farmer) when the unit output is sold.

In assessing the income effect of cotton production, according to Assgoba *et al.* (2014), returns in income are based on the utility gained from intensifying or not to intensify. In this study, economic agents are small-scale cotton farmers whose participation decisions perceived is through farming practices opted by cotton farmers. The income gains are classified through net income received from cotton revenue deducting the cost used in cotton production as shown in Figure 4. Output time's price of cotton production depends on farming practices used that are highly contributed by production efficiency. All farming practices and efficiencies depends on input uses (fertilizer, pesticides, seed cotton variety, planting technology, manure and labour power) in other word these variable are the sources of efficiency in TE, policy and institutional factors are the strong tools or bridge which is used to link between farmers and technologies as it facilitate increase efficiency (financial support, market, infrastructures, extension services and good institutional arrangements) and social economic factors also called factor of inefficiency in TE or called z which can cause increase or decrease of independent value (y) (education, age, land owned for cotton production, household size income, asset owned and experience in cotton production). All these have an influence for farmers' choices in cotton production and increase in productivity.

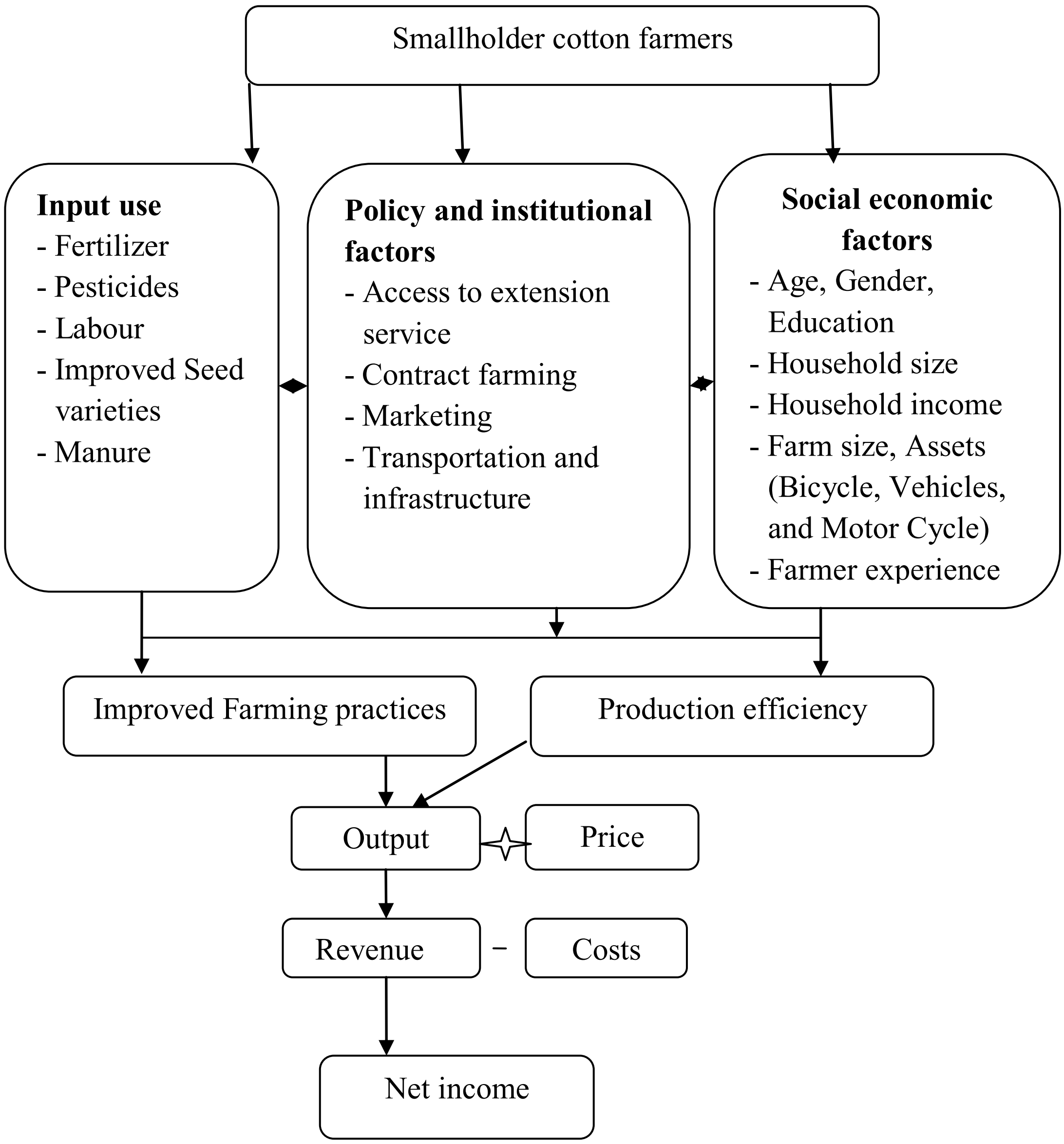


Figure 4: Conceptual framework of the study

3.3 Research Design

This study adopted a cross sectional research design, in which data were collected at a single point in a time. It was conducted from March 2015 to April 2015. Secondary data were obtained as well in supplementing the data collected. The population sample was selected to cover major cotton producing areas representing the Misungwi district in the region. The areas selected correspond to the potential cotton producers in four wards of Bulemeji, Igokelo, Misungwi and Ukiriguru. The selection criteria were based on the variation of farming system characteristics, particularly on plant technologies, input usage (fertilizer, pesticides, seed variety used), labour availability, and mechanization like use of animal traction/oxen, machinery and human manual labour/hand hoe.

3.3.1 Sampling of smallholder cotton farmers

One hundred and twenty (120) smallholder cotton farmers were randomly selected from population of 5520 cotton farmers in Misungwi district. These farmers were registered by Tanzania Cotton Board (TCB) assisted by government extension staff in the district the sample size was obtained using the following formula

$$S = N/1+N\,(e)^2$$

Where;

S= Sample size of smallholder cotton farmers, N= population size of cotton farmers in the district, e = level of precision or error, the recommended precision for social science is 5% because it gives confidence interval of 95%. If the resources are limited researchers may use larger level of precision greater than 5%. Also as argued by Bailey (1994), a sub sample should be at least 30 cases. Thus the sample of 120 respondents selected in this study was a good representative sample of the area selected due to time and budget constraints.

The smallholder cotton farmer was the main focus in sampling basing on farmer who intensifies and who does not intensify. Criteria for discriminating the two groups based on how efficient use of input to attain higher output considered by farmers as compared to technical production requirements set by the government research institute (Appendix 1). Farmers who were able to use at least three inputs and above was considered as a farmers who intensify while below that was considered as non- intensifying farmer. The intended respondent was the household head in his/her absence, the next best keen member aged from 18 years and above who is aware of cotton production activities was interviewed. In this study a households is defined as a unit of husband/wife, spouse, children and other dependants living together producing and consuming together under the single roof.

3.3.2 Sampling procedure

The accurate sampling is important in minimizing sampling bias for drawing reliable inference about population. In this study 120 smallholder cotton farmers were interviewed, purposive methods were used to select Mwanza Region, Misungwi District as well as Ukiriguru, Bulemeji, Igokelo and Misungwi wards. Simple random sampling used to select Buganda, Ng'walogwabagole, Nyamikoma, Wanzamiso, Mwajombo and Ng'wambola villages as well as households. Twenty respondents were consulted from each village in Misungwi district. Complement information obtained by using key informant interview which conducted to supplement the information that was not captured or not known by farmers.

3.3.3 Data collection methods

Data for this study were obtained through primary and secondary sources during field survey. Primary data were collected in Misungwi District using a structured questionnaire administered to respondents (appendix 2) in six villages of Buganda, Ngw'alogwabagole, Ng'wambola, Mwajombo, Wenzamiso and Nyamikoma. Data collected includes household characteristics (e.g. Age, Gender, Experience in cotton farming, Education level, Occupation, Acres of land owned for cotton, Variety of improved seed used, Mechanism of cotton production used, pesticides applied) and information pertaining cotton productivity.

Secondary data were obtained from District Agricultural Livestock and Development (DALDO) office. Sokoine National Agricultural library (SNAL) in Morogoro, Tanzania Cotton Board (TCB), LIZARDs Ukiriguru for consultation of various relevant documents published and unpublished for cotton production.

3.4 Analytical Framework

3.4.1 Descriptive statistics

In order to meet the objectives of the study, the Statistical package for social science SPSS Version 20 for descriptive analysis, STATA Version 11 and FRONTIER 4.1 were used for both qualitative and quantitative data analysis for this study. The analysis used in the study was based on hypothesis and specific objectives. For descriptive statistics the use of means, percentages, frequency distribution table were used in describing the general characteristics of the actors.

Basing on the hypothesis "No significant variation in technical efficiency for farmers growing cotton" technical efficiency method was employed to determine the level of input use efficiency for smallholder cotton farmers. In testing the hypothesis "No significant difference in income between farmers who were using intensification and those who does not use intensification" Gross margin analysis were used to determine the effects of intensification on income.

3.4.2 Stochastic frontier model

In order to estimate the technical efficiency on cotton production for objective two, the study used stochastic frontier model. This model was adopted from the work of Battese and Coelli (1995). The model proposed a stochastic frontier production function which has firm effects assumed to be distributed as a truncated normal random variable, in which inefficiency effects are directly influenced by a numbers of variables. From this study efficiency for cotton farmer was regressed against a set of socio-economic and institutional factors to identify the limiting factors and the state of cotton production. The Cobb- Douglas production function and the stochastic frontier were applied. A production function that was used to define the stochastic production frontier along the isoquant curve was specified as;

$$Y_i = f(X_i) \quad \ldots\ldots (1)$$

Where Y_i = Cotton output of the i^{th} respondent, X_i = farm specific production factors (size of land, fertilizer, improved seed, access to credit, and labour used in cotton production). The equation was in multiplicative form given by;

$$\mathbf{Y}_i = b_o \Pi \mathbf{X}_{ij}^{b_{ij}} e^{\varepsilon_{ij}} \quad \ldots\ldots (2)$$

Where: $Y_i =$ Cotton output

i^{th} = respondent, from i=1 up to 120; and j^{th} = input used

X_{ij} = The j^{th} variable input used for the i^{th} respondent

Π = A steady multiplicative symbol; $e =$ Natural logarithm;

ε = Error term for the i^{th} respondent and the j^{th}, b_o = a vector of a constant parameter;

b_{ij} = a vector of parameter estimates for the i^{th} and j^{th}

The Cob-Douglas production function of the study was specified as;

$LnY = \beta_0 + \beta_1 LnX_{1i} + \beta_2 LnX_{2i} + \beta_3 LnX_{3i} + \beta_4 LnX_{4i} + \beta_5 LnX_{5i} + \beta_6 LnX_{6i} + Vi -- Ui$..........(3)

Where;

Ln = denotes natural logarithms;

Y_i = Total amount of cotton harvested in 2013/14 season expressed in tons.

X_{1i}=Land size under cotton cultivation in 2013/14 season expressed in hectares

X_{2i}= Delinted seed cotton

X_{3i}= Fuzzy seed cotton

X_{4i}= Fertilizer

X_{5i}= Pesticide

X_{6i}= Manure

β_i 's = unknown parameter to be estimated

Vi = Represent independently and identically distributed random errors $N(0, \sigma_V^2)$

Ui = Represents non-negative random variables which are independently and identically distributed as $N(0, \sigma_u^2)$ i.e the distribution of U_i is half normal. $[U_i] > 0$ reflects the technical efficiency relative to the frontier production function. $[U_i] = 0$ for a farmer whose production lies on the frontier and $[U_i] > 0$ for a farmer whose production lies below the frontier.

Knowing that farmers are technically inefficient might not be useful unless the sources of inefficiency are identified. Thus in the second stage we investigate farm and farmers specific attributes that have impact on cotton farmers technical efficiency. The inefficiency function can be written as:

$U_i = Z_0 + Z_1 gen + Z_2 age + Z_3 educ + Z_4 Yrcot + Z_5 exten + Z_6 hhsiz + Z_7 credit$ ....(4)

Were;

U_i = Technical inefficiency,

Gender: Gender Dummy variable showing value of 1 for a male and 0 otherwise.

Age: Years of respondent growing cotton

Education: Dummy variable for smallholder cotton farmer level of education, assuming a value of 1 if the farmer has no formal education and 0 if otherwise

Years of cotton growing: Dummy showing the value of 1 for a smallholder cotton famer with experience and 0 otherwise.

Extension services: Dummy for Farmers received government or private extension services assuming the value of 1 if received and 0 otherwise

Hhsiz: Household size (number of people staying together and utilizing the resource together.

Credit: Dummy variable showing value 1 if the smallholder has obtained any form of agricultural input credit and 0 if otherwise.

W_i: an error term that follows a truncated normal distribution: and

Z_i' s: Inefficiency parameter to be estimated

The Cob-Douglas production function defined by equation 3 and the inefficiency model by equation 4 will be jointly estimated by the maximum likelihood (ML) method using FRONTIER 4.1 (Coelli, 1996). The FRONTIER software uses a three step estimation method to obtain the final maximum likelihood estimates. First the estimates of the α -parameters are obtained by ordinary least square (OLS). A two-phase grid search for δ is conducted in the second step with α - estimates set to the OLS values and other parameter set to zero. The third steps involves an iterative procedure, using the Davidon-Fletcher-Powell Quasi-Newton method to obtain the final maximum likelihood estimates with the value selected in the grid search as starting values.

3.4.3 Gross margin (GM) analysis

To address the third objective on the effect of income among cotton farmers gross margin analysis (GM) were used to determining levels of income gains for cotton farmers under intensifies and non-intensifies farmers. Various methods have been used to determine the level of firm's profit. One of the mostly used procedures is Profit margin that takes into account the variable cost and fixed cost, another method is Gross margin that takes into account only the variable costs. Profit margin measures the profit of a firm by summing the fixed and variable cost items and subtracting it from gross returns obtained from the sale of the crop. In most cases farmers do not deduct an opportunity cost for their own money invested in farming. Thus gross margin by taking into account variable cost only has been able to evaluate the economic variability of an enterprise and used in agriculture for farm planning, as contended by Ester (2011) that gross margin is determined by deducting variable costs from the gross income of a given crop within a given period of time. In this study gross margin is used as the proxy of profit in determining the level of income gain of smallholder cotton farmers

The gross margin of an enterprise is not necessarly an indication of profitability. This is only one aspect of an enterprise. Other items and factors are involved before the ultimate profitability is known. Increasing the intensity of enterprises on farm may increase the total farm gross margin but will not necessary increase the farm profit since the fixed cost may also rise in greater proportion. A higher gross margin may be achieved on farm but this could lead to lower profit if the resultant increase in fixed cost is greater than increase in gross margin.

Farm gross margin provides a simple method for comparing the performance of enterprises that have similar input requirements for capital and labor (Forestry, 2009).

Gross margins are usually computed per year or per cropping season. They are an indicator of farm profit and they provide a useful tool in terms of farm management, budgeting and estimating the likely returns or losses of a particular crop. Gross margin analysis was used in this study not only because it is one of the easiest and common methods to determine profitability but because according to the literature reviewed in this study gross margin analysis is one of the best methods of estimating profits of an enterprise to determine the level of income for cotton farmers. The GM Analysis used in this study expressed as

$GM = TR - TVC$

Where;

GM Represents Gross Margin

TR Represents Total Revenue

TVC Represents Total Variable Cost

The Gross Margin (GM) of each cotton farmer was computed, and comparison of mean GM of farmers who are intensifying and those who does not as well as their percentile distribution from the highest to the lowest profit levels was made.

CHAPTER FOUR

4.0 FINDINGS AND DISCUSSION

4.1 Social Economic Characteristics of the Respondent

The social characteristics discussed in this section include, age, sex, marital status, education level, occupation, farm size, household size and experience in cotton farming.

4.1.1 Age of farmers

According to Table 1, respondents mean age was 40 and 43 years for males and females respectively. This shows the importance of cotton production in the area, since majority of participant are in the middle age and capable farmers involve themselves in production. Basnayake and Gunaratne (2002) declared the importance of age as a factor that can explain the level of production and efficiency. Furthermore findings indicated that only few people below 25 years of ages engaged in farming activities among selected sample.

Based on gender most female participating in production were aged ranging from 28 to 61 while male ranged 17 to 73. This gives clear picture that males are highly involved in cotton production than females. Also, 79.2 percent within the identified age group of farmers in the study area were not intensifying while those who were intensifying represented 20.8 percent. Large group of farmers for non intensifying age group was between 39 to 49 while for intensifies lies between age group of 28 to 38. This shows the importance of age in cotton production and the ability to adopt new technology and the use of improved mechanism in increasing productivity.

Table 1: Respondents age for intensifies and non intensifies

Age	Non intensifies		Intensifies	
Age group	**Number**	**Percentage**	**Number**	**Percentage**
17-27	22	21	2	8
28-38	25	23.7	10	40
39-49	33	36.9	7	12
50-60	9	11.8	3	24
61 ≤	4	6.6	5	16
Total	**93**	**79.2**	**27**	**20.8**

Also it was found that among all the farmers sampled for the study, the majority had done farming for at least 2 years. Most of farmers who were involved in cotton production have dropped the crop and involve themselves to other activities due to challenges that are discussed in this study. The more farmers engaged in the cotton production the more efficiency and knowledge increased in producing cotton in the area.

4.1.2 Sex of farmers

In Table 2, the findings show that males (93.3%) are engaged in cotton production than females (6.7%); this means that many cotton producer are male headed households, implies that decision makers and most controllers of resources in the family are men. Sukuma tribe is a patriarch system. This imbalance in gender portrays that most of the potential economic activities that earn income are owned by males while women perform household roles. Also within the society most of the farm/land for cultivation is owned by males this gives high returns to male participation in cotton production than female. This finding is closely related to TBC (2013) which conducted a study on famer preference of cotton farm input involving 625 respondents where only 60 farmers were females while males were 565.

Table 2: Social Characteristics of cotton farmer representative in Misungwi

Farmers Characteristics	Numbers	Percentage
Gender of respondents		
Male headed	112	93.3
Female headed	8	6.7
Education of respondents		
primary level	96	80
secondary level and certificates	18	15
no school	6	5
Marital status of respondents		
Single	13	10.8
Married	101	84.2
Widower	3	2.5
Divorced	3	2.5

4.1.3 Marital status

Survey findings demonstrate that large proportional of sampled farmers were married (84.2 percentage), followed by those who were single (10.8 percentage), widow (2.5 percentage) and divorced (2.5 percentage). This means most farmers have stable families and consequently involvement in farming cultivation is high (Table 3). The higher involvement in farming cultivation could influence farmers to adopt new technologies especially on using improved method in cotton farming.

4.1.4 Household composition

Household composition and sizes have greater positive impact in farm operations. Most of the families with household's size from 4 members of household and above attained greater yield compared to family ranging below 4 member of households in the study area; this means that family is the sources of labour in most cotton producing families in the study area. The larger size also has implication on lowering the cost of operation that can be incurred on hiring labour.

4.1.5 Education of respondent

From the findings 80% famers have attained primary education level. While 15% have attained secondary level and 5% have no formal education. Generally most of respondent attended school, they have an exposure and ability to understand and use improved technologies that can lead to high productivity and income. Amani *et al.* (2005) observed the importance of education being more than other factors in determining adoption of technology in agriculture and it contributes to total outputs in Tanzania.

4.1.6 Land size under cotton cultivation in the study area

According to the analysis 82 Percent of smallholder farmers own land ranging from 0.5 acres to 5 acres and 18 percent hire land ranging from 0.5 acres to 2 acres, where 44 percent and 56 percent use delinted and fuzzy seed respectively. The borrowed land was only one percentage from their neighbors or parents and 56 percent among the sampled farmers use intensified method**.**

4.1.7 The State of Cotton Intensification in the Study Area

The rate of intensification in the study area is still low in attaining high productivity. The study expected to find higher percentage level of intensification and the use of improved seed variety in the area since the District is located within institutions which are responsible for cotton output improvement but the expectation was contrary where the allocated land for intensification was small and few people were using improved variety of seed in the area as shown in the Table 3.

Table 3: Levels of intensification and type of seed cotton used

Variables	Percentage				
	Intensification	**Non-Intensification**	**Delinted seed**	**Fuzzy seed**	**Both delinted and fuzzy**
Sex; Male	96	92.6	89.5	93.3	10.7
Female	4	7.4	10.5	6.7	
Household size	20.2	79.8	16	73.9	10.1
Farm size	20.8	79.2	15.8	72.2	10
Experience (years)	21	79	16	74.8	9.2
Mean age	20.8	79.2	15	74.2	10
Informal Education	0	7.4	15	4.5	0
Primary	84	85.3	84.2	83.1	100
Secondary and <	16	7.4	0	12.1	0

From the findings in Table 3, difference in gender participation between male 96 percent of intensifies to 92.6 percent of non intensifies and female 4 percent to 7.4 intensifies and non intensifies signifies the role of gender participation in cotton production. Most of smallholder cotton farmers with experience in cotton farming still opt for fuzzy seed and non intensified method. And for those with informal education do not intensify but 15% use delinted seed while 4.5% uses fuzzy seed. Those with primary education level opt for fuzzy seed and those with secondary and certificate 16 and 7.4 percent use intensified and non intensified respectively while opting for fuzzy seed variety.

4.1.8 Income from other crops and off farm activities in the study area

The main economic activity of the respondents in the study area is crop production accounting for 95% of farmers' activities. Other crops found in the area which is regarded as potential source of income to smallholder farmers were cassava, paddy, maize, groundnuts, sorghum, and vegetables. Most of the farmers who divert from cotton production to cassava and vegetable activities claim that they contribute more to their income and take short period of time compared to cotton production. From the district information on cotton production during 2012 to 2013 the mean output yields dropped from 252 to 250 Kg/acre. From average yield for farmers in the study area was 238Kg/acre for the selected sample, where it takes about 342Kg/acre and 211Kg/acre for farmers using intensified method and those who do not intensify respectively**.**

4.2 Determinants of Technical Efficiency on Inputs use Among Cotton Smallholder Farmers

4.2.1 Factors influencing technical efficiency

Factors such as land, type and quantities of seed used, inorganic fertilizer, agrochemicals, family size, education level, and experience in cotton growing, gender, age, access to extension services and access to credit are explained to influence technical efficiency positively or negatively depending on the farmer's circumstances.

4.2.2 The maximum likelihood estimates (MLE)

In this study the Maximum likelihood Estimate was done for all smallholder farmer respondents growing cotton in the area. The mean efficiency score reflect the dispersion of the efficiencies within smallholder farmers. From the study the findings show that the mean efficiency to be 46% which is low and there is high variation of mean between individual farmers, ranging about 10% to 99% from lower to highest level of efficiency respectively. High variation is due to high level of inefficiency resulting from farmers themselves. This depicts that farmers have to increase efforts in cotton production by 54 percent in order to attain higher productivity.

4.2.3 Production frontier and technical efficiency estimates

For this study a total of seven parameters were estimated in stochastic production frontier model by using Stata version 4.1 Software. Table 4 shows estimated coefficiency of input has positive signs, which implies that all contribute significantly to the increase cotton productivity. Land contributes much compared to other coeffincies from the results amounting for 72 percent which implies that increase production in the study area depends much on increase of cultivated land, where delinted seed being the least contributing coefficient to efficient taking 0.8 percent as shown in Table 4.

Table 4: MLE for parameters of stochastic frontier model (efficiency) and inefficiency model

Variables	Parameter	Coefficient	Standard-error	t-ratio
Frontier Model				
Constant	β_0	6.454	0.101	63.72
Land size	β_1	0.72***	0.005	148.07
Seed delinted	β_2	0.008	0.002	4.77
Seed fuzzy	β_3	0.069**	0.021	3.21
Fertilizer	β_4	0.063*	0.003	20.31
Pesticides	β_5	0.065*	0.004	18.27
Manure	β_6	0.019	0.003	6.68
Inefficiency Model				
Intercept	Z_0	-2.439	1.119	-2.18
Gender	Z_1	1.742	0.416	4.19
Age	Z_2	-0.002	0.354	-0.005
Education	Z_3	-0.155**	0.010	-1.556
Cotton growing years	Z_4	0.177	0.167	1.059
Extension access	Z_5	0.158	0.256	0.618
Hh size	Z_6	0.371*	0.215	1.727
Credit	Z_7	-0.041	0.009	-4.533
Efficiency parameter				
Sigma-squared	δ^2	0.575	0.17	3.388
Gamma	γ	0.99	0.000	160.
Log likelihood function	LLF	-87.56		
LR test of the one-sided error	67.66			
Mean technical Efficient	**46**			

*Indicate statistically significant at 5, ** at 10 and 1 percent respectively

In estimating TE of individual farmer, a stochastic frontier production function was estimated and the determinants for cotton productivity were obtained. The results presented in Table 4 shows the estimated coefficients of stochastic frontier production function due to efficiency and inefficiency. The log likelihood for the fitted model was found to be -0.88 which show the model fit well with the study. On the other hand the log likelihood ratio (LR) test of the one sided error was found to be 67.7 and was significant at 1 percent level from Kodde and Palm table one. Thus the overall model was significant and the explanatory variables used in the model were collectively able to explain the variations in cotton productivity. Further the model results show that the variance in technical inefficiency parameter γ is 0.99 and is significantly different from zero at 1 percent level. This implies that 99 percent of the variations in cotton output among smallholder farmers were due to technical inefficiency. Thus more efforts should be done by cotton stakeholders to improve production in the area.

Partial elasticity were generated from the stochastic production frontier estimation (Table 4); Land size (0.72), delinted seeds (0.008) fuzzy seeds (0.068), fertilizer (0.063), pesticides (0.065), and animal manure (0.018). Positive sign from the results indicate that 1 percent increase in land size, delinted seed, fuzzy seed, fertilizer, pesticides and animal manure leads to increased cotton output by 72%, 0.8%, 6.8%, 6.3%, 6.5%, and 1.8% respectively. From the results smallholder farmers can improve their productivity by employing more coefficients used for efficiency determination. By increasing the quantity of seed it reduces the risk of seed failing to germinate as well as direct proportional to the increased cultivated land as is in the technical efficiency which shows high production depends on increase in farm size cultivated, but they should employ more land since it has higher elasticity compared to others. The results are consistent with Goran *et al.* (2005);

James, (2008), who asserted that farmers fail to maximize output since they have limited available factors of production and underutilize land size.

Summing up all partial elasticity of production with respect to every input gives 0.93; this represents net return value known as total output elasticity or function coefficient. It shows whether there is expansion or contraction in production. If all factors are varied by the same proportion, output would increase by 0.93%. The results represent decreasing return to scale. This is due to contraction in land size than decrease in technical efficiency. In the study area farmers were lamenting about poor seed germination rate makes them to incur additional cost for gap feeling. It was claimed that some farmers had inadequate knowledge on improved seed (delinted seed) in the stage of sowing, this practice is said to affect the cotton seed germination rate. Also farmers were said to be confused with the recommended and supplied pesticide, claiming that current pesticides supplied are not capable of killing pests. Others are confused on the amount of water recommended for pesticide dilution. This can be proved by Walusi (2012) and Aswoga *et al.* (2011) who asserted that limited knowledge on the right proportion of pesticides (agrochemical) that should be applied leads to a negative influence on production among farmers.

4.2.3 Maximum likelihood inefficiency estimates

As discussed in chapter three stochastic models helps to identify technical efficiency and the determinants for inefficiencies simultaneously. The parameter estimates of inefficiency model of the Maximum likelihood estimation (MLE) to identify factors influencing technical efficiency among smallholder farmers have positive and negative sign. A negative sign of an inefficiency parameter means that the variable increases technical efficiency or reduces inefficiency, while a positive sign implies that a variable reduces technical efficiency or increases technical inefficient. In Table 4 age, education and access to credit had negative sign while gender, experience, extension services and household size had a positive sign.

Respondents' age was included in the inefficiency to scrutinize the effect of physical strength on efficiency, it was found with negative sign meaning that it has positive contribution to technical efficiency; farmers become more efficient as their aged up. From the results in Table 4 most of the farmers engaging in cotton farming are elders with inadequate strength for farming activities. This finding is supported by Bachewe *et al.* (2011), who argued that young farmers are stronger and likely to be exposed to methods and new technologies than elders. Also education had negative sign meaning that if the rate of illiteracy decreases, efficiency increases, thus literate farmers tend to be more technically efficient due to early adopter of improved technologies compared to illiterate farmers. This is consistent with Amani *et al.* (2005), who contended that formal education is likely to increase farm level efficiency. Credit is found to have negative sign, implying that farmers who have access to credit are technically efficient than those who do not access credit.

Sex of household head examined the effect of gender on technical efficiency and it was positive, implying a household headed by a female demonstrates lower level of technical efficiency compared to household headed by male. This is due to the presence of patriarch system in the study area and the distribution of roles among females and males. In the stay area males dominate all agricultural crop activities which are the major sources of income earning. Also the level of experience on cotton growing and access to extension services was found positive. This implies negative contribution on efficiency level. In the stay area, most of the farmers do not have experience since most of them have only two years in cotton production, this lowers technical efficiency. Furthermore, most of the farmers have less knowledge on input use which is caused by lack of experience and lack of committed extension officer. This is supported by Amaza *et al.* (2006), who reported presence of inadequate extension information which lowers efficiency level.

However, household size also has negative contribution to technical efficiency, the larger the size of household leads to lower cotton production because most of the families in cotton farmers have few effective labour; most are children who do not perform farm work which leads to lower productivity.

4.3 Profitability Analysis of Intensified and Non-intensified Cotton Farmers Determining Income Effects

In answering objective three, GM analysis was used to determine the effect of income as shown from the empirical findings in the Table 5 and 6. The aim of any business firm is to earn higher income, this motivates the need of assessing the gross margin level attained by farmers either under intensified or none intensified farming. The analysis was important in order to make conclusion to whether intensified farming helps farmers to get higher income level than none intensified farmers. In the analysis cost and return were computed to assess the gross margin of each individual cotton farmer under intensified and non intensified farming. Thereafter comparison was made based on gross margin per acre which is computed for both intensified and non intensified farmers.

Revenue was obtained as a product of cotton price and average quantity of cotton produced and sold per acre. The price of cotton per kg varied across farmers depending on the time of selling; being low at harvesting time and higher later on by obeying principle of demand and supply, but 750Tsh was the official price of cotton per kg. Gross Margin was obtained as average revenue per acre minus average variable cost per acre. As expected, the findings show that farmers from intensified farming get higher GM than non intensified farmer. The average gross margin was found to be 18 400Tsh and -26 800Tsh respectively for both intensified and non intensified farmers, the mean difference was found to be 45 200Tsh. The findings are not likely to those of Kunene (2010) who found that due to high operational costs intensified farmers got low returns compared to non intensified farmers. On other hand, the study is consistent with study of Rwaswami *et al*. (2005) who indicated that intensified farming helps farmers to achieve higher net returns than non intensified farming.

Table 5: GM for Intensified Farmers

Revenue	Quantity	Price	
Yield/acre (Kg/ha)	310	750	
Total Revenue			**232500**
PRODUCTION COST	**Quantity**	**Price**	**Cost**
Field preparation (acre)	1	25000	25000
Cultivation (acre)	1	25000	25000
Manure transportation/Tons	0.94	10000	9400
Sowing	1	11000	11000
Fuzzy Seed (kg)	12	450	5400
Delinted Seed (Kg)	9	500	4500
Manure (Tons)	0.94	20000	18800
Fertilizer(CAN/UREA) (Kg)	30	1000	30000
Weeding	1	25000	25000
Pesticides/20 Mills	171	5000	30000
Pesticide application	6	2000	12000
Harvesting	310	17714.3	18000
Total Cost			**214100**
Gross margin/Profit			**18400**

Table 6: GM for Non Intensified Farmers

Revenue	Quantity	Price (Tsh)	
Yield/acre	194	750	
Revenue			**145500**
Cost of production	**Quantity**	**Price**	**Cost**
Field preparation (Acre)	1	25000	25000
Cultivation (Acre)	1	25000	25000
Manure transportation/Tons	0.45	10000	4500
Sowing	1	11000	11000
Fuzzy Seed (kg)	14	450	6300
Delinted seed (kg)	7	500	3500
Manure	0.45	20000	9000
Fertilizer(CAN/UREA)			0
Weeding	1	20000	20000
Pesticides/20 Mills	8.75	5000	45000
Pesticide application(Mills)	6	2000	12000
Harvesting	194	11085.71	11000
Total Cost			**172300**
Gross margin/Profit			**-26800**

The gross margin for non intensifies shows no any need for farmers to keep on producing cotton since it gives loss in their income. But still farmers keep on producing cotton. This is due to the tendency that farmers does not keep records of cost during farming activities but keeps on complaining about low returns and others keeps on producing cotton to maintain status in the villages.

Furthermore, the study tested if there was a statistically significance difference in GM for farmers intensifying and who do not intensify during cotton production. The two groups were treated separately; using the paired t test for each group the study found that the means difference in GM with and without intensified methods for the two groups to be statistically difference at 1 percent level of significance. Finally; the study was able to reject the null hypothesis that; there is no significant difference in income between intensifies and non intensifying smallholder cotton farmers. Therefore; it was concluded that on average farmers using intensified methods in cotton farming were able to achieve higher gross margin than their counterpart non intensifying cotton farmer's and the difference was statistically significant at 1 percent level of significant.

4.4 Challenges and Prospects for Cotton Production in the study Area

4.4.1 Challenges faced by farmers in intensifying cotton production

Major challenges faced farmers during 2014 cotton production season were high cost of inputs (seed, fertilizer, pesticides) and untimely sale of the company dealing with input distribution. Low selling price of cotton seed set by the government which was not enough to cover the cost of production, also lack of extension services in the area especially on improved seed variety, fines posed by cotton inspector for those mixing cotton with other crop discouraged farmer and climate change in the area.

Furthermore farmers reported low production per ha lead them to earn low income, this was due to inability to access credit by smallholder cotton farmers, also the issue of inadequate market was reported among the challenges since buyers of cotton seed were interested with those who have high yield and neglected those with low yield per ha. Others reported poor relationship between cotton seed buying companies' and farmers due to inappropriate price they would like to be paid.

From the analyzed challenges articulated in the study area, each village had its unique challenges compared to the other. Higher input price was leading claimed by 89 respondents followed by pest and diseases claimed by 73 respondents, followed by low cotton price by 68 respondents, unreliable market by 62 respondents as shown in Table 7. The leading challenge was high input price observed in Buganda and Mwajombo by 19 respondents respectively, followed by pest and diseases in Buganda by 19 respondents, then low price by 19 respondent followed by low market prices. Other challenges are shown in Table 7, for the number of respondent interviewed and their percentage contributions in the village, for the sustainability of cotton production in the area the identified challenges should be considered so that farmers could enjoy the essence of intensification and income improvement.

Table 7: Challenges facing smallholders' cotton farmers

Variable	Buganda	N'gwalobagole	Mwajombo	Nyamikoma	Wanzamiso	N'gwambola	Total N	%
Pest and disease	19 (26.0%)	14 (19.2%)	13 (17.8%)	10 (13.7%)	8 (11.0%)	9 (12.3%)	73	15.1
Lack Knowledge	18 (47.4%)	2 (5.3%)	5 (13.2%)	4 (10.5%)	3 (7.9%)	6 (15.8%)	38	7.9
Higher input price	19 (21.3%)	16 (18.0%)	19 (21.3%)	18 (20.2%)	8 (9.0%)	9 (10.1%)	89	18.4
Poor soil fertility	15 (45.5%)	2 (6.1%)	1 (3.0%)	2 (6.1%)	6 (18.2%)	7 (21.2%)	33	6.8
Inadequate extension service	16 (34.8%)	7 (15.2%)	9 (19.6%)	4 (8.7%)	3 (6.5%)	7 (15.2%)	46	9.5
Unreliable market	18 (29.0%)	9(14.5%)	13 (21.0%)	6 (9.7%)	10 (16.1%)	6 (9.7%)	62	12.8
Lack of credit	15 (41.7%)	4 (11.1%)	8 (22.2%)	2 (5.6%)	2 (5.6%)	5 (13.9%)	36	7.4
Low price	20 (29.4%)	6(8.8%)	6 (8.8%)	14 (20.6%)	12 (17.6%)	10 (14.7%)	68	14.0
Poor seed quality	16 (59.3%)	3 (11.1%)	0	4(14.8%)	3 (11.1%)	1 (3.7%)	27	5.6
Bad weather	0	1(8.3%)	2 (16.7%)	1 (8.3%)	5 (41.7%)	3(25.5%)	12	2.5

4.4.2 Prospect of cotton production in the area

Among the question asked were the opinions of farmers on the sustainability of cotton production in the area. 92 percent declared the decrease in farmers' involvement in the cotton production due to low price, high running cost and time consuming up to maturity of the crop from sowing to harvest. Also negligence from the government compared to past years. This was supplemented by high variation of efficiency level among famers as shown by technical efficiency model in this study.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1Conclusions

The essence of this study was to assess contribution of agricultural intensification in cotton production and to find out its implication for productivity and income to smallholder farmers in Misungwi District. The specific objectives were: (i) to examines the status and challenges of agricultural intensification for smallholder cotton farmers (ii) to determine the level of input use efficiency for cotton smallholder farmers (iii) to analyze income effect of intensification on cotton o smallholder farmers in the study area.

The hypotheses of the study were tested based on the respective techniques and analytical methods employed in the study. Descriptive analysis, stochastic frontier production function and gross margin analysis were used. Descriptive analysis was used to examine the forms of agricultural intensification in the study area. The stochastic frontier was used to test the hypothesis that there was no significant variation in technical efficient for intensified and non intensified. Based on efficiency level findings, there was a significant variation. Using the comprehensive survey data of 120 smallholder cotton farmer in 2014 the study obtained production efficiency with a wide variation among cotton farmer in the district. The mean level of efficient for smallholder cotton farmer is 46 percent indicating there are remains considerable scopes to increase cotton production by using intensified method in cotton farming.

The cotton specific variables used to explain inefficiencies indicate that 99 percent of inefficient was due to farmer’s adaptability to production techniques. But for those farmers who have farming experience, contacts with extension services, those who had knowledge in using fertilizer and pesticides to be more efficient. High variation efficiency of farmers in adaptation of technical methods in cotton production from 99 percent to 10 percent affects much the income of individual. Within the District also it has obvious implication showing famers are below mean efficiency (about 46 percent) indicating more efforts should be done by the farmers to increase efficiency level and there is a need for proper policy to eliminate this gap.

Onwards the study results showed the presence of challenges that are influenced by institutional factors, climate change and lack of knowledge to farmers subjected to new input technologies. The lower rate intensification on cotton led to lower output of cotton production averaging 237Kg/acre below potential recommended 1000Kg/acre and leads to low income for cotton growers. Thus it can be concluded the data from cotton smallholder farmer in Misungwi suggest the existence of low productivity. Also it is shown that although farm size, use of fertilizer and seed variety was among the important determinants of cotton productivity; its effect on cotton productivity was not fixed, i.e. the increasing of farm size by one hectare on farm productivity on prevailing farm size. The constantly use of fertilizer on cotton production might not be friendly for a farmer as time goes. Also the seed variety used per hectares productivity depends on the knowledge of a farmer using it and climate change situation.

Gross margin analysis was used to determine income effect of intensification on cotton to smallholder farmer in cotton production. Based on findings farmers who intensify had high profit compared to non intensifies. Thus the rate of income effects varied. Those using intensified method had positive effects, meaning they had gains compared to those who were not intensifying. Encouraging the use of improved mechanism in cotton (intensification) could help farmers to increase efficiency and help in improving income.

This can be possible through strengthening extension services, farmers training and subsidizing inputs.

5.2 Recommendations

In view of major findings of this study and above conclusion the following recommendation are drawn in order to improve high cotton productivity, efficiency for higher income gains.

The more efforts should be intensified on the part of extension agents in training and provision of extension materials to the farmers so as to increase their efficiencies. Since returns to farmers on cotton production is dependent on yields, strategic technologies transfer to enhance adoption that lead to productivity improvement is crucial. The leverage points could be land improvement, use of high yielding varieties and tolerant varieties to insects and diseases, coupled with entrepreneurship and business skills for farmers to be able to manage the enterprise efficiently.

The study confirmed institution arrangement to be among the challenges in increasing cotton productivity. Thus there should be a critical success factor concerns the institutional arrangement and value chain governance. Arrangement of institutions and support service providers so as to enhance farmers' productivity change is important. Example could be strengthening contract farming in the study area by allowing individual farmers engage on contract with companies and promoting inter-linkage systems with other support services, notably financial institutions, research and advisory services. This system might allow farmers achieve higher yields through production services access and hence higher returns on the enterprise.

Marketing prices was found among the main problem encountered by cotton farmers in the study area. Unreliable marketing prices have revealed to be among the main obstacles for cotton farmers engagement in cotton production. This problem can be reduced by the government to set good prices for cotton and enforce it to different buyers of cotton regardless of whether it's a good production season or not. Therefore efficient price will encourage adoptability of improved mechanism in cotton production and influences productivity and income gains.

Further higher input prices and their availability on time found to be the hindrance to cotton smallholder farmers in the study area. The problem can be tackled by introducing and strengthening farmers association and entrust them with the task of supplying farm inputs. This assertion based on the facts that inputs supplied by farmers association in the past were found to be cheaper than those supplied by private traders. The large input price differential between farmers' associations and private traders could be attributed by profit bases. Farmers association supply inputs based on "no profit no loss" while private traders are oriented to profit maximization. Unfortunately farmers associations are unable to meet the input requirement for all farmers. Thus the government should increase the ability to such association to procure inputs by setting good budget to cotton production. This would enhance their ability to provide input a right time and quantity.

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APPENDICES

Appendix 1: Information on the Appropriate Use of Technology in Cotton Production

TATHMINI YA MAPATO NA MATUMIZI YA ZAO LA PAMBA (2013/2014)

LZARDI

Lengo: Kutoa taarifa kwa wadau kuhusu faida inayopatikana kutokana na matumizi ya teknolojia ambazo hutolewa na utafiti

Maelezo	Kufuata kanuni za kilimo bora cha pamba chini ya uangalizi wa watafiti			Kufuata kanuni za kilimo bora cha pamba chini ya uangalizi wa mkulima			Kulima bila kufuata kanuni za Kilimo bora cha pamba		
Mavuno (kilo/ekari)			1,000			650			340
Bei (shilingi/kilo)			750			750			750
Jumla ya mapato (Tsh/ekari)			750,000			487,500			255,000
Gharama kifedha:	Klasi	Bei	Gharama	Klasi	Bei	Gharama	Klasi	Bei	Gharama
Kulima shamba(plau/trekta/ekari)	1	78,000	78,000	1	50,000	50,000	0	0	0
Mbegu (kilo/ekari)	10	350	3,500	10	350	3,500	12	350	4,200
Mbolea - Urea (kilo/ekari)	30	1,100	33,000	30	1,100	33,000	0	0	0
- TSP (kilo/ekari)	30	1,200	36,000	0	0	0	0	0	0
Samadi (tani/ekari)	4	5,000	20,000	4	5,000	20,000	0	0	0
Kusafirisha samadi (trip)	3	4,000	12,000	3	4,000	12,000	0	0	0
Viatilifu – Insectido (acre pack)	6	2,500	15,000	4	2,500	10,000	3	2,500	7,500
Mifuko ya kuvunia	11	1,000	11,000	7	1,000	7,000	4	1,000	4,000
Kusafirisha pamba (trip)	4	9,000	36,000	2	9,000	18,000	1	9,000	9,000
Kuuza pamba	0	0	0	6	5,000	30,000	3	5,000	15,000
Jumla ya gharama (Sh/ekari)			**244,500**			**183,500**			**39,700**
Gharama Nguvukazi:									
Kutayarisha shamba	2	2,728	5,456	2	3,500	7,000	12	3,500	42,000
Kuweka samadi (watu/ekari)	5	2,728	13,640	4	3,500	14,000	0	0	0
Kupanda (watu/ekari)	5	2,728	13,640	4	3,500	14,000	4	3,500	14,000
Kuweka urea/TSP (watu)	5	2,728	13,640	3	3,500	10,500	0	0	0
Kupunguzia/Palizi 1 (watu/ekari)	8	2,728	21,824	5	3,500	17,500	6	5,000	30,000
Palizi 2 (watu/ekari)	6	2,728	16,368	5	4,000	20,000	6	4,000	24,000
Kuweka viatilifu (watu)	6	2,728	16,368	4	2,500	10,000	3	2,500	7,500
Kuvuna (debe/ekari)	200	200	40,000	130	200	26,000	68	200	13,600
Kung'oa masalia (watu)	5	2,728	13,640	5	3,000	15,000	5	3,000	15,000
Jumla ya gharama za nguvu kazi (Tsh/ekari)			**154,576**			**134,000**			**146,100**
Jumla ya gharama + 5% (Tsh/ekari)			**419,030**			**333,500**			**195,090**
Faida (Tsh/ekari)			**330,970**			**154,000**			**59,910**
Bei ya kurudisha gharama (Tsh/kilo)			**419**			**513**			**574**
Mavuno ya kurudisha gharama (kilo/ekari)			**559**			**445**			**260**

Kulima kwa utaalamu ni kufuata kanuni za kilimo bora cha pamba kama kuweka mbolea, kupalilia na kunyunyiza dawa za kuua wadudu

Technolojia za kilimo bora cha pamba zimewafikia wakulima wa Kanda za Ziwa na Magharibi

Kwa ushauri zaidi, wasiliana na:
Mkurugenzi, Utafiti na Maendeleo Kanda ya Ziwa,
Kituo cha Utafiti wa Kilimo – Ukiriguru,
S.L.P. 1433, Mwanza,
Simu: +255 732 981 065, Tovuti: lzardi@iwayafrica.com

Appendix 2: **Survey Questionnaire for Smallholders Farmer in Misungwi District Administered to the Sample Households**

You have been selected to provide some information on income effect associated with agricultural intensification on cotton. I will appreciate if you will cooperate with me for your experience by answering the following question freely and honestly. Your answer to these questions will remain strictly confidential.

Questionnaire No …………….. …………

Name of household head…………………................Respondent Name……………..…

Region…………………………………..….District……………………………………

Ward/Division ………………..…………..Village…………………………………….

Name of Enumerator…………………….....Date………………………………………..

Part A; Basic Information and Social Characteristics of the Respondent

1. Status of household head………………1= Male headed, 0=Female headed
2. Age of respondent……………………… Year
3. Sex of respondent………………………… 1= Male 0= Female
4. Marital status………………………1= Married 2=Single 3=Widow 4=Divorced
5. Education level………….. 1=No formal education, 2=Primary 3=Secondary, 4=Tertiary, 5= University
6. How many members of this household are living here now……………………….
7. What is your main occupation …………… 1= Farming, 0= Non farming
8. What are the three potential agriculture crop did you grow in 2013/14 season?

   1, ……….....................2,……………………… 3, ……………………………
9. What is total area used for agriculture (acre)……… …….Area owned used for agriculture…………….Hired used for agriculture………………… (acre)

10. Do you grow cotton in your farm? 1= yes 0 = No ( )

11. If yes for how long have you grown cotton ……………….. yrs

12. Did you grow cotton in 2013/14 season? 1= Yes, 0=No ( )

13. If yes; in (12). (a) How many acres of land used for growing cotton (acre)…………… (b) Area owned used for growing cotton………… (c) Area hired used for cotton growing ……………………… (acre)

14. What cost did you incurre in hiring area for growing cotton …………… (Tzs)

15. Who motivated you to cultivate cotton? 1. Neighbor farmer's 2.extension officer 3. Relatives 4. Politician 5.others (specify)…………………… ( )

16. What are the pulling factors for undertaking cotton production? 1. Increase income 2. Maintain status 3. Political pleasure 4. Other (specify) ……….. ( )

PART B. Production Processes

17. What are the total cost used for farm cultivation ………………………… (Tzs)

18. What types of equipment used during farm cultivation? 1. Hand hoe 2. Ox plough 3. Tractor 4. Other specify……………………………………. ( )

19. What types of labour did you use in farming activities? 1. Family 2. Hired 3. Both ( )

20. What types of seed cotton did you use during 2013/14 season? 1. Delinted seed 2. fuzzy seed ( )

21. What types of planting technologies did you use during planting? 1. Spacing 2. Broadcasting 3: Others (specify) …………………… ( )

22. What types of input did you use during 2013/14 season?

Types of input	Quantities (acre)	Application #	Area applied (acre)	Price per each input	Distance Km	Transport cost-Tzs	Means of transport
Manure							
Seed							
Fertilizer							
Pesticide							

23. How many times did you weed your farm per season ………………………

24. How many times did you spray chemical in your cotton per season farm………

25. How many kilograms did you harvest in the last cropping season………………

PART C: Farm Operation Inputs and Services Information

26. what was the farms operation inputs used in season 2013/2014

Activities	Cost	Types of labour=1. Family 2. Hired 3. Both	Mechanization
Farm preparation			
Fert application (sowing)			
Planting			
Gap feeling			
Growing fertilizer			
Weeding			
Chemical application			
Harvesting			

27. What can you say about accessibility of input in your area? 1. Easily accessible 2. Not easily accessible ( )

28. If Not in (27) what are the reasons 1. Not available on time 2. Too expensive 3. Lack of knowledge 4. I don't know ( )

29. How do you consider different institution in cotton production?

1. More important 2. Important 3. Not important 4. I don't know ( )

30. Do you get any information concerning agricultural production? 1. Yes 0. No ( )

31. Did you get any information concerning improved cotton production? 1. Yes 0. No ( )

32. If yes in (31) what was the main source of information? 1. Government extension agent 2. Research centre, 3. Newspaper, 4. Seed traders/Agro–dealer, 5.Other private shops 6. Radio / TV, 7. Neighbors /other farmers, 8. NGOs 9. Farmer groups / associations, 10. Other; specify ……………………. ( )

33. What types of information do you receive?

    1)…………………………2)……………….……… 3) …………………………

34. Are you satisfied with the information you received from the sources above? 1. Yes 2. No. If No explain……………………………………………………

PART D: Extension Services and Credit Accessibility in Cotton Production

35. How do you access extension services when needed?

    1. Very easy 2. Fairly easy 3. Not easy 4. Not at all ( )

36. What can you say on the importance of agricultural extension services and information on cotton production? 1. Very important 2. Fairy important 3. Not important 4. I don't know ( )

37. Have you received any advice on cotton production from extension agents? 1. Yes 2.No

38. If yes in (37) what was the advice about? 1. How to use inputs 2. Improved agronomic 3.cotton marketing 4. Others (specify) …………………..……………………………

39. Is there any association/farm group for any cotton production in this area?

1. Yes 0. No ( )

Name of association	Membership of association 1.yes 0.no	Function of group 1.credit 2.Agric. production	Years of membership	**Benefits** for being a member 1.easy to acquire inputs 2.easy to market produce 3.to get training

40. Information about credit

Loan accessibility 1. Available 2. Not available	Asked for loan 1. Yes 0. No	Have loan 1. Yes 0. No	Loan satisfies 1.yes 0.No	Source of loan	Purpose for loan.1. Cotton Farming 2. Other uses

41. Apart from credit do you have other sources of income for cotton production?

1. Yes 2. No ( )

42. If yes in (49) what are the sources from? 1. Selling other crops 2. Borrowing from others 3. Local government 4. Providing labour ( )

PART E: Choice on cotton production strategies/income activities during 2013/14 cropping year

43. What factors do you consider when deciding to produce cotton?

1. Price offered 2. Maintain status 3. Household cash need 4. Others…… ( )

44. What are the challenges are you facing producing cotton using intensified methods

Challenges	**Rating/tick**
1. Diseases and insect pests	
2. Inadequate technical knowledge	
3. Inputs price	
4. Poor soil fertility	
5. Inadequate extension services	
6. Unreliable market	
7. Lack of credit accessibility	
8. Other (Specify)	

45. What are the contributions of cotton productivity by using intensified method to your income? 1. High contribution 2. Average 3. Less contributing, 4. No any contribution (   )

46. What is the revenue per acres from cotton production during the 2013/14 cropping year

Type of crop	Total Quantity produced	Quantity sold	Unit price (Tsh)	Gross income (Tsh)	Net total income	Net cash income
Cotton						
Other (Specify						

47. Indicates income generated from method of cotton production per acres during the 2013/14 cropping year.

Type of methods	Unit	Quantity consumed	Quantity sold	Total Quantity produced	Unit price (Tsh)	Gross income (Tsh)	Variable Cost (Tsh)	Net total income	Net cash income
Local/organic									
Inorganic/modern methods									
Others (specify)									

48. By comparing cotton farming from the past and current what is the trend of farmers' involvement in the production of cotton? 1. Decreasing 2. Increasing (   )

49. If it decreases what are the reasons behind ....

50. If it increases what are the reasons ....

51. Comments or what can you tell about cotton production in general ....