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PRODUCTIVITY ANALYSIS OF SMALL-SCALE COTTON FARMERS IN MAKONDE DISTRICT, ZIMBABWE

BY

BRIDGET MAZIOFA

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF SCIENCE IN AGRIBUSINESS MANAGEMENT IN THE COLLEGE OF HEALTH, AGRICULTURE AND NATURAL SCIENCES

2022

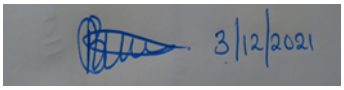
Abstract

To improve cotton production is undoubtedly one of the greatest challenges facing Zimbabwe. The purpose of this study was to analyze technical efficiency of cotton production of small-scale farmers in Zimbabwe Makonde District. The research targeted 378 respondents but only 237 responded. That means the research achieved a response rate of 62.7 %. The specific objectives were for small-scale cotton farmers in Makonde district, examine: first, the effects of farm level factors on technical efficiency , second, the effects of household level factors on technical efficiency, third the cotton yield per hectare on cotton production, and fourth, determinants of productivity of small scale cotton farmers. These objectives were analyzed using closed-ended questions using self-administered structured questionnaires. The data entered in Excel® and analyzed using SPSS software IBM® SPSS® Statistics 25, using multilinear regression analysis. The results indicated that household size (.003), total family income (.025), farm size (.000) and side marketing (.000) were significant in the interpretation of cotton productivity. With the increase in the number of individuals living together the chances of cotton production to increase was high, one person produced a yield of an average of 20kg per ha as compared to four individuals who had an average of 400kgs. With the level of education, the more an individual was educated there was an increase in cotton production. The percentage of individuals who side marketed was 54%, this means that there is a causative relationship as the more the individuals' side marketed, there was a decrease in cotton production. The larger the farm size under cotton production led to an increase in total gross yield of cotton The level of productivity showed that the maximum production of the respondents was 7591kgs with a minimum of 12kgs and a median of 602.08kgs. Based on the findings from this study it is recommended that various actions by the government and all other key stakeholders in cotton in order to improve technical efficiency and cotton productivity. Such actions should aim at improving access to farmland since 91.6% own 0-6ha, improve mechanization in cotton production, increase male involvement in this study males constituted about 47% of the participants, and improve the participation of youths since majority of the respondents were of the age group 41-50 with a percentage of 41.8% .

Keywords: Small-scale farmers, cotton, productivity.

Declaration

I declare that this dissertation is my original work except where sources have been cited and acknowledged. The work has never been submitted, nor will it ever be submitted to another university for the award of a degree.

Bridget Maziofa	
Student's Full Name	Student's Signature (Date)
Professor L. Dube	06/12/2021
Main Supervisor's Full Name	Main Supervisor's Signature (Date)

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Acknowledgement

I am most grateful to my Heavenly Father, the sole provider of knowledge, wisdom, love, mercy and grace for His protection throughout this programme. I sincerely appreciate my supervisor Prof. L. Dube who offered timely criticism and corrections that led me through the various stages of this project. I appreciate my father Mr Mtetwa and my late mother for showing me the value of education. To my sister Nicola I thank you and my mother in law Ms Musabayana for your continued support. Lastly I am grateful for my workmates and colleagues for all their contributions and support. May your lives be richly blessed.

Dedication

First and foremost I dedicate this dissertation to my Father above who gave me strength to complete this research. Secondly, to my husband Ignatious for his continued support and love and lastly to my children Taashidzwa, Lily, Sariah and Zion, you are a continued strength to my feeble soul.

List of Acronyms and Abbreviations

AGRITEX	Agricultural Technical and Extension Services
AMA	Agricultural Marketing Authority
AUREC	Africa University Research, Ethics Committee
A1	Family farms consisting of at least six hectares (depending on natural regions) plus a common grazing land for livestock.
A2	Commercial models of the accelerated land reform program where farmers are resettled in such a way that an individual has a farm where crop and livestock production is carried out within the farm.
COTTCO	Cotton Company of Zimbabwe
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
GDP	Gross Domestic Product
HA	Hectares
KG	kilograms
OLS	Ordinary Least Squares
SPSS	Statistical package for social sciences
UN	The United Nation

Definition of Key Terms

Socio economic factors	Refers to society related economic factors. These factors relate to and influence one another. These factors, land tenancy, system of ownership, size of holdings, availability of labor and capital, religion, level of technological development, accessibility to the market, irrigation facilities, agricultural research and extension service, price incentives, government plans and international policies have a close impact on agricultural activities (Tarver, 2020).
Factors of production	According to the Federal Reserve Bank of St Louis, they are four factors of production which are land, labor, capital, and entrepreneurship. They are the inputs needed for supply. They produce all the goods and services in an economy. That's measured by gross domestic product**.**
Small-scale farmers	These are the farmers that grew grow cotton on 1-6ha.
Productivity	The maximum use of given inputs to produce high yields.
Determinants of productivity	These consist of the knowledge and skills that are acquired through education, training, experience and technological knowledge and access.

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CHAPTER 1 INTRODUCTION

1.1 Introduction

Cotton is a white fluffy fiber that grows on a shrub like plant around a seed. The cotton plant is of the genus *Gossypium*. There are four species of cotton that are commercially grown, first, *Gossypium hirsutum* – known as the upland cotton, native to Central America, Mexico, the Caribbean and southern Florida (90 % of world production). Second, *Gossypium barbadense* known as the extra-long staple cotton, grown in tropical South America (8 % of world cotton). Third, *Gossypium arboretum* known as the tree cotton, native to India and Pakistan (less than 2 %). Fourth, *Gossypium herbaceum*. Levant cotton, native to southern Africa and the Arabian Peninsula (less than 2 %) (Cotton news, 2012).

The cotton production season can vary from six to nine months which implies that it is critical to plant cotton at the right time and using shorter season varieties as could be expected under the circumstances. The main varieties now used in Zimbabwe are QM 302 and CRMS 2, these have proven to have a shorter season to maturity ref. In Zimbabwe the cotton grown is not genetically modified.

Cotton is usually grown after winter when temperatures are moderate and rainfall is adequate, it germinates well in the middle and Highveld areas during the November to December month, whilst the Lowveld period is October to November. This is so because cotton requires a long frost free period followed by a period with significant sunshine and moderate rain between 600-1200 mm (Startupbiz, 2020).

The initial step of cotton production is planting of the cotton seeds. The seeds can be planted in supposed clusters or planted independently. The seeds are set either in shallow or profound ground contingent upon the temperature of the climatic area. Around nine weeks in the wake of planting the cotton balls will be completely developed and the fiber inside each cotton ball will begin to age and push outward. Following a month and a half the filaments will have developed adequately.

As discussed by Cotton news, 2012 the following stage is the reaping where the leaves of the cotton ball are eliminated from the fiber and the fiber is collected. In Zimbabwe cotton is handpicked making it the most favored in the world market. After the picking the fiber, the seeds and other waste are eliminated in a machine called a stripper. Thereafter the cotton fiber is compacted into bales for productive capacity.

The fiber is then separated to have three different components, which are the lint, linters and the seed. Lint can be spun to make thread, soft fabrics, fishing nets, coffee filters, tents, jeans, work suits, medical purposes, shoelaces, pillowcases, and dollar bills. Linters are used in plastics, paper products, films, yarn, cosmetics and a whole lot of other products. The seed is crushed into three separate products- oil, meal and hulls. The oil is used to make cooking oil, butter, salad dressings, cosmetics and in the preparation of snacks like chips, crackers and cookies. The hulls are used in stock feeds, fertilizer, fuel and packing materials (Cotton news, 2012).

Cotton is basically grown for its fiber, which is universally used in the textile industry as a raw material. This makes cotton a very significant commodity in the global economy. It is grown in over 100 countries and is an intensely traded commodity in the agriculture

sector, with over 150 countries participating in exportation and or importation of cotton (Estur & Knappe, 2006).

Cotton is deemed as a very political crop due to its significance in the world trade and to the economy of the majority of the developing countries. In many nations, cotton exportation is not only a significant contributor to foreign currency earnings but also account for an important proportion of the Gross Domestic Product (GDP) and tax income. Cotton is playing a vital role in the economic development of Africa: 37 of the 53 African countries are producing cotton and 30 are exporting to the outside market (Estur & Knappe, 2006).

According to UN Food and Agriculture Organization statistics 2019, the top 10 cotton producing countries (in 1 000 metric tonnes) are India (5,770), United States (3.999), China (3,500), Brazil (2,787), Pakistan (1,655), Turkey (806), Uzbekistan (713), Australia (479), Turkmenistan (198), and Burkina Faso (185). The five leading exporters of cotton being India, the United States, China, Brazil and Pakistan in 2019. Zimbabwe produces approximately 123 000 tonnes of lint cotton annually and exports to the international market amounts to 70 % and 30 % is used domestically (Rusere et al., 2006).

1.2 Background to the study

Zimbabwe's cotton is the third best cotton in the world according to the international market ratings. This cotton is highly favored because of its quality thus it is significantly on demand but there has been underproduction of cotton in the country with only a world market share of 2 % (COTTCO, 2020). After independence in 1980 the government

introduced various policy instruments in order to boost production of cotton farmers. The instruments included, price incentives, input subsidies and credit provisions. The largest cotton producer in Zimbabwe is Cottco, It has nine ginneries with a combined capacity of 265 000 tonnes of seed cotton. For this company to be commercially viable, it needs 265 000 tonnes of seed cotton annually. Figure 1.1 shows that cotton production has declined from 2011, which shows the highest production ever, and the graph continues to decline to date.

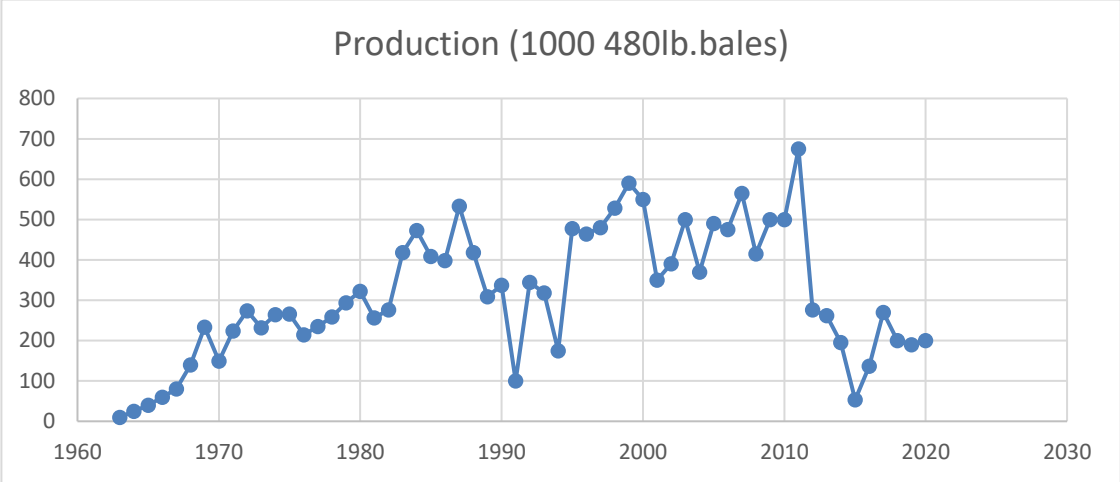

Figure 1.1 Zimbabwe cotton production by year
Source: Indexmundi. (2020)

There is a need to further look at improving productivity through addressing issues of cotton productivity and efficiency together. Thus the thesis will focused on Productivity Analysis which was conducted to identify areas for potential productivity improvement projects based on statistical data collected during the analysis. The analysis also pinpoinedt areas of delays and interruptions that cause loss of productivity (FAO; 2003)

Cotton, the second most important cash crop in Zimbabwe, is grown by thousands of small-scale farmers on an average plot size of about one hectare. Cotton is grown in four

main regions of the country, these includeGokwe South and Gokwe North, where the majority of cotton production takes place, Muzarabani, Mahuwe, Mutoko Mushumbi,Checheche, Mwenezi, Chiredzi. Binga, Kadoma, Chinhoyi, Raffingora, Mhangura Karoi and Zvipani (Esterhuizen, 2017).

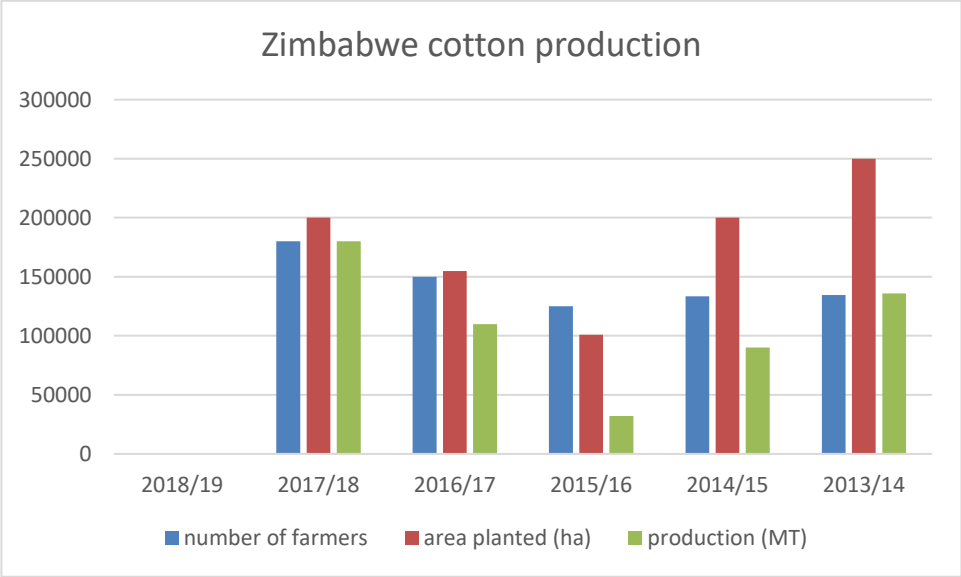

Figure 1.2 Zimbabwe cotton production against area planted
Source: from researcher compiled from various sources (AMA,COTTCO, AGRITEX)

From Figure 2 it shows that cotton production is always less than the area planted. Over the past years we have less farmers than the area planted, meaning that the farmers were planting more than 1 hectare of cotton. But when it now comes to output production seems to be below the area planted. According to Cottco (the cotton company of Zimbabwe, year), a farmer to be deemed to be productive they need to harvest at least 1 000 kg per ha.

The crop is usually grown under contract farming arrangements where contractors supply production inputs (seed, fertilizer and chemicals) to farmers on loan. At harvest, the

contractor buys back the contracted seed cotton, deducts costs of the inputs and pays the contract farmer the remaining balance (Esterhuizen, 2017).

However, in 2015 the government of Zimbabwe approved a three-year free presidential input scheme which was extended in 2018 to 2020, an input support program to revive the cotton production industry. This saw the contractor supplying the farmers with inputs (seed, fertilizer and chemicals) for free. After harvesting the contractor buys back the seed cotton with no deductions on the inputs and pays the farmer in full. This brought a significant raise in the number of contracted farmers but still production was below the expected (Esterhuizen, 2017). Table1.1, shows an increase in farmers due to the introduction of the presidential inputs in the 2016/17 season and a slight decrease in the number of contractors.

Table 1.1 Number of farmers in different seasons

Seasonal year	**Number of farmers**	**Number of contractors**
2019/20		7
2018/19	372 000	7
2017/18	385 343	6
2016/17	155 145	6
2015/16	125 000	8
2014/15	133 333	8
2013/14	134 452	8
2012/13	161 233	16

Source: from researcher compiled from various sources (AMA, COTTCO, AGRITEX)

Low levels of agricultural production have been the major problem facing the Zimbabwean economy since Independence. Given the importance of agriculture and particularly the cotton sub sector in Zimbabwe on rural livelihoods and general well- being of the macro-economy there is need to identify the determinants of production in the sector for policy advice. Cotton production is conducted in regions where there is low rainfall (450-500mm) and so most farmers grow cotton in order to boost their incomes or them to be able to purchase food. After independence in 1980 the government introduced various policy instruments in order to boost production of cotton farmers (Mahofa, 2007) for example the introduction of monopsony buyer Cotton Marketing board(CMB) used lower producer prices to subsidize inputs into textile industry.

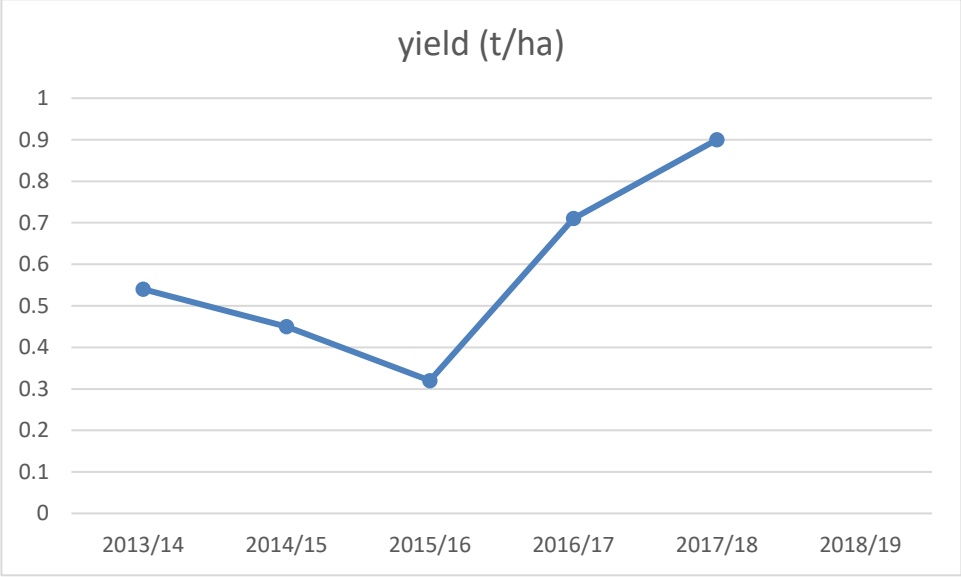

Figure 1.3 Average yield per hectare in Zimbabwe
Source from the researcher; complied data from various sources (COTTCO, AGRITEX, AMA)

From table 1.3 on average the farmers were failing to reach the 1 ton per ha mark where they were considered to be highly productive in the cotton industry.

1.2 Statement of the problem

Cotton production plays a pivotal role in the livelihoods of small-scale farmers in Makonde and the nation as a whole, since the crop has the potential of generating foreign currency hence the need to increase production. There are more than 21 000 cotton farmers in Makonde with each farmer producing approximately 3 bales per ha (634 kgs) . With the presidential scheme a farmer is expected to produce a yield of 5 bales (1 000 kgs) per ha. With the favorable weather conditions of Makonde and the rich soils this target should be attainable. For the past years according to Agricultural Marketing Authority (AMA) reports, cotton yields have not been raising with the increase of farmers. With the introduction of the presidential free inputs scheme and the increase in cotton prices there should be an increase of farmers as well as production per ha. Makonde the year 2021 only contributed 5% of the total production of Zimbabwe (AMA, 2020).

1.3 Research Objectives

1.3.1 General objective

The overall objective was to analyze productivity of small-scale cotton farmers in Zimbabwe in Makonde district.

1.3.2 Specific objectives were to determine:

1. Demographic characteristics of on technical efficiency of small-scale cotton farmers in Makonde district.
2. Farm level (socio economic) on technical efficiency of small-scale cotton farmers in Makonde district.
3. Productivity levels of small scale cotton farmers in Makonde district
4. Determinants of productivity of small scale cotton farmers in Makonde district.

1.4 Research Questions

1. What are the demographic characteristics of small-scale cotton farmers in Makonde?
2. What are the socio economic characteristics of small-scale cotton farmers in Makonde?
3. What are the productivity levels of small scale cotton farmers in Makonde district
4. What are the determinants of productivity in Makonde?

1.4 Research Hypothesis

The thesis was guided by the following hypothesis;

H1: There is a statistically significant relationship between age, gender, household income, farming experience, level of education and household size on cotton yield of small-scale farmers in Makonde district. There is no statistically significant difference between marital status and cotton yield in Makonde district.

H2: There is no statistically significant difference between marital status and cotton yield in Makonde district.

H3: There is a statistically significant relationship between extension services, side marketing and farm size on cotton yield of small-scale farmers in Makonde.

1.5 Significance of the study

Studying the analysis of cotton productivity had an impact on the improvement during and after the presidential free inputs program. Understanding the concept and applicability of technical efficiency showed the need of effectiveness use of inputs to produce an output. This identified gaps that can be further exploited, knowing and understanding the key variables, which affect production of farmers is of great importance in the reviving of Zimbabwe's economy. It also provided information to all stakeholders about their influences on cotton productivity and the role they can play in improving cotton productivity. Explanations of production differences between years included weather variability and input quantities. Identifying the reasons for differences in cotton production in Zimbabwe is not only important from a historical perspective, but also useful to evaluate the effects of existing and new policies.

i. Policy makers- the findings of this study helped policy makers to make well informed, relevant and viable policies that positively influenced the productivity of small scale cotton farmers in the Makonde area, Mashonaland west of Zimbabwe.
ii. Academic world- this study contributed greatly to the academic world by providing materials for the study of cotton productivity in Zimbabwe. The

findings of the study also provided a basis for further study of the same topic by other researchers.

iii. Business owners –the findings of this study helped business owners such as seed companies, fertilizer companies and chemical companies to have a better understanding on the factors affecting cotton farmers in order to make viable business decisions.

iv. The researcher - this study benefited the researcher by having an increase in knowledge on the subject of cotton productivity in Zimbabwe.

1.6 Delimitations of the study

This study was delimited to;-

i. Areas that grew cotton in the past 5 years under the Presidential free input scheme. For the past four years the government of Zimbabwe has been issuing seed cotton under the presidential free input scheme so there has not been any contract cotton farming to date.

ii. Mashonaland west, Makonde district because Makonde was once the major cotton producing area. Over the years cotton production has lowered making it the most suitable area to conduct this study.

iii. The study was also limited to small scale farmers, those that grow cotton 5ha and below because small scale farmers are those that grow cotton on 5 and below hectares.

1.7 Limitation of the study

i. A purposive sample was used (it is a sampling technique in which the researcher relied on his or her own judgment when choosing members of population to participate in the study) as opposed to random sampling (this is where each sample has an equal probability of being picked) therefore the study cannot be generally applied to a larger population. But the researcher put into consideration areas that grew cotton so as to have a true representation of the population.

ii. There were travelling constraints due to the COVID 19 pandemic. The researcher improvised by engaging extension officers who were already stationed in the areas of the study to assist with data collection.

iii. There were budgetary constraints to meet transport, airtime, stationery and other necessary expenses during the study. The researcher reached out to family and friends for assistance that made the funds to be available.

iv. There were was participants who were illiterate. The researcher overcame this by engaging extension officer located in the areas of study to assist by reading out the questionnaire, interpreting and writing the answers of the participants.

1.8. Organization of the study

The study was organized into five different chapters. Chapter 1 covered the introduction, background of the study of the productivity analysis of small-scale cotton farmers. It also covered the statement of the problem, research objectives and questions, significance of the study and the limitations. Chapter 2 focused on the review of related literature, the theoretical and conceptual framework. Empirical tools commonly used in assessing production performance was also reviewed. Chapter three was the

methodology this focused on the research design, sample size, area of study, philosophical assumptions, data sources, description of variables analytical framework. Chapter four was where the data was presented, analyzed and interpreted. Chapter 5 provided a summary of the study, conclusions and recommendations.

1.9 Chapter summary

This chapter has described by way of problem statement that there is a knowledge gap regarding the productivity of small-scale farmers in the Makonde area in Zimbabwe. The background to the study looked at the studies that have been carried out other countries related to cotton productivity. The chapter also described the significance of the study to different stakeholders as well as outline the hypothesis, research limitations and delimitations.

CHAPTER 2 REVIEW OF RELATED LITERARTURE

2.1 Introduction

This chapter embodies a review article and assessment of the variation of existing materials addressing small-scale farmer productivity, measures of farm productivity, productive potency and measures of technical efficiency. Further, it integrates this study into a broad framework of relevant theory and analysis by noting areas wherever it differs in approach or where it concurs with previous connected research.

2.2 Theoretical framework

2.2.1 Production theory

The theory of production relates to the mix of the factors of production and how to utilize these factors to maximum effect. Raw cotton obtained directly at its place of origin, that is the cotton fields is of moderate significance. However, that same cotton if transported to the vicinity of a textile mill it assumes value. Production creates or adds utility. In simple theoretical framework, inputs are usually identified as capital and labour, however, cotton production is a multilevel input exercise where numerous inputs including land, labour, equipment (cultivators, ploughs), ox, chemicals (fertilizers, insecticides, pesticides, herbicides) and entrepreneurship are employed. The theory asserts that seed cotton produced depends on the mixing of these inputs, that is the level of technology and the scale of production; quantity of inputs used. Thus, from this theory one can model out scale and technical efficiency effects of production (Mutukumira, 2014). According to Mishra (2017), all inputs are variable.

2.2.2 Production function

A production function is a mathematical calculation which shows the level of output that can be produced from a given combination of inputs. The function gives a link to the levels of inputs used and attainable levels of outputs.

The general form of production function is given by $Q = f(L,K)$ where Q stands for the quantity of output, L stands for the quantity of labor used, and K stands for the quantity of capital employed in the production process. It can be expressed in the form of an arithmetic table. Table 2.1 shows that with the addition of each unit of fertilizer there is an increase of total corn yield.

Table 2.1 Production function

Production function		
Units of fertilizers used	**Total Corn Yield (Bushels)**	**Additional Corn for Each Additional Unit of Fertilizers (Bushels)**
0	26.0	
1	38.0	12.0
2	47.0	9.0
3	52.5	5.5
4	54.0	1.5

Source: Harsh (2020)

Geometrically by means of a simple graph.

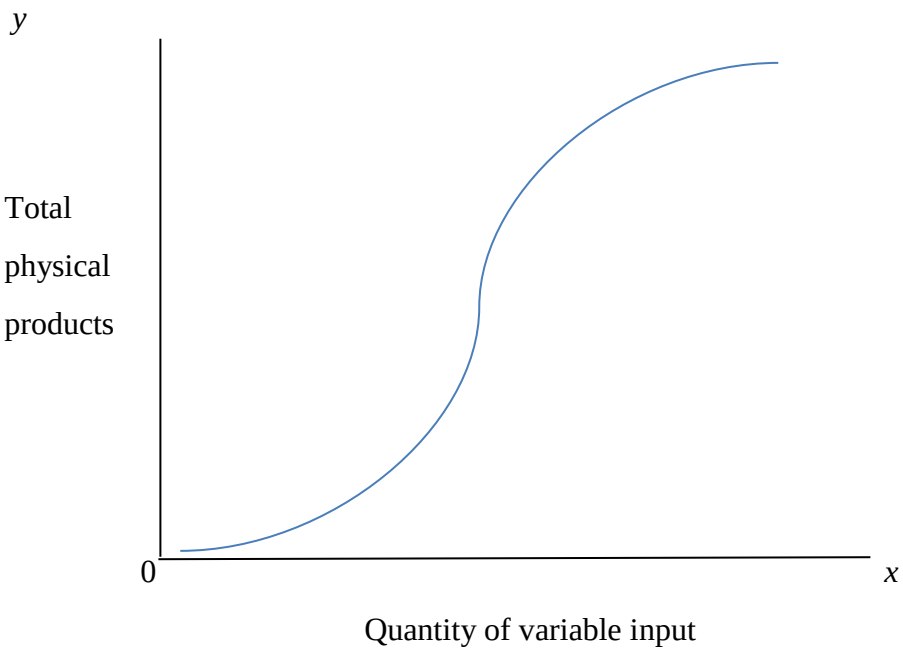

Figure 2.1 Production function
Source: Harsh (2020)

Or an algebraic expression in which output is a dependent variable and input, the independent variable.

In this study, the production function is in algebraic form, it was expressed as:

Y =f(x),

Where Y represents the output, x, the input and 'f' means is a function of, or 'depends upon, or is determined by'. Here, it is assumed that output depends upon a single factor. However, it must be understood that in actual life, agricultural output (and for that matter, any output) is never a function of a single factor. It rather depends upon a variety

of factors, such as seeds, amount of fertilizers used, irrigation, nature of soil This can be written as:

$Y = f(x_1, x_2, x_3 \ldots\ldots\ldots\ldots\ldots\ldots x_n) + u$

This function means that output depends upon all factors represented like by x_1, x_2., and also the level of unknown or uncontrollable factors represented by u. It is not feasible to consider all controllable factors simultaneously in any one study.

Therefore, each factor may be studied in combination with some factors considered as fixed. For illustration, a farmer may be interested in knowing how the output of cotton will change as the two inputs namely, the seeds and fertilizers are changed while other factors are held constant at fixed levels.

2.2.3 The concept of productivity

Productivity aims at the maximum utilization of resources for yielding as many goods and services as possible, desired by consumers at lowest possible cost. Productivity is the ratio of output in a period of time to the input in the same period time.

Productivity can be measured with the help of following formula

$$\text{Productivity} = \frac{\text{Quantity of Goods and Services Produced}}{\text{Ammount of Resource Used}}$$

Mathematically $P = \frac{O}{I}$

Figure 2.2 Productivity equation

Where:-

P is productivity

O is quantity of goods and services produced

I is amount of resources used

Source: Harsh (2020)

In simple terms, Productivity is the ratio of output to some or all of the resources used to produce the output

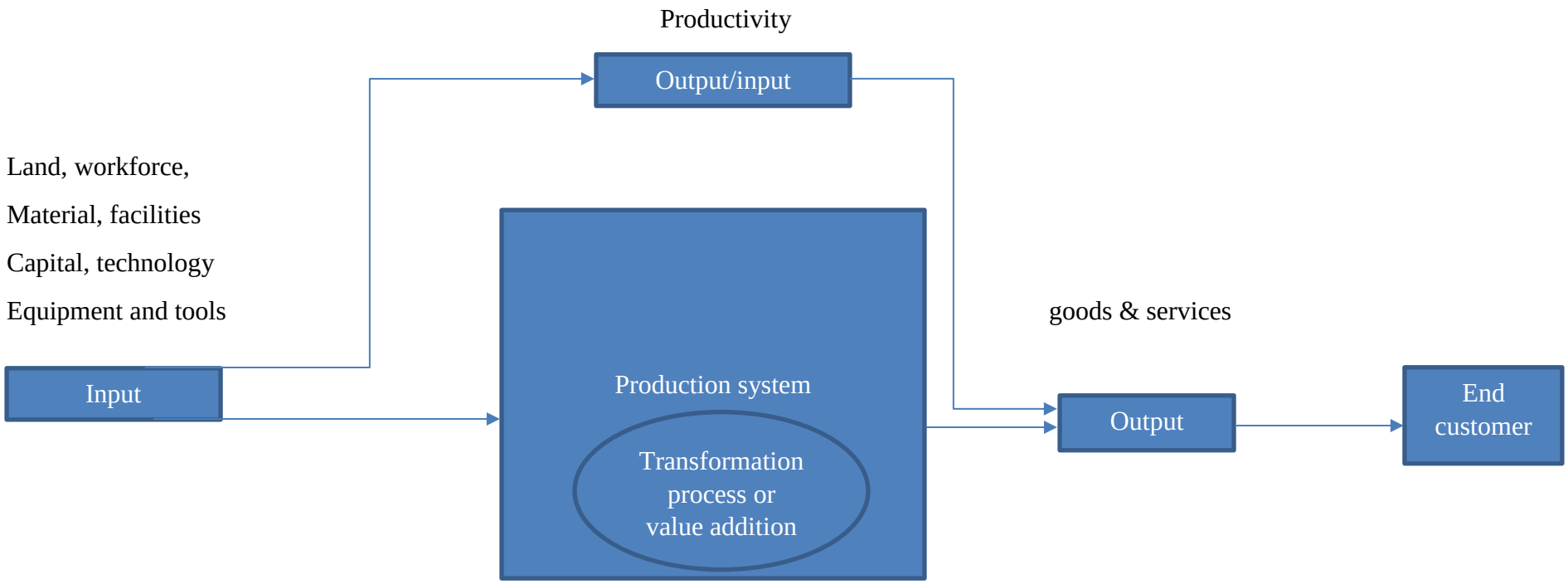

Figure 2.3 Productivity cycle

Source: Harsh (2020) Productivity cycle

“Productivity is the quantitative relation between; what a firm produces and what a firm uses as a resource to produce output, i.e. arithmetic ratio of amount produced (output) to the amount of resources (input)” Harsh (2020).

Productivity refers to the measure of output (e.g. products) from a production process per unit of input (e.g. labor and capital). Productivity is usually expressed as a ratio of output to inputs. It can be expressed as units of a product (e.g. cars) per worker-hour (total number of hours worked by all workers on that car). Given the cost of the worker-hour, productivity can also measure the efficiency of a company. These measures are quantitative and relatively easy to measure. However, other factors of productivity, such as creativity, innovation, teamwork, and even quality are qualitative and more difficult to measure. In most business models, profitability is a function of productivity, price, and volume. In other words, a company's success is measured by how efficiently it uses its resources to produce its product, the price it can sell its products, and how many products it can actually sell. When comparing companies within a sector, for example, it is very important for investors to understand the relative productivity comparisons between companies producing the same products.

2.2.4 Efficiency

According to Heyne (2019), economic efficiency is measured not by the relationship between the physical quantities of ends and means, but by the relationship between the value of the ends and the value of the means. The ratio of physical output (ends) to physical input (means) necessarily equals one.

Efficiency, in production economics is synonymous with frontier production. Frontier production is the maximum possible output that can be produced by a given set of inputs. According to Coelli (1995), efficient firms operate on the production frontier while inefficient firms operate beneath the production frontier. From a theoretical point of view, it is possible for inefficient firms to increase output by simply avoiding wasteful production, without adding more resources.

2.3 Relevance of the Theoretical framework of the study

2.3.1 Measurement of technical efficiency

Debreu (1951) and Farrell (1957) offer a measure of technical efficiency as one minus the maximum equi-proportionate reduction in all inputs that still allows continuous production of a given output rate (Lovell 1993).

Ashraf *et al.* (2019) measured and estimated the technical efficiency of cotton growers, they applied Data Envelopment Analysis (DEA). In addition, they used Tobit regression analysis to determine the impact of technical efficiency determinants on cotton production. Their results showed that the age of the peasants, the number of workers and the sales price of the farmers had a significant impact on the yield of cotton, while the method of sowing had a negative impact on the productivity of cotton.

Dessale (2019) used the stochastic production frontier to analyze technical efficiency of small holder wheat growing farmers. Parameter estimates showed that wheat output was positively and significantly influenced by area, fertilizer, labor and number of oxen. The estimated mean levels of technical efficiency of the sample farmers were about 82 %. The estimated stochastic production frontier model together with the inefficiency

parameters showed that age, education, improved seed, training and credit were found to have negative and significant effect on technical inefficiency, while farm size was found to have positive and significant effect on technical inefficiency of wheat production.

Etienne *et al.*, (2018) used both a semiparametric model and a fully parametric stochastic frontier model, they found significant production shortfalls for smallholder maize production. While labor, capital, and land all significantly affected the total output, the estimated mean efficiency score for farms with less than 10 hectares of land (A1) appeared to be under 0.75, and for the entire sample (A1 and A2) ranged between 0.595 and 0.772. There clearly existed a great potential for maize farmers to improve the technical efficiency and increase the total output. Gender and age of the household head, access to extension services, and activities of other crops significantly affected the technical efficiency of smallholder maize production in Zimbabwe. They also found that all farms operated under increasing returns to scale and that the technical efficiency score tended to increase with the level of output.

Dube & Mugwagwa (2017) conducted a study that employed the stochastic frontier analysis to estimate the production function and technical efficiencies. The results showed that contract farmers had a higher technical efficiency of 94 % whilst non-contract farmers had a mean technical efficiency of 67 %. The overall mean technical efficiency of the smallholder tobacco farmers in Makoni district was 73 %. These results showed that contract tobacco farmers were more efficient than non-contract tobacco farmers. The results also revealed that fertilizer and fixed costs are important inputs in smallholder tobacco production. More importantly, the study also found that contract farming significantly improved the technical efficiency of farmers. Non-contract farmers

were 10.84 times more inefficient than contract farmers and this result was significant at 5 % level. Other determinants that significantly improved technical efficiency were education level of farmer, the total cropping area, gender of farmer whilst access to other loans apart from the contract farming credit reduced technical efficiency.

Babangida *et al.,* (2017) analyzed their data using stochastic frontier production model and the Cobb-Douglas production function. The result of the overall elasticities of production which give the level of return to scale derived from the Cobb-Douglas equation was 0.68. The result of the study further showed that 30 % of the farmers had technical efficiency of 0.81 times and above while 70 % of the farmers operate at less than 0.8 efficiency level. The farmers with the best and least practice had a technical efficiency of 0.99 and 0.10, while the average technical efficiency index was 0.65 respectively. This implied that on the average, output fall by 35 % from the maximum possible level due to inefficiency. The result of the determinants of technical inefficiency showed that the coefficients for age and farming experience were significant at 1 %.level of probability, while educational level, household size and marital status were negative and not significant.

In this study a stochastic frontier analysis (SFA) method and the Cobb-Douglas production function will be employed.

2.3.2 Theoretical prediction of variables

The variables used were socio- economic factors such as age, gender, household size, level of education, household income, farming experience, marital status, farm size and

extension services. These were independent variables with cotton yield production being the dependent variable.

With the increase in age, household size, level of education, household income, farming experience, farm size and exposure to extension services there yresulted in an increase in cotton production demonstrate. When it came to marital status, a single member it is predicted that it will negatively impact on the production of cotton demonstrate. The more the available the labor the more there will be a positive impact on cotton production demonstrate. The pricing of cotton should also have an impact on cotton production.

2.3.3 Empirical review

-In cotton production, socio-economic factors play a vital role in the overall productivity of cotton by small-scale farmers. It is crucial to understand what other studies have been done, similarities and differences, recommendations and the analytical models used (Matthew, 2017). This provided a gap that justified this study.

2.3.4 Factors affecting efficiency and production in cotton

Bahta *et al.,* (2020) collected their data using Data Envelopment Analysis and Double Bootstrap Approach in a Principal Component Regression. Primary data were gathered using a questionnaire. Empirical results revealed that the mean technical efficiency of the respondents was 77 %, which indicated a potential for them to increase their efficiency by 30 %. The factors that increased technical efficiency included human capital, extension contacts and compliance with best management practices. The policy implication of this study was the need for robust group incentive schemes to promote

farmer-to-farmer skills transfer to boost the technical efficiency of smallholder maize irrigation farmers in Zimbabwe.

Essossinam *et al.,* (2019) conducted a study to determine the level of technical efficiency of cotton producers and analyzed its determinants where. The stochastic frontier analysis was adopted. The results showed that the average technical efficiency of cotton producers was 48.33 %. It was realized that it was possible to increase the level of cotton production to 51.67 % using the available resources. The factors that affected technical inefficiency of farmers included the use of herbicides, the education level and the nature of the soil. They argued that in order to increase the productivity of cotton, policy should target on the capacity building of the producers by an effective support of the extension agents in order to ensure the follow-up of the technical itineraries.

Zulu *et al.,* (2019) employed descriptive statistics to describe farm characteristics, and a production function (Cobb–Douglass production function (CDPF)) analysis using the ordinary least squares (OLS) criterion to estimate the parameters affecting sugarcane production. Results showed that late harvesting (by up to three (3) weeks), late fertilizer application (by up to six (6) months, and chemicals (Gramoxone) application (by up to five (5) months) were primary challenges facing SSGs, likely to result in declining sugarcane yield. The CDPF regression analysis reveals that significant predictors of the production function are: labor and the amount of chemicals (Gramoxone) applied. Labor (man-days/ha), amount of chemicals (Gramoxone) applied are found to be statistically significant and positively correlated with sugarcane production. The government, through the relevant Department of Agriculture, including the private sector, should

intensify out-grower technical services for SSGs to realize higher production per hectare.

Barasa *et al.*, (2019) analyzed their data using stochastic frontier models. The mean technical efficiency index was estimated at 0.65 indicating an opportunity of 35% for farmers to attain full efficiency. Technical efficiency was positively influenced by age of farmers (0.01); Education years (0.06); Years of farming experience (0.05); Frequency of extension services (0.05); Land Size (0.02) and negatively influenced by household size.

Asfaw *et al.*, (2019) concluded their study by suggesting that though agriculture is contributing a lot to the Ethiopian economy, the agricultural sector was explained by low productivity, caused by a combination of natural calamities, demographic factors, socio-economic factors; lack of knowledge on the efficient utilization of available; and limited resources (especially land and capital); poor and backward technologies and limited use of modern agricultural technologies. Moreover, the sector was dominated by smallholder farmers that were characterized by subsistence production with low input use and low productivity, and dependency on traditional farming and rainfall.

Begum *et al.*, (2019) conduction a research on turmeric farming and it displayed much variability in technical efficiency ranging from 18 to 96% with mean technical efficiency of 84%, which suggested a substantial 16% of potential output of turmeric can be recovered by removing inefficiency. Besides improving technical efficiency, potential also exists for raising turmeric production through intensive training and extension services. For a land scarce country like Bangladesh this gain could help increase income and ensure better livelihood for the hilly farmers.

Thompson *et al*., (2018) investigated the Variable-Rate Application (VRA) on Fertilizer Use in Cotton Production. The author declared that precision agriculture technologies (PA) are increasingly important in cotton production because input prices continue to rise. Farmers increase input efficiency using precision agriculture technologies by adjusting inputs to match soil fertility and plant nutrition requirements. This research examines the factors affecting changes in fertilizer use following variable-rate fertilizer application in cotton production. Data from a 2009 survey of cotton producers in 12 states of the United States were used in the analysis. Farmers who used precision soil sampling, planted larger cotton area, relied on other farmers for information about PA, grew picker cotton, and had higher household income were more likely to decrease fertilizer application with VRT. Results from this analysis are useful to farmers and policy makers interested in reducing fertilizer use in the face of rising fertilizer prices and growing concerns about the environmental impacts of farming.

Bilgili *et al.*, (2018) identified six factors influencing the decision-making in cotton production, which included economic, technical, political, environmental, personal, and product-related factors. The logistic regression model attempted to explain the factors convincing farmers to cultivate cotton. The variable related to the cotton experience of farmers was found significant. Besides, the variables of the number of individuals per household, total agricultural area, cotton plantation area in 2013, 2011, 2000, and 1990 were statistically significant. Cotton cultivation areas in the Eastern Mediterranean region tended to shrink rapidly after 2000s. In addition to increasing the cost of cotton production, factors like competitor product costs, productivity, changes in technology and price fluctuations played a role in the decline. They discovered that the decision to

cultivate cotton is affected by not only the price of cotton but also the government supports in place, changes in foreign trade practices, technology, human resources, competitor product prices, and yield.

According to Abdulal *et al.*, (2018), their study used the input-oriented data envelopment analysis to examine the technical efficiency of maize production in northern Ghana using cross-sectional data for the 2011/2012 cropping season. The mean technical efficiency was 77%, giving credence to the existence of production inefficiency. Technically, efficient farmers used an average of 395.80 kg of chemical fertilizer, 27.04 kg of seed, 4.04 l of weedicides and hired labor of three persons to produce a yield of 2.34 tons/ha of maize. Largely, maize production exhibited increasing returns to scale. Agricultural mechanization and level of formal education did not have positive effects on technical efficiency, whereas agricultural extension had a positive effect on technical efficiency. They argued that technical efficiency in maize production could be improved through informal and non-formal educational platforms where farmers without formal education learn improved cultivation practices. They noted that the agricultural extension department could be strengthened to provide effective extension services to farmers to improve on their technical efficiency. Animal and other non-mechanized power sources are complementary technologies and as such should be allowed to co-exist in Ghanaian agriculture.

Vitale *et al*., (2018) assessed the technical and economic viability of wheat farms, the efficiency of 141 wheat farms in the Western Great Plains was estimated. Results found substantial inefficiency among all producer types. The largest source of inefficiency was

input use among smaller farms. The smaller farms were the most scale efficient, reducing concerns over their future viability.

William (2017) conducted a study to analyze productivity of small scale cotton farmers in Biriadi district. The author analyzed the objectives by the use of the Cobb Douglas Stochastic Production Function and frontier 4.1 program. The results showed that technical efficiency was found to be influenced positively by household total income, farming experience, household size, and access to extension services. Cultivation cost and marital status (divorced) contributed negatively on technical efficiency whereas farmers' education and sex of farmer had results that were statistically insignificant in determining the level of technical efficiencies of farmers.

Okuyama *et al.,* (2017) this study focused on the production outcomes for five crops cultivated in Senegal: upland rice, lowland rice, groundnut, maize, and pearl millet. Technical efficiency (TE) of the production of each crop was estimated using data envelopment analysis, and the determinants of TEs were assessed using generalized linear regression analyses. Average TEs for upland rice, lowland rice, groundnut, maize, and pearl millet were estimated as 0.76, 0.88, 0.89, 0.94, and 0.90, respectively. The identified factors that had a positive impact on TE were years of cultivation experience, amount of nitrogen fertilizer applied, and participation in a farmers' association. Weeding hours, seeding rate, size of the cultivated area, and delays in sowing time were negatively associated with TE. The factors that significantly affected TE differed among the crops. Optimizing these factors could enable potential yield increase of upland rice, lowland rice, groundnut, maize, and pearl millet by 24, 12, 11, 6, and 10 %, respectively.

Gebrehiwot (2017) results showed an average level of technical efficiency of 48%. It was suggested that substantial gains in output and/or decrease in cost can be attained with the existing technology. All the variables included in the model to explain efficiency were found significant and with the expected sign, except education and number of dependents. The research tried to assess the impact of a new extension service (participatory in nature) on farmers' productivity in a semi-arid zone, as compared with the conventional extension service and found in the literature areas with relatively better climatic conditions. It was suggested that, if extension administrators could work to uplift the average and below average farmers into better performing farmers level, the overall production and living condition could improve substantially in the research area, and more or less in the rest part of the country.

According to Ahmad (2017), cotton profit function was examined with an econometric model which points out price of output and quantity of output positively affected profits while the cost of inputs negatively affected profit of the cotton cultivation. Model inputs cropped area, land preparation, seed, fertilizer, pesticides, irrigation, and labor were statistical significant and positively affecting cotton production. Stable and supportive output prices of cotton production prerequisite for increasing output productivity and profitability for cotton farmers such type of measure encouraged farmers to improve farming practices and perk up the socio-economic status of farming community.

Zulfiqar *et al.,* (2016) conducted a study to assess the effect of socioeconomic factors, farmers' risk perceptions, the production management technologies, and access to information and credit on the adoption of price, climate, biological, and financial risk management strategies. The potential for simultaneous adoption of these strategies was

also hypothesized and evaluated. Allowing for prospective correlation between the risk management strategies, a multivariate probit model was used on 302 randomly selected cotton farmers from Punjab province of Pakistan using multistage random sampling. The research findings established the simultaneous adoption of the four risk management strategies and that the adoption of one strategy encourages the farmer to adopt other strategy (ies). Significant factors in the adoption of various risk management strategies were found to be education, farming experience, land ownership, farmers' risk perceptions, the production management technologies, information access and credit access. The improvements in information access through quality extension services from the government and provision of alternative risk management options, including Crop Loan Insurance Scheme, are crucial to assist farmers in managing risks at farm level.

A study by Chisanga et al., (2016) investigated different sources of technical efficiency as well as the impact of technical efficiency on the welfare of cotton farmers in Zambia by using the Data Envelopment Analysis (DEA) and then supplemented by the Stochastic Frontier Approach (SFA). It was found that Zambian cotton farmers are less efficient compared to farmers in other countries, their technical efficiency average 43% and only 20 percent of the cotton farmers produce at 50 % or above.

Omache (2016), the analysis of data collected was done by the use of descriptive statistical methods and inferential analysis using statistical package for social sciences and multiple correlation analysis and presented in Tables. Analyzed data showed that there was a positive correlation of 0.169 between extension service delivery and agricultural productivity. There was a positive correlation of 0.117 between farmers" training methods and agricultural productivity. There was a positive correlation of 0.155

between the methods used for the dissemination of agricultural information and agricultural productivity. Social economic factors can influence agricultural productivity negatively or positively. From the findings combination of both family and hired labor is used heavily when conducting all farm activities meaning that if family labor is removed from the equation, the cost of production will go up. The author concluded that technology in agriculture should be embraced and encouraged. Also the use of fully tested and recommended inputs was a sure way to go since this gives a farmer quality and better yields. Extension service delivery should also be enhanced and strengthened.

Sodjinou *et al.,* (2015) found that organic cotton adoption is mainly determined by farmers' socioeconomic characteristics, the physical distance between farm and house, and contact with extension and advisory services. Organic farming was more attractive to women compared to conventional farming. This because such type of cotton farming enables women to hold a separate cotton farm and thus increase their economic independence, whereas with the conventional system they depend mainly on the farm of the (male) head of the household. Older, less educated and low-income farmers who express environmental concern were more likely to adopt organic cotton. Subsequently, organic cotton should be considered as a prospective policy option to reach the poor and strengthen their livelihoods conditions while contributing to preserve the environment and natural resources. Furthermore, farmers who had their farm near their homes were likely to adopt organic farming than those who had their farms far from their home. It also came out that organic farmers have more contacts with advisory and extension services.

Karimov (2014) illustrated that the results from the traditional frontier models, which used black box tools, led to biased outcomes. The model displayed that farmers' educational background, farm size, water availability, the application of manure, access to formal credit, Water User Association's services, farmers' participation in off-farm work and poor drainage systems, significantly contributed to input use efficiency. A quantile regression also showed that knowledge indicators played a significant role in improving farmers' efficiency in cotton production. The impact of agricultural experience on technical efficiency was positive, but not significant, in the middle and higher efficiency percentiles. Interestingly, having a basic education was not sufficient in achieving higher efficiency, based on the results obtained. The findings suggested that the provision of agricultural training and the development of agricultural extension services would help farmers acquire new technologies and enhance their decision-making capabilities in farm production which subsequently improve resource use efficiency in cotton production.

Mahofa (2007) conducted a study to identify factors affecting cotton production in the country during the period 1965-2005.Nerlovian supply response function was used to conduct the study. Empirical findings reveal that the major factors were government expenditure on research and extension and short-term credit extended to farmers by commercial banks and Agribank. The elasticity of supply response with respect to research and extension was 0.17 and 0.4 in the short-run and long-run respectively. The elasticity of supply response with respect to agricultural credit was found to be 0.32 in the short-run and 0.74 in the long-run. Simulation experiments reveal that a 10 per cent increase in the provision of short-term credit will result in a 3.2 per cent increase and 7.4

per cent increase in area planted to cotton. And also it was found that a 10 per cent increase in government expenditure on research and extension will result in a 1.7 per cent increase in area planted to cotton in the short run and 4 per cent in the long run. The study also documented low elasticities of supply response with respect to own price and that of competing products (maize in this case). A comparative analysis of domestic and international cotton marketing reveal that there is some relationship between the two markets. A Spearman correlation coefficient of 0.72 was found between world price (Cotton-A Index) and the domestic lint price expressed in US dollars and was significant at 1 percent. Nominal protection coefficients were also computed for the period and it was found that the degree of protection in the domestic sector was declining over the years, but generally farmers have been taxed.

2.4 Conceptual framework

Based on the literature different factors have been identified to have impacts on cotton productivity. These include, government expenditure on research and extension, application rate of fertilizers, the production management technologies, access to information and credit on the adoption of price, climate, biological, financial risk management strategies, economic, technical, political, environmental, personal, product-related factors, household total income, farming experience, household size, access to extension services, cultivation cost, marital status, farmers' education and gender. In this study, cotton production will be a dependent variable linked conceptually with the independent variables which are socio economic factors, demographics and determinants

of productivity which include, age, gender, household size, level of education, household income, farming experience, marital status, farm size, extension services and side marketing.

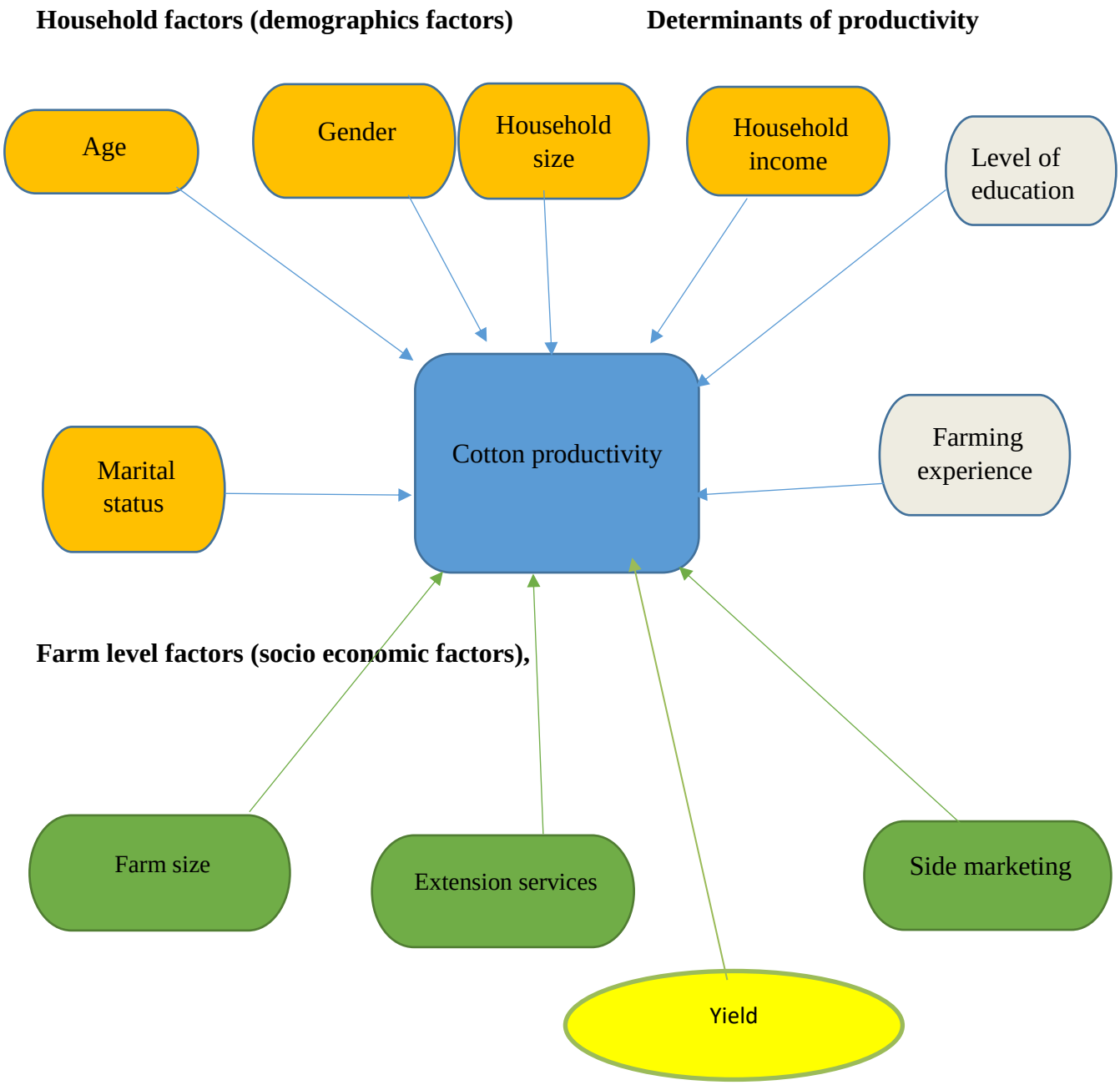

Figure 2.4 Conceptual framework
Source: Researcher's own construction

2.5 Summary

In this chapter, I reviewed the literature on productivity analysis. It was based on the theoretical and conceptual framework that formed the components of this study's analysis. The theory of productivity and efficiency was also reviewed. Finally, I reviewed previous related studies to identify areas where the approach was different or consistent with the current study. The researcher found in literature searches that research on cotton production has been conducted, but have not found any specific research on productivity analysis of small-scale cotton farmers in Makonde district of Zimbabwe. Such studies are important for developing appropriate intervention programs to improve efficiency for the benefit of society and farmers in general. To design an intervention, you need to understand the controllable factors that affect productivity.

CHAPTER 3 METHODOLOGY

3.1 Introduction

This chapter discussed the research methodology used during the study. The research design was described in terms of how the study was carried out and the philosophical approaches behind the selected methods. Data collection methods was then discussed, providing a justification for the selected methods. The sampling techniques used in the study was discussed in this chapter. The research tool was designed to be the tool used to collect data from participants. Finally, the chapter discussed the different ways in which data was presented and analyzed, while also explaining the reasons for the chosen methods.

3.2 Research Design

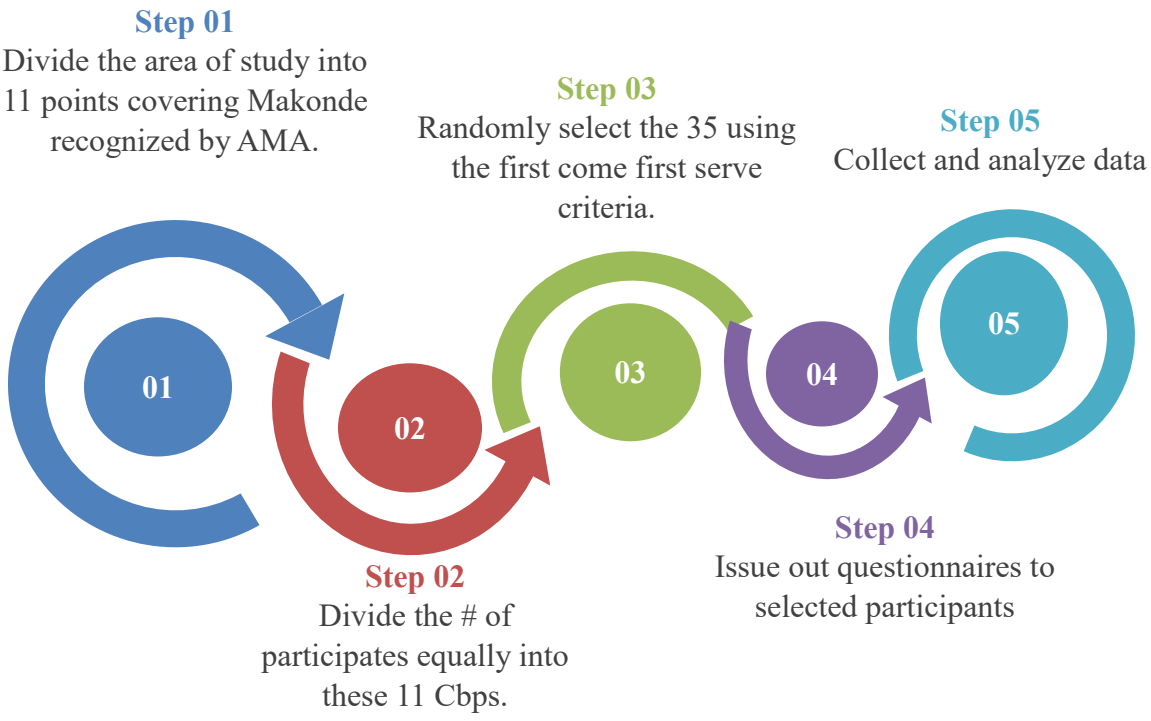

Figure 3.1 Research process

Source: Researcher‟s own construction

This research analyzed data for models, trends, and it helped in making scientific predictions and comparisons. Quantitative research was conducted to uncover constructive responses to participants' opinions, attitudes, behaviors, and other variables. Numerical data was then generated from the responses and analyzed to describe the productivity of small-scale cotton farmers in Makonde, Zimbabwe.

The design covers what researchers do by writing the hypothesis and its operational implications for the final analysis of the data. This research was focusing on the productivity analysis of small-scale cotton farmers in Makonde district. Cross-sectional survey was performed using preliminary data for the 2019/20 seasons. Once all measurements were obtained for the sample members, the cross sectional survey design was chosen for this study because it has some advantages such as quick and easy to obtain data, the design is cheap and easy to manage.

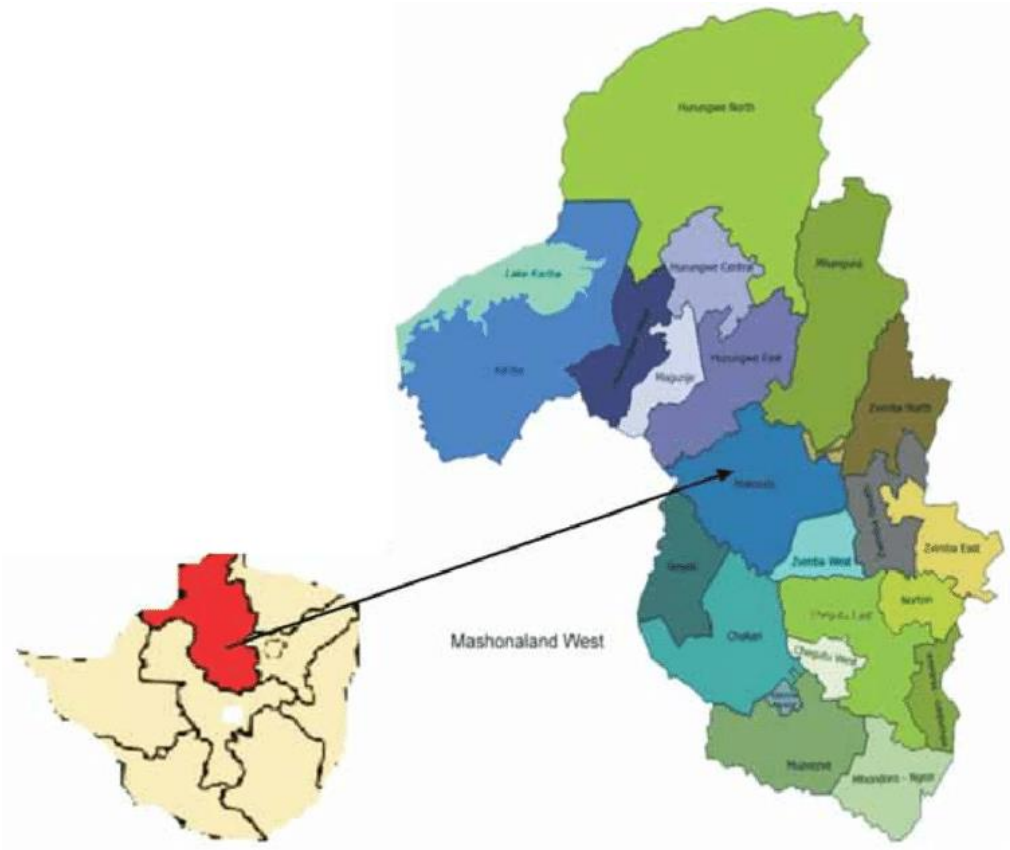

Figure 3.2: **<u>Map showing the Location of Makonde District in Mashonaland West</u>**
Source: Reseachgate.net (2021) [Coordinates 17.2847° S, 29.9741° E]

Makonde is a district in the Mashonaland West Province of Zimbabwe and covers an area of about 8 680 square kilometers. It is bound by Guruve District (Mashonaland Central) in the North and North East, Zvimba District in the East, Chegutu District in the South, Kadoma District in the South West, Gokwe North District (Midlands Province) also in the South West and Hurungwe District in the West. The area is divided into 19 wards, which constitute 2 parliamentary constituencies namely Makonde and Mhangura and the whole district is under the jurisdiction of Chief Nemakonde (Leesa, 2018).

Makonde District is a farming district. Crops grown include cotton, maize, soya beans and tobacco. Cattle is widely raised in the district for dairy products and beef, on a commercial basis. The main mineral which is mined is copper. Makonde is a mountainous area which usually has shallow sandy loam soils. It falls under region 3. Annual rainfall ranges between 650-800 mm and usually experiences normal season length that stretches from November to April (Leesa, 2018).

3.2.1 Research Approach

The research approach consisted of planning and processes of steps of general assumptions coupled with detailed methods of data collection, analysis, and interpretation. Therefore, it was based on the type of research problem addressed, Chetty (2016).

Research approach was divided into three types:

1. Deductive research approach
2. Inductive research approach
3. Abductive research approach

In this research, the deductive method was used and it followed the following processes described by figure 3.2.

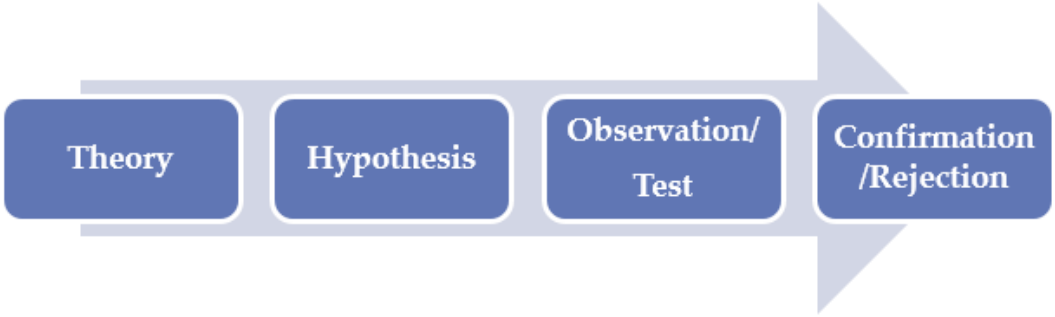

Figure 3.3 Research approach (deductive research)
Source: Dudovsky (2011)

In this research the data was collected using the philosophical assumptions of post positivist knowledge claims. It employed surveys. Lastly it employed methods such as closed ended questions, predetermined approaches and numerical data. These were obtained from farmers who had been growing cotton for the past 5 years.

3.3 Population and Sampling

3.3.1 Population

In this research the target population were the small scale farmers who grew cotton from 2019/20. These were the farmers who registered to grow Cotton with AMA in Makonde district, these amounted to 21 000 registered growers.

3.3.2 Sample size and sampling procedure

A sample may be defined as a selected item (people or item) to participate in a study; People are referred to as subjects or participants. Sampling is the process of selecting a group of people, events, behaviors, or other elements to study. Sampling frame is the list of all elements of the population being sampled. If the population is national or

international in nature it can be very large. A framework is needed so that everyone in the population is identified so that they are equally likely to be selected as a subject (element).

Sample size

According to Kothari (2004), sample size is defined as the number of items to be selected from the universe to constitute a sample. The sample size was obtained by using the formula developed by Yamane (1967) as it can be seen in the equation below:-

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

Where:

n = sample size

N =Total number of respondents

e=standard error

In this study, the sample size was determined by using RAO soft, a software that randomly selects a sample size using a random number generator. With a margin of error of 5%, confidence level of 95 %, population size of 21 000 and a response distribution of 50%. The recommended sample size becomes 378.

Therefore, basing on the result obtained using the formula above, the sample size that was taken into consideration in this study involved 378 small scale cotton farmers, this sample size is manageable taking into consideration time and budget constraints, and it is also supported by Sekaran (2003) who postulates that the sample with number

observations ranging between 30 and 500 is acceptable. Also based on the number of variables and the type of data employed in this study, the sample size proposed is sufficient.

3.3.3 Response rate

The sample size was determined by using RAO soft, a software that randomly selects a sample size using a random number generator. With a margin of error of 5 %, confidence level of 95 %, population size of 21000 and a response distribution of 50 %.The recommended sample size became 378.

The research targeted 378 respondents but only 237 responded. That means the research achieved a response rate of 62.7 %. According to Fincham (2008), a response rate of 60 % and over is considered excellent. This makes response rate of 62.7 % acceptable. Table 3.1 summaries this;

Table 3.1: Response Rate

Total sample response rate	**Frequency**	**Percentage**
Responded	237	62.7%
Non-respondents	141	37.3%
Total	**378**	**100%**

Sampling techniques

Both probabilistic and non-probabilistic sampling were employed in this study .Non probabilistic sampling was applied when establishing a sample frame. Makonde district comprises 11 cotton buying points recognized by the agricultural marketing authority (AMA). Therefore, purposive sampling was applied by choosing only those areas recognized by AMA. Simple random sampling was then applied in obtaining about 35 respondents from the central buying points (CBP) making a total of 385 respondents. This number of respondent was sufficient to represent the population to be studied. The age being from 18 years and above.

3.4 Data collection instruments

The study included preliminary data collected from small cotton producers in different neighborhoods of Makonde district using closed-ended questions using self-administered structured questionnaires, in which the questionnaire was used as a data collection tool by researchers according to their qualifications and demerits. Questionnaires are relatively inexpensive, less time consuming, less biased about sample representation, ensuring confidentiality of information, and can easily collect data from a larger sample. Despite the fact that questionnaires have various advantages, they also have some disadvantages, such as low response rate, loss of opportunity to ask questions or clarification, and lack of direct contact between respondents who completed the questionnaire and interviewer. Ensuring that the questions asked in the questionnaire were answered as expected, the questions were short and straightforward with no ambiguous words or sentences, and then a pre-test with a small group of respondents. General understanding of questions, revise the questionnaire and make any changes to the questions.

3.5 Data collection procedure

3.5.1 Data entry and management

Data entry and management was done by using SPSS and EXCEL software, this is due to the fact that SPSS and EXCEL are suitable software for data entry and management.

3.5.1.1 Model Specification

The model had specifications which related to determining which explanatory variables to include or exclude from the regression equation. In general, the specification of a regression model should be based primarily on theoretical considerations and not on empirical or methodological considerations (Allen, 1997).

Table 3.2 shows a description of the variables that were assumed to influence productivity and thus included in the construction of the multiple regression model to assess the determinants of cotton productivity.

Table 3.2 Variable description

Variable	**Name of variable**	**Definition of variable**	**Measurement**	**Hypothesized impact**
Dependent variable				
cy	cotton yield	Cotton output resulting from combination of various inputs	kilograms harvested	

Independent variables				
le	Level of education	Education level of respondent	No one…1=yes 0=no Grade 7….1=yes 0=no Form 2…..1=yes 0=no Form 4……1=yes 0=no Form 6…….1=yes 0=no Certificate….1=yes 0=no Diploma……1=yes 0=no Degree…1=yes 0=no	+
fti	Farmers total income	Income earned by the farmer	bond	+
fe	Farming experience	Experience obtained by the respondent on cotton farming	Number of years spent in cotton farming	+

es	Extension service	Extension services provided to the farmer	Accessed, 1 Not accessed, 0	+
a	Age	Age of respondent	Number of years lived by the respondent	+
hs	Household size	Number of household members of the respondent	Number of household members	+
g	Gender	Sex of respondent	Sex of respondent	+
fs	Farm size	Size of farm cultivated by the farmer	hectares	+
ms	Marital status	Marital status of the farmer	single, 1=yes, No =0	+/-

Table 3.2 (cont'd)

Variable	Name Of Variable	Definition Of Variable	Measurement	Hypothesised Impact
			married, 1=yes, No=0 divorced,1= yes, No=0 separated,1=yes, No=0 widow(er), 1=yes, No=0	
sm	Side marketing	Selling to other merchant	1=yes 2=no	+

The variables were represented as follows;

Cotton productivity (***cy***)

It was considered as a dependent variable and is associated with various independent variables. The existence of a relationship between them was judged on the basis of speculation. In this case, the cotton production of small-scale farmers is called dependent variable, and some selected economic factors that were associated with influencing cotton production are associated as independent variables of farmers in the study area.

Household-level factors:

These include independent variables; the cotton production level is adjusted to determine age, gender, level of education, agricultural experience, marital status, gross income and family size and how they have an impact on cotton production level.

Age of respondent (***a***)

According to the 2013 report from the United Republic of Tanzania (URT), the respondent's age is defined as the number of years they lived on their last birthday, with reference to the night of the census. Alam et al., (2013) found that the average age of farmers is 32 years, which means that young people dominate cotton production. This predominance could be due to the labor-intensive nature of cotton production and therefore requires more energetic, agile, aggressive and aggressive young people, capable of making good production decisions and having more influence on productivity than older farmers

Household size (***hs***)

URT (2013) defines household size as a group of individuals or groups who live in the same homestead or premises, but not necessarily in the same dwelling unit, the same cooking facilities, and the same head of household they report to. Atala et al., (2015) defines household size as the composition of a household, which reflects the number of individuals in a household living together in a household. This factor was specifically associated with the dependent variable (productivity) by providing more labor for growing, weeding, planting, pesticide use and other related activities for farmers, who are more dependent on family labor to increase their productivity.

Level of education (***le***)

According to UNESCO (2011) level of education is defined as teaching programs that can be classified into a series of series that represent broad measures of educational progress in terms of complexity of educational content. This means that the more advanced the program, the higher the level of education. It can also be expressed in terms of the number of years leading up to the level of special education. This factor was related to dependent variables by acquiring and applying knowledge of modern variable methods, as well as increasing the ability to solve problems related to fields. Asif et al., (2005) found that education has an important role in adopting better technology and achieving higher productivity levels. More educated farmers manage better farming methods than less educated farmers and they easily learn about new developments and innovations related to crop production techniques. In addition, they have the advantage of understanding the current marketing situation about agricultural inputs and outputs at the local and national levels.

Farmers' total income (***fti***)

The total income of families is known as the farmer's combined gross income from various sources. It consists of all types of salary income, wages, retirement income, transfer benefits, and government investments. The total income of farmers was related to the productivity of cotton, especially when it is grown, determining the size of the fields.

Farming experience (***fe***)

Farmers' experience is defined as the knowledge that a person acquires while working in agriculture. It provides many benefits, such as imparting skills and knowledge to farmers to improve their farming skills and ultimately improving agricultural efficiency. Alam et al., (2013) suggest that a large number of farmers have improved their cotton production through further study and agricultural experience. According to the study, farming experience indicates that most farmers have been in the farming business for a long time and are therefore dealing with cotton production in the area. Atala et al., (2015). This year's farming experience has increased agricultural productivity among farming families in Nigeria.

Farmers' gender (***g***)

Gender is defined as the state of being male or female, in research this is one of the factors that are termed as dummy variables, and it is normally denoted by number 1 and 0 that means if a farmer is female then is represented by 1 and if the farmer is male then is represented by 0 and vice versa. Alam et al., (2013) indicated males dominate cotton production by 88%, Atala et al., (2015) indicated that male dominate by 90%, this tells us that female involvement in cotton production from these studies was only 12% and 10% respectively. The male dominance could be due to the nature of cotton production, which is a labour intensive crop and as a cash crop preferably interesting more males than females.

Farm-level factors:

These include independent variables such as farm size, access to dissemination services and the ability of the farmer to side market.

Extension services (***es***)

Extension services refer to number of visits the extension officer makes to the farmer with the aim of providing advice concerning good agricultural practices. Sodjinou et al., (2015) highlighted that with respect to support from extension services, the number of visits made by the extension agents is positively and significantly associated with the adoption of organic cotton farming. Organic cotton farmers benefit from serious extension services from NGOs and development organizations, which are the major drivers of organic value chains in Benin and in West Africa in general.

Side marketing (***sm***)

Side marketing takes place when parties to the contract violate the agreement, either when a farmer chooses to sell to other merchants or when a company buys from farmers it has not contracted.

A priori, cotton productivity (cy) is expected to increase with level of education (le), Farmers total income (fti), Farming experience (Fe), extension service (es), Age (A), Household size (Hs), Gender (G) and Farm size (Fs). This is based on previous research by several scholars who discovered that experience reduces inefficiencies namely Dube & Guveya, (2014).

3.6 Analysis and Organization of Data

Data was entered into SPSS and was presented by way of tables, charts and graphs and text. Simple frequency tables (for single variables), pie charts and frequency tables for grouped data (with many values) were used appropriately to present data in tables in this

research. Labels, titles and footnotes will be used to describe the information being presented by the tables.

In the first stage of data analysis, the researcher looked at the assumption if household factors have a positive effect on cotton production of small-scale farmers in Makonde. The household factors in this research included age, household size, level of education, gender, farmers' total income, farming experience and marital status.

In the second stage of data analysis, the researcher looked at the assumption if farm level factors have a positive effect on cotton production of small-scale farmers in Makonde. The farm level factors in this research included, side marketing, extension services and farm size being the independent variables and cotton yield being the dependent variable.

In the third stage of data analysis, the researcher looked at the assumption if yield had a positive effect on cotton productivity of small-scale farmers in Makonde.

In the fourth data analysis, the researcher looked at the determinants of cotton productivity of small-scale farmers in Makonde.

Statistics were also used to represent a sample data. Summary statistics such as measures of central tendency (mean, mode or median) and measures of spread (range, variation,

standard deviation and coefficient of variation) were also used to present and analyze data from this research.

3.6.1 Analytical Framework

The analytical framework in table 3.3 underneath guides the review in a rational manner guaranteeing that the researcher does not fail to focus on the current objectives. It additionally assists with building up the information necessities and devices expected to gather the information for the fulfilment of the specific objectives.

Table 0.3: Summary of objectives and research approach

SPECIFIC OBJECTIVES	ANALYTICAL APPROACH	DATA REQUIREMENTS	TOOLS
To determine the demographic characteristics of small-scale cotton farmers in Makonde.	Descriptive statistics	Demographic characteristics of growers (age, sex, experience, marital status, education,)	Questionnaires
To determine the socio economic characteristics of small scale cotton farmers in Makonde.	Descriptive statistics	Socio economics characteristics of growers (farm size, extension services and side marketing)	Questionnaires
To examine the productivity levels in Makonde.	Multiple linear regression	Factors of production, yields	Questionnaires
To identify the determinants of efficiency levels in	Multiple linear regression	Demographic characteristics, yields, socio-	Questionnaires

cotton productivity in Makonde district.	economic characteristics of growers

3.7 Ethical considerations

During this research a lot of ethical considerations were put into place so that research participants were not harmed. Respect for the dignity of research participants was a priority. Full consent of the participants was obtained prior to the study. The protection of the privacy of the research participants was guaranteed. An adequate level of confidentiality of research data was ensured. The anonymity of the individuals and organizations participating in the investigation was guaranteed. Any deception or exaggeration about the goals and objectives of the investigation was avoided at all costs. Any type of communication related to the investigation was done with honesty and transparency. Any type of misleading information was avoided, as well as the representation of the results of the primary data in a biased way. COVID 19 regulations were observed at all costs. These included wearing of masks, social distancing of one meter, hand sanitation points were available and not more than 15 people were gathered at once.

3.8 Summary

This research will analyze the productivity of small-scale cotton farmers in Zimbabwe through a mixed method approach. The strength of the approach is that it will use quantitative data, which will be analyzed and interpreted to give a better analysis of productivity. According to the analysis it is hoped that the researcher can come up with a

conclusion of which factors increase productivity and as a result will be able to make recommendations for the improvement of future projects in the cotton industry so as to revive the industries that lay idle yet once they were a source of employment to many.

CHAPTER 4 DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

The aim of this research was to investigate cotton productivity of small-scale farmers in Makonde district, Zimbabwe The data collected is quantitative data collected from different small-scale farmers in Makonde district in Zimbabwe.

4.2 Data presentation and analysis

The data was analyzed and organized as and described in chapter 3 section 3.6.

4.3 Demographic factors (household factors)

4.3.1Gender

53.2 % of the respondents are female while 46.8 % are male (figure 4.1). Generally women were more involved in cotton production due to the fact that cotton is no longer popular and for the past years it wasn't paying wellRef Though there is no major difference between males and females, it shows that more women are being involved in farming this is supported by Nosowitz (2019).

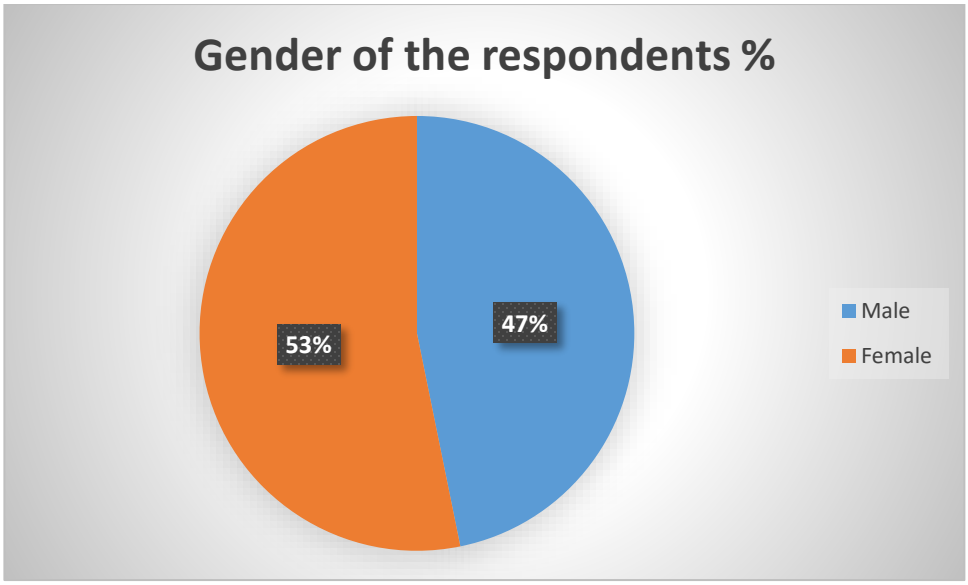

Figure 4.1: Gender of respondents (N=237)

4.3.2 Age

Table 4.1 shows 41.8 % of the respondents who grew cotton were in the range of 41-50 years. Those who are of the age range of 31-40 years constitute 28.3 %. These are the most productive age groups. This study confirms the findings by Taurer (1995) that the most productive age groups range from 30-44 years. The mean age of the respondents was 44 years, the minimum age being 18 and the maximum age being 81.

Table 4.1: Age of the respondents (N=237)

Age categories in years	Percent
18-30	9.3
31-40	28.3
41-50	41.8
51-60	11.4
61 and above	9.3
Total	100
mean	**43.7**
minimum	**18**
maximum	**81**

4.3.3 Marital status

Figure 4.2 shows that 69.2 % of the respondents are married and 4.2 % are single, 6.8 % are divorced, 6.8 % are separated, 12.7 % are widows and 0.3 are widowers. This study

confirms the study by Kirite *et al*, (2003) that there are usually more married women who are into farming in Kenya.

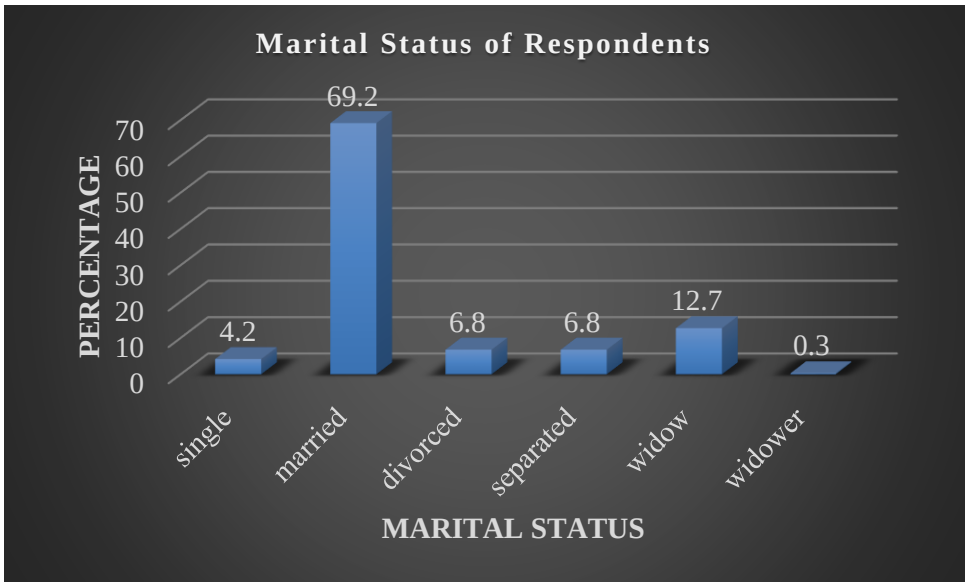

Figure 4.2 Marital status (N=237)

4.3.4 Household size

According to table 4.2, 62.4 % of the respondents have a household size of between 1-5 individuals leaving together and assisting with the farm labor. 28.7 % have between 5-10 members, 4.6 % have 10-15 members, 4.2 % have 15 members and above. This means there are fewer households with large numbers of individuals leaving together. This supports a study done by Dube *et al.,* (2014) in Chipinge. The mean household size of

the respondents was 5, with a minimum of I family member and a maximum of 27 household members.

Table 4.2 Household size

Household size in categories (N=237)	
	Percentage
1-5	62.4
6-10	28.7
11-15	4.6
16 and above	4.2
Total	100.0
mean	4.95
minimum	1
maximun	27

‘

4.3.5 Family income

According to figure 4.3, 77.6 % of the respondents have an income of between 0-2500 Zimbabwean dollars, 11.4 % have an income of 2500-5000 Zimbabwean dollars, 5.9 %

have an income of 5000-7500 and those that had more 7500 Zimbabwean dollars were only 5.1 %.

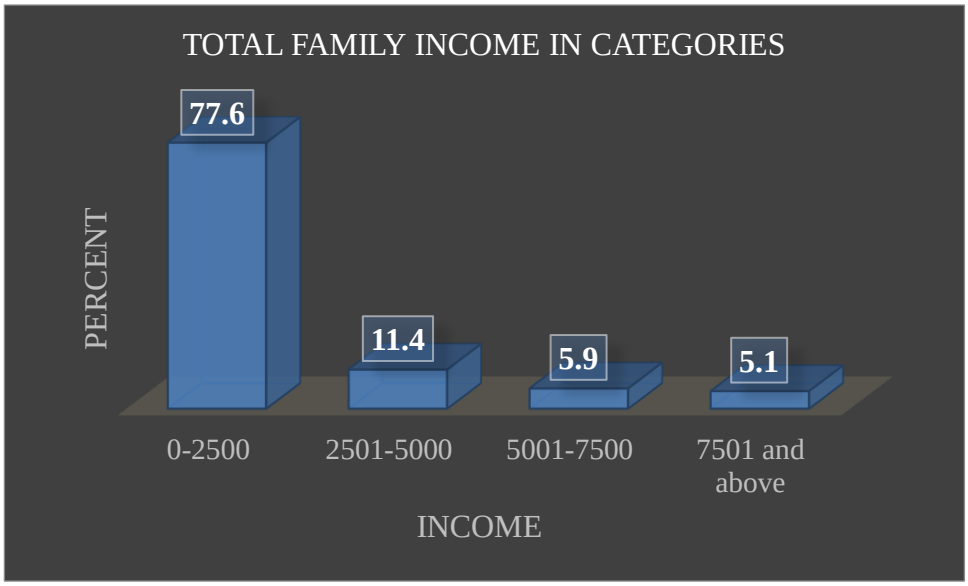

Figure 4.3 Family total income in Zimbabwean dollars (N=237)

4.3.6 Level of education

Figure 4.4 shows that 69 % of the respondents have a secondary or higher education whilst only 31 % have only a primary or less qualification.

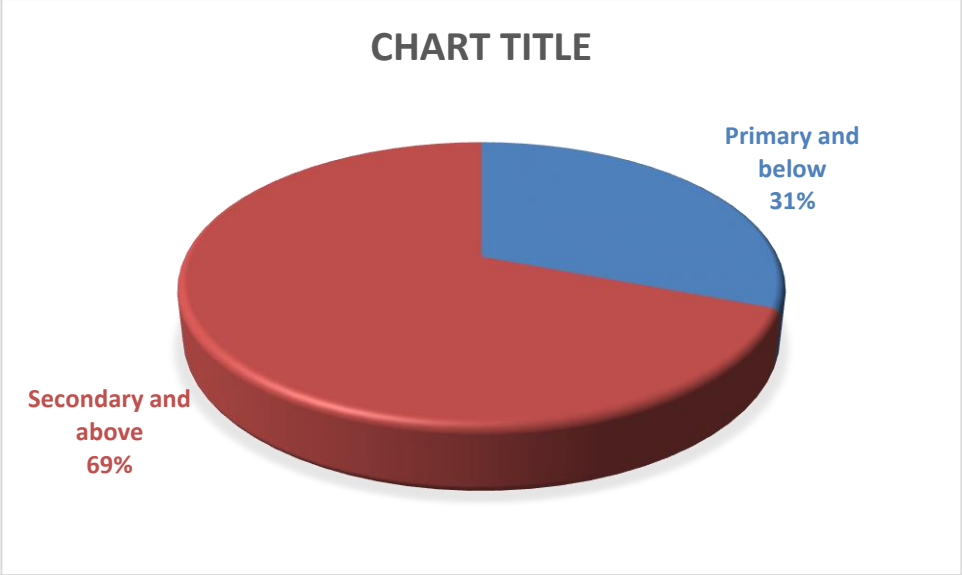

Figure 4.4 Level of education (N=237)

4.3.7 Farming experience

Table 4.3 shows that 46 % of the respondents have 0-10 years' experience in cotton production. 10.5 % have between 10-20 years' experience. 12.7 % have 20-30 years' experience, 13.5 % have 30-40 years of experience and 17.3 % have 40+ years of experience. The findings by Atala et al. (2015) in Nigeria and Gul et al. (2009) in Turkey indicate that the more experienced the farmer is the more productive they are. The mean number of years of experience in cotton production was 19, the minimum number of years is 1 year and the maximum was 75 years experience.

Table 4.3 Farming experience

Family experience in categories (years)	
	Percentage
0-10	46.0
11-20	10.5
21-30	12.7
31-40	13.5
41 and above	17.3
Total	100
mean	19.29113924
minimum	1
maximum	75

4.4 Socio economic factors (farm level factors)

4.4.1 Farm size

According to table 4.4, 91.6 % of the respondents have a land size of 6 ha and below. 2.1 % own land which is between 6-12 ha. 4.2 % own 12-18 ha of land and 2.1 % have more than 18 ha. The minimum number of ha the respondents had was 1, with the maximum owning 56 ha and the mean being 6.9 ha.

Table 4.4 Farm size (N=237)

Farm size in ha in categories	
	Percent
0-6	91.6
7-12	2.1
13-18	4.2
19 and above	2.1
mean	6.873417722
minimum	1
maximum	56

4.4.2 Extension services

According to figure 4.5, 62.4 % of the respondents had access to extension services and only 37.6 % had no access to extension services.

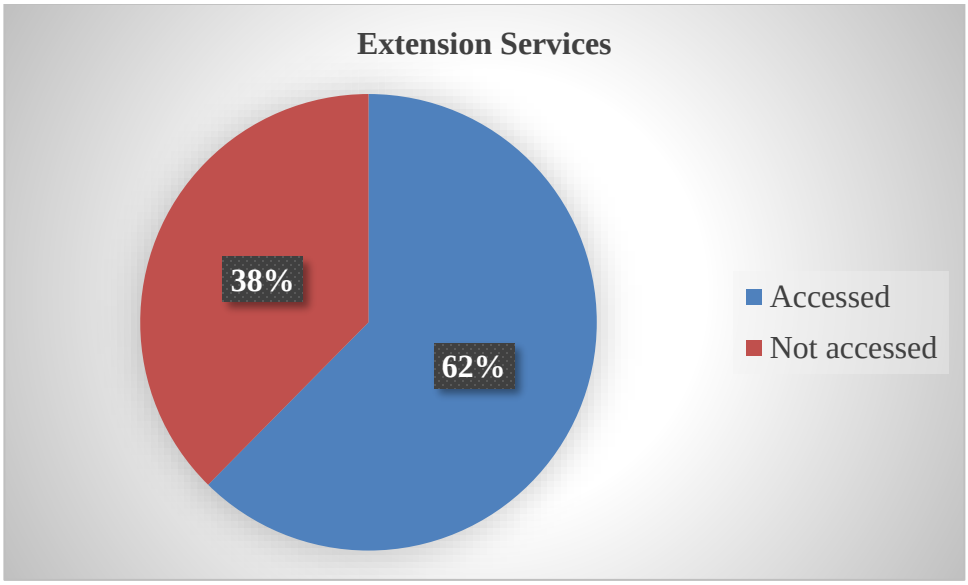

Figure 4.5 Extension services (N=237)

4.4.3 Side marketing

According to figure 4.6, 53.6% side marketed inputs this was either by selling or diverting the inputs and using them for other crops other than cotton. 46.4 % did not side market.

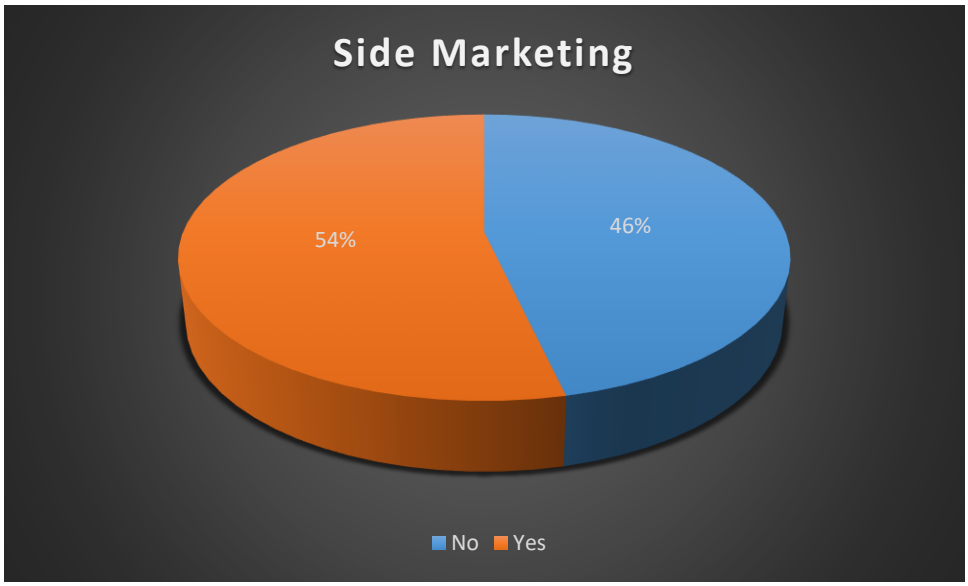

Figure 4.6 Side marketing (N=237)

4.5 Level of productivity

The cotton yield ranges from 12 kgs to 7591 kgs per household. The average yield per household being 602.08 kgs. Table 4.5 shows the distribution of the yields obtained from the respondents. The mean yield is 602.08 kgs which is less the expected yield of 1000 kgs per ha.

Table 4.5Level of productivity

Level of productivity					
	Range	min	max	mean	Std. Deviation

Cotton yield (kgs)	7579	12	7591	602.08	977.88

4.5.1 Level of productivity in categories

46.9 % of the participants had a yield of less than 250 kgs. 18.7 % had 251-500 kgs, 13.6 % had between 501 and 750 kgs. 8.5 % had between 751-100 kgs in terms of yield. Those that had more than 1500 kgs were 7.6 %.

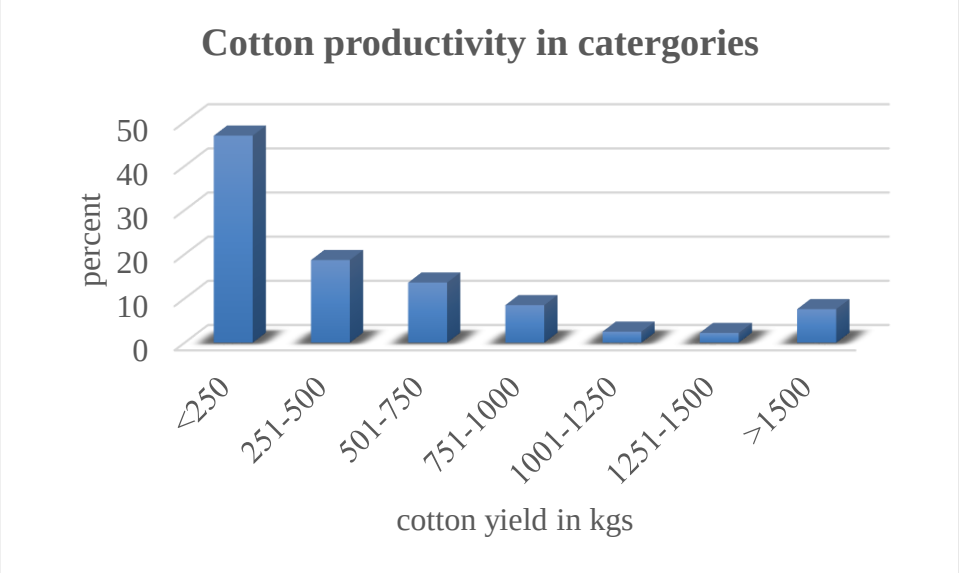

Figure 4.7 Cotton Productivity (N=237)

4.5.2 Cross study of cotton yield with gender

The cotton yield was analyzed with gender to see if male or female headed households are more productive in this industry. Although they were fewer males, according to table 4.6 male headed households appear to be more productive. Male headed households had a total production of 112611 kgs compared to female who had 30083 kgs. The median

for male headed households was 1014.5kgs whilst for females it was 473.8 kgs. The maximum production for male headed households was 7591 kgs and a minimum of 12 kgs whilst the female headed households had a maximum of 889 kgs and a minimum of 12 kgs.

Table 4.6 Cross Study of Cotton Yield byGender

Gender	Cotton yield (kgs)			
	Total	median	max	min
Male	112611	1014.5	7591	12
female	30083	473.8	889	12

4.5.3 Cross study of cotton yield with access to extension services

Those that had access to extension services had a total production of 119575 kgs and those that had no access to extension services had a total yield of 23119 kgs. The median for those who received extension services of any form was 807.9 kgs whilst those who had no access to extension services was 259.8 kgs. Maximum yield obtained by those who accessed extension services was 7591 kgs and a minimum of 25 kgs and those that had no access, their maximum yield was 2300 kgs and the minimum was 12 kgs. This shows that extension services does have an impact on cotton yield.

Table 4.7 Cross Study of Cotton Yield against access to extension services

Access to extension services	Cotton yield (kgs)			
	Total	median	max	min
Yes	119575	807.9	7591	25

No	23119	259.8	2300	12

4.5.4 Cross study of cotton yield with level of education

Those that had a secondary or greater education qualification had a higher total yield of 92223 kgs as compared to those that a primary or lower education who had a total yield of 50471 kgs. The average yield of those that had primary education and below was 691.4kgs and those that had a secondary and above level of education had 562.3 kgs. The maximum yield of those with primary and below level of education was 7591 kgs and a minimum of 20 kgs compared to those who had a secondary or higher level of education who had 6720 kgs and 12 kgs respectively.

Table 4.8 Cross Study of Cotton Yield against level of education

Level of education	Cotton yield (kgs)			
	Total	median	max	min
Primary and below	50471	691.4	7591	20
Secondary and above	92223	562.3	6720	12

4.5.5 Cross study of cotton yield with marital status

Table 4.9 shows that those that are married are more productive than those that are not. The total production of those that are married was 122467 kgs compared to those that

were not they had 20227 kgs. The average of those that were married was 816.4 kgs compared to those who were not, they had an average of 232.5kgs. The maximum yield for those that were married was 7591 and the minimum was 12 kgs. Those that were not married had a maximum yield of 889 kgs and a minimum yield of 20 kgs.

Table 4.9 Cross Study of Cotton Yield against marital status

Marital status	Cotton yield (kgs)			
	Total	median	max	min
Married	122467	816.4	7591	12
other	20227	232.5	889	20

4.6 Determinants of cotton production.

According to table 4.10, the model is significant with an F-statistic of 57.7. The variables included in the model explain about 66 percent of the variation in the competitiveness index.

Table 4.10 OLS Estimates of the Determinants of the small-scale cotton farmers in Makonde, Zimbabwe.
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.818[a]	.670	.658	571.909

a. Predictors: (Constant), Side marketing, Level of education, Family total income, Farm size (ha), Extension services, Gender, Household size, Farming experience (years)

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	151098982.449	8	18887372.806	57.745	.000[b]
	Residual	74574341.863	228	327080.447		
	Total	225673324.312	236			

a. Dependent Variable: Cotton yield

b. Predictors: (Constant), Side marketing, Level of education, Family total income, Farm size (ha), Extension services, Gender, Household size, Farming experience (years)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-254.420	182.224		-1.396	.164
	Gender	-157.146	90.054	-.080	-1.745	.082
	Household size	39.782	13.394	.162	2.970	.003
	Family total income	.072	.032	.098	2.254	.025
	Level of education	56.219	31.105	.083	1.807	.072
	Farm size (ha)	115.367	10.537	.541	10.949	.000
	Farming experience (years)	.560	3.151	.010	.178	.859

	Extension services	-160.240	96.696	-.080	-1.657	.099
	Side marketing	-337.843	94.548	-.173	-3.573	.000

a. Dependent Variable: Cotton yield

The variables which are insignificant in affecting cotton productivity are extension services, level of education, gender and farming experience. The variables which are significant in describing cotton productivity are household size, farm size, family total income and side marketing.

The results indicate that cotton productivity of small scale farmers is higher for farmers with more labour. The higher the number of individuals per household the higher the chances for an increase in yield. Those that had 4 members and upwards achieved more than 600 kgs per ha.

As expected *a priori*, the results indicate that cotton productivity is higher for farmers with a larger farm size as compared to those with smaller land sizes. On average those farmers who owned more than 6 ha of land would have a yield of more than 1000 kgs.

Generally, farmers with access to extension services should achieve higher yields than farmers without access to extension services. This result is not expected *a priori*. The reason for this could be as a result of the fact that most of the farmers are receiving extension services have been growing cotton for an average of 19 years so whether there is constant supervision or not it will not affect yields.

As expected *a prior*, the results indicate that family income is significant in interpreting cotton production. Usually the more income one has, the more it is perceived to be more productive than farmers with no income.

4.7 Discussion and interpretation

According to the regression analysis of the socio-economic factors using the simple linear regression, the following are the discussion and the interpretation.

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$

H0: $\beta_1 = \beta_2 = \beta_3 = 0$

H1: At least one of the β coefficients is not equal to 0

At $\alpha = 0.05$, both the t- values of side marketing and farm size are statistically significant because their corresponding p-values < 0.05. Therefore, both side marketing and farm size are individually useful in the prediction of cotton yield.

There was evidence that farm level factors have a positive effect on cotton production of small-scale farmers in Makonde.

H0: $\beta_1 = 0$ (extension services is not a useful predictor of cotton production)

H1: $\beta_1 \neq 0$

At $\alpha = 0.05$, we fail to reject H0

T statistic is insignificant (because p – value > 0.05)

There was no evidence that extension services does contribute any information in cotton production.

H0: $\beta_2 = 0$ (farm size is not a useful predictor of cotton production)

H1: $\beta_2 \neq 0$

At $\alpha = 0.05$, we reject H0

T statistic is significant (because p – value < 0.05)

There was evidence that farm size contributes information in cotton production.

H0: $\beta_3 = 0$ (side marketing is not a useful predictor of cotton production)

H1: $\beta_3 \neq 0$

At $\alpha = 0.05$, we reject H0

T statistic is significant (because p – value < 0.05)

There is evidence that side marketing contributes information in cotton production.

According to the regression analysis of the household level factors using the simple linear regression, the following are the discussion and the interpretation.

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5$

H0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$

H1: At least one of the β coefficients is not equal to 0

At α = 0.05, the t- values of household size and family income are statistically significant because their corresponding p-values < 0.05. Therefore, both household size and family income are individually useful in the prediction of cotton yield.

The t- values of gender, level of education and farming experience are insignificant because their corresponding p- values > 0.05. Therefore, they are irrelevant in the prediction of cotton yield.

At α = 0.05, we fail to reject H0.

There was evidence that some household level factors have a positive effect on cotton production of small-scale farmers in Makonde. These are household size, this being the number of individuals living together on the same land and family total income, this being the amount of money the farmer brings in to enhance farming production. With the increase of the area under cotton production, it was seen that the productivity levels increased.

4.8 Summary

This chapter presented the findings of the study on Productivity Analysis of Small-Scale Cotton Farmers in Makonde District, Zimbabwe. According to the findings, some farm and household level factors have a positive effect on cotton production of small-scale farmers in Makonde. These are side marketing, farm size, household size and family income. The results also showed that gender, level of education, extension services and farming experience in this research do not necessarily affect cotton production. These

variables were insignificant maybe due to the fact that the government is fully funding all inputs at zero costs.

CHAPTER 5 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter discussed in details the summary, conclusions and recommendations. Following the data collected from the study as well as the analysis and interpretations, this chapter will focus on presenting a summary of the findings, discussing the conclusions and implications of the findings. Furthermore, recommendations will be made as well as suggestions for further research.

5.2 Discussion

This study was mainly focused on the analysis of the productivity of Small-Scale Cotton Farmers in Makonde District, Zimbabwe. Data were analyzed through the use of stochastic frontier (Cobb Douglas) Production function. The efficiency levels of farmers were calculated by using the data analyzed in SPSS in order to assess their influences on cotton production.

The findings are, though the research was focused on small scale farmer there were some farmers who were registered as commercial though they were few. Majority of the farmers have a land size of 6ha and on that land since they grow other crops cotton was planted on either 1ha, 2ha or 3 ha. The percentage of respondents who actually side marketed constituted 54%. This shows that the farmers are actually abusing the free inputs and this is causing a decline in the expected cotton production. Those that sold to other companies that did not sponsor them with the inputs was due to how the other companies were paying. If other companies pay at a faster rate than those companies they are registered to, there is more frequency to side market the produce.

62 % of the respondents received some form of extension services. The extension services included mainly on farm visits by extension officers. 38 % did not receive any farm visits by extension officers. Those individuals who were visited by extension officers had a lesser chance of side marketing. Extension services was statistically insignificant in contributing information about cotton productivity, most farmers have an average of more than 19 years' experience in farming cotton. The farmers have a knowhow on cotton production since most of the farmers were from either Gokwe, Sanyati or Muzarabani.

Cotton is a labour intensive crop, so it is only normal to have more males growing the crop. In this case they were more females with a percentage of 53%. Generally women are more involved in cotton production due to the fact that cotton is no longer popular and for the past 5 years it wasn't paying well. Most farmers had diverted to growing tobacco which was paying better. Recently more farmers are going back to growing cotton because of the government initiative of providing free cotton inputs. Though it is a labour intense crop it has become a cheaper crop to grow. The middle aged individuals are the majority that are into cotton production. The younger generation or the youths are busy looking for fast money. They are not willing to wait for 6 months for a crop that they don't know how much it will be bought for.

Although, education plays a vital role in the cotton productivity. The results showed that the more advanced in education an individual is, there was no significant change in productivity. This showed that if the farmer is willing to be productivity they can with or without education, all that is required is the desire.

According to the findings respondents who were married were more technical efficient with a percentage of 69.2. Widowers had the lowest efficiency most probably due to the

norm that the children and the women do most of the work while the husband monitors. Most of the respondents had a household size of 4. This a good number to maintain a 1ha plot of cotton they will assist each other in the farm labour. Those families who had more family member had a higher cotton production output. It is also interesting that majority of the respondents did not have a source of income meaning the more available the inputs are the more people will venture into cotton production.

5.3 Conclusions

Based on the discussion presented in chapter four and summary of the findings, the study concludes that male participation in cotton farming in Makonde district needs to be strengthened against the current female dominance; as far as the technical efficiency is concerned, farmers need various initiatives by the government and other stakeholders in order to improve their technical efficiency since there is still that opportunity.

1. Research Objective 1 sought to examine the effects of household level factors (demographic factors) on technical efficiency of small-scale cotton farmers in Makonde district. It can be concluded that there are some household factors that have an impact on the technical efficiency of small scale farmers in Makonde. This included the number of individuals per household. There is need to engage more males and youths in cotton production. If only the older generation carries on the tradition of cotton farming and not pass it on to the next generation there will be a time when the older generation will be no more. This will result in cotton production coming to an end. There is need introduce other varieties that would require less chemical use and varieties that are more susceptible to herbicides. Currently the variety that is being used is very sensitive to herbicides,

hence the only way is to weed by using human labour. With the scarcity of labour there is need to look for other alternatives. Machinery could also be introduced, since cotton is a labour intense crop. Most farmers with small farmers are reluctant to increase their hectarage under cotton due to lack of labour.

2. Research Objective 2 sought to examine the effects of farm level factors (socio economic factors) on technical efficiency of small-scale cotton farmers in Makonde district. The researcher concludes that with increase of the land size farmers will be able to grow more cotton resulting in an increase of cotton production. Since most farmers have 6ha of farming they are limited to the variety of crops they would want to grow. On those 6ha the farmer wants to grow other crops like maize, soya beans, groundnuts, tobacco, cotton, round nuts, sweet potatoes and others as well as built their houses there. So there is the tendency of farmers to divide their land, resulting in reduced planted area for cotton. Side marketing has adverse effects. In the earlier years that is what caused a lot of companies to close down namely Cargill which was the cotton giant in business. There is need for government intervention since the government's aim is to reopen the cotton industries that were since closed, namely David Whitehead. There is need for more mobile extension officers on the ground to assist and monitor farmers.
3. Research Objective 3 sought to determine if cotton yield per hectare has any effect on cotton production of small scale cotton farmers in Makonde district. The researcher concludes that there is indeed an effect of yield per ha as having an impact on productivity. To the farmers who received their inputs in time and

used them effectively had an average yield of 602kgs per ha. There is need to distribute chemicals that are effective and have farmer trainings whenever there is the introduction of new chemicals. All inputs need to be distributed in time and there should be constant follow up on how the free inputs are being used.

4. Research Objective 4 sought to find out the factors affecting cotton production of small scale cotton farmers in Makonde district. The researcher concludes that household size, farm size and side marketing are individually useful in the prediction of cotton yield.

5.4 Implications

This study urges the government, policy makers and other stakeholders to take seriously consideration in implementing various policies, plans and strategies that may have effect on improving technical efficiency and productivity of small scale cotton farmers that will eventually trigger agricultural and economic development to the people in the study area Makonde and Zimbabwe as a whole.

Some of policies, strategies and plans that have been set in Zimbabwe for improvement of agriculture sector in regards to cotton production was established in 2016. This also saw the presidential inputs also including maize, sugar beans and small grains.

These policies will bring more meaningful results in the study area if their implementation will be on aspects that can have direct influence on improving technical efficiency and productivity to cotton. Important aspects in Makonde district based on the findings of this study that need government and other stakeholder initiatives through different policies are timely provision of inputs and implements to farmers to enhance

cotton cultivation within the season, setting prices that reflect costs of production. Inputs suppliers should supply agricultural inputs timeously.

5.5 Recommendations

This study recommends different measures to all key stakeholders of cotton in order to improve technical efficiency and cotton productivity in the study area, the following recommendations are made.

The government

The study revealed that the small scale farmers in Makonde received their inputs late into the season. Literature shows that there is strong support of cotton farmers in other areas like Gokwe where they receive inputs much earlier before the season begins. It is recommended that the government and other stakeholders take actions that will improve access to inputs by sending more inputs to areas that are easily accessible to most farmers. These inputs need to be senton time.

Stricter measures need to be put in place in order to stop farmers from side marketing. The study showed that side marketing contributes to the reduction of cotton production. With regard to household size which was found statistically significant in determining cotton productivity of farmers, the findings also implied that cotton production in the study area is still dominant on households‟ labour for most of the activities such as ploughing, weeding, pesticide application and harvesting; the study recommends government and other stakeholders to take actions towards shifting the production to a modern agricultural practices which is more efficient.

Policy makers

The study showed that there are more women than men in cotton production in Makonde and that the majority of farmers were not knowledgeable about other better and efficient

ways of growing cotton. Literature revealed that the government played an important role in the adoption of cotton growing in other parts of the world and as such the researcher recommends that government initiatives should be more focused on the increase of the level of education to farming communities by attracting the educated people to involve themselves more in cotton cultivation. Furthermore, the study recommends more initiatives by the government and other stakeholders to be taken towards increasing men involvement so as to reduce the existing gender gap of cotton production in the study area which is significant.

There is need to put into place policies that give more focus on improving cotton production and productivity levels. Also promoting wealth creation for the benefit of all stakeholders; and spearheading increased domestic processing of goods to enhance value addition, manufacturing, application of new technologies; promotion of higher yields and larger crop production volumes, commercial farming, as well as contract farming; and establishment of forward and backward agro- processing industries.

Furthermore, the researcher recommends government initiatives and other stakeholders to improve infrastructures such as roads that will facilitate timely provision of inputs, access to markets and the collection of the delivered cotton seed. The study the government should also introduce educational programs and also machinery so that the youths will be more involved in the production of cotton since they are the future of tomorrow.

Seed, Fertilizer and Chemical manufacturing companies and other stakeholders

The study revealed that due to the presidential free input scheme it has created a monopoly for companies like Cottco, Quton, Superfert and Curechem, hence the delays, input shortages and lack of varieties. Past literature shows that in the past when a lot of

companies were involved the inputs were in excess and the varieties were better. The researcher recommends that the government engages more cotton companies to distribute the free inputs to remove monopoly. So far Cottco is the only company that is working with the government to distribute free inputs. The government should also start to introducing pre-plant prices for cotton so that farmers will know in advance how much the cotton will be bought for planning purposes.

5.6 Suggestions for further research

This study conducted productivity analysis of small scale cotton farms in Makonde district and one of its objectives was to determine the level of technical efficiency of small scale cotton farmers in Makonde district, the study did not conduct allocative and economic efficiency of small cotton farmers in the district, therefore this study suggests that other studies should focus on analyzing allocative and economic efficiency of small scale cotton farmers in the district.

This study used cross sectional data in conducting productivity analysis of small scale farms in Makonde district, the study suggest that other studies should be conducted in the district by using time series data so as to assess the long time effect to small scale farmers.

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APPENDICES

Appendix 1: Letter of consent

Africa University

(A Methodist Related Institution)

To whom it may concern

My name is Bridget Maziofa and I am a student of Africa University currently studying for a Master in Agribusiness degree. In partial fulfillment of the requirements of the program, I am doing a research titled: "Productivity analysis of small-scale cotton farmers in Zimbabwe: Makonde district, Mash West."

This research is being done primarily for academic purposes aimed at establishing the productivity of small scale cotton farmers and explore the various factors that may affect productivity in this area.

I kindly seek for your consent (on attached form) to participate in this research. You may withdraw at time and I assure you that information obtained from you will be treated with strict confidentiality and anonymity.

Please feel free to contact the Africa University Research Ethics Committee if you need confirmation or clarity on anything I have mentioned on the following contact details

Appendix 2: Research Participant Information and Consent Form

You are being asked to participate in a research study. Researchers are required to provide a consent form to inform you about the research study, to convey that participation is voluntary, to explain risks and benefits of participation, and to empower you to make an informed decision. You should feel free to ask the researchers any questions you may have.

Study title:	Productivity analysis of small-scale cotton farmers in Makonde District, Zimbabwe
Department and Institution:	College Of Health, Agriculture and Natural Sciences. Africa University

1. PURPOSE OF RESEARCH

- You are being asked to participate in a research study of productivity analysis of small scale cotton farmers in Makonde.
- You have been selected as a possible participant in this study because you have been growing cotton for the past 5 years under the presidential scheme.
- From this study, the researchers hope to learn about the factors that are contributing to cotton production in Makonde.
- Your participation in this study will take about 30 minutes.
- In the entire study, 378 people are being asked to participate. *(provide number)*

2. WHAT YOU WILL DO

- This research is solely for academic purposes.
- You are required to participate at your own free will.
- You will be required to answer all question truthfully.
- After the completion of the study the researcher will share the findings with all participates.

3. POTENTIAL BENEFITS

- You will not directly benefit from your participation in this study. However, your participation in this study may contribute to the understanding

i. Business owners –the findings of this study will help business owners such as seed companies, fertilizer companies and chemical companies to have a better understanding on the factors affecting cotton farmers in order to make viable business decisions.

ii. Policy makers- the findings of this study will help policy makers to make well informed, relevant and viable policies that will positively influence the productivity of small scale cotton farmers in the Makonde area, Mashonaland west of Zimbabwe.

4. POTENTIAL RISKS

- There are no foreseeable risks associated with participation in this study.

5. PRIVACY AND CONFIDENTIALITY

- The data for this project are being collected anonymously. Neither the researchers nor anyone else will be able to link data to you.
- Although we will make every effort to keep your data confidential there are certain times, such as a court order, where we may have to disclose your data.
- In this research no names will be used only a participant number will be issued
    - Data may be accessed by;
        - Researchers and Research Staff.
        - AUREC
    - The results of this study may be published or presented at professional meetings, but the identities of all research participants will remain anonymous.

6. Your rights to participate, say no, or withdraw

- Participation is voluntary. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled.
- You have the right to say no.
- You may change your mind at any time and withdraw.
- You may choose not to answer specific questions or to stop participating at any time.
    - Choosing not to participate or withdrawing from this study will not make any difference in the quality of any services you may receive.

- Whether you choose to participate or not will have no effect on your grade or evaluation.
- You will be told of any significant findings that develop during the course of the study that may influence your willingness to continue to participate in the research.

7. Costs and compensation for being in the study

- You will not receive money or any other form of compensation for participating in this study.

8. Contact Information

If you have concerns or questions about this study, such as scientific issues, how to do any part of it, or to report an injury, please contact the researcher

If you have questions or concerns about your role and rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact, anonymously if you wish, the AUREC .

9. Documentation of Informed consent.

Your signature below means that you voluntarily agree to participate in this research study.

Signature……. Date……..

Signature of Assenting Child (13-17; if appropriate)

……

Date……

You will be given a copy of this form to keep.

A signature is a required element of consent – if not included, a waiver of documentation must be applied for.

Appendix 3: QUESTIONNAIRE

SECTION A-1: GENERAL INFORMATION

1. Participant no (head of household)……
2. District……
3. Ward……
4. Village…….
5. Gender of head of house household…….
6. Household size…….
7. Date……..

SECTION A-2: PERSONAL INFORMATION

1. Number of females in the house hold……
2. Number of males in the house hold……
3. Age group of the family members (place with a number of members were appropriate)

   0-10 …….. 11-20…… 21-30…….. 31-40…… 41-50……..

   51+……
4. Level of education (tick were appropriate)

   No one…… grade 7….. Form 2…….. Form 4……. Form 6…… certificate……..

   Diploma…….. Degree……..
5. Marital status of the house hold (please tick were appropriate)

Married……. Divorced……. Separated….. Widow……. Widower……

SECTION B -1 COTTON ESTABLISHMENT AND HARVESTING

1.

Was area harvested equal to area planted? (please tick were appropriate) Yes ▭ No ▭	If NOT What were the reasons why it was less than the area planted? (Please tick were appropriate) Drought ▭ Animals ▭ Diseases and pests ▭ Lack of casual labor ▭ Inputs provided ▭ Other (specify below)	How many kilograms of seed cotton did you harvest per hectare last season?	What was the total harvest in kilograms last season on cotton?

SECTION B-2: SEED COTTON MARKETING AND SALES

1. How many hectares were sponsored by the cotton company? ……..
2. How many hectares did you cultivate? ……..
3. Did you plant in all the cultivated area? (please tick were appropriate) yes ☐ no ☐

If no what were the reasons for not planting in all the cultivated area	(please tick were appropriate) Need to plant other crops ☐ Lack of seeds ☐ Lack of fertilizers ☐ Other (specify below)

4. Did you harvest from all the hectares planted? (please tick were appropriate)

   Yes ☐ no ☐

If no what were the reasons for not harvesting in all planted hectares	(please tick were appropriate) Drought ☐ Disease and pests ☐ Lack of labor ☐

	Lack of funds for paying labor ☐ Other specify below

5. Total number of kilograms harvested last season……..
6. Did you sell all the harvested seed cotton to the contracted company? yes ☐ no ☐

If no reasons for side marketing	(please tick were appropriate) They were paying in cash ☐ They were paying on the spot ☐ Other specify below

7. What was the price of seed cotton this season? …….
8. Total value of the seed cotton…….

What was the methods of selling?	How many buyers this season? (please tick were appropriate)	When was the relationship established? (please tick were appropriate)	Are buyers' residents or visiting?

(please tick were appropriate) Buyers searching for producers ☐ Taking the produce to central buying points ☐ Other (mention)…..	One ☐ More than One ☐	Less than a week ☐ Less than a month ago ☐ Six months ago ☐ One year ago ☐	(please tick were appropriate) Permanent residents ☐ Visiting ☐

Where do the visiting buyers come from?	Have there been changes from previous season? (please tick were appropriate) Yes ☐ No ☐	What are the changes? Explain. (please tick were appropriate) Increased number of visiting buyers ☐ Increased number of local buyers ☐	Who does the grading of the crop? (please tick were appropriate) Farmer ☐ Sponsor ☐ Special grader ☐ Other (specify)

What things does the price offered depend on? (please tick were appropriate)	Did you transport crop for sale? (please tick were appropriate)	What is the average distance you transported for sale? (please tick were appropriate)
Quality ☐ Quantity ☐ Time ☐ Other	Yes ☐ No ☐	0-5KM ☐ 6-10KM ☐ 11-15KM ☐ 16-20KM ☐

SECTION C:OTHER CROPS PRODUCED

1.

List by ranking all other important crops you cultivated last year?		How much did you harvest in each crop? (kgs)	What was the sales price per kilogram?	What was the total revenue obtained from sales of each crop harvested?	What was the total cost of operations/production and harvesting for each crop?
Name of crop	Planted Area				

2. Were inputs issued used for the purpose of cotton production only? (please tick were appropriate) yes ☐ no ☐

If no what are the reasons

i. ……..

ii. ……..

SECTION D: SOURCE OF LABOUR

1.

Number of household members	During the last cropping season, how many days did household members spend on the following activities during the cotton production season?			Did you hire any labor to work on this crop in the last season? (Please tick appropriate) Yes ☐ no ☐		
	Land preparation &Cultivation	weeding	harvesting	Land preparation and cultivation and cost	Weeding and cost	Harvesting and cost

SECTION E: FARM IMPLEMENTS AND MACHINERY AND COST Please tick farm implements used or owned by the household last season

1.

Type of implement	
Hand hoe	

Knapsack	
Oxen/ donkeys	
Ox plough	
Ox seed planter	
Ox cart	
Tractor	
Tractor plough	
Tractor drawn planter	
Boom spray	
Cotton picker	
Storage facilities/ shed	

SECTION F: EXTENSION SERVICES

1.

Did you receive any agricultural advice in the last production season? (please tick) Yes ☐ No ☐	What type of agricultural advice did you receive? (please tick) Cultivation ☐ Marketing ☐ Prevention of crop disease ☐ Sorting ☐ Grading Storage ☐ Transport ☐ All the above ☐ Other (specify)	Where did you mostly receive the agricultural advice from? (Please tick) Government programs ☐ Farmers Associations ☐ Small scale farmers network ☐ Experienced farmer ☐ Relative (s) within family ☐ Other specify	How many times did you receive extension services last season? (please tick) Never ☐ Once ☐ Twice ☐ Thrice ☐ More than three times ☐

SECTION G: FARMING EXPERIENCE

1. How many years have you been a cotton farmer? ……..
2. Did you receive any cotton training? (please tick were appropriate) yes ☐ no ☐

If no how did you learn how to grow cotton……

SECTION H: SELF EMPLOYMENT

1.

<table>
<tr><td rowspan="2">Did you employ yourself in any business activity in the last year other than agriculture?

(please tick)

Yes ☐ No ☐</td><td rowspan="2">What kind of business did you operate?

(please tick)

Fishing ☐

Livestock keeping ☐

Carpentry ☐

Petty business ☐

Other (specify)</td><td colspan="3">How much income did you earn per DAY/MONTH/YEAR from your business?

(choose appropriate)</td><td rowspan="2">How much were the operating costs related to your business?</td></tr>
<tr><td>day</td><td>month</td><td>Year</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
</table>

SECTION I : HOUSEHOLD TOTAL INCOME

1.

What is the total income earned by your household last season?	What were the source of household total income (off farm sources)? (please tick were appropriate) Pensions ☐ Salaries ☐ Seasonal wage ☐ Relative support ☐ Rent ☐ Equipment ☐ Other activities (specify)	What were the sources of household total income (on farm sources)? (please tick) From cotton ☐ From other crops ☐ Others (specify) ☐

SECTION J: FARMING CHALLENGES AND RECOMMENDATIONS

1. What challenges do you face regarding cotton production? (Please tick were appropriate)

i. Poor quality of seeds ☐
ii. High production cost ☐
iii. High marketing cost ☐
iv. Unreliable market ☐
v. Unreliable weather ☐
vi. Delayed payment ☐
vii. Lack of inputs ☐
viii. Disease ☐
ix. Poor infrastructure ☐
x. Lack of market information ☐
xi. Increased competition level against competing commodities. ☐
xii. Low fertility of soils ☐

Other_____

2. What recommendations do you have on improving cotton productivity and efficiency?

i. _____

ii. _____

iii. _____

iv. _____

v. _____

vi. _____

vii. _____

viii. _____

ix. _____

Appendix 4 AUREC Approval

AFRICA UNIVERSITY
(A United Methodist-Related Institution)
INVESTING IN AFRICA'S FUTURE

AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE (AUREC)

P.O. Box 1320 Mutare, Zimbabwe, Off Nyanga Road, Old Mutare-Tel (+263-20) 60075/60026/61611 Fax: (+263 20) 61785 website: www.africau.edu

Ref: AU1939/21 5 March, 2021

BRIDGET MAZIOFA MTETWA
C/O CHANS
Africa University
Box 1320
Mutare

RE: **PRODUCTIVITY ANALYSIS OF SMALL-SCALE COTTON FARMERS IN MAKONDE DISTRICT, ZIMBABWE**

Thank you for the above titled proposal that you submitted to the Africa University Research Ethics Committee for review. Please be advised that AUREC has reviewed and approved your application to conduct the above research.

The approval is based on the following.

a) Research proposal
b) Data collection instruments
c) Informed consent guide

- **APPROVAL NUMBER** AUREC1939/21
  This number should be used on all correspondences, consent forms, and appropriate documents.
- **AUREC MEETING DATE** NA
- **APPROVAL DATE** March 5, 2021
- **EXPIRATION DATE** March 5, 2022
- **TYPE OF MEETING** Expedited
  After the expiration date this research may only continue upon renewal. For purposes of renewal, a progress report on a standard AUREC form should be submitted a month before expiration date.
- **SERIOUS ADVERSE EVENTS** All serious problems having to do with subject safety must be reported to AUREC within 3 working days on standard AUREC form.
- **MODIFICATIONS** Prior AUREC approval is required before implementing any changes in the proposal (including changes in the consent documents)
- **TERMINATION OF STUDY** Upon termination of the study a report has to be submitted to AUREC.

AFRICA UNIVERSITY
RESEARCH ETHICS COMMITTEE (AUREC)
APPROVED
P.O. BOX 1320, MUTARE, ZIMBABWE

Yours Faithfully

MARY CHINZOU – A/AUREC ADMINISTRATORFOR CHAIRPERSON, AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE