**ANALYSIS OF SORGHUM MARKET CHAIN IN ISIOLO COUNTY, KENYA**

**GITONGA GREGORY KALAWA**

**A152/27693/2019**

**A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS OF SCIENCE IN AGRIBUSINESS MANAGEMENT IN THE SCHOOL OF AGRICULTURE AND ENTERPRISE DEVELOPMENT, KENYATTA UNIVERSITY**

**JANUARY, 2023**

# DECLARATION

I hereby swear that the work contained in this thesis is entirely unique to me and has not previously been submitted for consideration by any other university or other award.

Signature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Gitonga G. Kalawa**

**Department of Agricultural Economics**

**Supervisors, declaration**

We, the undersigned certify that the candidate developed this thesis under our guidance, as university supervisors we thus approve the submission.

Signature  Date: 30/01/2023

**Dr. Gabriel Mwenjeri (PhD)**

**Department of Agricultural Economics**

**Kenyatta University**

Signature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Dr. Lucy Ngare (PhD)**

**Department of Cooperative and Agribusiness**

**Cooperative University of Kenya**

**DEDICATION**

I dedicate this thesis to my beloved mother Rukunga Dorcas and my uncle Rukunga Charles. Through their prayers and genuine support, I accomplished beyond what I had anticipated. May the good Lord bless you abundantly.

**ACKNOWLEDGEMENTS**

First and foremost, I thank the almighty God for providing me with the gift of life and the opportunity to further my education at Kenyatta university. For granting me a bursarship so I may complete my master's in agribusiness management and their unwavering support throughout my studies, I am indebted to my sponsor Kenya Climate Smart Agriculture Project (KCSAP).

Additionally, let me pass sincere appreciations to my university overseers Dr. Lucy Wangare and Dr. Mwenjeri Gabriel, for the guidance and support in the course of proposal development, collection of data as well as analysis. I appreciate you and pray that the Almighty lord will bless you abundantly for your support while I was Studying in Kenyatta University.

Let me also convey special gratitude to the Ministry of agriculture officials in Isiolo County for according me immense support during data collection. Lastly, I appreciate my colleagues at Kenya Fisheries service for their and guidance during the data analysis phase.

# TABLE OF CONTENTS

[DECLARATION ii](#_Toc125881240)

[TABLE OF CONTENTS v](#_Toc125881241)

[LIST OF FIGURES ix](#_Toc125881242)

[LIST OF TABLES x](#_Toc125881243)

[ABBREVIATIONS AND ACRONYMS xi](#_Toc125881244)

[OPERATIONAL DEFINITIONS OF TERMS xii](#_Toc125881245)

[CHAPTER ONE 1](#_Toc125881246)

[INTRODUCTION 1](#_Toc125881247)

[1.1 Background to the Study 1](#_Toc125881248)

[1.2 Problem statement 5](#_Toc125881249)

[1.3 Objectives 6](#_Toc125881250)

[1.3.1 General objective 6](#_Toc125881251)

[1.3.2 Specific objectives 6](#_Toc125881252)

[1.4 Research questions 6](#_Toc125881253)

[1.5 Justification of the study 7](#_Toc125881254)

[1.6 Scope of the study 7](#_Toc125881255)

[CHAPTER TWO 9](#_Toc125881256)

[LITERATURE REVIEW 9](#_Toc125881257)

[2.0 Introduction 9](#_Toc125881258)

[2.1 The sorghum production and marketing in Kenya 9](#_Toc125881259)

[2.2 Conceptualizing the paradigm of Structure-Conduct-Performance 11](#_Toc125881260)

[2.3 Empirical review 13](#_Toc125881261)

[2.4 Theoretical Framework 16](#_Toc125881262)

[2.4.1 Limitations of Industrial Organization Theory 17](#_Toc125881263)

[2.5 Conceptual Framework 19](#_Toc125881264)

[2.6 Research Gaps 21](#_Toc125881265)

[CHAPTER THREE 22](#_Toc125881266)

[RESEARCH METHODOLOGY 22](#_Toc125881267)

[3.0 Introduction 22](#_Toc125881268)

[3.1 Study Area 22](#_Toc125881269)

[3.2 Research design 23](#_Toc125881270)

[3.3 Target population 23](#_Toc125881271)

[3.4 Sample size marketing 23](#_Toc125881272)

[3.5 Sampling technique 24](#_Toc125881273)

[3.6 Type, source of the data collection instrument 24](#_Toc125881274)

[3.7.1 Descriptive statistics 24](#_Toc125881275)

[3.7.2 Structure, Conduct and performance 25](#_Toc125881276)

[3.7.2.1 Market structure 25](#_Toc125881277)

[3.7.2.2 Market conduct 26](#_Toc125881278)

[3.7.2.3 Market performance 26](#_Toc125881279)

[3.7.4 Factors that determine marketable sorghum supply 27](#_Toc125881280)

[3.7.5 Factors that Determine the choice of sorghum marketing channel 28](#_Toc125881281)

[CHAPTER FOUR 30](#_Toc125881282)

[RESULTS AND DISCUSSION 30](#_Toc125881283)

[4.1 Socio-demographic characteristics of respondents 30](#_Toc125881284)

[4.1.1 Producers Age 30](#_Toc125881285)

[4.1.2 Gender of Producers 31](#_Toc125881286)

[4.1.2 Sorghum producers’ education level of 32](#_Toc125881287)

[4.2 Socio-Demographic Characteristics of Sorghum Traders 33](#_Toc125881288)

[4.2.1 Age of Traders 33](#_Toc125881289)

[4.2.2. Gender of Traders 33](#_Toc125881290)

[4.2.3. Education level of Traders 34](#_Toc125881291)

[4.3 Determination of market structure, conduct, and performance 35](#_Toc125881292)

[4.3.1 Market structure 35](#_Toc125881293)

[4.3.1.1 Traders’ market concentration 35](#_Toc125881294)

[4.4 Gross Margin 38](#_Toc125881295)

[4.5 Total Gross marketing margin (MM) 41](#_Toc125881296)

[4.6 Marketing efficiency 41](#_Toc125881297)

[4.7 Market Conduct 42](#_Toc125881298)

[4.8 Determinant of sorghum producer market supply 42](#_Toc125881299)

[4.9 Determinant of sorghum trader market supply 45](#_Toc125881300)

[4.10 Marketing channel choice determinants 47](#_Toc125881301)

[CHAPTER FIVE 52](#_Toc125881302)

[SUMMARY, CONCLUSION AND RECOMMENDATION 52](#_Toc125881303)

[5.0 Introduction 52](#_Toc125881304)

[5.1 Summary 52](#_Toc125881305)

[5.2 Conclusion 53](#_Toc125881306)

[5.3 Recommendations 55](#_Toc125881307)

[REFERENCES 57](#_Toc125881308)

[APPENDICES 63](#_Toc125881309)

[APPENDIX I: QUESTIONNAIRE 63](#_Toc125881310)

[APPENDIX II: COVER LETTER TO RESPONDENTS 70](#_Toc125881311)

[APPENDIX III: MAP OF ISIOLO COUNTY 71](#_Toc125881312)

[APPENDIX IV: DIFERENT SORGHUM FORMS AND DELICACIES 72](#_Toc125881313)

# LIST OF FIGURES

[Figure 2.1 Paradigm on the relationship between structure, conduct, and performance 13](#_Toc125107946)

[Figure 2. 2 Conceptualizing S-C-P 20](#_Toc125107947)

Figure 3.1 Map of Isiolo County……………………………………………………22

[Figure 4.1: Lorenz curve for traders in Isiolo county 37](#_Toc125107948)

# LIST OF TABLES

[Table 4.1 Age Distributions for producers in Isiolo County 30](#_Toc125107949)

[Table 4.2 Gender of sorghum producers in Isiolo County 31](#_Toc125107950)

[Table 4.3 Education level of the producers in Isiolo County 32](#_Toc125107951)

[Table 4.4 Age Distributions for traders in Isiolo county 33](#_Toc125107952)

[Table 4.5 Gender of sorghum traders in Isiolo county 33](#_Toc125107953)

[Table 4.6 Education level of the producers in Isiolo County 34](#_Toc125107954)

[Table 4.7: Gini coefficient for traders in Isiolo county (retailers and wholesalers) 36](#_Toc125107955)

[Table 4.8: Wholesaler’s Gross Margin 38](#_Toc125107956)

[Table 4.9: Retailer’s Gross Margin 39](#_Toc125107957)

[Table 4.10: Producer’s Gross Margin 40](#_Toc125107958)

[Table 4.11: Determinants of sorghum producer market supply 43](#_Toc125107959)

[Table 4.11: Determinants of sorghum trader market supply 45](#_Toc125107960)

[Table 4.12: Results of Multinomial Logit regression on sorghum market outlet choices 48](#_Toc125107961)

# ABBREVIATIONS AND ACRONYMS

**ASALs** Arid and Semiarid Lands

**CMB**  Commodity Market Board

**FAO** Food and Agriculture Organization

**IO**  Industrial Organization

**K-S**  Kolmogorov-Smirnov

**KCSAS**  Kenya Climate-Smart Agriculture Strategy

**MNL** Multinomial Logit model

**MEI**  Marketing Efficiency Index

**MOALF** Ministry of Agriculture Livestock and Fisheries

**PGMM** Producer's Gross Marketing Margin

**PS** Producer's Share

**SCP**  Structure, Conduct, and Performance

**CIDP**  County integrated development plan

**SSA** Sub-Saharan Africa

**SSF** Small-scale farmers

**TGMM** Total Gross Market Margin

**USDA** United States Department of Agriculture

**USSD** Unstructured Supplementary Service Data

# OPERATIONAL DEFINITIONS OF TERMS

**Market chain** - refers tolinked actors that move a specific product from production to consumer sales. It refers to the various interconnections that exist between all of the individuals and activities taking part in the transit of agricultural goods from the farm to the end user.

**Market chain analysis** refers to examination of all activities, gaps, constraints, opportunities, associated with the transactions and parties involved in the transportation of agricultural products from the point of production to final consumers.

**Livelihood resilience** is whereby actions as well as plans of a household's livelihood are better prepared to deal with shocks, navigate ambiguity, and adjust to changing situations.

**Market channels -** The chain of intermediaries through which various food grains flow from producers to consumers.

**Market conduct** - firms' activity or strategies, such as pricing, purchasing and sellingactivities that may lead to informal collaboration or collusion between firms.

**Market efficiency –** refers to the goal of increasing the input-output ratio.

**Market margin -** a pricing differential between two places in a marketing channel.

**Market Performance –** the influence of conduct and structure on cost, output volume and prices.

**Market Structure** – This an environment where a firm operates**.**

**Market supply –** the amount of a product that all producers are willing to sell throughout a range of prices at any particular time.

**Small-scale farmers** are those whose operations are not big enough to fascinate all the services they require to boost productivity significantly. Farmers practicing on less than 2 acres.

**Value chain** - the set of players and activities that take a fundamental agricultural commodity from field production to final consumption, adding value to it at each stage.

**ABSTRACT**

The sorghum market in Kenya has grown significantly over the past few years, and it has continued to expand as a result of the commodity receiving considerable attention from a variety of interest groups. The absence of a planned and aggressive marketing strategy for raw sorghum and its value-added products, however, continues to be a significant barrier to the market's further expansion. This study analyzed the market chain of sorghum with reference to structure, conduct, and performance, and analyzed the causal factors of selling outlets preference and selection among sorghum farmers in Isiolo County. Data was collected from 203 producers and 85 traders using random and clustered sampling respectively. Structured questionnaires were used to acquire information from respondents. Analysis was done using STATA version 14 to obtain descriptive statistics and the empirical results using multiple linear and multinomial logistic regressions. The Lorenz curve and Gini coefficient were employed to assess the level of market concentration in the research area. The performance of the sorghum market in Isiolo county, Kenya, was evaluated using the marketing margin, marketing efficiency and gross margin. The study's findings revealed that the Gini coefficient for wholesalers and merchants was 0.612, an indication that the market was very concentrated thus consequent income disparity. Additionally, this research revealed that producers had the largest gross margins of Kenya shillings Ksh11 per Kilogram, followed by wholesalers and retailers with Ksh9 per kilogram and Ksh5 respectively. I used Multiple linear regression to predict the sorghum producer market supply. Factors such as gender, selling price, farm size under sorghum production, producers’ age, education level and membership to a cooperative were found to be positive and statistically significant. In addition, to predict the sorghum trader market supply, results indicated that experience, age, selling price were positive and statistically significant while buying price and trader type were negative but significant. To determine the market outlet used by the producer, multinomial logit regression was applied. Factors such as age, education level, farm size under sorghum production, access to information regarding the market were positive and significant while membership to a cooperative group, experience and distance to the market were negative but significant. In conclusion, it was discovered that sorghum trading and production in Isiolo are profitable but uncompetitive. Therefore, this study suggests that the national government together with county government should formulate regulations that strengthens sorghum production and marketing to make it more competitive and ensure all the actors are well protected from the hefty cost that reduces their efficiency hence low-profit margins. Secondly, since the profits from both producers and traders are still low, access to information should be accelerated through investment in telecommunication platforms such as the use of cell phones to aid reliable and timely sharing of market information to the users. Given the market's relative lack of competition, it was important to establish a clear market research and development strategy for sorghum in order to remove market obstacles and advance market efficiency through quality control, decreased price volatility, and a steady supply of the commodity. Furthermore, in order to lessen the likelihood of a closed and uncompetitive market, the government must put in place an institutional structure to control sorghum contracts and assist market participants in contractual arrangements. By putting these policies into place, the county's general sorghum market may become more effective and organized, ensuring fair returns for all participants.

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background to the Study

*Sorghum bicolor (L.) Moench*, is a type of grain sorghum, which is the fifth most significant cereal crop in the world (Dahlberg *et.al*.,2011). Sorghum is mostly farmed for rural food security in Africa and Asia's semi-arid and arid lands (ASALs), likely because of its adaptability and diversity (Mwadalu *et.al.,*2013). It is used in the processing of a wide range of tasty and healthy traditional dishes, including dumplings, fermented and unfermented porridges as well as semi-leavened bread. In addition, sorghum is used as a subsistence consumption, and as the finest barley substitute for lager beer production. Progressively it is becoming a part of the foundation of successful food and beverage enterprises (Floros *et.al*.,2010).

Agriculture forms one of key income sources among farmers in most third world countries. The Kenyan agricultural sector has a multiplier effect of 1.64 to the non -agricultural sector and is among the top GDP contributors at 23%. (KNBS, 2019). Sorghum is a traditional crop in Kenya that is grown in various areas of the nation, particularly in the drier parts such as Isiolo County. It is primarily grown for subsistence purposes, but farmers reduced its cultivation when white settlers introduced maize, which quickly replaced it as the primary crop and main source of food. However, there is currently increased heed in boosting drought adaptive crops, often considered to be well suitable to severe conditions, so as to boost the nations’ food security. Sorghum breeding is a topic of extensive research, and Sub-Saharan Africa (SSA) is home to a wealth of information on the latter. There have lately been produced stable, high-yielding sorghum varieties (Jordan *et.al*.,2011).

Smallholder farmers have been encouraged to grow sorghum due to its propensity to not only survive in harsh climates but also requires fewer inputs than most other main grains, including maize. For instance, in Kenya, the ASALs are the primary focus of the initiatives to support sorghum production. This promotion is carried out as part of the government's goal to help the nation satisfy household food security demands and boost non-urban income (Ochieng *et.al.,*2011). These promotions are intended to have an influence on several producers’ livelihoods by way of increased food security as well as agricultural expansion, as well as crop growth and income production.

Droughts are becoming more common in eastern Kenya and can often last for two to three years If planted in semi-arid regions like the eastern province with enhanced production techniques, improved sorghum cultivars can thrive and produce effectively under such uncertain weather conditions which in the long run fosters food security (Mwangi *et.al*.,2009). A number of initiatives, including the Kenya Climate Smart Agriculture Project (KCSAP) and organizations like the International Fund for Agricultural Development (IFAD), have taken lead on orphan crop promotions in ASALs   to encourage the growth of crops like sorghum, among others, in acknowledging the role they take part in foods’ security. The fundamental objective of these efforts is to persuade farmers to use these enhanced cultivars in order to increase rural incomes and food security. Sorghum is one of the most significant grains in the ASALs. About 40 cultivars have been released in the recent years as a result of successful study on its cultivars. Despite yields continuing to drop, sorghum cultivation area has been growing. By combining their resources, several governments have made an attempt to increase the yield and production of this crop (Olembo *et.al.,*2010).

Understanding the state of the sorghum market chain is necessary to boost productivity, as productivity growth is closely tied to marketing effectiveness. In order to increase farmer production, it is vital to help them enhance their marketing efficiency. While the average yield for every hectare nationally decreased from 1.8 tons each hectare in 2009 to 0.7 tons every hectare in 2020, the land size under sorghum cultivation expanded from 173,172ha in 2009 to 203,180ha in 2020(Gweyi *et.al*.,2022). Sorghum output has varied between anticipated potential yields and actual yields despite numerous attempts to increase yields. Farmers have so far only been able to produce up to 1.2 tons per hectare of the Gadam sorghum variety, despite the type's anticipated potential yield of 2-2.5 tons per hectare (Karanja *et.al.,*2009). For instance, East Africa Breweries Limited (EABL), through the IFAD-funded initiatives and Orphan Crops programme, had anticipated collecting 12,000 tons of sorghum from the farmers in 2010, but they only managed to deliver close to 1,000 tons (Africa the Good News,2011).With the increased demand in the manufacturing industry for different uses in making products such as snacks and various brews in the brewing industry sorghum marketing should be streamlined to enhance proper commercialization. Globalization, urbanization, migration, and rising per capita income are the key factors driving the process of agricultural commercialization, which entails the shift from subsistence to increasingly agriculture which is market-guided and the use of high-quality inputs. (Omiti et.al.2009)

The domestic market for sorghum is limited since it’s majorly used as a starch, some opt to purchase maize instead. The key consumers of sorghum are locals, about 89.6% of the buyers (Beinah et al., 2020). The countries importing Kenyan sorghum are mainly African countries which are third-world countries. This translates to inadequate incomes for the farmer as well as sorghum wholesalers and retailers. (WFP, 2018). Efficient agricultural markets and value chains are critical for producing and sustaining prosperity (German *et al*, 2020). The majority of small-scale producers rely on agricultural production for a living while supplementing it with various off-farm sources of income. Several household-specific and market-related limitations jeopardize sorghum-based livelihoods. Many small-scale farmers face challenges such as low yields, subjection to poor prices unfavorable market interactions and reducing net marketing profitability through uncompetitive market behavior (Mukarumbwa & Mushunje, 2010). As a result, farmers lack motivation to effectively participate in sorghum marketing as an economic activity. Producers have to contend with low market prices as well as significant transaction costs. This might be due to the distance between primary production zones and viable market centers, as well as a lack of organizational support systems and a skewed institutional framework (Makindara et al., 2013).

The availability of competing cereals from local and regional markets at significantly lower rates has pushed sorghum out of the production, processing, marketing, and consuming sectors. Sorghum has minimal value addition activities, which has harmed the crop's ability to provide a sustained margin for stakeholders across the market chain (Aduguna, 2007; Rukuni *et al*., 2006). It is vital to examine various African countries' marketing chains and give ideas and methods for developing and promoting marketing chain efficiency (Dalipagic and Elepu, 2014; Hamukwala *et al*., 2010). Sorghum-based subsistence initiatives are hampered by some household-specific and market-related issues which need to be identified and possible solutions formulated. There is need to analyze operations and stakeholders along the sorghum marketing chain to optimize operational efficiencies.

## 1.2 Problem statement

Efficient coordination of economic transactions is greatly facilitated by agricultural markets (Edwards *et.al*.,2006). A marketing system's effectiveness in delivering goods from the farm gate to ultimate customers at costs that guarantee fair returns for all market players depends on both the organizational structure of the system and the efficiency of its marketing avenues (Chang *et.al*.,2010). Understanding the sorghum market in Isiolo County, Kenya, in terms of its composition and the behavior of players depending on the kind of the structure of market they are exposed to and its efficacy requires doing market chain analysis. A market's success is determined by its structure and the actions of its participants in terms of pricing, net returns, margins, and expenses. There is, however, little verifiable data on the way the Isiolo County sorghum market is organized, characteristics of it players, their impact on the market's performance, and the variables affecting the both trader and producer marketable supply. Additionally, there is no empirical data on factors that influence Isiolo sorghum producers on preference and choice of selling outlets.

In the past, EABL provided the sorghum farmers in Isiolo with a guaranteed and organized outlet for their produce. However, their exit led to emergence of several marketing channels which present dilemma to the farmers as they seek to dispose their produce. The marketable sorghum supply in Isiolo county is limited in quantity despite the high demand (MoALF, 2017). Sorghum market has also remained inefficient resulting to a lot of inefficient pricing. For instance, the farm gate price of Gadam sorghum is 35Ksh/Kg while consumers pay about Ksh. 60 per Kg in the main market (MOALF,2017). This leads to these questions: What are the factors that have led to market and price inefficiencies of sorghum market in Isiolo?

According to Machethe (2004), in his study whether Agriculture can reduce poverty, argues that, market participation is significant among smallholder farmers because they derive livelihoods from this economic activity.

Therefore, the aim of this study was to evaluate sorghum market chain in Isiolo county by accessing it competitiveness, factors that affect marketable supply and what stimulate sorghum farmers in Isiolo county to make certain decisions reading selling outlets preference and choice.

## 1.3 Objectives

### 1.3.1 General objective

The overall goal of this study was to examine sorghum market chain as a commodity in Isiolo County.

### 1.3.2 Specific objectives

1. To examine the structure, conduct and performance of the sorghum market in Isiolo County
2. To deduce the determinants of marketable sorghum supply in Isiolo County.
3. To establish the determinants of marketing channels choice and selection among smallholder sorghum farmers in Isiolo county

## 1.4 Research questions

1. What are the determinants of marketable sorghum supply in Isiolo County?
2. How is the sorghum commodity market in Isiolo County structured, run, and performing??
3. What are the determinants of market channel choice and selection among smallholder sorghum farmers in Isiolo County?

## 1.5 Justification of the study

Sorghum has remarkable potential to lower food insecurity and raise the living conditions of those who live in ASALs. The government and NGOs have devoted a significant amount of funds to boosting the cultivation of sorghum, particularly in ASALs, by encouraging the use of new, improved varieties and technology and recognizing a crucial market, the EABL. The majority of smallholder producers and traders still face significant challenges in achieving increased returns, despite the deregulated production and marketing system for the sorghum crop. Numerous causes, including uncompetitive market, could be the cause of the discrepancy between research-based production returns and real returns. Evaluating the market performance through structure conduct and performance will offer vital information for formulating policies, plans, and actions that will enhance the effectiveness of the sorghum marketing system and increase livelihood resilience. The results of this study will also be used for a literature review by researchers who wish to investigate sorghum marketing in more detail. These results will also help different parties involved in the marketing of sorghum make wise decisions.

## 1.6 Scope of the study

This research was carried out in Isiolo County, Kenya. It focused on the operation of sorghum marketing chain, the interaction among the participants within the chain, marketing data, firms incorporated in marketing and variables impacting sorghum supply. Furthermore, the key challenges facing the sorghum market chain were identified. Data from this study elucidated the findings from the analysis of factors influencing SSF in commercializing the sorghum value chain for livelihood resilience. Diverse market categories, the duty of participants in the channels, bargaining characteristics of producers, purchasing and selling methods as well as traders’ actions in the entire marketing process were looked into.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.0 Introduction

This details an overview of various studies that have been conducted on agricultural marketing chain analysis. A theoretical review and empirical evidence are the two primary categories in which the literature is classified. The empirical analysis was organized into sub-categories focusing on the study's dependent and independent variables. Examples are marketing structures, a market's organizational characteristics, market supply, market channels, and government rules. It concludes with the conceptual framework that shows how both predictor and response variables were linked.

## 2.1 The sorghum production and marketing in Kenya

Sorghum in Kenya is a crucial crop both as an income generating crop for households and security. It is mainly grown by small-scale farmers, who commit less than 2 Ha to the production (Okeyo *et al.*, 2020). Isiolo is one of the key producers of the crop. The marketing chain of this crop is crucial for achieving the aims of the farmers of reducing hunger while reducing the rates of poverty in the region. Sorghums production in various regions of the world can be characterized as unstructured, and the activities in the sector are predominately informal.

In the marketing of sorghum, there are several stakeholders in the marketing chain. Each has a role to play to ensure that the process is complete end the consumers get the needed product at the most reasonable price (Kilambya and Witwer, 2019). The major players of the marketing chain are wholesale or retail traders. Producers also, in their activities, grow the crop applying small inputs and seeds that they might have kept from the previous harvest. The seeds are planted on small pieces of land in hectares thereby leading to meagre yields (Chimoita Onyango Gweyi-Onyango and Kimenju, 2019). During the harvesting times, the farmers always save a third of their produce for local consumption, and the others are taken to the market. In the production of the crop, the main challenge is the farmers sticking to the traditional farming methods and poor selection of the variety of the products that would give them a high yield. Farmers in sorghum farming are subsequently prone to losses because of the speculations on the prices from the middlemen.

Contract farming is a common practice in the production of sorghum. These are relatively organized farmers who mainly grow the crop under contract with a miller or processor. One of the essential elements that these framers consider is the ability to bargain the prices for their products. Landowners are also important stakeholders in the sorghum farming sector (Okeyo et al., 2020), Kilambya and Witwer (2019) add that individuals in the arid and semi-arid land have agreements with individuals with the interest of cultivating the crop. When they are getting into the contracts, they might include some clauses that the farmers do not understand effectively, and they only realize they have made a mistake after getting into these contracts. These are contracts likely to reduce the revenue that they collect from the activities of the production. It is evident in the past that sorghum growing has not effectively reduced the farmers' poverty rates as they do not have the right bargaining power, and the contractors are exploiting them.

After sorghum is harvested, the marketing involves sale transactions between the several individuals acting as middlemen and the sellers. The interactions between them mainly depend on the prices dictated by several factors. Farmers in their activities have little incentive to add value to the crop after it is harvested. They lack the techniques to guarantee excellent buy-in, either through better production techniques or post harvesting. This study underpins the main challenge in the situation which includes improper market chain analysis to invest either in value addition such as facilities for storage and equipment, transportation, milling in large quantities or proper marketing channels selection.

The related entities that bring a given product from creation to consumer sales are referred to as a market chains (Lundy *et al.*, 2008). The very long market chains typically end in a reduced percentage of profits gained from the goods because the inputs and gains are distributed among many players. Shorter market chains have relatively high revenue generation. A market chain analysis attempts to examine all activities, gaps, restrictions, opportunities, and risks associated with each step of a product from production to consumer sales (Lundy *et al*., 2008).

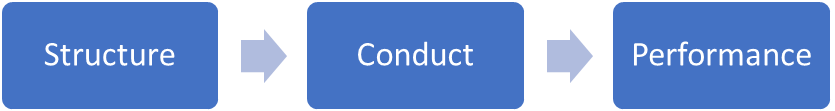
## 2.2 Conceptualizing the paradigm of Structure-Conduct-Performance

According to (Tung *et al*., 2010), the paradigm of structure, conduct as well as performance, is a way for finding out the association between market structure, behavior, and performance. Two ideas underpin the paradigm: price and industrial organization theories. This theory advocates assessing by what means a corporation operates by examining its degree of industrial maturity, vertical integration, government participation, diversity cost structure. Raible (2013) further comprehends that industrial organization theory is founded on market structure, which relates to how the market works. Thus, the market system impacts a company's strategy and decision-making in terms of strategic supply management.

(Webber *et al.,* 2018) uses the price theory to describe the income-generating activities that generate or pass value in trading among various economic players. Three primary market structural variables are proposed in theory: concentration of supplier and buyer, the degree of differentiated products, and the entry condition. The Diamond-Water Paradox was coined by Smith (1776) explaining the multiplex subject of why water is far much cheaper while diamonds are so dear, bearing in mind that diamonds are not crucial for survival compared to water. The jargon is explained by the fact that obtaining a kilogram of diamonds is far more complex than getting an equivalent mass of water in terms of the quantity of work required. As a result, Webber argues that labor is the fundamental unit of exchange value for products, resulting in their actual price. The nominal price, on the other hand, is based on the exchange rate of the currency used for the transaction.

Joe S Bain (1986) first established the SCP framework in the 1986. The structure's primary hypothesis is that observable structural aspect of a market drive business activity inside that market, and firm behavior determines structural characteristics and measurable outperformance (Lee, 2008). According to (Edwards *et al*., 2006), the SCP paradigm has two opposing hypotheses; traditional structure performance and efficient structure. Because market concentration drives businesses to cooperate, according to the structure-performance theory, concentration of the market is thus oppositely proportional to the degree of competition.

According to the efficient structure hypothesis, a firm's performance and efficiency relate positively. This is because the market share happens as a result of competition, in which entities with stunted-cost structures profit through dropping costs and increasing market share. Thus, in contrast to the classic SCP paradigm, it asserts that more efficient organizations gain more profits due to their efficiency rather than collusive behaviors.

****

#### Figure 2. Paradigm on the relationship between structure, conduct, and performance

## 2.3 Empirical review

The SCP framework has been used in several studies to assess market conditions in specific agricultural markets. For example, in Ethiopia's Alamat District, Teka (2009) employed the S-C-P model to investigate the effectiveness of the fruits and vegetables market as well the profit realized from their production. Even though the vegetables and fruits business operate markets that are imperfect, the research revealed that, wholesalers, farmers, retailers and assemblers, profited from producing and selling them. Additionally, the Alamata business was characterized by price-fixing, with wholesalers knowing that farmers did not have proper facilities to store their perishable goods, and so market conduct did not indicate competitiveness. As a result, knowing that they had no alternative but to sell, they offered producers lower prices for their goods.

According to the survey, one challenge that inhibited productivity and production in fruits and vegetables businesses was a lack of practical extension help. Teka's research is applicable to this study since it aids in detecting self-seeking traits on the behavioral efforts of marketing chain players that result in market inefficiencies in fruits and vegetables (Quandt *et al.,* 2013). The study, however, differs from the current study in terms of concentration estimations. In contrast to Teka's analysis, the Gini factor was used employed to estimate the concentration of sorghum market.

As applied by Teka, concentration ratio does not account for the market share distribution across all enterprises in the industry. Because of its capacity to assess disparities across different participants in the market and ease of reading, the Gini figure was coupled with Lorenz curve to evaluate sorghums market structure in Isiolo County (Giroh *et al*., 2010 and (Girei *et al*., 2015).

The structure, conduct, and performance model were used by (Haruna *et al*., 2012) to investigate of the Upper Eastern Region tomato market in Ghana. The Gini index was used to evaluate the tomato market organization. Retailers, producers and wholesalers, all had market assemblage proportions of 0.64 0.68, and 0.58, respectively. The ratios indicated that all participants, notably producers, have a significant level of market concentration. The selling price of tomatoes varied among customers in different market regions because of lack of pricing knowledge, indicating the prevalence of price discrimination (Haruna *et al*., 2012). In contrast to the present study, it did not combine the Lorenz curve with the Gini index. Alternatively, the Lorenz curve, is crucial because it reflects profit distribution among market players and also shows the extent of benefit distribution, imbalance among market participants (Onyango, 2019).

To evaluate the palm oil market performance, marketing margin was used (Tiku *et al*., 2012) used. Merchandisers, commissioned agents, processors and retailers made up 29.0%,7.8% ,37.2% 26.1%, of the market. As a result, retailers and processors obtained the greatest marketing margins. Overall, existing market conditions were better than the Commodity Marketing Board's market arrangements (CMB). (Tiku *et* *al*., 2012) evaluated market performance just using the marketing margin. The writers did not look at profit margins to see which market segments were the most profitable or to assess each sector's economic sustainability. Profit margin estimates were used in the current study to complete a picture of the sorghum market's performance in Kenya's Isiolo County.

For farms that use local food markets, there is an expanding body of information concerning marketing tactics and farm success. However, due to data limitations, this study is restricted to a wide classification of straight together with intermediate market avenues. The United States Department of Agriculture (USDA), for example, has generally gathered information based on commodity classifications rather than market routes (Gupta and Jablonski, 2016). (Brown *et al*., 2007); (Tegtmeier and Duff, 2005); (Woods Ernst and Tropp, 2017); (Gupta and Jablonski, 2016); (Starr *et al*., 2003) are among those looking into the paucity of market channel-specific data mostly using surveys and case studies technique particularly pointed at the local producers of food.

Others, on the other hand, have indicated that well comprehensive and structured research approach would perfectly show out the diversity of specialty crop producers' selling outlets profiles, as well as the varied marketing and labor costs associated with various marketing venues (Hardesty and Leff, 2010); (Schmit and LeRoux, 2014); (Murray and Gwin, 2016). While studies that employ an econometric model and national-level data to be aware of the causal factors and performance of unbroken marketing techniques appear to help explain household, outer market and farm-level, characteristics, they are unable to provide information on specific market channel efficiency or how market channels perform within a market portfolio. This void can be filled by using survey data to investigate the elements that determine the success of individual market channels.

## 2.4 Theoretical Framework

This research was founded upon Industrial Organization (IO) theory in expounding the concept of the market structure and how its functions (Tirole,1998) rather than an individual organization's "conversion process, goods, and expenses" (Ramsey, 2001). This theory is concerned with how a market's structure influences company's strategy and decision making. The IO model's strategic management implications are that businesses should find and strive to compete in settings that offer the highest chances for productivity and profitability. According to the latter, a business's choice of industries and market segments has a more significant effect on performance than strategic choices about internal resources, skills, and critical competencies.

The industrial organization theory of Ramsey (2001) focuses on the market in which a firm works rather than on itself. According to the S-C-P model, there exist a "causal link connecting market structure where a business operates, the organization's behavior, and financial performance." Therefore, IO focuses on a company's entire market and industry conditions, with the methodologies and analysis component utilized to uncover strategic alternatives that enterprises have in their particular marketplaces, including Strategic Supply Chain (Porter, 1981; (Teece *et al*., 1997).

Fundamental producers influence market structure' and consumers' characteristics such as the quantity, kind of commodity sold, together with traders’ dispersal in the market (Beamon and Chen, 2001). Variables, including the item traded, entry and exit obstacles, and the number of customers and sellers, are all considered when determining the sorghum market structure. As a result, how sorghum market is structured affects how businesses and other market participants behave.

For example, suppose sorghum purchasers (wholesalers, retailers, and producers) in the research area had a weighty level of market power. In that case, they could abuse it by setting prices sufficiently low to push out competitor away from the market (Beamon and Chen, 2001).

The sorghum market's success is determined by the sort of conduct displayed by structure and market participants. Its efficiency is determined by reviewing the outcomes of the market's sorghum players. Profit margins, marketing margins, and technological improvements are ratios that can measure operational productivity (Edwards *et al*., 2006).

Therefore, in this research, the timely delivery of good sorghum seeds to farmers impacts the amount of sorghum produced, have an impact on market structure. It affects market structure depending on the number of sorghum producers and consumers who enter and leave the market and entry barriers. Additionally, the number of sorghum buyers and sellers influences how pricing is established, affecting the performance of market participants in marketing and the costs experienced according to each player along the sorghum marketing chain. The results of the enterprises, along with the sorghum market in the ASALs (Isiolo) of Kenya, were summed up using marketing margin and marketing efficiency in this study.

### 2.4.1 Limitations of Industrial Organization Theory

The IO model's limitations are due to the existence of the theory's four fundamental assumptions. First, it is assumed that an organization's strategic options are dictated by its external environment. Secondly, it assumes that businesses have the similar assets. Third, firms share tactical capabilities and take the same planned undertakings.

Fourth, decision-makers are rational, which means they are expected to execute precise prudent measures with the same assets. The resource-based firms’ perspective, which is a competing view of strategy, has called into question the assumptions of the IO method.

The logic premise of the SCP paradigm is also its restriction, as it can only be utilized to generate market performance conclusions in fully competitive markets. As a result, the structure performance hypothesis appears to be valid only in markets with perfect competition and homogeneous goods. Market share and profitability are correlated favorably in various markets. The causal relationship between structure and performance dissolves once the response effects and causality flows emerge in an industry's SCP model, because companies can affect market structure through their behavior and, eventually, their performance (Ferguson and Ferguson, 1994).

Despite the fact that this model is broadly used for competitive analysis its main flaw is that perfect information is rarely available in actual market conditions, limiting its applicability to only stable markets in terms of demand, market structure, and technological development (Chang *et al*., 2010) As a result, the SCP paradigm's applicability is limited because homogenous product circumstances are unusual, and businesses can influence market homogeneity through innovation or advertising, for example. In changing markets, using the SCP might be deceiving (Ferguson and Ferguson, 1994).

Due to the neoclassical assumption base of the SCP approach, its use is constrained, which indicates equilibrium states and perfect information. The paradigm, however, continues to work. It's a big theoretical framework for studying Industrial Organization.

The SCP paradigm, which is the theoretical foundation of IO, aims to find strategic choices that firms make in their various industries since it focuses on where a company operates rather than itself (Porter, 1981); (Teece *et al*., 1997), (Ramsey, 2001).

## 2.5 Conceptual Framework

Modeling structure and conduct is possible using SCP theorem. The design of a market has an impact on how organizations make decisions. It goes on to say that the behavior of traders influences the industry's performance. Some researchers suggest that the relationship chain isn't always unidirectional and can even induce reverse causation. This could imply that an industry's structure is influenced by performance (Tiku *et al*., 2012). This is depicted in figure 2.2.

**Independent variables Moderating Variable Dependent variable**

**Market Channels**

* exploitative,
* convenient,
* better informed
* means of connecting with the market

**Supply**

* Costs,
* Inputs,
* Market Price
* Demand

**Agricultural marketing**

* Profitability
* Supply seasons
* Variety
* Quantity supplied

**Conduct)**

* Price taking,
* Product diversification
* market power exploitation

**Government policy**

* Regulated market
* Infrastructure development
* Market co-operative

**Structure and Performance**

* Structure:

Number of competencies, product heterogeneity, and entry and exit costs

* Performance

profitability, productivity efficiency, and allocative efficiency

#### Figure 2. Conceptualizing S-C-P

Origin: Modified from Frakt (2010)

## 2.6 Research Gaps

Based on the above literature review, this study has uniquely examined the relationship that exists between market participant’s behavior and market structure through market chain analysis for sorghum in Isiolo county. Employing the paradigm of structure, conduct and performance (SCP), the current study has focused on assessing the performance of the sorghum market which has not received much attention like production and productivity enhancement

The study also specially used the concept of Gini coefficient and Lorenz curve to examine the structure of the sorghum market using the enterprise survey data to assess the level of inequality in distribution of sales income or otherwise.

To model the determinants influencing the marketing channel selection the study employed multinomial logistic regression of which it’s not widely applied in similar studies.

.

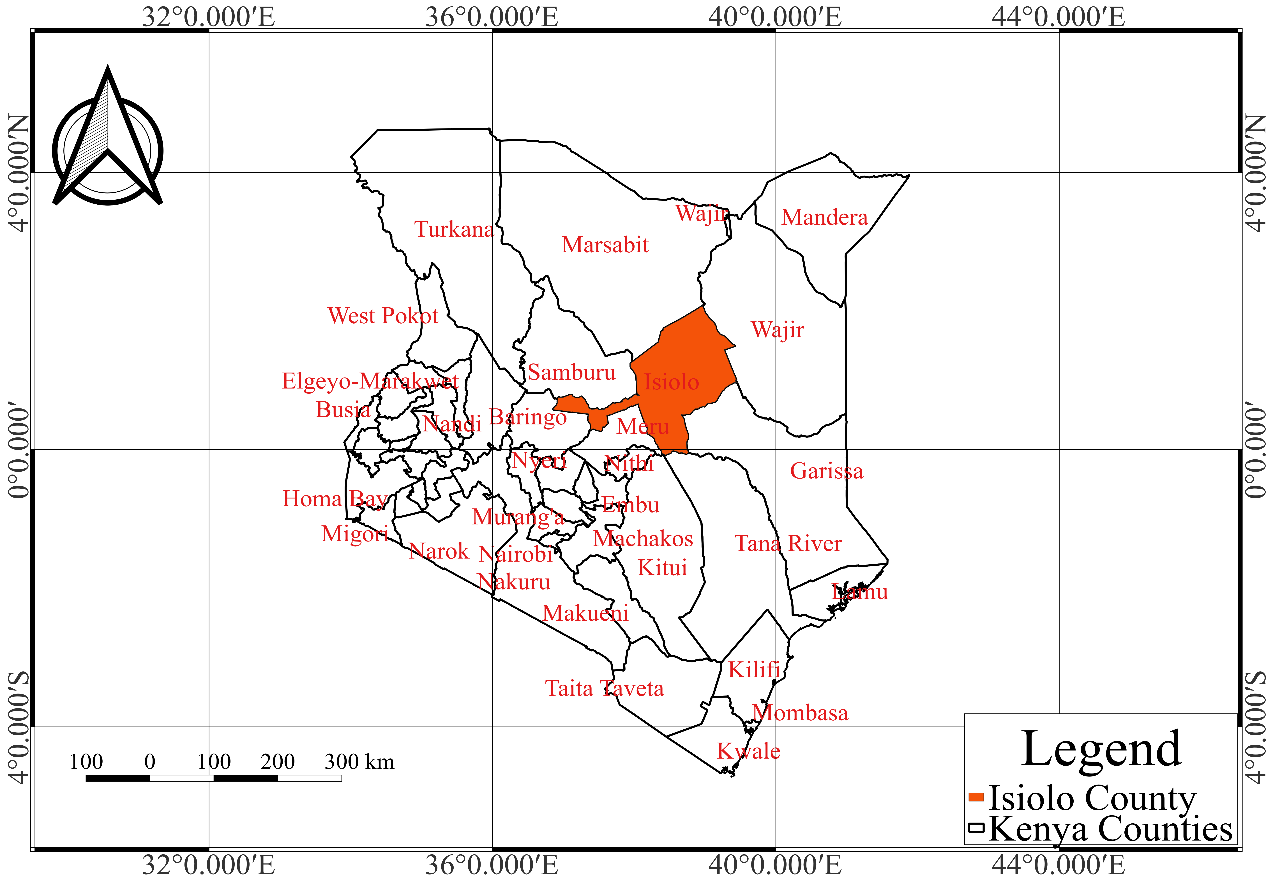
# CHAPTER THREE

# RESEARCH METHODOLOGY

## 3.0 Introduction

This study was conducted in Isiolo county. Sorghum has been selected as one of the most important marketable farms produces here. This chapter discusses the various steps and the phases used to complete this research and ensure the research objectives were achieved. This section included the study design, data collection method, target population, data analyzing procedures and expected output.

## 3.1 Study Area



##### Figure 3.1 Map of Isiolo County

Isiolo county covers approximately 25,700 Km2 and has a population of roughly 268,002 (KNBS,2019). The annual rainfall ranges between 200mm and 650mm (Department of Meteorology, 2021).). It lies between agro-ecological zones LM 4 to LM 6. There are about 12,000 farmers in Isiolo, the majority of who practice rain-fed agriculture, with 10% doing irrigated agriculture (County annual agricultural report,2020). Sorghum is among the most dominant crops grown here for both subsistence and commercial purposes and most farmers grow the local sorghum variety.

## 3.2 Research design

Exploratory research design was employed since there are no similar earlier studies conducted in the study area. The goal was to provide insight for future information use and provide basis for literature review or similar studies in future. After grounding a clear picture of the sorghum market chain this study aims at refining a more systematic formulation and development of further research gaps in the future. This study will also clarify terms and define the existing terms regarding the un documented queries regarding the topic at hand.

## 3.3 Target population

The study mainly targeted small scale sorghum farming households, and sorghum traders (retailers and wholesalers).

## 3.4 Sample size marketing

The following formulae were used to calculate the farmer’s sample size;

……………………………3.1

***Where;***

**n**= the desired sample size

**N**= the study population (total number of sorghum-growing households)

**e**= sampling error

A 95 % confidence level interval with a 0.05 error acceptability margin was used (Mugenda and Mugenda, 2003).

415 / [1+415x 0.052] = 203.7109

A sample size of 203 sorghum farmers was used.

To achieve a high level of accuracy, the entire trader’s population (retailers and wholesalers) was used in the study since their population was finite from the county MOALF report of 2020.

## 3.5 Sampling technique

The entire retailer’s population was be used since their population is finite and they are not many to reduce the error margin. The farmers and traders were approached randomly from farms, homesteads and marketplaces. The farmers interviewed also indicated whether they belonged to farmers’ groups or not and the specific farmers' groups. The study took place in all the three sub-counties and wards within the sub-counties.

## 3.6 Type, source of the data collection instrument

Smallholder farmers across Isiolo county and retailers, as well as wholesalers, formed primary data sources. Secondary data sources included a list of various relevant published and unpublished reports and Kenya Climate-Smart Agriculture Strategy bulletins (KCSAS) and county government reports and records. Structured questionnaires were used to collect data.

### 3.7.1 Descriptive statistics

In assessing and defining household traits, marketing functions, and sellers’ features, categorical variables including frequencies, mean, cross tables, standard deviation, and percentages were utilized to present the results.

### 3.7.2 Structure, Conduct and performance

### 3.7.2.1 Market structure

The manner in which different industries are classified is differentiated in regards to competition nature and degree for services and goods. Market structure characterization is based on the features that influence how businesses taking place in certain markets are conducted and performing. (Shubik *et al*., 2013). The market structure can be regarded as perfect competition, monopolistic, monopoly and oligopoly. The type or nature of the market structure is influenced by the quantity traders and consumers, their negotiation abilities, the concentration of the market, the diversification of products, and finally the level of difficulty in entering or leaving the market.

**Market concentration**

This assesses the proportions to which sales in an agricultural market are controlled by one or several merchants (Fafchamps *et al.,* 2006). This study used Gini coefficient, Lorenz curve and concentration ratio to evaluate the level of market concentration. The following formula was used to compute the Gini coefficient: (Tiku *et al*., 2012):

**G = 1-XY** …….*………………………….3.2*

**G** is the Gini coefficient's value, **X** is the proportion of sellers, and **Y** is the cumulative proportion of sales. Sorghum quantity traded was divided into separate groups for the purpose of estimating the proportion of sellers (X) ranging from the least amount to the biggest. The precise number of merchants who transacted in each of the categories was then divided by the overall number of trader respondents.

The total annual sales for each category were computed and weighted in relation to the total annual sales of all the categories in order to determine the cumulative proportion of sales (Y).

### 3.7.2.2 Market conduct

This is referring to the pricing strategies and other market policies that market participants adopt together with the manner by which they harmonize their decision-making. (Haruna *et al*., 2012). This was accessed using the following variables; Product differentiation, promotion and advertisement procedures, Price setting, entry, and exit behaviors.

The degree of cooperation was measured by determining whether there are coordinated restrictions on products in the market, in this case, sorghum, resulting in higher market pricing.

The market's various purchasing and selling activities were also studied. The research also looked into whether market participants differentiate their sorghum in any way to set it apart and make it more appealing to buyers.

### 3.7.2.3 Market performance

This is the outcome of the association between marked price to costs, output size, and the effectiveness of production (Mahlia *et al*., 2019). It can be measured by analyzing the marketing margin, market efficiency, and producer share.

The total marketing margin is given by the following formula;

***Total Gross Marketing Margin****;*

The producer's gross marketing marginwas calculated as =

***Where; GMMp*** represent the farmer total marketing margin.

The marketing efficiency index was used to assess marketing efficiency. It is the net price ratio obtained by farmers to total marketing costs plus total margin.

***Marketing efficiency index;***

Where:

**MEI**: Marketing Efficiency Index;

**NP** is Net Price given to producers

**NM** is Net Marketing Margin of other players in the chain)

**MC** is the sum of selling cost

### 3.7.4 Factors that determine marketable sorghum supply

Multiple linear regression aided to assess the connection among dependent and explanatory variables. Econometric analysis helped to understand the magnitude and direction and the impact of explanatory variables to response variables. Because all sorghum producers in the study area provide their goods to the market, there is no clustering of sorghum producers into participants and non-participants in the sorghum market. The following matrix was used to calculate the econometric analysis:

**Y = β0 +β1xi1+β2xi2+…βpxiP+Ꜫ**

W***here; Y*** is the sum of sorghum availed for sale by farmers from within Isiolo county only in Kgs. (Dependent variable and it is a continuous variable)

**β0** is a vector of approximated constant of the independent variables

**βp** is the slope coefficient for each independent variable.

**Ꜫ** is the error term

**xi** = Independent variables (commodity price per Kg, cost of all inputs per Ha, land size in Ha, market information access, household level of education, gender of the household, distance from production point to market in Km, extension contact, quantity of sorghum produced) Gender, education and access to information are dummies while the rest of the variables are continuous.

### 3.7.5 Factors that Determine the choice of sorghum marketing channel

Individuals are considered to have proclivity explained on top of laid down options in this study. Farm gate or direct sales, using intermediaries, and own distribution were the farmers' marketing options for sorghum. The dependent variable for our MNL was the selection of sorghum outlet, which included three categories with the selection of farm gate as the base outcome for the model. The dependent factor possessed greater than 2 nonhierarchical alternatives, whereas independence variable constituted other options features as well as traits of respondents such as; age, education, and gender. Multinomial logit was preferred in this study since it analyzes decisions covering above dual grouping in the predicted variables, thus enabling the determination of selection and probable use of various selling routes. The following model was be used for channel choice analysis;

***Where***;

**SM choice =** Sorghum selling outlet used (Farmgate direct sales, use of middlemen and own distribution)

**β =** coefficient associated with each explanatory variable

**Ꜫ** = is the error term

Gender, education and age refer to demographic features of producers. Education level and gender are dummy categorical variables while age and land size are continuous variables.

# CHAPTER FOUR

# RESULTS AND DISCUSSION

The outcomes of data analysis are covered in this chapter, along with discussions on the outcomes. The results are displayed in tables of frequencies and percentages for the categorical variables while the continuous variables are displayed in tables of means and standard deviations. The model outputs are also displayed in tables indicating the model coefficients and significant outcomes in form of p values. The results start with the sociodemographic factors and characteristics, followed by econometric analysis and finally model analyses. The interpretation is discussed after every result is displayed.

## 4.1 Socio-demographic characteristics of respondents

The sociodemographic factors included the age brackets of the respondents, the gender of the household head, and the educational attainment level of the respondents. The results of the factors are displayed in the tables below.

### 4.1.1 Producers Age

##### Table 4. Age Distributions for producers in Isiolo County

|  |  |  |
| --- | --- | --- |
| Age of the producer | Frequency | Percentage |
| 30 years and below  30-39  40-49  50-60  60 and above | 6  29  64  58  36 | 3  15  33  30  19 |
| Total | 193 | 100 |

*Source: Field survey 2022*

As shown on Table 4.1, most farmers were in their middle age with an average of 49.41. The findings are higher than those of the sorghum agricultural survey conducted by (Sirma A J *et al.,* 2016) which found that the average was 41.32. The producer's varied between 23 to 88, with a standard deviation of 10.69 years. According to these findings, 51 percent of the producers are under the age of 50. This suggests that sorghum producers are of productive age, meaning they are energetic and hence capable of actively participating in sorghum production and other economic activities.

These results concur with those of (Ogeto *et al.,* 2013) who discovered that 58.3% of sorghum producers were in their middle age. The lower age of Isiolo sorghum farmers can be explained by the intense climate change which has made the production of other crops in the region next to impossible thus more people opt for sorghum which is hardy and more suitable for the prevailing weather conditions.

### 4.1.2 Gender of Producers

##### Table 4.2 Gender of sorghum producers in Isiolo County

|  |  |  |
| --- | --- | --- |
| Gender of the producer | Frequency | Percentage |
| Men  Women | 132  61 | 68  32 |
| Total | 193 | 100 |

*Source: Field survey 2022*

The results revealed that males dominated the sorghum production at 68% while the females were at 32%. This shows that there is a gender gap in the sorghum industry. The imbalance may be expounded by the verity that sorghum production in Isiolo county is seen as a laborious task because of the numerous production tasks required, including guarding the crop from predators and managing bulkiness during harvest.

This study’s’ vary from those of (Ogeto *et.al.,* 2013) who found that females were made up of a higher proportion in sorghum production at 54.6% in contrast to males who were at 45.4%. However, both studies indicate the existence of gender imbalance in sorghum production.

### 4.1.2 Sorghum producers’ education level of

##### Table 4. Education level of the producers in Isiolo County

|  |  |  |
| --- | --- | --- |
| Education level | Frequency | Percentage |
| No formal education  Primary level  Secondary level  Tertiary level | 51  78  47  17 | 26  42  24  8 |
| Total | 193 | 100 |

*Source: Field survey 2022*

This survey findings show that most sorghum farmers had basic primary education at 42 percent while secondary, tertiary, and non-formal followed at 24, 8, and 26 percent respectively. The farmer’s education level influences market participation, and resource management and contributes to the degree of technology adoption in production (Lanyasunya *et al*., 2001).

This study concurs with that of (Ogeto *et al.,* 2013), Which indicated that the majority of sorghum producers in Nakuru county had primary education. This could be linked to the fact that basic primary education in Kenya is free. From these findings, it is clear that most producers are literate hence they have a lower risk of being exploited by traders or middlemen since they can do information searches. Literate producers are also more decisive.

## 4.2 Socio-Demographic Characteristics of Sorghum Traders

### 4.2.1 Age of Traders

##### Table 4.4 Age Distributions for traders in Isiolo county

|  |  |  |
| --- | --- | --- |
| Age of the trader | Frequency | Percentage |
| 30 years and below  30-39  40-49  50-60  60 and above | 8  27  35  9  4 | 10  33  42  11  5 |
| Total | 83 | 100 |

*Source: Field survey 2022*

The mean age of sorghum traders in Isiolo county was 41.3. According to table 4.4., the percentage of traders interviewed below the age of 30,40,50,60, and above 60 were 10,33 42,11, and 5 percent respectively. According to the findings of the study, sorghum trade in Isiolo county is an industry that is dominated by middle-aged workers.

### 4.2.2. Gender of Traders

##### Table 4.5 Gender of sorghum traders in Isiolo county

|  |  |  |
| --- | --- | --- |
| Gender of the producer | Frequency | Percentage |
| Men  Women | 19  64 | 22.8  77.2 |
| Total | 83 | 100 |

*Source: Field survey 2022*

According to the outcomes of this research, most traders were females at 77.2 percent while 22.8 were males. From the analysis, it is evident that female traders dominated in trading of sorghum in Isiolo county. This gender imbalance between traders could be attributed to the fact that cereals trading in Isiolo county is culturally considered feminine.

It’s in agreement with (Babarinde *et.al.,* 2016), which stated that females dominated at 89.1 percent while the males were at 10.9 percent.

### 4.2.3. Education level of Traders

##### Table 4. 6 Education level of traders in Isiolo County

|  |  |  |
| --- | --- | --- |
| Education level | Frequency | Percentage |
| No formal education  Primary level  Secondary level | 14  35  34 | 17  42  41 |
| Total | 83 | 100 |

*Source: Field survey 2022*

According to the findings of the study, 41% of the traders surveyed had middle education level, 42 percent with a primary level while the non-formal education had 17 percent. The analysis shows that most of the sorghum, traders in Isiolo county had a comparatively middle education level. This could be caused by fact that education in Kenya is free up to the primary level. According to (Smale *et al.,* 2008), traders with basic formal education, have advanced techniques and skills and therefore they are more likely to make informed decisions such as price setting and negotiations since they can carry out information searches. Therefore, it is clear from the study's findings that Isiolo traders are not particularly susceptible to being taken advantage of. However, this study differs from that of (Pakwan , 2008), whereby in his evaluation of sorghum trading, a bulk of the traders lacked formal schooling.

### Determination of market structure, conduct, and performance

### 4.3.1 Market structure

### 4.3.1.1 Traders’ market concentration

The average quantity of sorghum traded was 114.92 per person per season with a total of 9538Kgs. Most traders’ sales ranged between 3,000 and 6000 Kgs of sorghum per season. Traders typically sold 620,961.5 Ksh worth of sorghum per season.

The trader’s Gini coefficient was 0.612 (Table 4.7), suggesting that there was little competition because the market for dealers was highly concentrated hence oligopoly.

##### Table 4.: Gini coefficient for traders in Isiolo county (retailers and wholesalers)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Quantity sold (Kgs)** | **No of traders** | **The proportion of Traders (X)** | **Cumulative %** | **Sales (Ksh)** | **Proportion of Total Yearly Sales** | **Cumulative (Y)** | **XY** |
| 0-3000 | 17 | 0.205 | 0.205 | 23500 | 0.038 | 0.038 | 0.008 |
| 3000-6000 | 32 | 0.386 | 0.591 | 161956 | 0.261 | 0.299 | 0.115 |
| 6000-9000 | 23 | 0.277 | 0.868 | 167535 | 0.270 | 0.569 | 0.158 |
| 9000-12000 | 2 | 0.024 | 0.892 | 20730 | 0.033 | 0.602 | 0.015 |
| 12000-15000 | 2 | 0.024 | 0.916 | 28500 | 0.046 | 0.648 | 0.016 |
| 15000-18000 | 0 | 0.000 | 0.916 | 0 | 0.000 | 0.648 | 0.000 |
| 18000-21000 | 2 | 0.024 | 0.940 | 39000 | 0.063 | 0.711 | 0.017 |
| Above 21000 | 5 | 0.060 | 1.000 | 179740 | 0.289 | 1.000 | 0.060 |
| **Total** | **83** | **1.000** |  | **620961** |  |  | 0.388 |
| **Gini coefficient 0.612** | | | | | | | |

#### Figure 4.: Lorenz curve for traders in Isiolo county

Several researchers have used the Lorenz curve as well as Gini coefficient to address market structures of different agricultural products. In South Sudan for instance, Ngigi (2008) discovered that the grain market had a Gini value of 0.7, an indication that the market was crowded. In Pwalungu Ghana, the coefficient was adopted by (Haruna *et al*., 2012) to find out Tomatoes’ market concentration and found that it was highly concentrated at 0.64 and 0.58 for retailers and wholesalers respectively. A Gini value of 0.54 and 0.54 for traders and processors each, was discovered by (Tiku *et al*., 2012) during a study on palm oil traders in the Nigeria’s Cross river state, an implication that the market was oligopoly in nature. Zorinah (2016) In a study on cabbage markets performance in Botswana's central district, it was also discovered that traders and wholesalers Gini factors were, at 0.672 and 0.509, singly, indicating that the market was less competitive. However, some studies have had different and contrasting outcomes. (Ugwumba, 2011) in Nigeria discovered a Gini coefficient of 0.19 and 0.26 between retailers and producers during a study of the live-catfish market structure in Anambra State, indicating a competitive market

**Market Performance**

## 4.4 Gross Margin

The gross margin from the sale of sorghum for the wholesalers was 9.7 per kilogram while the total gross margin was 29424.4. The total revenue was 193695 while the total cost stood at 164270 accounting for the aforementioned gross margin per kilogram and the total gross margin. The gross margin of sorghum sales is tabulated below.

##### Table 4.: Wholesaler’s Gross Margin

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Wholesalers Gross Margin** |  |  |  |  |
| Item | Unit | Quantity | Price | Total |
| **Revenue** |  | 3018 | 64.18 | **193695.2** |
| Output | Sorghum in kg |  |  |  |
| **Variable cost** |  |  |  |  |
| Buying cost |  | 3018 | 45.38 | 136956.8 |
| Transport | kg/ha |  |  | 9950 |
| Loading and Off-loading costs | Ltr/ha |  |  | 3450 |
| Marketing Loss |  |  |  | 5594 |
| Marketing Cost |  |  |  | 8320 |
| **Total Variable Costs** |  |  |  | **164270.8** |
| **Gross Margin** |  |  |  | **29424.4** |
| **Gross Margin /kg** |  |  |  | **9.749636** |

*Source: Field survey 2022*

**Retailers gross margin**

The table below summarizes the gross margins for the retailers. The total revenue for retailers stood at 406652, the total variable cost stood at 372480 thus making the gross margin to stand 34172 which translates to 5.24113 per kilogram of sorghum.

##### Table 4.: Retailer’s Gross Margin

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Retailers' Gross Margin** |  |  |  |  |
| Item | Unit | Quantity | Price | Total |
| **Revenue** |  | 6520 | 62.37 | **406652.4** |
| Output | Sorghum in kg | |  |  |
| **Variable cost** |  |  |  |  |
| Buying cost |  | 6520 | 45.07 | 293856.4 |
| Transport | Ksh/ha |  |  | 25600 |
| Loading and Off-loading costs | Ksh/ha |  |  | 9500 |
| Marketing Loss | Kg/ha |  |  | 12683.83 |
| Marketing Cost | Ksh/Kg |  |  | 30840 |
| **Total Variable Costs** |  |  |  | **372480.2** |
| **Gross Margin** |  |  |  | **34172.17** |
| **Gross Margin/kg** |  |  |  | **5.24113** |

*Source: Field survey 2022*

**Producer gross margin**

The table below summarizes the results of gross margin calculation for the producers. The revenue realized by the producers is 479611, against 358142 in variable costs thereby realizing 121468 in gross profit margin which translates to 11 per kilogram.

##### Table 4.: Producer’s Gross Margin

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Producer Gross Margin** | |  |  |  |
| Item | Unit | Quantity | Price | Total |
| **Revenue** |  | 10634.4 | 45.1 | **479611.4** |
| Output | Sorghum in kg |  |  |  |
| **Variable cost** |  |  |  |  |
| Labor |  |  |  | 202540 |
| Labor-weeding |  |  |  | 50640 |
| Seeds | kg/ha |  |  | 31650 |
| Production Loss |  |  |  | 22672.8 |
| Harvesting cost |  |  |  | 50640 |
| **Total Variable Costs** | |  |  | **358142.8** |
| **Gross Margin** |  |  |  | **121468.6** |
| **Gross Margin/kg** |  |  |  | **11.42224** |

*Source: Field survey 2022*

Reporting and understanding the gross margins are very important as it calculates the profits of the core business under operation using the variable costs while excluding the fixed costs. The gross margin for wholesalers is higher compared to that of retailers owing to the differences in quantities sold. The gross margins for both retailers and wholesalers are positive thus indicating positive indices in gross profits in the business of sorghum. The differences could be attributed to the distances to the market, seasonality and the quantities sold by the different stakeholders. The gross profit margin is greatest among the producers bearing in mind that fixed costs are not included in the calculation.

## 4.5 Total Gross marketing margin (MM)

The pricing differential between two separate points in a marketing channel is known as the marketing margin. (Smith, 1992).

The final consumer price from the producer is 62 while the producer price is 45.10. The marketing margin for the whole process from the producers to the final consumers is 27%. This means that the average cost of acquiring a customer is 27% more buying price from the producer. The marketing cost is passed down to the consumer and thus the consumers buy at a higher cost.

**TGMM=** X100 = 27%

## 4.6 Marketing efficiency

This is the extent to which the present market prices mirror all obtainable and applicable knowledge regarding the real worth of the product traded that offers maximum possible opportunities for traders to buy and sell without incurring additional transactional cost (Rösch *et.al.*, 2017). It provides a financial and marketing feasibility estimate for carrying out any extra services. A signed estimate that is positive would support the use of such services, whereas an estimate that is negative would show contrary. (Abdou, 2007). From this study the value was positive hence demonstrates the need for supplementary marketing activities to be used in the entire chain.

Marketing Efficiency (ME) = = 31.7% / 0.32

## 4.7 Market Conduct

This was assessed using the following variables; Product differentiation, promotion and advertisement procedures, Price setting and product differentiation, entry, and exit behaviors. The extent of collaboration was assessed by examining whether traders could join trade associations to control the market by fixing or reducing prices to keep new competitors out, resulting in anti-competitive market practices or not. Despite having no barriers to this trader had no form of coordination or trade unions The market's various purchasing and selling activities were also studied. Price setting was a major query for this research to find out how the prevailing market and farm gate prices are set. It was noted that there exists no reliable way of price determination nut instead the demand and supply forces majorly determine at how much sorghum will bet traded at. Rates of sorghum were not openly advertised since it was a uncompetitive market, thus dealers were charging varied prices. This research also looked into whether traders had a way to differentiate their sorghum to ensure it is distinguished and more appealing to consumers and minimal value addition activities were note. Only very few traders had invested on value addition activities such as proper packaging. No notable efforts on advertising, packaging, or branding efforts for sorghum were recorded.

## 4.8 Determinant of sorghum producer market supply

To determine marketable sorghum supply, multiple linear regression was applied. The dependent variable is the sum of sorghum availed for sale by farmers from within Isiolo County only in Kgs.

|  |  |  |
| --- | --- | --- |
| Table 4.11: Determinants of sorghum producer market supply | | |
| **Variable** | **Coefficient** | **Std. Error** |
| Age of HH | 0.238\*\*\*(4.23) | 0.033 |
| Distance to the market | -0.009(-1.14) | 0.009 |
| ­Experience | -0.020(-1.45) | 0.006 |
| Sorghum land size | 0.893\*\*\*(7.34) | 0.044 |
| Price (SP) | 0.915\*\*\*(7.59) | 0.053 |
| Education | 0.007\*(1.73) | 0.004 |
| Cooperative membership | 0.019\*(2.41) | 0.008 |
| Gender | 0.015\*(2.12) | 0.007 |

*Source: Field survey 2022. \*Statistically significant at 10% level, \*\* statistically significant at 5% level, \*\*\* statistically significant at 1% level, t- values in parenthesis.*

According to the results of this study, the household head age influences the quantity of sorghum supplied to the market positively. The positive sign shows the direct relationship between the age and the amount of sorghum supplied to the market. This means for additional year, the quantity of sorghum supplied increased by 0.238 units. This could be associated with sorghum producers being at a productive age, meaning they are energetic and hence capable of actively participating in sorghum production and other economic activities.

Gender was a dummy variable encoded 1 female and 0 male. As shown, it has a positive effect on the quantity supplied. Females could be attributed to have better ways and strategies to post-harvest losses as compared to men thus the expected positive effect in market supply. The results indicated that when respondent being a female, the sorghum supplied will increase by 0.015 units.

Education level had a positive influence on the sorghum supply. Educated producers have more knowledge and experience that allow them to interpret information about the market.

This could reduce market cost, improve post-harvest handling mechanisms and market participation profitability. Thus, an increase in one year of education will result to an increase of sorghum supply by 0.007 units.

The selling price of sorghum impacted the volume of sold produce emphatically and was notable at 1%. This was an indication that sorghums market price rises, the volume of the sorghum traded in the market also increases, which increases the quantity of sorghum sold per producer. This means that price increase by 1 unit will boost the sorghum supply by 0.915 units.

Land size referred to the portion of land specifically set aside for sorghum production. It was positively linked to sorghum supply in the market. As portion of land allocated to sorghum increase by 1 hectare, the quantity of sorghum supplied increase by 0.893 units.

Being a member of the cooperative had a positive influence on the quantity of sorghum market supply. The regression confirmed that being a member of a cooperative, farmers will tend to boost the amount of marketable sorghum by 0.019 units. This implies that obtaining and verifying information through cooperative helps to supply more quantities of sorghum. In addition, adequate market channels and information on prices come in handy through a cooperative and help to pool together the risks.

The R2 which is the correlation of determination was at 93.79%. It means that 93.79% in the sorghum supply has been explained by the above variables. The F-statistic was less than 0.0001 which indicated that the general significance of the model was a good fit. This study concurs with that of (Wondim *et.al.,*20017)

ontheir study on determinants of maize market supply, production and marketing constraints in Denbela district of Ethiopia which also found that house hold size, education level and area under cultivation were significant determinants of marketable supply. However, this study differs from that of (Kaso et.al.,2015) during a study on wheat market supply determinants in Arsi district of Ethiopia which found education level was not a significant factor influencing marketable supply by producers.

## 4.9 Determinant of sorghum trader market supply

The supply of the sorghum trader market was predicted using multiple linear regression. The dependent variable was the quantity of sorghum supplied in the market in kilograms. The models result showed that experience, age, and whether one is a wholesaler or retailer, buying and selling price were statistical significance. They are the variables that influence the trader market supply.

|  |  |  |
| --- | --- | --- |
| Table 4.11: Determinants of sorghum trader market supply | | |
| **Variable** | **Coefficient** | **Std. Error** |
| Age | 0.745\*(2.00) | 0.373 |
| Buying price | -1.173\*(-1.89) | 0.619 |
| ­Selling price | 1.883\*(2.88) | 0.653 |
| Trader type | -0.661\*\*\*(-5.97) | 0.111 |
| Gender | 0.106(1.34) | 0.079 |
| Education | -0.033(-0.69) | 0.048 |
| Experience | 0.031\*(2.44) | 0.012 |

*Source: Field survey 2022. \*Statistically significant at 10% level, \*\* statistically significant at 5% level, \*\*\* statistically significant at 1% level, t- values in parenthesis.*

According to the results, the age of the trader influences the amount of sorghum supplied positively. The positive sign shows the direct relationship between the age and the amount of sorghum supplied to the market. This means for traders’ additional year, there is an increase in the quantity of sorghum by 0.745 units. This could be associated with traders being at an informative age with accessibility to information meaning they are energetic and hence capable of actively participating in search for sorghum produce and other economic activities.

As a dummy Trader type was coded 1 retailer and 0 wholesaler. As demonstrated, it has a detrimental impact on the amount delivered. The results indicated that when respondent being a retailer, the sorghum supplied will decrease by 0.661 units. On average the value of sorghum quantity is lower for retailers than it is for wholesalers. This could be attributed by the marketing channel the retailers are using to get the quantity. The longer the channel, the more the cost which reduces the quantity of supply. More so, inadequate information on availability of produce by the retailers could lead to lower volumes of supply.

Being a trader with experience positively influenced the quantity of sorghum supplied to the market. The regression confirmed that having experience in trading will tend to increase the amount of marketable sorghum by 0.031 units. This could be because an experienced trader can obtain information from previous networks of producers which aids to supply more quantities of sorghum. In addition, they are more aware of adequate market channels and information on prices enabling them to have more supply of the produce.

The selling price of sorghum affected the volume of traded produce positively and was significant ay 1%. This implied that as the market price of sorghum rises, the amount of the sorghum traded in the market increased as well. This means that an increase in price by I unit will increase the sorghum supply by 1.883 units. This could be due to the high demand in sorghum which may be at lower quantities which led to high prices and consequently, traders would sell expensively so as to make more profits.

The buying price of sorghum from producers influenced the volume of marketed produce negatively. This prompted that as the buying cost of sorghum at farm level decreased, the aggregate sorghum sold in the market also decreased. This means that a decrease in price by I unit would reduce the sorghum supply by 1.173 units. This would be because the producers would hold the produce and opt to sell at a later date due to the low prices offered to them.

The R2 which is the correlation of determination was at 94.87%. It means that 94.87% in the sorghum supply has been explained by the above variables. The F-statistic was less than 0.0001 which indicated that the overall significance of the model was a good fit. This study is in line with that of (Belayneh et.al.,2022) found out education level, price as well as experience as significant factors influencing marketable trader supply during the study on determinants of sesame market supply in west Omo Ethiopia.On the contrary (Roy *et.al*.,1975) during an econometric analysis of the sorghum market identified house age as a non-significant factor determining trader suplly.

## 4.10 Marketing channel choice determinants

Marketing choice of sorghum farmers were farm gate or direct sales, use of middlemen and own distribution. Producers were identified in either of these categories. From our MNL, response variable is the choice of sorghum outlet and was categorized into three with farm gate choice being the base category. The change in the logit for a one-unit change in the independent variable is evaluated by the approximated coefficients, which hold the other explanatory variables continual. A responder is more likely to pick the stand-in channel outlet if the estimated coefficient is positive, whereas a producer is less likely to choose the substitute market outlet if the projected coefficient is negative. Table 4.12 provide results of the multinomial logistic regression.

##### Table 4.12: Results of Multinomial Logit regression on sorghum market outlet choices

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables | Own distribution (Coefficients) | Std. error | Use of middle men  (Coefficients) | Std. Error |
| Age  Gender of HH  Experience  Distance to the market  Education   * Primary * Secondary * Tertiary   Farm size  Coop. membership  Market information | 1.242\*(1.86)  0.519(0.90)  - 0.494(-0.39)  -0.690(-0.81)  1.338\*\*(2.31)  3.041\*\*\*(3.26)  1.267(1.42)  0.977(0.38)  -1.143\*\*(-2.02)  2.940\*(1.92) | 0.667  0.578  1.271  0.851  0.578  0.932  0.891  2.543  0.567  1.650 | 0.787(1.31)  3.114(1.06)  -0.790\*(-1.18)  -1.983\*\*(-1.91)  0.474(0.64)  2.490\*\*(2.41)  -0.315(-0.27)  6.317\*\*(2.11)  0.357(0.54)  1.933(1.36) | 0.625  2.938  0.567  1.040  0.357  1.035  1.168  2.992  0.667  0.938 |

*Source: Field survey 2022. Number of observations: 193, LR chi2 (36) = 62.34. Pseudo R2= 0.2560, Prob > chi2 = 0.0042. Log likelihood = -168.670*

*\*Statistically significant at 10% level, \*\* statistically significant at 5% level, \*\*\* statistically significant at 1% level, t- values in parenthesis. Base is farm gate outlet*

The likelihood ratio test and the Chi-Square goodness of fit test were used to evaluate a model's overall fit. By contrasting the fit of two models with and without the predictor variables, the likelihood ratio test determines how well all of the independent variables relate to the multinomial response variable. Based on the results of the MNL regression, the Likelihood Ratio (LR) Chi-Square of 62.34 shows that none of the independents' regression coefficients are equal to zero. The p-value confirmed that there are factors influencing sorghum market decision because it was significant (p-value = 0.0042). The probability of picking a certain outlet serves as the outcome variable in this regression. Two models were approximated for the likelihood of I choosing to sell to middlemen outlets relative to farm gate and (ii) opting to sell via own distribution relative to farm gate based on the estimate's two replicates of explanatory variables. The age coefficients in both models were positive although significant in only one at 10%. This suggested that older producers have the likelihood of choosing own distribution and use of middlemen by 124.2 % and 78.7% individually compared to farm gate outlet. The results imply that age increases the likelihood of choosing own distribution relative to farm gate outlet. It is significant to notice that access to resources including money, family labor, equipment, buildings, and land is increased with age in Kenya's traditional society. As a result, it is anticipated that the majority of middle-aged producers work for themselves through their own firms. This allows them to take care of their dependents and themselves. As such, they could be selling individually making it more significant from our results.

In both models, the coefficients for educational attainment were statistically significant and positive. The findings insinuate that literate producers to a greater extent will choose own distribution and use of middle men relative to farm gate outlet. The impact of educational requirements on successful entrepreneurship varies by nation, it is crucial to remember this. For instance, in Kenya, elementary and secondary education can promote the expansion of small and medium-sized businesses. Because of this, it is believed that the elementary and secondary education of a large portion of the sorghum producers in this research is sufficient for them to make wise decisions about their market outlet.

The coefficients of choosing an outlet in regards to experience in both models although statistically significant in use of middle men were negative. Having more experience as a producer decreases the probability of choosing the outlet to own distribution and use of middlemen by 49.4% and 79% respectively. Increase in experience is likely to increase the choice to farm gate outlet against own distribution and use of middlemen. This could be because, the market is not constant and these changes and new prices are adopted during particular seasons. As such, having more experience will not be a major determinant to choose due to the unpredictable market patterns.

Although significant in one model, the negative distance to market coefficients suggests that a kilometer reduction in market distance reduced likelihood of selling sorghum through direct distribution and through the use of middlemen relative to farm gate by 0.690 and 1.983 units, respectively. The research demonstrates that farmers' decisions to sell their sorghum products through farm gate outlets were favorably impacted by their distance to the market. Distance to market could motivate producers to sell at farm gate prices due to high transportation costs to the market place through own distribution and less prices from middlemen.

The possibility of boosting sorghum production by 35.7 percent with the employment of middlemen as opposed to farm gate is suggested by the positive coefficient of participation in cooperative society in the first model. Nevertheless, the second model's negative coefficient indicates that it reduces the likelihood of selling sorghum through own distribution relative to farm gate by 1.143 units. The fact that many of the sorghum growers joined to a cooperative, which offered a platform for information and knowledge sharing, may be responsible for this discrepant conclusion. Due to the positive access to market information coefficients in both models, there is a 294 and 193 percent greater chance of picking one's own distribution and using middlemen in comparison to farm gate, respectively, when one is more aware of market trends like pricing. Even more so, the statistical significance of access to market information in own distribution suggests that it has a considerable impact on sorghum sold separately. The finding suggests that the choice of market outlet is determined by market information, since one is able to gather knowledge on what’s in happening in the market. The details of pricing in the final market where sorghum is to be sold influence the kind and degree of value to be sold as well as the selection of market outlet that will work best for a producer to a reasonable extent. The positive coefficients of farm size under sorghum production although significant in one model imply that an addition in the size of farm under sorghum production by 1 ha increases the probability of sorghum sold by choosing the market outlet via own distribution and use of middlemen relative to farm gate by 0.977, and 6.317 units respectively. The result indicates that an increase in land size for sorghum production positively influences market choice decision to sell individually or use middlemen. More so, land size was statistically significant in use of middle men suggesting it has a significant influence on sorghum sold via this outlet. This could be because, increased land size will lead to increased sorghum production and hence there will be a surplus in the market. This will reduce the buying price from the producers due to the excess sorghum in the market. As a result, the producers’ will sell to the middlemen to avoid losses thus the positive influence in our model. The results of this research agree with those of James (2014) who found that farm size, gender, age and education had a greater impact on farmers decision on marketing channel selection. However, other studies for instance that of Gockowski &Ndoumbe (2004) and Mussie *et al*. (2001) found a negative link amongst selling outlet selection as well factors such as farm size.

# CHAPTER FIVE

# SUMMARY, CONCLUSION AND RECOMMENDATION

## 5.0 Introduction

## 5.1 Summary

This study analyzed the market chain of sorghum market system in Isiolo County in terms of structure, conduct, and performance. The distinct goals were; to examine the marketable sorghum supply determinants , to investigate structure, conduct and performance of sorghum market and to establish the causal factors of marketing channels choice and selection among smallholder sorghum farmers in Isiolo County .Descriptive data were employed to provide a broad socioeconomic profile of the producers and dealers., Gini coefficient to estimate the market concentration, gross margin to evaluate market performance, multiple linear regression analysis was adopted to access the marketable sorghum supply and multinomial logit in establishing the variables influencing farmers choice of market outlet.

Sample size consisted mostly of male producers at 68% while the traders are mostly women at 77.2%. Most respondents were in the age brackets between 30 – 49 for both producers (64%) and traders (35%). Most producers and traders have attained basic education (78%) and traders at 42%. The estimated Gini value of 0.612 demonstrated a highly concentrated market with little competition. The gross margin for retailers was ksh 5.24 per kilogram, ksh 9.7 per kilogram for wholesalers and ksh 11.42 per kilogram for the producers.

Among other actors, the producers gain highest proportions of profit compared to their counterparts. Marketing of sorghum has a positive index in profits and sales and therefore vital for increase in revenue generation.

Multiple linear regression was employed to predict sorghum producer markets supply. Factors such as gender, selling price, farm size under sorghum production, producers’ age, education level and membership to a cooperative were found to be positive and statistically significant. In addition, to predict the sorghum trader market supply, results indicated that experience, age, selling price were positive and statistically significant while buying price and trader type were negative but significant. To determine the market outlet used by the producer, multinomial logit regression was applied. Age, education level, farm size under sorghum production, access to market information were positive and significant while membership to a cooperative group, experience and distance to the market were negative but significant.

## 5.2 Conclusion

This study concludes the following;

To start with, since the Gini coefficient was 0.612 it can thus be concluded that trader’s market was crowded and therefore its structure was not competitive. Sorghum was exchanged on average at 114.92 kg per person every season, for a total of 9538 kg. Most traders sold between 3,000 and 6000 Kgs of sorghum in a season with an average sale amounting to Ksh 620,961.5 per season.

Secondly, the performance of sorghum market in Isiolo County can be defined as oligopolistic. When compared to sorghum merchants, producers were shown to have larger gross margins (Ksh11.42) (wholesalers and retailers with Ksh7 per kilogram and Ksh5 respectively). The gross margins for both retailers and wholesalers are positive thus indicating positive indices in gross profits in the business of sorghum

Thirdly, this study affirms that besides quantity produced, different factors influence the amount of sorghum supplied in the market. Marketable sorghum in Isiolo sorghum market is influenced by gender, age, education level, farm size under sorghum production, cooperative membership, as well as selling price since they were statistically Significant. Age, experience, trader type, selling and buying price also had a significant influence in sorghum trader market supply.

Fourthly, from the multinomial logit regression it can be concluded that various selling outlets are preferred by producers depending on several factors. For instance, age, education level, farm size under sorghum and access to market information were all positive and significant in the model suggests an increase in probability that a producer will prefer own distribution and use of middlemen relative to farm gate outlet. A producer is less likely to pick intermediaries and own distribution than to choose for farm gate when factors like expertise, proximity to the market, and cooperative membership have a negative approximated correlation value.

Lastly since the marketing efficiency value (MEI) was positive 0.32, it can be concluded that additional marketing services that boost the degree to which the current market prices would reflect all available, relevant information about the actual value of the sorghum traded that offers maximum possible opportunities for traders to buy and sell without incurring additional transactional can be applied.

## 5.3 Recommendations

Following are some suggested policies based on this study's findings;

First, to make the market more competitive policies that advocate for value addition and product differentiation of sorghum should be developed. This will ensure that traders are not only focused on selling raw sorghum. Some can add value by investing in packaging or engaging in processing raw sorghum into products such flour. The governments should strengthen value addition of sorghum, processing cooperatives and improve their infrastructure facilities either directly through cash transfers or grants to producers and traders or linking them to donors and investors.

Secondly, since pricing affected the supply of marketable sorghum, it is necessary to put in place an institutional framework to govern sorghum contracts and aid market participants in contract negotiations. This will lessen the likelihood of a market that is closed and uncompetitive. By putting these regulations into place, the county's general sorghum market may become more effective and coordinated, guarantee fair returns to all market participants, and maintain appropriate gross margins for both farmers and dealers.

Thirdly this study suggests that access to market information should be made better by way of improving implementation action plan or upgrading and reinforcing the already in place policies since access to information was significant factor influencing selling outlet choice and selection. The latter should be done to enable the farmers get information on current prices and devise means to reduce losses by providing with post-harvest techniques. Information should be readily available either through media or mobile applications and Unstructured Supplementary Service Data (USSD).

Lastly to optimize efficiency by managing risk and uncertainties, this study recommends that producers should be offered with certified planting seeds and given relevant financial aid to increase the area under cultivation and boost their harvest since farm size was statistically significant. This will help to increase the quantity of marketable sorghum supply hence more income to both producers and traders hence improving their well-being and the economy at large. Certified seeds that are tolerant and suitable to the prevailing weather conditions will also shield producers from risk and uncertainties.

# REFERENCES

Abdou, A. I. (2007). Modified marketing efficiency criteria for consideration in cropping structure planning: a case of newly reclaimed land farmers in Egypt. In 16TH INTERNATIONAL FARM MANAGEMENT ASSOCIATION CONGRESS, A VIBRANT RURAL ECONOMY–THE CHALLENGE FOR BALANCE

Africa the Good News (2011). Kenyan Farmers Drawn to Sorghum Crops. June 9.

Babarinde, S. A., Ajiboye, O., Adeleye, A. D., & Pedro, T. J. (2016). Survey of insect infestation of stored grains and management of the pest problems by grain merchants in Ogbomoso Metropolis, Southwestern Nigeria.

Bain, J. S. (1986). Structure versus conduct as indicators of market performance: the Chicago-school attempts revisited. *Antitrust L. & Econ. Rev.*, *18*, 17.

Beamon, B. M., & Chen, V. C. (2001). Performance analysis of conjoined supply chains. *International journal of production research*, *39*(14), 3195-3218.

Beinah, A., Kunyanga, C., & Ngugi, K. (2020). Utilization and Processing of Sorghum by Small Holder Farmers in Drought Prone Agro-Ecological Zones of Kenya.

Belayneh, A. W., Yesho, E. G., & Gemeyida, K. H. (2022). Determinants of sesame market supply in West Omo and Bench Sheko zones, Southwest Ethiopia. *International Journal of Agronomy*, *2022*.

Brown, C., Miller, S. M., Boone, D. A., Boone Jr, H. N., Gartin, S. R., & McConnell, T. R. (2007). The Importance of Farmers’ Markets for West Virginia Direct Marketers. *Renewable Agriculture and Food Systems*, *22*(1), 20-29.

Chang, Y. C., Yu, S. Y., & Chen, R. S. (2010). Industry Concentration, Profitability and Stock Returns. *Information Management, Innovation Management and Industrial Engineering 2010 International Conference*, *3*, 45-48.

Chimoita, E. L., Onyango, C. M., Gweyi-Onyango, J. P., & Kimenju, J. W. (2019). Socio-economic and institutional factors influencing uptake of improved sorghum technologies in Embu, Kenya. *East African Agricultural and Forestry Journal, 83(2), 69-79*, *83*(2), 69-79.

Dahlberg, J., Berenji, J., Sikora, V., & Latkovic, D. (2011). Assessing sorghum [Sorghum bicolor (L) Moench] germplasm for new traits: Food, fuels & unique uses. *Maydica*, *56*(2), 165.

Edwards, S., Allen, A. J., & Shaik, S. (2006). *Market Structure Conduct Performance (SCP) Hypothesis Revisited using Stochastic Frontier Efficiency Analysis. In Selected Paper submission at the AAEA Annual Meetings*. Long Beach, CA.

Fafchamps, M., & Gabre-Madhin, E. Z. (2006). Agricultural markets in Benin and Malawi. *African Journal of Agricultural and Resource Economics*, *1*(311-2016-5507), 67-94.

Ferguson, P. R., & Ferguson, G. J. (1994). *Industrial Economics: Issues and Perspectives* (2nd ed.). The Macmillan Press LTD.

Floros, J. D., Newsome, R., Fisher, W., Barbosa‐Cánovas, G. V., Chen, H., Dunne, C. P., ... & Ziegler, G. R. (2010). Feeding the world today and tomorrow: the importance of food science and technology: an IFT scientific review. *Comprehensive Reviews in Food Science and Food Safety*, *9*(5), 572-599.

Girei, A. A., Dire, B., Salihu, M., & Iliya, M. M. (2015). Assessment of Problems Affecting the Structure, Conduct and Performance of Cowpea Marketing in Yola North and Yola South Local Government Areas in Adamawa State, Nigeria. *Brit. J. Market. Stud*, *1*, 41-50.

Giroh, D. Y., Umar, H. Y., & Yakub, W. (2010). Structure, Conduct, and Performance of Farm Gate Marketing of Natural Rubber in Edo and Delta States. *African Journal of Agriculture Research*, *1780*(1783).

Gupta, C., & Jablonski., B. R. (2016). Farm Impacts of Farm-to-Grocer Sales: The Case of Hawai’i. *Journal of Food Distribution Research*, *47*(3), 61-83.

Gu-Shin, Tung, Lin Ching-Yi, and Wang Chih-Yuan. "The market structure, conduct and performance paradigm re-applied to the international tourist hotel industry." *African Journal of Business Management* 4, no. 6 (2010): 1116-1125.

Hardesty, S. D., & Leff, P. (2010). Determining marketing costs and returns in alternative marketing channels. *Renewable Agriculture and Food Systems*, *25*(1), 24-34.

Haruna, I., Nkegbe, P., & Ustarz, Y. (2012). Structure, conduct and performance of tomato marketing in Ghana. *Journal of Economics and Sustainable Development*, *10*(3), 2222- 2855.

Jordan, D. R., Mace, E. S., Cruickshank, A. W., Hunt, C. H., & Henzell, R. G. (2011). Exploring and exploiting genetic variation from unadapted sorghum germplasm in a breeding program. *Crop Science*, *51*(4), 1444-1457.

Joshi, N. (2020). *Future crop suitability assessment and the integration of Orphan crops into Kenya's food systems* (Master's thesis, Faculty of Science).

Karanja, D., Kamau, C., Muthoni, L., Kaguma, A., Kariuki, C. W., Kavoi, J., Ochieng, A., Wafula, W J., Ariithi, C.C.K. and Kega, V. (2009). *Improving F****o****od Security and Income of Farmers in ASALs Through Commercialization of Gadam Sorghum Project.* Unpublished. KARI-Kaumani, Machakos, Kenya.

Kaso, T. (2015). Market supply and value chain analysis of wheat: the case of Tiyo and Hetosa districts in Arsi, Ethiopia. *Jimma University*, 1-14.

Kilambya, D., & Witwer, M. (2019). Analysis of incentives and disincentives for sorghum in Kenya. *Gates Open Res*, *3*(441), 441.

Kiome, R. M., Bamanya, B. G., Wamwere-Njoroge, G. J., Rao, E. J. O., Audi, P., Parker, M., & Muoki, P. (2019). The Accelerated Value Chain Development program national conference report, 26–27 April 2018: Developing value chains to farming as business with technology and innovations in Kenya.

KNBS, R. (2012). Kenya National Bureau of statistics.

KNBS, R. (2019). Kenya National Bureau of statistics

Lanyasunya, A. R., & Lesolayia, M. S. (2001). *The El-Barta Child and Family Project--Community Based Early Child Care and Development Programme: An Integrated Approach. Working Papers in Early Childhood Development*. Bernard van Leer Foundation, PO Box 82334, 2508 EH, The Hague, Netherlands.

Lee, K. (2008). Opportunities for green marketing: young consumers. *Marketing intelligence & planning.*

Lundy, M., Gottret, M. V., Ostertag, C., Best, R., & Ferris, S. (2008). Participatory Market Chain Analysis for Smallholder Producers. *Catholic Relief Services*, *Reprint Edition*, 130

Mahob, R. J., Ndoumbe-Nkeng, M., Ten Hoopen, G. M., Dibog, L., Nyassé, S., Rutherford, M., ... & Bilong, C. B. (2014). Pesticides use in cocoa sector in Cameroon: characterization of supply source, nature of actives ingredients, fashion and reasons for their utilization. *International Journal of Biological and Chemical Sciences*, *8*(5), 1976-1989.

MoALF, C. R. P. (2017). Climate risk profile for Isiolo County. Kenya County climate risk profile series.

Mugenda, & Mugenda. (2003). *Research methods*. Nairobi: Acts Press.

Murray, T., & Gwin, L. (2016). *Practical Strategies to Assess and Improve Small Farm Profitability*. Oregon State University Extension Service EM 9149, July.

Mussie, A., Mwanga, J., Mwangi, W., Verkuijl, H., Mungi, R., & Elang, A. (2001). Adoption of improved wheat technologies by small scale farmers in Mbeya District, southern highland, Tanzania. *International Maize and Wheat Improved Centre (CIMMYT) of the United Republic of Tanzania*.

Mutisya, D., Karanja, D. R., Kisilu, R., Mwangi, D. M., & Kamau, C. C. (2015). Effects of millet as trap crop for control of birds on white sorghum in Eastern Kenya.

Mutura, J. K., Nyairo, N., Mwangi, M., & Wambugu, S. K. (2015). Analysis of determinants of market channel choice among smallholder dairy farmers in Lower Central Kenya. *International Journal of Innovative Research and Development*, *4*(10), 264-270.

Mwadalu, R., & Mwangi, M. (2013). The potential role of sorghum in enhancing food security in semi-arid eastern Kenya: A review. *Journal of Applied Biosciences*, *71*, 5786-5799.

Mwadalu, R., & Mwangi, M. (2013). The potential role of sorghum in enhancing food security in semi-arid eastern Kenya: A review. *Journal of Applied Biosciences*, *71*, 5786-5799.

Ngigi, M. (2008). Structure, conduct and performance of commodity markets in South Sudan: Linkage’s food security.

Njinju, S. M., Gweyi, J., & Mayoli, R. N. (2022). Sorghum Production Challenges in Drought Areas of Siaya and Baringo Counties, Kenya. *East African Agricultural and Forestry Journal*, *86*(1-2), 8-8.

NURHILALIA, N., RAHMAN Kadir, A., MAHLIA, M., JUSNI, J., & ADITYA, H. P. K. P. (2019). Determinant of market orientation on SME performance: RBV and SCP perspective. *Journal of Distribution Science*, *17*(9), 35-45.

Ogeto, R. M., Cheruiyot, E., Mshenga, P., & Onyari, C. N. (2013). Sorghum production for food security: A socioeconomic analysis of sorghum production in Nakuru County, Kenya.

Okeyo, S. O., Ndirangu, S. N., Isaboke, H. N., Njeru, L. K., & Omenda, J. A. (2020). Analysis of the determinants of farmer participation in sorghum farming among small-scale farmers in Siaya County, Kenya. *Scientific African*, *10*(00559).

Olembo, K. N., M'mboyi, F., Kiplagat, S., Sitieney, J. K., & Oyugi, F. K. (2010). Sorghum breeding in sub-Saharan Africa: the success stories. African Biotechnology Stakeholders Forum (ABSF).

Omiti, J. M., Otieno, D. J., Nyanamba, T. O., & McCullough, E. B. (2009). Factors influencing the intensity of market participation by smallholder farmers: A case study of rural and peri-urban areas of Kenya. *African Journal of Agricultural and Resource Economics*, *3*(311-2016-5509), 57-82.

Pakwan, J. T. A. (2008). *Evaluation of Sorghum Markets in Sudan with Emphasis on Gadarif Area* (Doctoral dissertation, UOFK).

Porter, M. E. (1981). The contributions of industrial organization to strategic management. *Academy of management review*, *6*(4), 609-620.

Quandt, S. A., Dupuis, J., Fish, C., & D’Agostino Jr, R. B. (2013). Peer reviewed: Feasibility of using a community-supported agriculture program to improve fruit and vegetable inventories and consumption in an under resourced urban community. *Preventing chronic disease*, *10*.

Raible, M. (2013). *Industrial Organization theory and its contribution to decision-making in purchasing* (Bachelor's thesis, University of Twente).

Ramsey, J. (2001). The Resource Based Perspective, Rents, and Purchasing's Contribution to Sustainable Competitive Advantage. *Journal of Supply Chain Management*, *37*(3), 38-47.

Rösch, D. M., Subrahmanyam, A., & Van Dijk, M. A. (2017). The dynamics of market efficiency. *The review of financial studies*, *30*(4), 1151-1187.

Roy, S. K., & Ireland, M. E. (1975). An econometric analysis of the sorghum market. *American Journal of Agricultural Economics*, *57*(3), 513-516.

Schmit, T. M., & LeRoux, M. N. (2014). *Marketing Channel Assessment Tool (MCAT) Benchmark Performance Metrics.”*. Dyson School of Applied Economics and Management, College of Agriculture and Life Sciences, Cornell University, Ithaca, New York.

Shubik, M., & Levitan, R. (2013). Market structure and behavior. In *Market Structure and Behavior*. Harvard University Press.

Sirma, A. J., Senerwa, D. M., Grace, D., Makita, K., Mtimet, N., Kang’ethe, E. K., & Lindahl, J. F. (2016). Aflatoxin B1 occurrence in millet, sorghum, and maize from four agro-ecological zones in Kenya. *African Journal of Food, Agriculture, Nutrition and Development*, *16*(3), 10991-11003.

Smale, M., Diakité, L., Dembélé, B., Traoré, I. S., Guindo, O., & Konta, B. (2008). *Trading millet and sorghum genetic resources: Women vendors in the village fairs of San and Douentza, Mali*. Intl Food Policy Res Inst.

Smith, A. (1776). An inquiry into the nature and causes of the wealth of nations: Volume One. London: printed for W. Strahan; and T. Cadell, 1776.

Smith, L. D. (1992). *Costs, margins and returns in agricultural marketing*. FAO.

Starr, A., Card, A., Benepe, C., Auld, G., Lamm, D., K. Smith, K., & Wilken, K. (2003). Sustaining Local Agriculture: Barriers and Opportunities to Direct Marketing Between Farms and Restaurants in Colorado. *Agriculture and Human Values*, *20*, 301-321.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, *18*(7), 509-533.

Tegtmeier, E. M., & Duffy, M. (2005). Community Supported Agriculture (CSA) in the Midwest United States: A Regional Characterization. *Leopold Center Pubs and Papers*, *151*.

Teka, A. G. (2009). *Analysis of fruits and vegetable market chains in Alamata, Southern zone of Tigray: The case of onion, tomato and papaya* [Unpublished master's thesis]. Dept. Agricultural Economics. Haramaya University., Ethiopia.

Tiku, N. E., Olukosi, J. O., Omolehin, R. A., & Oniah, M. O. (2012). The structure, conduct and performance of palm oil marketing in Cross River State, Nigeria. *Journal of Agricultural Extension and Rural Development*, *4*(20), 569-573.

Tirole, J. (1998). *The Theory of Industrial Organization.* The MIT Press.

Ugwumba, C. O. A. (2011). Analysis of catfish farming system and its impact on net farm income in Anambra State, Nigeria. *Journal of Agricultural and Biological science*, *6*(2), 26-30.

Webber, D. J., Webber, G. A., Berger, S., & Bradley, P. (2018). Explaining productivity in a poor productivity region. *Environment and Planning A: Economy and Space*, *50*(1), 157-174.

WFP, 2018. Growing Rainfed Crops in Dryland Zones: Cereals and Legumes.

Wondim, D., Tefera, T., & Tesfaye, Y. (2020). Determinants of maize market supply, production and marketing constraints: The case of Dembecha district, West Gojjam zone, Ethiopia. *International Journal of Economy, Energy, and Environment*, *5*(5), 83.

Woods, T., Ernst, E., & Tropp, D. (2017, April). *Community Supported Agriculture: New Models for Changing Markets.* Washington, D.C.: U.S. Department of Agriculture, Agricultural Marketing Service.

Zorinah, P. (2016). *Analysis of structure, conduct and performance of cabbage market in central district of Botswana* (Doctoral dissertation, University of Nairobi).

# APPENDICES

## APPENDIX I: QUESTIONNAIRE

**MARKET CHAIN ANALYSIS OF SORGHUM IN ISIOLO COUNTY, KENYA**

The respondent should be a sorghum farmer or trader. The questionnaire will be used to generate information for academic work only and the information obtained from the respondent will remain confidential.

**SURVEY QUALITY CONTROL**

Enumerator’s name: \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_

Date: \_ \_ / \_ \_ /\_ \_ \_ \_ Start time: \_ \_ h \_ \_ End time: \_ \_ h \_ \_

**A. GENERATION INFORMATION**

| Age ­­ | Gender | Marital status | Education level | Household size | Sorghum Farming /Trading experience | Stakeholder role | Subcounty |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1=Male  2=Female  3=other | What is the marital status of the farmer?  1= Single  2=Married  3= Divorced  4= Separated  5= Widowed | Highest level of education achieved by the farmer: 1=No formal education  2= Primary  3= Secondary  4= Tertiary | Number of people living in the household | Number of years you have been in sorghum farming | 1= Farmer  2=Trader | 1=Isiolo  2= Merti  3=Galbatulla |
|  |  |  |
|  |  |  |  |  |  |  |  |

**B. Farmer Questionnaire**

1. What is the mode of land ownership?

1=lease

2=owned

2. What are the main crops grown on your farm?

1=Sorghum

2= Maize

3=Beans

4= other

3. What is the proportion of sorghum among the crops grown?

1=Whole

2=Half

3=Quarter

4. What is the land size on which sorghum is grown?

5. How much do you use on fertilizers?

6. How much do you use on buying seeds for planting?

7. How much do you use on labor for the planters, harvesters and transporters to the market?

8. What is the harvest size of sorghum/acre in Kgs?

9. Is sorghum produced of high value in the market in Isiolo county?

1= Yes

2= No

10. Is the harvested sorghum sold to the markets or is it used for subsistence use?

1= commercial

2=subsistence

11. What are the proportions of sold sorghum vs subsistence?

1= whole

2=Half

3=Quarter

12. Which months are planting months?

13. Which are the harvesting and selling months?

14. What is the selling price of sorghum per Kg?

15. Who determines the selling price?

1=Demand driven

2=Government

3=Farmers

4=Cooperatives \marketing boards

5=Any other

16. How do arrive at the agreed selling price?

1=Informal discussions

2=Active consultations with other stakeholders

3=Trade union

17. How do you market sorghum produce?

1=social media

2= mainstream media

3=marketing boards

4=No marketing

5=word of mouth

18. Which is your preferred selling channel?

1=Farm gate direct sales

2=Own distribution

3=Use of middlemen

4=Any other

B. Why do you prefer the above-selected method? (Tick all applicable)

1=Maximum profit

2=low production

3=very high production

4=proximity to market

19. I. How much do you sell direct to consumers per kg of sorghum?

ii. How much do you sell to traders (resellers) per kg of sorghum?

20. Where do get your information on sorghum production and marketing?

1=social media

2=Mainstream media

3=word of mouth

4=marketing boards

5=Agricultural extension services

21. What are the major challenges you face as a sorghum farmer?

22. What is the level of satisfaction with farming sorghum?

1=Highly satisfied 2=moderately satisfied

3=Indifferent 4=moderately dissatisfied

5. Highly dissatisfied

23. Do you belong to any farmer’s group?

1 = YES, 2 = NO,

If yes specify the farmer’s group.

**C. TRADERS QUESTIONNAIRE**

1. Where do get your produce?

1=From farmers

2=own farm

3=From middlemen

2. What is your purchasing price of sorghum per Kg?

3. How much do you sell per Kg of sorghum?

4. How do you determine the selling price?

5. How many kgs do you sell per day?

6. How do you market your products?

7. Where do you get information from?

8. What is the mode of transport to the market?

9. What is the total cost of transport?

10. What are the major challenges experienced?

**THANK YOU**

## APPENDIX II: COVER LETTER TO RESPONDENTS

Date …….…………….

TO WHOM IT MAY CONCERN

Dear Sir/Madam:

**REQUEST FOR COLLECTION OF DATA**

I am **GITONGA GREGORY KALAWA**, a Masters' student at the Department of Agribusiness Management in the school of Agriculture and Enterprise Development, Kenyatta University.

I am conducting a research study titled: **"MARKETING CHAIN ANALYSIS OF SORGHUM IN ISIOLO COUNTY, KENYA"**.

The purpose of this letter is to advise you that you have been selected to take part in this research. We ask for your time and information on the study's subject matter.

Please help by completing the interview instructions that are enclosed. The information obtained will be used exclusively for academic reasons and will be handled with the highest respect and secrecy.

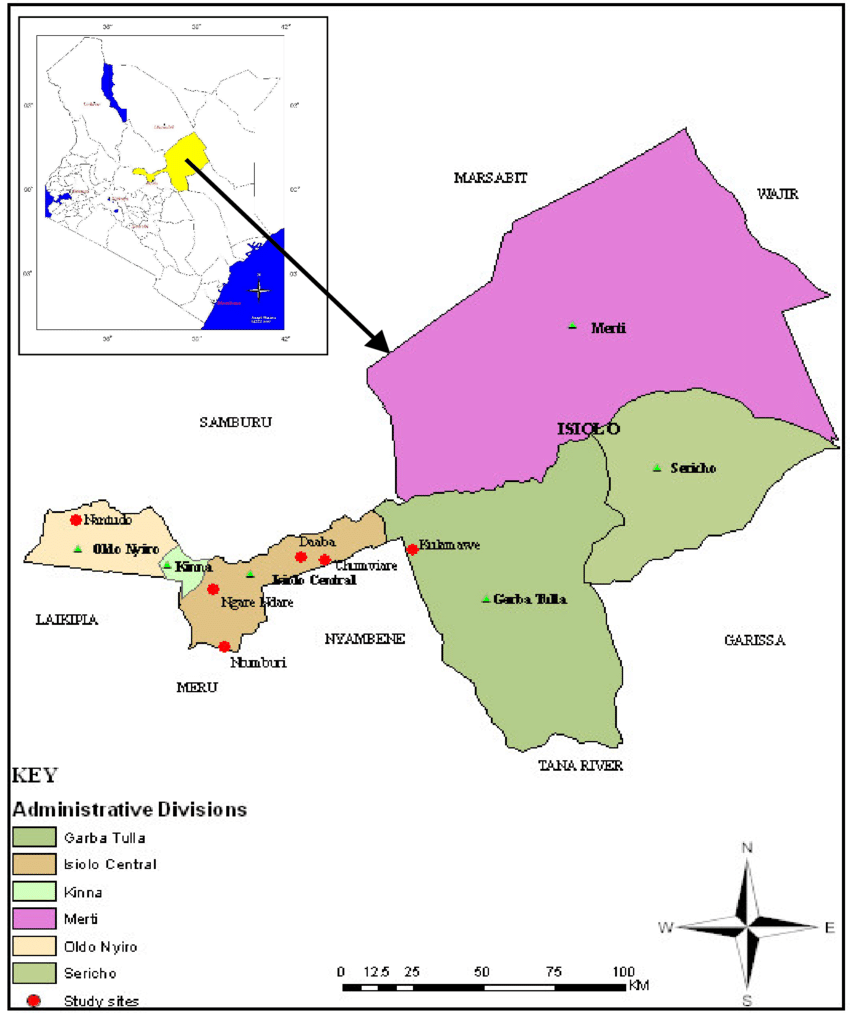
Your cooperation and assistance will be much appreciated.

Yours Sincerely,

**GITONGA GREGORY KALAWA**

**A152/27693/2019**

## APPENDIX III: MAP OF ISIOLO COUNTY



**Source: Google maps (2021)**

## APPENDIX IV: DIFERENT SORGHUM FORMS AND DELICACIES

****

****