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ANALYSIS OF PERFORMANCE AND EFFICIENCY OF PEARL MILLET (*Pennisetum glaucum* (L.) R. Br.) MARKET VALUE CHAIN: A CASE OF MBEERE DISTRICT, KENYA

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A Thesis Submitted to the Graduate School in Partial Fulfillment for the Requirements of the Collaborative Master of Science Degree in Agricultural and Applied Economics (CMAAE) of Egerton University

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DECLARATION AND APPROVAL

Declaration

This work is my original work and has not been presented in any other university for the award of any other degree.

Silas Okech Ongudi

KM17/2762/10

..... 20th NOV, 2013

Signature Date

Approval

This work has been submitted with our consent as university supervisors

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Department of Crops, Horticulture and Soil Science, Egerton University

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ABSTRACT

Pearl millet commercialization has the potential of supporting the 500 million food insecure rural households residing in marginal areas of Kenya. Despite the numerous program attempts in improving its productivity and market potential within Mbeere district, thousands are still food insecure. Poor coordination, overcrowding of actors activities and limited marketing opportunities has resulted in weak market value chains and underdeveloped output markets which have diluted commercialization initiatives. This study examined the performance and efficiency of pearl millet market value chain in order to improve its competitiveness and productivity for the benefit of the farming communities in ASALs of Kenya. Specifically, this study analyzed the existing pearl millet market value chain and its efficiency, identified traders key marketing constraints and determined consumers' willingness to pay for value added pearl millet products. A multistage sampling technique was used to collect information from 255 market actors using a semi structured questionnaire and analysis done using descriptive statistics, marketing margin analysis and Contingent valuation methodology. Result showed that majority of the actors had a mean age between 42- 52 years. Most producers (62.5%) were males while females (100%) concentrated in pearl millet marketing activities. Empirical findings showed that, producers share of the final consumer price was 23.3% with processors having a higher margin compared to traders and producers despite their limited functions.Transport cost, police bribes, border taxes, rent and commission charges formed major components of marketing costs. Most consumers (70%) were willing to pay a premium price of 42% above the normal market price of Kshs 100 for value added pearl millet products. Age, number of children below 12 years in a household, gender of household head, income and awareness were important factors that positively influenced consumers WTP premium prices. Therefore, increasing efficiency through reduction in marketing costs and promotion of collective action, coordination and cooperation between actors are the main recommendations for this study.

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LIST OF ABBREVIATIONS

AGOA	African Growth Opportunity Act
ALLPRO	ASAL Based Livestock and Rural Livelihood Support Project
ASALs	Arid and Semi-Arid Lands
FAO	Food and Agriculture Organization of the United Nations
GoK	Government of Kenya
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFAD	International Fund for Agricultural Development
KARI	Kenya Agricultural Research Institute
KEPHIS	Kenya Plant Health Inspectorate Services
MoA	Ministry of Agriculture
NGOs	Non-Governmental Organizations
TDC	Technology Development Center
USAID	United Stated Agency for International Development

CHAPTER ONE
INTRODUCTION

1.1 Background Information

Millets are highly variable grasses believed to have originated from West African wild grasses over 40,000 years ago (National Research Council, 1996). They are identified by their small grain sizes and are considered as the fourth most important cereal after rice, maize, and sorghum in terms of cultivation and production in the tropics. Statistics indicate that over 95 percent of millet production areas are concentrated in African and Asian countries (Basavaraj *et al.*, 2010).

Millets forms a staple diet for over 500 million households who are mainly small scale farmers living in arid and semi-arid lands of the poorest states of the world (National Research Council, 1996). They cover over 15 and 12 million hectares in Africa (Nigeria, Niger, Chad, Burkina Faso, Mali, Sudan, Uganda and Kenya) and Asia (China and India) respectively. Within the last 5 years, millet production in Africa has been on a downward trend partly due to high demand and profitability of competing crops, although, pearl millet still account for almost 87 percent of the total area planted with millets (ICRISAT, 1996; Bennetzen, 2003).

Pearl millet (*Pennisetum glaucum* (L.) R. Br.) is the most commonly used of all millets around the world. It performs well under hot and dry climatic conditions with rainfall of between 200-600 mm annually and in highly saline soils where maize and potatoes would record poor yields. In comparison to irrigated commodity crops supported by Kenyan government policies, pearl millet requires only 25 percent of rainfall demanded by sugarcane and banana (Nagarajan *et al.*, 2007). Therefore, pearl millet relieves Kenya's government of irrigation water or power demands making it an excellent alternative for producers operating in harsh environmental conditions like arid and semi-arid lands. In Kenya, however, pearl millet producers are classified as poor (with limited cash income alternatives), with no crop insurance and are wholly dependent on subsistence production for food, feed and fodder needs (Nagarajan *et al.*, 2007).

Pearl millet has several merits: it forms an excellent feed for livestock, both as grain and forage. Studies have revealed that broilers fed on pearl millet are heavier with better feed conversion rate than those fed on maize (Gulia *et al.*, 2007). The crop is a major ingredient in

fuel and ethanol production with a fermentation estimated at 30 percent greater than that of maize. In addition, pearl millet Distillers Dried Grains with Soluble (DDGS) co-products has higher protein and fat content than that of maize (Gulia *et al.*, 2007). In the rural household food baskets, pearl millet grains are important ingredients recommended for children, elderly and convalescents due to its high levels of protein (up to 12 percent), energy (3600 K cal kg^{-1}) and a balanced amino acid profile making it a cheap source of grain iron (Fe) and zinc (Zn) (Parthasarathy *et al.*, 2006; ICRISAT, 2007). In addition, its stems area major source of raw material for hut construction, fencing, thatching and production of brooms, mats, baskets and sunshades.

Although, pearl millet is nutritionally rich compared to other cereals, its consumption pattern has reduced significantly in the past three decades. This has been linked to its lengthy cooking time, changes in consumers taste and preference, biased policies of supplying fine cereals at subsidized prices to urban consumers and the free distribution of maize seeds to small scale farmers even though they perform poorly in arid and semi-arid lands. This has discouraged small scale farmers who have continuously allocated more land to maize despite its dismal performance in ASALs. As a result, the total area allocated to pearl millet in Kenya, has reduced from 115,302.6 ha (2007) to 100,143.9 ha (2011) with per hectare yield declining from 1,610 kilograms in 1980 to an estimated 200-800 kilograms in 2008 against the potential of 1,500-3,000 kg ha^{-1} (KARI, 2007; GoK, 2007; KARI, 2008; MoA, 2008; GoK, 2012). These negative trends have resulted in imports from Tanzania and Uganda especially for industrial processing estimated at 1,560 metric tons annually (United States Agency for International Development (USAID), 2010).

In addition, small scale pearl millet producers have identified several market constraining factors limiting pearl millet value addition and promotional attempts. Amongst these are: poorly developed and fragmented marketing channels with weak value chains, high assembly and processing costs, uncompetitive grain prices which collapses during harvesting season, lack of market information, limited processing facilities, in-adequate all year round grain supply and high cleaning costs, low access to credit, lags in legal and policy framework (FAO, 1996; Rohrbach, 2004). In addition, Gulia *et al.*, (2007) acknowledged that pearl millet has no minimal set price and this has limited farmers' interest despite local communities' preference for the crop. It is necessary therefore to increase pearl millet marketing and value addition initiatives in order to increase its consumer demand.

As part of intervention to promote pearl millet marketing and value addition, the crop has received increased attention within the Kenya's production structures. For instance, within the last three years, the government of Kenya has put more emphasis in promoting the usage of traditional crops like pearl millet to improve their acceptability and consumption which will in turn increase small holder incomes and reduce food insecurity (GoK, 2003). From 1994-2007, the government of Kenya and International Fund for Agricultural Development (IFAD) initiated the Eastern Province Horticulture and Traditional Food crops project to improve smallholders' incomes and food security through increased production of traditional food crops covering pearl millet. To further promote millet production, International Crops Research Institute for Semi-Arid and Tropics (ICRISAT), International Sorghum and Millets (INTSORMIL) and Bill and Melinda Gates Harnessing Opportunities for Productivity Enhancement (HOPE) funded project have developed interventions like breeding, distribution of improved varieties and the promotion of resource conservation and management to address productivity and marketing challenges (Karanja *et al.*, 2009).

Despite the above external interventions, serious widening supply deficits are the norm within the pearl millet growing zones as very little of pearl millet reaches the final markets. In fact, it is estimated that in Zimbabwe less than 3 percent of the pearl millet produced enters formal production channels (Rohrbach, 2004). In the animal feeds sector, less than 2 million tons (9 percent) of pearl millet is fed to animals in comparison to 30 million tons of sorghum (Léder, 2004).It is not clear to what extent the above initiatives have been helpful in improving the competitiveness of pearl millet in ASALs of Kenya.

1.2 Statement of the Problem

Despite the many efforts aimed at improving pearl millet productivity and marketing in Mbeere district, weak supply networks and independent working relationship between actors is a major concern derailing this process. Yet, for successful achievement of improved market value chain, efficient collaboration, networking and coordination are important. Past studies have shown that efficient coordination has the potential of improving market demand and ultimate producers' output value thereby stimulating farmer adoption and production of targeted crops. Nevertheless, information on pearl millet marketing and value chain potential, coordination, distribution and collaboration is limited or nonexistence at all. Therefore, this study is an attempt to analyze the millet value chain operating in Mbeere district and its related markets of Kenya.

1.3 General objective of the study

The overall objective of this study was to contribute towards the competitiveness and enhancement of market access of pearl millet for the benefit of the farming communities in Arid and Semi-Arid Lands of Kenya.

1.3.1 Specific objectives of the study

i. To conduct value chain mapping of the pearl millet marketing system connecting production areas of Mbeere district and the final markets of Kenya
ii. To evaluate the marketing channel efficiency of pearl millet and the benefits accruing from farm gate to final consumers
iii. To identify major marketing constraints affecting pearl millet traders in Mbeere district of Kenya
iv. To determine consumers' willingness to pay for pearl millet value added products within the markets of Kenya

1.4 Research questions

i. Who are the key actors' involved in the pearl millet value chain in Kenya?
ii. How efficient is the pearl millet market channel in terms of returns accruing to different actors along the value chain in Kenya?
iii. What are the main marketing constraints affecting pearl millet traders in Mbeere district-production areas and markets of Kenya?
iv. Are consumers willing to pay a premium price for pearl millet value added products?

1.5 Justification of the study

Pearl millet is a potential alternative food crop in ASALs of Kenya that can offer immediate food and nutritional security to over 79 percent of food insecure rural population if proper marketing channels are established. Therefore, knowledge of market channel efficiency will provide valuable information to policy makers about the potential opportunities for improving the welfare gains from pearl millet market related activities. In addition, analysis of millet value chain will help policy makers in the identification of weak chains and entry points thereby guiding production improvement initiatives and distribution decisions. Moreover, identification of marketing channel information will offer policy direction aimed

at linking the producers and the final markets. Furthermore willingness to pay (WTP) information will provide support to marketing policy initiation, certification and labeling processes.

1.6 Scope and limitations of the study

The study was limited to only pearl millet actors operating in Mbeere and final markets of Kenya. Moreover, the use of snowball sampling might have resulted in biased information as most interviewers were directed to similar actors. In addition, snow ball sampling technique required longer completion time but due to the tight schedule of most interviewees, brevity was maintained.

1.7 Operational definition of terms

Brokers- These are specialized middlemen who operate from urban towns buying pearl millet grains in their own name at discounted prices and selling to processors at higher prices to earn commission.

Dry milling - In this process, millet grains are first cleaned and dried for approximately 1 - 3 hours to allow moisture to spread throughout the grain. After which the coarse grains are sieved to completely remove any foreign material and then subjected to roller mills and particle size separation equipment to produce flour.

Farmer's share- This is the proportion of consumers food expenditure received by farmers, expressed as a percentage of the consumers' food expenditure.

Large scale processors –These are urban based processors with machine capacity greater than 90 horsepower. They undertake milling function as a business and perform retailing functions.

Market trader – These are retailers and wholesalers who buy the pearl millet in bulk and then sell on demand to other actors at higher prices to earn profit.

Orphaned crops -are a set of diverse minor crops not traded internationally but are of regional importance.

Rural agent - These are rural based actors who do not have personal cash for purchases in his name and therefore work for urban based traders for a commission.

Small scale processors- These are rural based processors with a machine capacity of below 90 horsepower and undertake processing functions to meet local consumer demands.

Snowball sampling- is a non-probability sampling technique used in identifying potential subjects in situations where subjects are hard to locate. This method relies on referrals from initial respondents in generating additional respondents.

Value chain actors- These are individuals participants involved in the transfer of pearl millet along the value chain.

Wet milling - In this process, millet grains are first cleaned and then soaked in water for 1 - 2 hours to allow grain to absorb this water, swell and to remove foreign particles. The softened grain is ground to produce wet porridge which is then heated for 30 minutes before consumption.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter reviews literature on value chains, analytical techniques and theories supporting in depth understanding of value chain development and commercialization initiatives. It was divided into several sub sections summarizing value chain concepts, studies on the marketing margins, and consumers' willingness to pay for value added pearl millet products.

2.1 Value chain concepts, theory and applications

A value chain describes a full range of activities required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use (Kaplinsky and Morris, 2001). Therefore, in the literature, the term value chain can interchangeably be used to mean supply chain, a market channel, market chain or value added chain as it involves multitude of functions undertaken in the production of goods and availing them to the final consumer.

According to porter, the above definition of a value chain can be interpreted from two perspectives: narrow or broader perspective. In a narrow perspective, a value chain refers to all activities undertaken in order to transform raw materials to desired final product for use by the final consumers (Porter, 1985). Porter argued that to enhance a firm's level of competitiveness, its activities should be divided into: primary activities like inbound logistics, production, outbound logistics, marketing, and after sale service while supporting activities includes firm infrastructure, human resource development, technology development and procurement. A broader perspective puts more emphasis on the participation of various members of the chain whose activities supports conversion of raw materials to the final sale of the product to consumers. This approach, therefore, is composed of supplier's value chain, firm's value chain, distributor's value chain and buyer's value chain.

2.1.1 Concepts of value chain

A value chain concept is a distinctive type of chain in which participants seek each other's support in improving competitiveness and efficiency. It is a tool for development as it facilitates identification of policies for small holder farmers in increasing profit levels (The International Trade Centre, 2003). In addition, it gives a clear understanding of a sector's

performance thereby contributing to national development. Value chain concept, on the other hand, stresses the significance of value addition at each value chain stage, thereby treating production as one of its value adding components (United Nation Industrial Development Organization (UNIDO), 2009).This therefore demands collaborative networking to reduce disagreements as part of an integrated chain of economic functions and linkages across geographic boundaries (Gudmundsson *et al.*,2006).

2.1.2 Value chain analysis model

Value chain analysis is the process of breaking the chain into constituent parts to understand its structure and functioning (UNIDO, 2009).Value chain analysis includes additional analytical elements beyond subsector analysis like governance, inter-firm cooperation and the geographical coverage extending to the global markets (UNIDO, 2009). Therefore, the process of value chain analysis involves identification of chain actors and discerning their functions and relationships at every stage of the chain; determining chain governance, facilitating chain formation and strengthening; identification of value adding activities within the chain and assigning costs and added value to each of the identified activities (UNIDO, 2009). This analysis supports understanding of enterprise positioning in an economic process. In addition, value chain analysis helps in the identification of new business opportunities and the possible leverage points for upgrading purposes.

In this study, value chain analysis concept has been used to assess the performance of smallholder farmer markets in terms of structure and functions of each chain actor and to identify strength of value chain linkages aimed at determining the overall competitiveness of pearl millet in Kenya. This analysis also provides an opportunity for small scale farmers to enhance their position in terms of production and marketing in the global market. Vale chain analysis model can be simple of extended in nature. A value chain can take a simple shape as shown in figure 1. From figure 1, production is considered as a value adding stage of the pearl millet value chain (Kodigehalli, 2011).

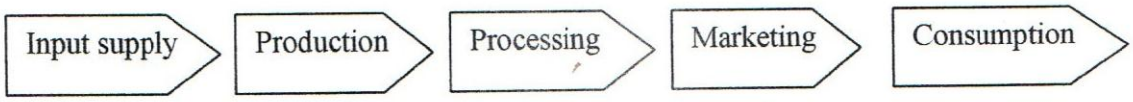


Figure 1: Diagrammatic representation of a simple value chain

Source: Kodigehalli, 2011

However, in the real world, a value chain tends to be more complex and with interlinked activities performed by different actors located all around the globe. These complexities result in an extended model of a value chain which enhances a deeper understanding of all value chain subsectors and integrated solutions (Kaplinsky and Readman, 2001). An extended value chain (Figure 2), first involves describing preproduction, actual production, post production and industrial processing and marketing to the final consumer. However, in a perfectly functioning system, supply chains are guided by internationally standardized methodologies supported by national legislations (Odame and Muange, 2010). Therefore, the working of this value chain was determined partially by extraneous policy factors (enabling environment/value chain influencers) generated by national and local authorities, research agencies; and institutions like policies, regulations, and practices beyond the direct control of value chain actors.

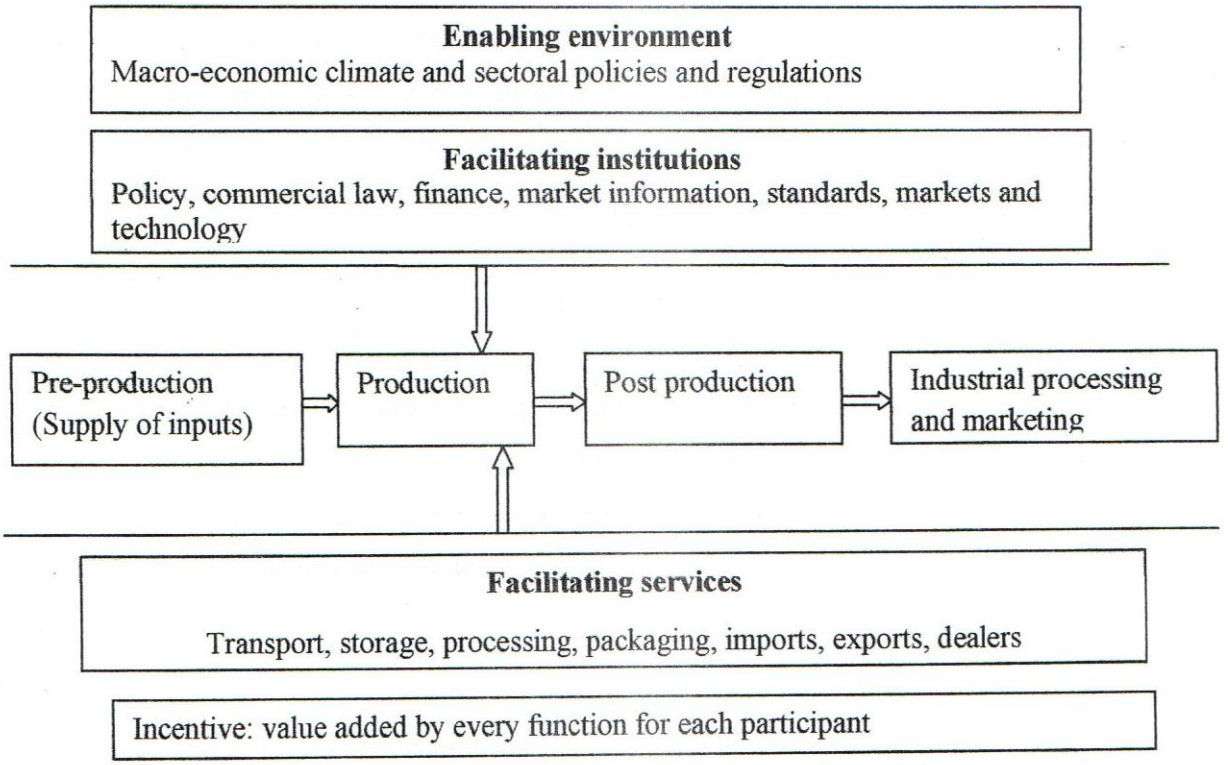


Figure 2: A diagrammatic representation of an extended value chain model

Source: Kaplinsky and Readman (2001)

Value chain actors, on the other hand, need adequate access to facilitating services like transport, processing, extension services, storage facilities and credit financing organizations in their operations. In addition, they need to access technical and market services to improve

on their operational efficiencies (Hellin and Erenstein, 2009). Therefore, all chain participants and their activities support the movement of pearl millet along this marketing channel which in turn forms a market. Within these markets, individual participants perform diverse functions in order to offer different outputs to meet its targeted consumer needs. Therefore, by connecting the vital capabilities of a supply chain in an efficient manner with the activities of the actors, productivity improvement and output surpluses are realized. If these surplus outputs are sold, actors income levels and household food consumption and security simultaneously.

2.2 Dimension of global value chain analysis

Global value chain analysis can be categorized in five dimensions: the technical structure and the actors, the territorial/geographical coverage, form of governance structure and the input-output structure (Gereffi, 1994; Keane, 2008). A technical production process is categorized into input supply, primary production, processing, marketing and the final consumption. Under input supply, all activities from seeds to technical equipment necessary for efficient production and production of the raw materials are covered. However, in cases where raw materials are deficient of market, processing of raw materials to finished products is necessary. The number of actors found in this stage is dependent on the amount and quality of the product, the complexity of product and production processes involved (Schipmann, 2006). The next stage is marketing which can directly be done by producers or processors. Therefore, there is a direct link between the amount of traded goods and the requirement for marketing. As the amount of traded goods increases, the need for marketing also increases. The last stage is consumption in which consumers are the driving force and determines the kind, amount and quality of a product.

A territorial structure is the geographic spread of production and marketing activities to different locations (Stamm, 2004). In this structure, some chains are global with activities being undertaken in different continents and thus gives a general notion of the diversity in the locations of the different stages of the value chain (McCormick, 2001). Under input-output structure, a value chain is considered as a set of products and services linked in a sequence of value adding economic activities (McCormick, 2001). This structure has both less visible structure (flow of knowledge and expertise) and visible structures (intermediate goods, raw materials) connected in a value creation process (Stamm, 2004). At every stage along the chain, services for instance transport and finance may be required to facilitate the process. It

therefore summarizes the amount and quality of a product needed by a specific stage of the chain in fulfilling the conditions of the subsequent stage, profit distribution in the chain, information flow between different stages of the chain and the value created at specific stage.

Lastly, a governance structure refers to the general form of inter node connections resulting in a systematic efficiency and is internal to a value chain. A governance structure, therefore, determines allocation of scarce resources; gains and their flow within chains. Global value chain structure can either be internal or external. External governance structure, on the other hand, includes compulsory standards for producers if they have to access markets. Although these structures are usually important, they remain outside of the modeling sphere of the global value chain (Keane, 2008).Internal governance structures are shaped by variables related to technology, information complexity and codification and the learning ability of suppliers (capabilities). These variables are decided upon by the technological characteristics of products and processes, effectiveness of industry actors and the social processes covering the development, dissemination and adoption of standard and new codification schemes (Keane, 2008).

The mode of governance of a chain shapes the functional division of labor along a given chain as it sets entry barriers through which economic profits may be concentrated in a given segment (Gereffi, 1994). However, global buyers (retailers, marketers, and traders) exert high degree of control over spatially scattered value chains although they do not own production, transport or processing facilities (Gereffi, 2001).

Through globalization, two separate governance structures can be observed: producer-driven and buyer-driven for global commodity chains (Gereffi, 2001). Producer driven chains are chains controlled by large transnational manufacturers' responsible for production networks and coordination. These chains are characterized by huge initial capital or technological intensiveness controlled at upstream levels like in automobiles or in computer industries. Lead firms in these chains source customized intermediate goods from pre selected suppliers based on close scrutiny and long term relationship. In addition, they are members of global oligopolies profit competency sourced through returns to scale, sales volume and technological advances.

Buyer driven chains, on the other hand, are governed by marketers, large retailers and brand name manufactures who set decentralized productions networks in different exporting

countries like the third world countries. These chains are characteristic of a highly competitive but a globally decentralized factory systems which lowers production entry barriers. In these chains, production systems are done by a tiered network of developing countries making finished products intended for foreign buyers. However, product specifications are supplied by these large foreign buyers. Profits, on the other hand, originate from a distinctive blend of high value research, design, sales and marketing and financial resources which allows retailers and marketers an opportunity to act as strategic brokers linking overseas buyers and local traders (Gereffi, 2001; Roldan and Wim, 2005).

2.3 Value chain coordination

Coordination describes non-market relationship existing between firms in diverse segments, or between internal and external parties in a chain (Kaplinsky, 2000). On the other hand, coordination can be used to mean exchange of nonmarket information, capabilities and activities between two separate segments of commodity chains not linked through ownership (Roldan and Wim, 2005). In most instances, coordination arises between developing countries suppliers and industrialized countries buyers as it forms a good method of guaranteeing reliable transactions in high risks instances, technological backwardness, heterogeneous production conditions and unstable financial systems.

Therefore, chain co-ordination is an enhancing barrier to entry allowing agents to incorporate measures aimed at reducing costs and risks while at the same time increasing speed and reliability of supply and thus increase sales (Gibbon, 2001). The existence of chain co-ordination is hinged on the benefits accruing to the driver of the chain. However, in a market based governance structure with numerous buyers and sellers, coordination is loose as a result of easier product standardization from low entry barriers.

2.4 Value chain governance

Governance refers to the inter-firm relationships and institutional mechanisms through which non-market co-ordination of activities in the chain takes place. In short, governance is the control exerted by different actors over the activities making up the chain. It defines who participates and who does not participate in a chain, setting of inclusion rules, assisting chain participants in accomplishing of the set standards and monitoring of their performance (Kaplinsky, 2000; McCormick, 2001). The ability of a given firm to govern is pegged on its

intangible competencies like research and development, marketing, branding and resign (Humphrey and Schmitz, 2001).

Governance ensures interactions between actors along a given value chain exhibit some reflection of that organization. In addition, transaction between chain actors is organized in a systematic way to allow firms to meet specific requirements of processes, products and logistics in serving their markets (Kaplinsky and Morris, 2001). According to Humphrey and Schmitz (2001), governance is necessary in value chains as it enhances a firm's ability to market access, fast tracks the acquisition of a production capability, acts as a funnel for technical assistance to producers, forms a leverage point for policy initiatives and finally, it facilitates understanding of gains distribution along the value chain.

2.4.1 Forms of value chain governance

Value chain governance consists of three forms: legislative, executive, and judicial (Kaplinsky and Morris, 2001). Most of value chain studies overlook these very important distinctions and believe that only one party covers all the three sets of powers, however, in reality, this is wrong. Kaplinsky and Morris attribute this bias to the difficulty of value chain studies in explaining the prevalence of value chain inefficiency in real world situation.

The legislative governance refers to the setting of parameters (rules and regulations) governing the operation of the value chain relating to product quality, frequency of deliveries and on time deliveries. The set rules are assumed to be meeting the basic cost parameters which guarantee supply, price, and quality of products, conformance to international standards, phyto-sanitary and Hazard Analysis and Critical Control Point (HACCP) requirements. Once rules and regulations are set, judicial governance undertakes monitoring of performance and compliance by suppliers. This arm of governance undertakes auditing of performance to ensure suppliers' compliance with the set rules of engagement (Kaplinsky and Morris, 2001).

Finally, the executive arm of governance is charged with assisting value chain participants in meeting the set rules of participation. It provides assistance to value chain participants in meeting of the operating rules or managing different secondary links within the chain. Therefore, the executive arm may help suppliers in achieving quality standards or introduce a supplier to a service sector firm to aid in meeting of the required standards (Kaplinsky and

Morris, 2001).Although these governance roles may be offered by internal or external actors, they are likely to change with industrial maturity and evolution.

2.4.2 Types of governance in global value chains

According to Gereffi *et al.*, (2005), governance in global value chains can be categorized into five basic types: market, modular, relational, captive, and hierarchy. These categorizations are based on the complexity of information and knowledge transfer necessary to sustain a given transaction, the extent to which information and knowledge can be codified and the capability of actual and existing suppliers in fulfilling the transaction requirement.

In market coordination, market linkages are not fully transitory between separate stages of the chain like in spot markets but transactions are market coordinated. Under market coordination conditions, there is persistency of market linkages over time with repeated transactions. Therefore, the costs of switching to new partners are considered low for both parties in the chain (Gereffi *et al.*, 2005).Under modular value chains, suppliers manufacture goods in accordance with the varying customers' specification. These suppliers therefore are fully responsible for the competencies around every employed process technology (Stamm, 2004). In addition, these suppliers make use of generic machines which limits transaction specific investments while making capital outlays for materials and components on behalf of customers thus offering the possibility for stronger integration.

Captive value chains are the commonest in cases where suppliers are less qualified and therefore great deal of intervention and control are expected from lead firms. Lead firms, on the other hand, encourages build-up of transactional dependence aimed at locking in suppliers who in turn exclude other similar firms from garnering the benefits accruing out of their efforts. As these suppliers are small scale in nature, they face higher switching costs and thus are classified as captives. In addition, captive suppliers are not only engaged in simple assemblies but are also dependent on lead firms for logistics, design, component purchase and upgrading of process technologies (Gereffi *et al.*, 2005). Finally, high degree of control and monitoring by lead firms are the major characteristic of these firms.

Under relational value chains, complex interactions exist between buyers and sellers which in turn result in mutual dependence and high level of asset specificity. These mutual dependencies managed through social and spatial proximity, reputation and the occurrence of family and ethnic ties. The codifiability of information is usually low with most informational

exchanges being accomplished through face-to-face interaction governed by high levels of explicit coordination. These result in high cost of switching to new partners (Gereffi *et al.*, 2005). Finally, hierarchical value chains are characterized by vertical integration as no individual supplier operates as a lead firm. Therefore, product specifications are not easily codified due to lack of highly competent producers (Gereffi *et al.*, 2005). Finally, the central form of governance is the managerial control, moving from headquarters to affiliates or subsidiaries.

Interaction of the determinants of value chain and specific governance types

The type of global value chain governance arises from assigning unlike values to the key variables: complexity of inter-firm transactions, the degree to which this complexity can be mitigated through codification and the extent to which suppliers have the necessary capabilities to meet the buyers' requirements.

Table 1: Determinants of value chain governance

Governance type	Information complexity	Ability to codify information	Supplier capability	Degree of explicit coordination and power asymmetry
Market	Low	High	High	Low
Modular	High	High	High	↑
Relational	High	Low	High	↓
Captive	High	High	Low	
Hierarchy	High	Low	Low	High

Arrow (1) represent an increasing complexity of transactions which reduces suppliers competence in relation to new demand; (2) is the de-codification of transactions while (3) represent the decreasing suppliers competence

Source: Gereffi *et al.*, (2005)

In captive global value chains where power is exerted directly on suppliers by lead firms, there is high degree of explicit coordination and a large measure of power asymmetry with the lead firm. According to Ivarson and Alvstam, (2010), captive chains arise as a result of high complexity and ability to codify specifications; however, the suppliers' capabilities are low. In such instances, intervention and control on the part of the lead firms are required to

encourage transactional dependencies. Under relational value chains, power balances between diverse firms are more symmetrical as a result of equal contribution of key competences resulting in explicit coordination which is achieved through close dialogue between more or less identical partners. It arises from un-codified product specifications, complexity of transactions and the high capability of suppliers. Under this chain, implied knowledge warrant some exchange between buyers and sellers as capable suppliers provide strong outsourcing motivation for lead firms to access complementary competencies (Gereffi *et al.*, 2005; Ivarson and Alvstam, 2010).

In modular global value chains, power asymmetries remains relatively low as suppliers and buyers work with multiple partners resulting in easy switching for customers and suppliers (Gereffi *et al.*, 2005). A modular chain, therefore, arises as a result of easier codification specifications for complex products or when suppliers possess much competence in delivering a complete package for internalizing a hard to copy information which reduces asset specificity and the need for direct monitoring (Ivarson and Alvstam, 2010).

2.5 Market Power in Value Chains

Governance is concerned about power and the ability to exert control along the chain or at any point within a chain. Exertion of power can be from two perspectives: within the chain or outside the chain. Within the chain, power can be exerted by participating big firms or even suppliers at farm level and workers within firms while outside the chain, power comes from the state and other institutions created by enabling environment and from consumers. The knowledge of whether a powerful firm in a chain is a buyer or a producer supports the determination of strategies for use when restructuring value chains while taking consideration of these suppliers (Frederick and Gereffi, 2004).

A firm which possesses industrial power shapes the distribution of profits and risks to activities. The competitive structure of firms in a supply chain result in better producer returns through capturing of larger percentage of export prices. Also, farmers are offered technical expertise, inputs and credit for firms which intend to secure their supplies. However, in a monopolized system with state-owned enterprise as the only trader, rents are extracted from farmers, who fare more poorly than under a competitive system. Competition amongst buyers undermines enforcement of rules. Therefore, farmers usually are challenged to dishonor most contracts they have with sellers and sell to the next available high bidder.

To curb contract enforcement malpractices, strategies like appropriate incentives and penalties should enhanced, informal personal relationships be encouraged, coordination amongst buyers be tightened, naming of defaulters in order to affect reputations and enhancing group responsibility should be implemented (FAO, 2007). In agricultural value chains, small holder farmers are vulnerable to oligopsony or monopsony powers of the first-stage buyers (Piyapromdee *et al.*, 2009). Therefore, to support these vulnerable small scale producers from market powers, most governments in developing countries support initiatives like creation of state owned marketing boards with statutory powers to buying of farmers surplus produce and selling to profitable channels not easily accessed by these producers and the formation of cooperative societies,.

2.6 Upgrading in value chain

Upgrading is the creation of competence in product development and or sales and marketing or becoming stronger in operations' (Fleury and Fleury, 2001). In summary, upgrading involves a faster pace of innovation in comparison to the competitors. Upgrading enables chain actors or firms to undertake supplementary value intensive functions requiring large sums of money thus making it hard for them to be substituted (Stamm, 2004).

The concept of upgrading facilitates the understanding of diverse shifts undertaken by firms in order to increase and improve their participation in global chain levels (Humphrey and Schmitz, 2000). These diverse shifts which are an indication of upgrading include for instance, transforming inputs into outputs more efficiently through reorganizing the production system or introducing new technologies, a process called process upgrading. Secondly, through product upgrading, an industry can move into a more sophisticated product lines in terms of unit values. Third, firms can upgrade through the acquisition of new and superior functions like marketing or design or by dropping its current low value added functions within the current product line product line and focus exclusively on high value added activities, a process called functional upgrading. Finally, firms can upgrade by relating the acquired competence from a specific function to move into a new sector or leave a specific inefficient chain to new efficient one, such a process is called inter sectoral upgrading (Fleury and Fleury, 2001; Guilliani *et al.*, 2005).

2.6.1 Preconditions for value chain upgrading

Preconditions for value chain upgrading should be a strategic focus of a firm's innovation process, policy environment and investment options if it has to maintain its position along the chain (Schmitz, 2006).The existence of a learning process to chain actors, type of a production system and the existing value chains knowledge systems forms major prerequisites for any value chain upgrading strategy. Therefore, an improvement in a learning process, improves a firms position in a value chain (Stamm, 2004). Necessary conditions for and effective learning processes include: access and availability of an extension service, market information and further education. However, these necessary conditions require effective governance structure in a chain to be implemented.

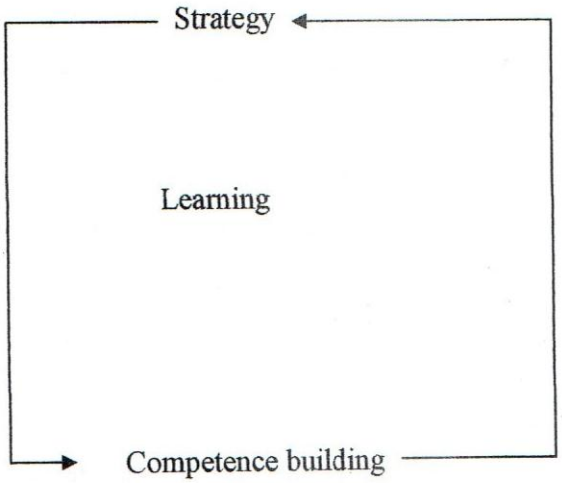


Figure 3: Typology of strategy and competency building

Source: Fleury and Fleury, (2001)

In order to support and improve a firm's competitive strategy, effective process of competence building must be in place. However, during defining of its competitive strategy, a firm must have full understanding of its alignment of that strategy and the characteristics of the required competency. A firm may relate to others firms and compete in a given market through three different strategies (Fleury and Fleury, 2001). For example, through operational excellence, a company's strategy may be to offer products in the market that optimizes

quality/ price ratio. Therefore, the key competences for success are operations including logistics, manufacturing and distribution.

Second, a company can compete in terms of its continual investment aimed at creating new products for specific customers and market segments, a strategy called product innovation. The key success factors include: research, development and engineering. Finally, through client intimacy, companies specialize with demands of targeted customers in specific locations. Most of these firms develop solutions to the manifested demands in form of product and systems and thus profound knowledge of client business and its clients are necessary. Key success factors are sales and marketing which trigger research, development and engineering capabilities (Fleury and Fleury, 2001).

2.7 Value chain mapping

Mapping a chain involves constituting a visual image connecting industries in a value chain and other players in a specific market (United Nations International Labour Organization (UNILO), 2009). In undertaking a mapping process, figures, models, diagrams and tables are used to support the understanding of a given value chain. Value, on the other hand, is a means of making what is seen and encountered more easily understood. Mapping a value chain eases a clear understanding of the series of activities and the main actors and relationships involved in the value chain. In addition, it provides tools and examples on how to capture the different dimensions of a value chain.

Therefore, in undertaking a value chain mapping exercise, essential dimensions to be included in the chain are noted. After mapping of a value chain, analysis of costs and earnings should follow. This analysis provides an idea of costs, revenues and profits incurred by different actors. This analysis explains the causes and fluctuations in revenues over years and thus reveals the income of different actors from their business by comparing the revenues and costs.

2.8 Marketing channels

Marketing channels are networks of organizations creating utilities for the benefit of final consumers. As such, they form vital links in reaching the final consumers through creation of products and information flow, negotiation, ownership and promotional activities. The performance of a marketing channel is related to structure and conduct of its operating actors.

A marketing channel can be classified into centralized or decentralized systems (Olukosi and Isitor, 1990). Centralized channels involve agents acting as middlemen between producers and the final consumers while decentralized channels involve consumers and agents buying directly from producers and are considered a shorter channel. Marketing channels of most developing countries are characterized by long chains with numerous middlemen between producers and consumers which lowers the margin of producers (Moses, 1990). To improve producers' competitiveness and profitability, an effective channel strategy design, purposive selection of channel members, motivation of channel members, channel strategy coordination and evaluating the performance of individual channel members should be an important strategy.

2.8.1 Markets and value chain past studies

Integration of market information and farmers activities has the potential of increasing farmers' income levels. Using a value chain approach to analyze poultry value chain in South East Asia, McLeod *et al.*, (2009) noted that information flow could help reduce the complexity of value chains. They observed an informal relationship between lower level actors but a formal relationship between breeders, commercial farms and contract farmers. As a result of the low level of awareness amongst collectors, they recommended a constructive involvement of private sectors coupled with the increased working relationships between policy champions.

Grimaud *et al.*, (2007) on evaluating milk quality using a value chain approach in Uganda observed that poor hygiene conditions and inefficient preservation system from production to consumption within the informal milk sector. They concluded that an optimal involvement of all functional units within the chain was necessary in ensuring proper storage and quality of milk. They recommended an improvement in handling practices, storage conditions and an adoption of global strategies to reduce milk losses and control quality along the value chain.

The profitability of an agricultural enterprise is influenced by the status of infrastructure and distance to its final market. Using linear regression models to determine the structure and function of charcoal supply chain in Uganda, Shively *et al.*, (2010) observed an inverse relationship between distance travelled by charcoal and its producers return. They recommended a progressive or regressive tax on charcoal actors to generate more revenue

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and encouraged the formation of fiscal and pricing policy frameworks focused on the central nodes within the value chain.

2.9 Distribution of revenue, cost and profit amongst chain actors

After mapping a value chain, specific components of the value chain like revenues, costs and profits should be undertaken to provide better insights about the functioning of the chain. Analysis on costs provides a clear picture on specific costs incurred by different actors as well as revenues and profits they earn in return.

2.9.1 Distribution of revenues

Revenue is composed of different marketing margins belonging to different actors in the value chain. Therefore, a marketing margin presented in percentage form reflects the distribution of revenue to different chain actors (Figure 4). However, a marketing margin must cover all costs involved in moving of a product from one stage to the next plus a reasonable return for performing that transfer (Shepherd, 2007).

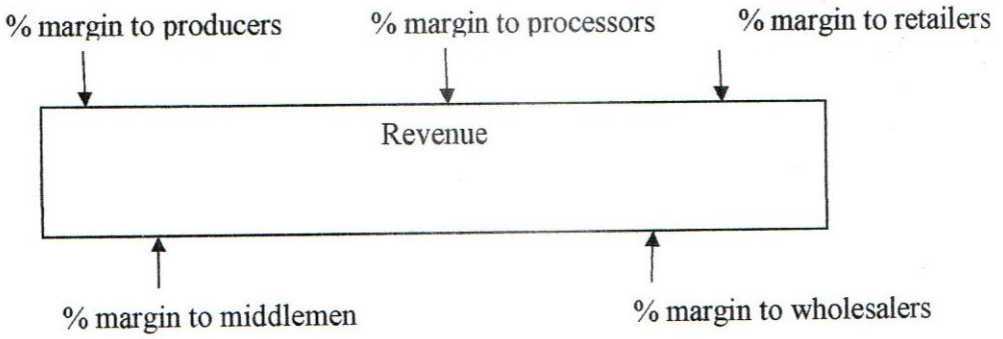


Figure 4: Distribution of revenues between chain actors

2.9.2 Distribution of costs

The total costs incurred by the final consumer represent the added cost incurred by specific chain actors. An added cost reflects shows the interests of chain actors in adding values to the final product to consumers. Therefore, in distributing specific costs amongst actors, activities incurring exceptionally high cost should be given priority (Figure 5).

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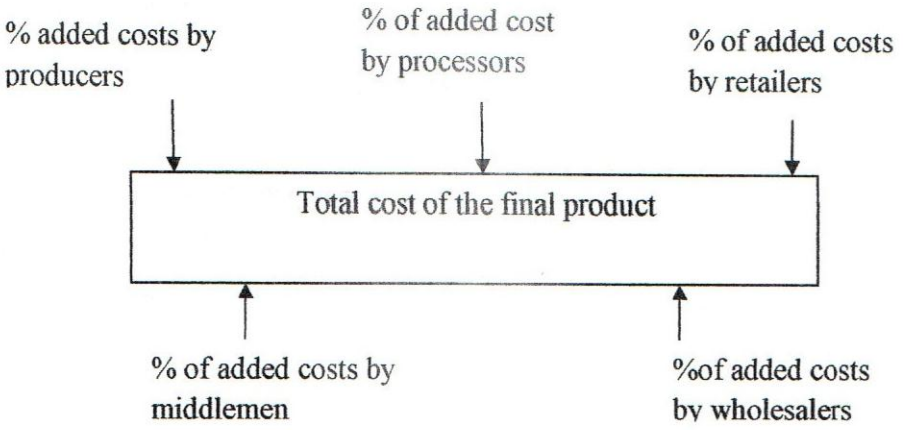


Figure 5: Distribution of costs by value chain actors

2.9.3 Distribution of profits

Profit comprises of earnings accruing to different chain actors from selling of the final product. Analysis of margins and profits along the chain, help in the determination of who benefits from participation in the chain and which actors could benefit from increased support or organization. This is important for small scale producers who are vulnerable to the globalization process especially those operating in third world countries (Figure 6).

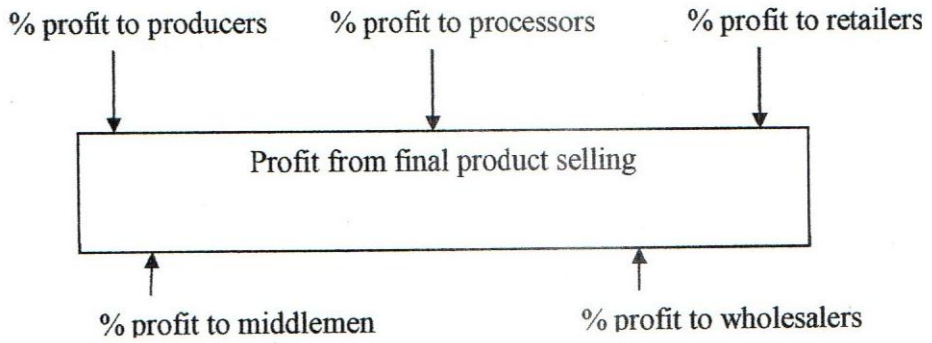


Figure 6: Distribution of profits between value chain actors

2.10 Marketing margins

A marketing margin is the portion of consumers' food expenditure accruing to food marketing organizations. It represents the difference between consumer payment for food and what the producers receives and it therefore, represents the price of a utility adding activity

and functions performed by food marketing firms (Kohl and Uhl, 2002).In most instances, the size of the margin is dependent on the length of a marketing chain.

Marketing margins can be presented in absolute and relative terms (Pomeroy and Trinidad, 2005). Absolute marketing margin is the difference between price paid by the final consumers and what is obtained by the producer and is based on the absolute levels of prices. It is considered as a good indicator of the trends in marketing costs. Relative margins, on the other hand, are expressed as a percentage depending on the relative levels of prices. There is a strong cumulative effect on margins as a result of increasing the number of intermediaries in a marketing process.

2.10.1 Measures of marketing margin

Marketing margin can be measured through: marketing bill and farm-retail price spread approach. A marketing bill approach is the difference between total consumer expenditures for all locally produced foods and what farmers receive for equivalent farm prices (Kohl and Uhl, 2002). The bill excludes marketing margin, level of farm prices and costs of a given sector and therefore additional information is necessary in its evaluation. It is influenced by the cost of marketing inputs and consumers demand for additional marketing services.

A farm-retail price approach is the difference between the price paid by the final consumers and the payment received by producers (Kohl and Uhl, 2002). It gives a clear picture of how a consumers' expenditure is divided amongst different market levels. It comprises of profit and variable costs (cost of labour, overhead costs, transportation and packing costs). This approach measures the cost of assembling, transportation and retailing of farm products. Therefore, changes in farm retail spread directly affect the profitability of an enterprise. This method was adopted in this study.

2.10.2 Past studies on marketing margins

In a normal market condition, an efficient marketing system is expected to lower consumers' expenditure. Using a marketing margins approach in understanding milk marketing efficiency in Turkey, Gumus *et al.*, (2010) observed that dealers and producers received 64.96 and35.04 percent of the consumer price respectively. They attributed the high consumer prices per litre to high retail demand, market risks, quality and spatial factors. They recommended a

reduction in the number of intermediaries and producers' value addition initiatives through rural agro tourism initiatives.

Increasing small scale producer incomes remains a target for many government policy initiatives. Using a hedonic price model in analyzing California fresh peaches market, Parker and Zilberman (1993) observed an inverse relationship between fresh peach marketing margins and season but a direct relationship with peach quality. Producer gains from quality improvement were estimated at5.9 cents premium per pound. In addition, there were potential producer gains from improving peach quality early in the season, improvement in marketing technologies and loss reduction initiatives.

Cholan (2007) using a marketing margin approach in understanding the broilers market in Pakistan acknowledged the high level of inefficiencies. He noted a low producer's margin (15 Rupees per kg) compared to retailer's margin of 89 Rupees per kg retailers. He recommended fixing of poultry selling prices on cost of production and technical training of extension agents.

Using a marketing margin analysis in comparing the organized and unorganized broilers value chain in India, Gangwar *et al.*, (2010) observed the slow evolution of poultry market structure with a marketing margin of 49 and 28 percent in unorganized and organized channels respectively. However, the marketing efficiency indices were1.63and 0.75within the organized and organized poultry channels respectively. Broiler marketing was constrained by the erratic supply and corruption within the broiler transportation network and lack of refrigerated transport systems.

Using marketing margin approach in analyzing broilers marketing margins, Al-Masad *et al.*, (2010) observed the existence of traditional poultry marketing system with producers-middlemen-retailers and consumers as the dominant and most efficient channel in Jordan. Producers obtained the lowest market margin percentage (15.40) compared to middlemen (35.89) and retailers (48.75). They concluded that producers were being exploited by middlemen partly due to financial exclusion and recommended a government intervention in improving credit access.

In analyzing raw milk marketing margins using marketing margin analysis in Mexico, Ortiz *et al.*, (2008) observed formal contractual agreement between gatherers and producers despite informal nature of milk marketing channels. The result showed that the net marketing margin

of gatherers was 25.7 and 20.1 percent with and without opportunity cost of labour respectively and thus the activities of gatherers was revenue yielding.

Using deconstructed marketing margins in analyzing the fresh coconut margins in Ghana, Abankwah *et al.*, (2010) observed fragmented nature of coconut marketing system. Itinerant wholesalers received 71.5 percent, sedentary wholesalers' 30 percent while retailers' received 88.7 percent of the coconut margin. They recommended increased awareness creation; involvement of other traders into coconut marketing and equal distribution of profits for efficient market performance.

2.11 Constraints to marketing of agricultural products

Developing economies marketing chains are faced by numerous constraints in limiting their improvement. Angelucci and Conforti (2010) on analyzing agricultural risks in vegetables, fruits and spices amongst Small Island States noted misplacement of policies and lack of credit as the main factors affecting price variability along the value chain. Amongst processors, they observed unreliability of supply sources but traders were constrained by low commodity exchanges and the complexity of market based instruments like bank loans. There was need for agricultural integration to cover wider business chains to promote small holder farmers income levels.

Farm level specialization and marketing opportunities are influenced by the annual return on investments. Gibbon (2003) on African Growth and Opportunity Act (AGOA) and the global commodity chain in Southern Africa clothing industry noted specialization of rural firms on long run domestic market chains and mid-market segments. He realized that cotton manufacturers were constrained by availability and quality of fabrics, poor and trade inhibiting government policies, lack of technical skills, credit opportunities, high overhead structures and rigidity of firms which have reduced diversification strategies. He concluded that, the nature of competition should revolve around price, lead times, and floor space occupancy. He recommended an improvement in design and sampling investment, increased expenditure of time and resources on sales and follow up.

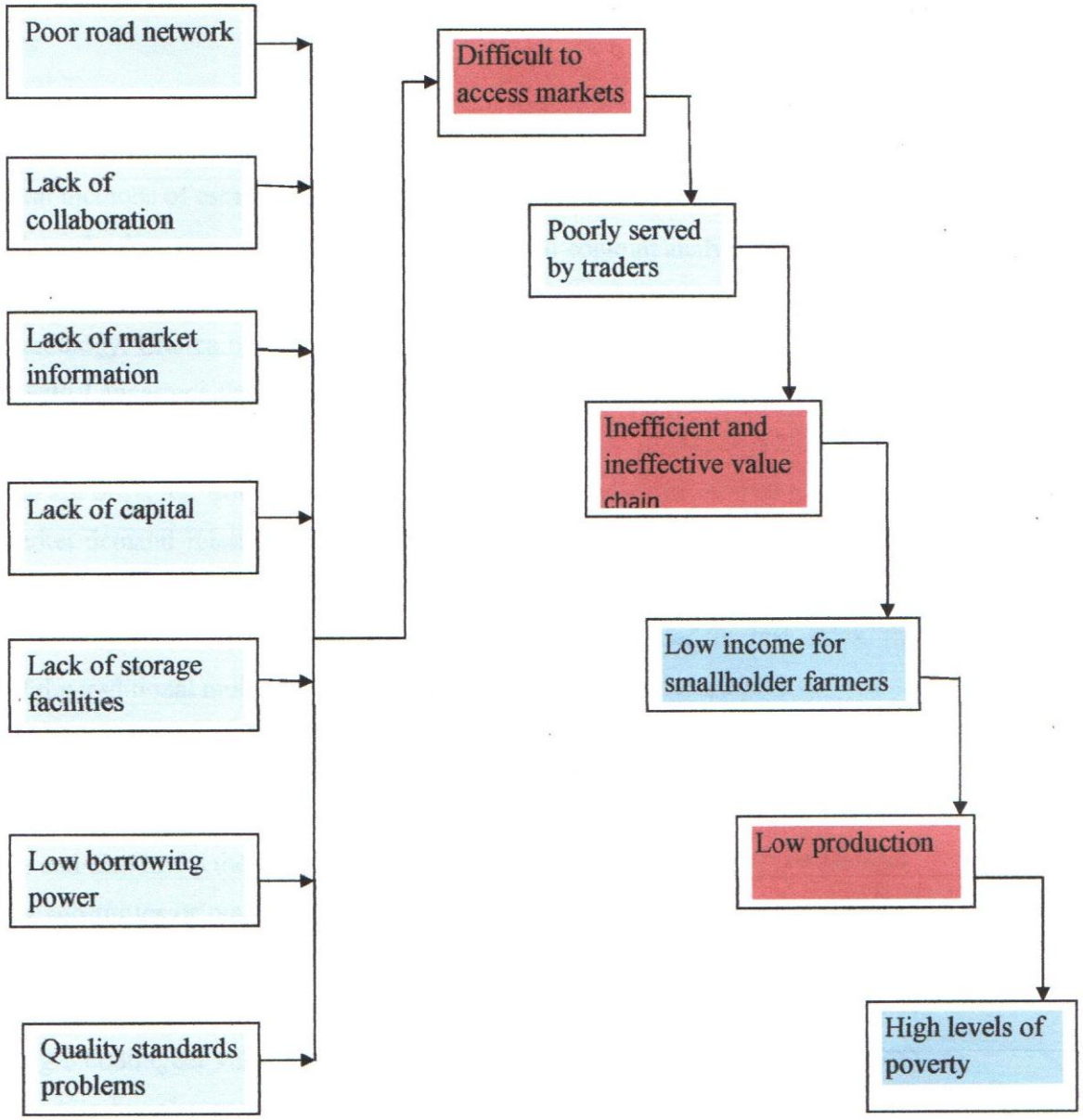


Figure 7: Summary of smallholder producer's constraints and their effects on value chain

Source: Rogath, (2010)

Farms and firms operating in developing countries face number process and product specific standards that producers have to meet in order to access the international markets. These standards have raised the competitive challenges for producers as non-compliance result in exclusion from profitable international markets (Nadvi, 2008). However, producers were constrained by lack effective competition, storage facilities, and poor service by small traders

resulting in uncompetitive thin markets and the low levels of demands limiting opportunities for better prices.

2.12 Consumers' willingness to pay

There are several methods of estimating consumers' willingness to pay for novel goods in the absence of real purchasing power. These include choice based conjoint analysis, experimental designs and dichotomous or double bound dichotomous choice questioning using contingent valuation methodology. Choice based conjoint analyses are commonly applied because they are consistent with Lancaster's theory of utility maximization. However, their willingness to pay estimates is often criticized as biased upwards (Stevens *et al.*, 2000). In addition, only discrete choices are observed from the respondents, making the identification of willingness to pay and market demand relatively intricate. Moreover, it is also difficult to incorporate consumer demographics and other explanatory variables into conjoint models. Therefore, it is difficult and not supported by existing software of estimating models that relax the assumptions of the traditional multinomial Logit models (Lusk and Hudson, 2004).

Secondly, the use of experimental auction is not realistic as it requires subjects to be recruited and compensated to be at a specified laboratory session (Lusk and Hudson, 2004). This introduces bias and also limits the required sample size. Additionally, bids might be censored or truncated by substitutes or outside alternatives unavailable within an experiment. Finally, depending upon the procedure applied, it is a common practice to detect a large frequency of zero bidding partly because of disinterested participants. The third technique is the double bound following a contingent valuation methodology. This methodology is not only subject to starting point bias but also complicates the relevant estimate of willingness to pay due to its non-perfect correlation between the first and second dichotomous choice questions (Lusk and Hudson, 2004). Therefore, this study used a modified version of the double bounded methodology-a semi double bounded contingent valuation methodology.

2.12.1Studies on consumer willingness to pay and its determinants

Information access influences a household purchase decision. Using contingent valuation method in Italy genetically modified (GM) foods, Boccaletti and Moro (2000) observed WTP premium between 6-10 percent of the regular price of similar products. These estimates were influenced by household income levels, educational level of the household head and the level of awareness of product availability in the market.

Sanogo and Masters (2002) used experimental auction design to determine Malian mothers' demand for quality certificated infant foods. Empirical results indicated that on average, mothers were willing to pay an additional US $ 0.70 per 400g of certified infant foods above substitute product's normal price. They attributed price premium to high cost of ingredients; packaging and brand recognition. The main determinants of mean WTP were wealth of a household, educational level and employment status of women.

In analyzing Chinese consumer's WTP for biotech foods using contingent valuation methodology, Lin *et al.*, (2006) found the mean WTP for biotech soybean oil to be between23.4 - 52.6and for biotech rice between 41.5-74 percent. These WTP estimates were determined by consumers' employment status, place of residence and income levels.

Using a Logit model in evaluating the factors affecting WTP a premium price for organically grown produce amongst USA consumers', Govindasamy and Italia, (1999) observed that, gender of a household head, income levels and age of respondent were the major demographic characteristics. However, the likelihood of paying a premium decreases with the number of individuals within a given household.

Lusk *et al.*, (2001) used an incentive compatible elicitation mechanism in analyzing USA consumers WTP for non-genetically modified corn chips. They observed that consumers were willing to pay to exchange a bag of genetically modified ingredient chips for a bag of non-genetically modified ingredient chips. However, the average bid levels in first and second price auctions were not statistically different from one another despite the second price auction inducing greater percentage to offer positive bid compared to first auction.

2.13 Conceptual framework

As value chain involved all activities from pearl millet production to final consumption, a multi-dimensional content framework developed from numerous theoretical concepts and empirical studies involving various actors either at national or international level was followed (Figure 8). Analysis of a value chain framework aids in the understanding of marketing chain processes and identification of challenges related to marketing and involvement of small scale pearl millet producers into the value chain.

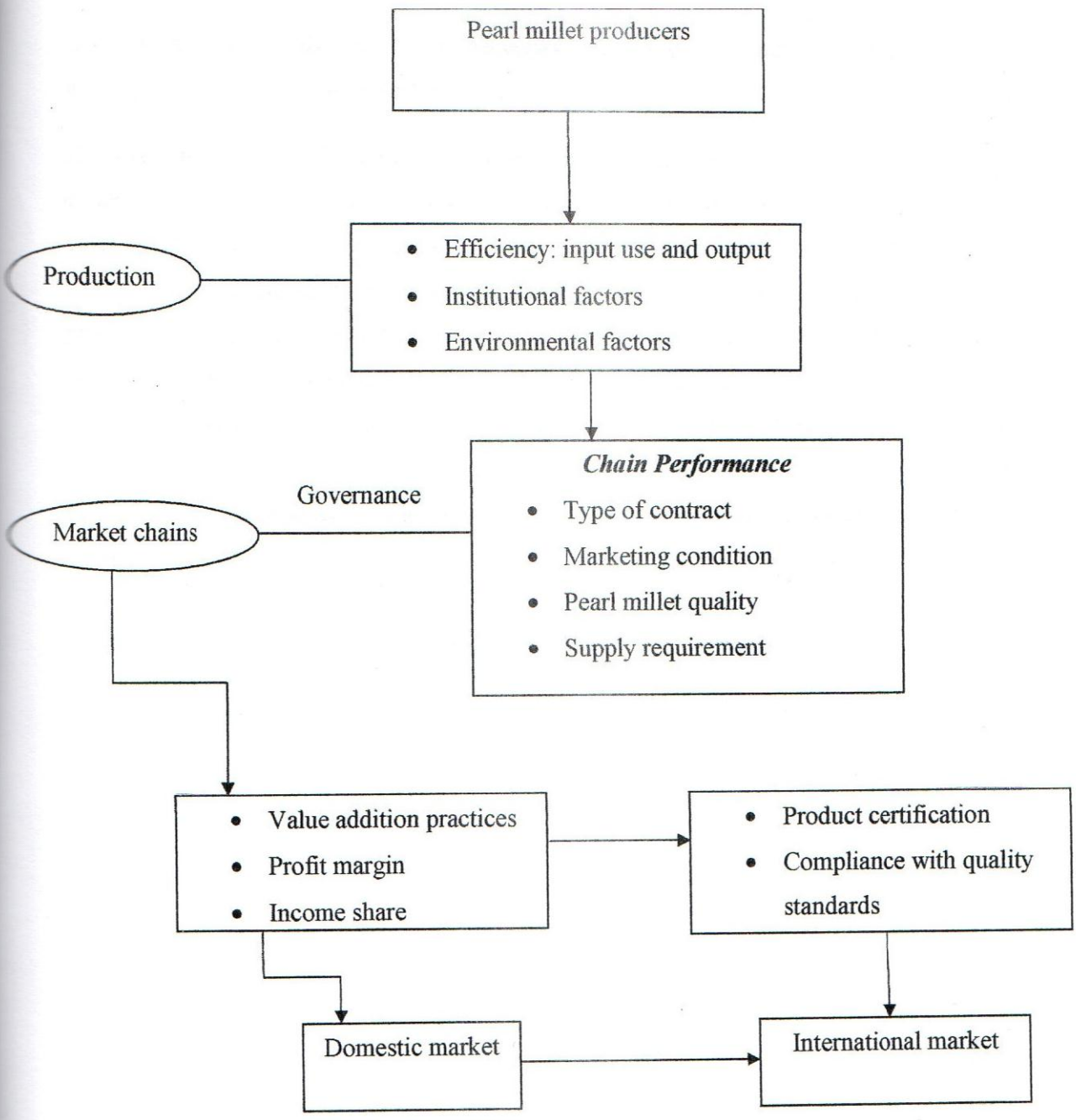


Figure 8: Conceptual framework of pearl millet marketing chain

Source: Adopted from Kodigehalli, (2011)

As shown in Figure 8, pearl millet production is influenced by numerous factors: first technology (use of mechanized tools), resource use efficiency and management and physical factors especially land, labour and capital. Secondly, institutional factors like extension, existence of a market, storage services, and transport network and research system are key inputs in production activities. Finally, for effective performance of pearl millet,

environmental factors like rainfall are necessary. Therefore, combined, these factors directly affect pearl millet value chain performance.

However, for small scale farmer to access domestic markets, they need to meet all the expenses of production plus a sizeable profit margin. In addition, famers need to undertake value addition practices to increase their profit margins and in doing so they enhance security of their incomes. However, in accessing international markets, additional conditions need: product certification, compliance with international quality standards needs to be met. However, in most developing countries, poor quality and low levels of production are major constraining factors hindering small scale farmers. Therefore, profit margins received by small scale farmers are considered a function of value additions undertaken, compliance with quality standards, product certification and income share necessary to meet the production costs.

CHAPTER THREE
RESEARCH METHODOLOGY

Introduction

This chapter presents methodological framework consisting of the study area, study population and sampling frame, sample size, data collection procedures and data analysis.

3.1 Study area

This study was undertaken in Mbeere district of Eastern province, Kenya due to the climatic conditions (LM3 and LM4) necessary for pearl millet production, presence of numerous small scale pearl millet processing units and the long history of pearl millet production. The district is bordered to the North West by Embu; East by Mwingi; South and South East by Machakos; South by Meru; West by Kirinyaga and Tharaka to the North East. The district covers a total area of 2,097KM^2 and lies between latitude $0^0 45'$N and $0^0 52'$N; longitude $37^0 35'$E and $37^0 40'$E with an altitude range of 500-1200m above sea level on Tana River basin with a slope moderated by Kiambere, Kiang'ombe and Kianjiru Hills (GoK, 2005).

The district experiences bimodal and unreliable annual rainfall averaging between 640 - 1110mm with most parts receiving less than 750mm annually. It has two main growing periods: long rains of April - June and short rains occurring between October-December with a total growing length of between 90-119 days. The economic activity of the area are mixed farming with livestock production composed of indigenous species of cattle, goats and chickens while crop production is limited to rain fed agriculture (GoK, 2005). However, the unreliability of rainfall increases major crop failures especially for maize.

The average temperature ranges between 20-30^{0}C and sometimes rises above 30^{0}C in March-the hottest month. The soils range from chromic Cambisols to rhodic Ferralsols and Luvisols with varying degree of stoniness, rockiness and soil depth (GoK, 2005). These soils are infertile and are highly sensitive to erosion as a result of surface sealing and hard pan setting.

3.2 Study population and sampling frame

The sampling frame for this study consisted of producers, rural agents, brokers, traders (retailers and wholesalers), processors (small scale and large scale) and consumers involved in pearl millet market value chain. For producers, the frame was compiled with the assistance of Ministry of Agriculture extension department and community leaders. For agents, traders

(wholesalers and retailer) and processors, the list was compiled from various local markets (Siakago, Kiritiri and Ishiara) with assistance from farmers and local authority staff. Using the list generated, a simple random sampling was used to select the recommended sample size.

3.3 Sampling procedure

A multi stage sampling methodology was used to select a total of255respondents for the study. In the first stage, purposive sampling technique was used to select Siakago and Evurore divisions due to their pearl millet history, presence of numerous small scale pearl millet processing units and their agro-ecological zones of LM3-LM4 necessary for pearl millet growing. Intermediaries, on the other hand, were identified using snowball sampling technique with initial information being provided by producers from whom they bought pearl millet.

3.3.1 Sampling of farmers

From the above selected divisions, a list of pearl farmers was developed based on the Ministry of Agriculture data set and was verified with the assistance of community opinion leaders. Using simple random sampling technique, a total of 120 farmers were selected for this study.

3.3.2 Sampling of rural agents and brokers

Agents and brokers were identified during local market days (Tuesday and Friday). The identified agents and brokers were interviewed based on their availability. Brokers were sampled mainly with assistance of traders and large scale processors. Using a semi structured questionnaire, two brokers were interviewed due to their excellent knowledge and functions within the pearl millet trade. The collected data of importance included: market buying and selling price, relationship with other actors, risks associated with market participation and constraints to their involvement in marketing.

3.3.3 Sampling of traders

A total of 25 traders were selected from Siakago, Ishiara and Kiritiri markets. The collected data of importance included: buying and selling practices, traders' relationship with other traders, constraints to trading and risks in marketing of pearl millet.

3.3.4 Sampling of small scale millers

Small scale millers were identified through the assistance of Ministry of Agriculture (Engineering Division). Using a structured questionnaire, three small scale millers were interviewed to provide information on their machine capacity utilization, constraint to expansion, risks associated with milling and grain acquisition and storage services.

3.3.5 Sampling of large scale processors

Large scale processors were identified through snow ball sampling. Using a semi structured questionnaires, eight processors were interviewed to provide information about pearl millet seasonal variation, risks associated with milling and trading, role of state in promoting pearl millet business and potential for contract farming and local sourcing.

3.3.6 Sampling of consumers

For consumers, a total of 100 households were randomly selected within the outskirts of Siakago town. The collected data of importance included: levels of awareness with pearl millet product, socio-economic characteristics of households, willingness to pay estimates and factors influencing willingness to pay estimates.

3.4 Sample size

The total farm households interviewed was estimated using the formula by Kothari, (2003):

$$\mathbf{n} = \frac{\mathbf{z^2 p.q}}{\mathbf{e^2}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1.5)$$

Where n is the sample size; z is the alpha; **p** represents the proportion of population of importance which in this case are small scale pearl millet growers, **q** is the estimate of the variance; e is the acceptable margin of for the mean being estimated. As the proportion of small holder pearl millet farmers in the Mbeere district are estimated at 90 percent, taking *p* as 50 percent was considered a representative size with minimal error. Therefore, q= (1-p) and is therefore estimated at 0.5; z =1.96 at 95 percent confidence level; e -was the margin of error estimated at 0.0895 while n was the size of population.

$$n = \frac{1.96^2 * 0.5 * 0.5}{0.0895^2}$$

$$n = \frac{3.8416 * 0.25}{0.0080}$$

n = 120 farmers growing pearl millet

As the target population of pearl millet consumers was not well documented, the study used 50 percent as the proportion of consumers (p). Therefore, a total of 100 consumers were selected for this interview using the formula below.

$$n = \frac{1.96^2 * 0.5 * 0.5}{0.098^2}$$

$$n = 100 \text{ consumers}$$

Stakeholders survey design

For other stakeholders, a snowball sampling methodology was used in the preparation of a list of actors. A total of 25 traders, 2 brokers and 8 processors were sampled for analysis within Ishiara, Siakago, Kiritiri, and Nairobi markets.

3.5 Data collection and preparation

Primary data was collected from 255 pearl millet value chain actors (120 producers, 25 traders, 2 brokers, 8 processors and 100 consumers) located at various market centers using structured questionnaires administered by trained enumerators. Collected data of importance included: access to support services (credit and price information), marketing constraints, information on the perceived strength and weakness of millet business operations, marketing costs and margins, demographic characteristics of the actors, intermediaries' roles in pearl millet transactions.

3.6 Data analysis

A combination of descriptive and inferential statistics was used in the interpretation of results from the collected data.

3.6.1 Descriptive statistics

Tables, frequencies and percentages were used in analyzing the socioeconomic characteristics of the respondents. Descriptive statistics were generated using STATA version 8 and SPSS version 17. Variables of importance included: gender, age of actors, educational levels and employment patterns of the actors. In describing the pearl millet market map, first identification of the final pearl millet markets (Nairobi) and supply source (Mbeere district) was done. This was followed by participatory survey of all relevant actors along the chain identifying the physical functions at every stage of the chain.

In analyzing constraints affecting traders, descriptive statistics involving the use of percentages and graphs to represent the respondents' choices was used. Percentage figures were generated using SPSS version 17. However, if a given constraint received higher percentages from the respondents, then it was considered very important while low percentages represented less importance of the given factor. However, if a factor had no impact; a nil score was allocated.

3.6.2 Inferential statistics

In measuring pearl millet market value chain performance, marketing margin and efficiency analysis was used in this study.

i) Analysis of marketing margin

Before estimating pearl millet channel efficiency, a marketing margin was estimated. The formula below was used as in Ajala and Adesehinwa,(2008).

$$\text{Marketing Margin (MM \%)} = \frac{\text{Selling Price} - \text{Supply Price}}{\text{Selling Price}} * 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1.6)$$

Analysis of producer's share

In determining the optimal performance of a marketing channel, a producers share was calculated using the formula.

$$\text{Producer share} = \frac{\text{Producer Price}}{\text{Retailer Price}} * 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1.7)$$

Analysis of marketing efficiency

A marketing efficiency is a ratio of value addition for a product to its marketing costs. Value addition is measured by the prices consumers are willing to pay to acquire a given product due to the satisfaction they receive from its consumption (Rangasamy and Dhaka, 2008; Ajala and Adesehinwa, 2008).

Value added can be calculated as;

$$\text{Value added (V)} = \text{Selling price of the product} - \text{Raw material costs} \quad \ldots\ldots\ldots \quad (1.8)$$

Where; raw material costs are those incurred in procuring pearl millet. Marketing efficiency is the ratio of total value added to total marketing costs (Rangasamy and Dhaka, 2008; Ajala and Adesehinwa, 2008).

$$\text{Marketing efficiency index (ME)} = \frac{V}{I} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1.9)$$

Where total marketing costs (I) consist of both variable and fixed costs as it includes all current expenditures of a marketing function from production to final consumption. The higher the ME index, the higher the marketing efficiency and vice versa. To analyze socio economic factors related to marketing margins, a multiple regression model was estimated with per unit marketing margin as the dependent variable (Shively *et al.*, 2010):

$$y_i = \beta x_i + \varepsilon_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1.10)$$

Where y_i represent per unit marketing margin; x_i is the vector of explanatory variable for every respondent; β is the vector to be estimated including constant term and ε_i is the error term. Table 2 shows the description of variables in multiple regression estimation models.

Table 2: Nature and a priori expected signs of regression analysis of the determinants of retail marketing margin

Variable	Description	Expected sign
Processing	Whether a household undertakes processing before sales (1- Yes; 0- No)	+/-
Age of respondent	What is the age of the respondent (years)	+
Experience in marketing	The number of years dedicated to selling of pearl millet	+/-
Credit access	Do a trader have access to credit services (1-Yes; 0- No)	+
Educational level	The highest level of education of a trader (Number of years in school)	+

ii) Analysis of consumers' willingness to pay

In eliciting consumers' willingness to pay for pearl millet value added products, a semi-double-bounded Logit model- a buildup to the traditional double bounded model initially proposed by Davis in 1963was estimated using LimDep software (McCluskey *et al.*, 2001; Lin *et al.*, 2005). In this model, percentage bids were pegged on price differentials and the first bid (B_1) was assumed to be equivalent to zero to indicate price equality between pearl millet value added products and finger millet products to reduce starting point bias. The second bid (B_2) or the premium bid was contingent to the first bid and was assigned to a consumer only if he was willing to buy at a price higher than initial bid amount. The second bid (B_2) and the initial bid (B_1) allows for setting of the lower and upper bounds on the unobservable consumers true willingness to pay (WTP) for products.

If the consumer responded to the first question with a 'yes', then he was willing to purchase pearl millet product at a premium price. This is consistent with economic theory. From this, a follow up question was posed because value addition is linked to a positive product attribute. From these iterations, three possible outcomes of a semi-double-bounded model was obtained: 'yes' 'yes'; 'yes' 'no' and 'no'. A 'yes' 'yes' indicated a consumers willing to purchase pearl millet product at a premium; 'yes' 'no' indicated a consumer as having intermediate willingness to pay while a 'no' indicated customers non willingness to purchase pearl millet products at a premium.

Therefore, discrete outcomes (Dg) of the above bidding processes are shown below (Rodríguez *et al.*, 2008; Lin *et al.*, 2005; McCluskey *et al.*, 2001):

$$Dg = \begin{bmatrix} group\ 1\ WTP \leq B_1 \\ group\ 2\ B_1 < WTP \leq B_2 \\ group\ 3\ B_2 < WTP \end{bmatrix} \ldots\ldots\ldots\ldots \quad (1.1)$$

From the discrete outcomes above, group 1 represented individuals not willing to purchase at any discount and are considered to have the lowest WTP; group 2 represented intermediate willingness to pay and finally, group 3 represented those who did not require any discount but accepted to pay the highest premium. Therefore, assuming a linear function of an individual *i* WTP for processed pearl millet products can be summarized as:

$$WTP_i = \alpha - p\beta_i + z_i + \varepsilon_i \text{ for i= 1, ...n} \ldots\ldots\ldots\ldots (1.2)$$

Where βi is the ultimate bid an individual i faces; $z_i$is a column vector of observable socio-demographic characteristics of an individual (age, income, employment status, gender, and the number of children below 12 years in a household); α, β *and* ' are the parameters to be estimated; $z_i$and ε_i are assumed to be linear in parameters for all individuals, with an error term independently and identically distributed with a mean zero and a variance σ^2. Under the above assumptions, the individual choice probability may be stated as in McCluskey *et al.*, (2001):

$$\text{Prob. (D=J)} = \begin{bmatrix} G(\propto -\rho\beta_1 + Z)\ for\ 1 \\ G(\alpha - \rho\beta_2 + Z) - G(\alpha - \rho\beta_1 + Z)\ for\ 2 \\ 1 - G(\alpha - \rho\beta_2 + Z) for\ 3 \end{bmatrix} \ldots\ldots\ldots (1.3)$$

The likelihood function can therefore be stated as below:

$$L = \sum_i \begin{bmatrix} I_{D_{i1}} = InG(\alpha - \rho\beta_{D_i} + z_i) + \\ I_{D_{i2}} = InG(\alpha - \rho\beta_{D_i} + z_i) - G(\alpha - \rho\beta_{D_i} + z_i) \\ + \\ I_{D_i3} = In(G(1 - G(\alpha - \rho\beta_{D_i} + z_i) \end{bmatrix} \ldots\ldots\ldots (1.4)$$

Where I_k is the indicator function for even k and$I_k = j$ denoting the j^{th} alternative occurrence. In the empirical implementation, G (.) may be defined to as a standard logistic distribution function with a mean of zero and standard deviation $\sigma = \pi/\sqrt{3}$. The parameters of the function to be estimated using maximum likelihood function are α *and* ρ. The value of (rho) ranges between 0 and 1 and should be positive to form downward sloping *S*-curve as a negative value would be contradictory to economic theory. Finally, the mean WTP is derived as a ratio of α/p through restricting variables coefficients to zero in parameter estimation with the exception of the random bid (Rodríguez *et al.*, 2008; Lin *et al.*, 2005; McCluskey *et al.*, 2001).The final mean WTP is written as:

$$E\ (WTP, \alpha, p, \beta, z) = \alpha + \lambda z_i)/p \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1.11)$$

The empirical specification of the final model for estimating factors of WTP is shown below.

$$\mathbf{WTP_i} =$$

$$\boldsymbol{\alpha - \rho HHhead + {}_1Income + {}_2Nochildren + {}_3Education + {}_4Employment\ status + {}_5Gender + {}_6Age + {}_7Awareness + {}_8Heard + \varepsilon_i}$$

$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1.12)$$

Table 3: Nature and a priori expected signs of Logit analysis of the factors determining consumers' WTP

Dependent variable	Definition	Expected sign
WTP (Willingness to Pay)	If respondent is WTP a price premium for pearl millet products	1-Yes; 0- Otherwise
Independent variables		
Income (Income)	The monthly income level of the household head	+
Children (Nochildren)	The number of children below 12 years in the household	+
Education (EducLevel)	Highest educational level of the respondent	-
Gender (Gender)	Gender of the decision maker	+/-
Employment (Employmentstatus)	Is the household head employed	+
Age (AgeofHH)	Age of the decision maker (years)	-
Household head (HHhead)	If the buyer is the head of the household	+
Awareness (Awareness)	The household head level of awareness of pearl millet value added product	+/-
Heard (HeardProduct)	If the household has heard of a pearl millet value added product	+

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents the findings of the study and is organized into: descriptive statistics, value chain mapping, marketing constraints, marketing efficiency and finally, consumers' willingness to pay for the pearl millet value added products.

4.1 Descriptive analysis of pearl millet value chain actors

The selected socio-economic variables (age, educational level, and gender and employment status) of pearl millet market actors were considered in this section. Table 4 presents a summary of the result.

4.1.1 Socio-economic characteristics of pearl millet value chain actors

In terms of education, majority of the producers (52.5 percent) were in primary school; 26.7 percent were with secondary education with only 12.5 percent being considered to be within illiterate category. For traders, 56 percent had primary school education while 44 percent had secondary school education while 52 percent of consumers were in primary school while 32 percent possess secondary education. On average, there was a low level of literacy amongst the producers and this implies that producers may not be in a position to capture the benefits associated with pearl millet marketing as they may be disadvantaged during bargaining process (Table 4).

Table 4: A summary of the respondents' socio-economic characteristics within Mbeere district

Variables		Percentage Distribution		
		Farmers	Traders	Consumers
Mean age in years		52.4 (15.94)	41.56 (11.26)	45.42 (11.74)
Educational level	Illiterate	12.5	-	5
	Primary	58.9	44	52
	Secondary	-	56	31
	Tertiary	26.6	-	9
	University	1.67	-	3
Gender	Male	62.5	-	61
	Female	37.5	100	39
Respondents Employment status	Full time	-	72	18
	Part time	-	24	21
	Unemployed	-	-	55
	Housekeeper	-	-	4
	Retired	-	-	2

*Values in the parenthesis indicates standard deviation

The number of years a person takes in performing any marketing function directly influences his/her marketing experience and thus his profit levels. Therefore, the more experience a marketer is, the higher his understanding of a marketing system, conditions and prices trends. From the study, the average mean ages for producers, trader and consumers was 52.40; 41.56and 45.42 years respectively (Table 4). This implies that majority of the actors were dynamic youths within the economically active age bracket of 21-50 years and thus they were able to take risks associated with marketing. Therefore, these actors could make a meaningful impact in the promotion of agricultural production and marketing when adequately motivated with training and credit facilities.

The result further revealed that 62.5 percent of producers were males and this reaffirms earlier research findings that farming in the area was a male dominated activity (Table 4). In addition, it shows that most households were male headed partly as a result of HIV/AIDS menace in the area. However, pearl millet marketing was mainly dominated by women (100

percent) partly due to the local tradition linking women to cooking and light farm activities like marketing, harvesting and processing.

The results further confirmed that pearl millet traders were employed within the informal systems with 72 percent of them undertaking pearl millet marketing on a full time business. However, most consumers (55 percent) were unemployed, 21 percent were employed on part time basis while 18 percent were on full time employment. The implication of these finding is that traders were employed on full time basis in grain marketing.

4.1.2 Ownership of productive assets by household producers

Productive asset[1] ownership is an important tool in marketing and informational access. Producers were asked to list specific items they considered necessary for their market access. Table 5 provides a summary of respondents who answered yes if they owned these assets.

Table 5: Ownership of productive assets by household producers

Productive assets	Frequency	Percentage
Radio	97	80.8
Bicycles	39	32.5
Television	18	15
Computer	1	1
Mobile phones	90	75

The status of productive assets ownership amongst producers is shown in Table 5. From these findings, an estimated 81 percent of producers owned radios; 33 percent bicycles; 18 percent television and 75 percent mobile phones within the study area. Mobile phones support communication between producer, agents and traders during sales negotiation and dissemination of extension message targeting rural producers. Therefore, government should enhance extension-farmer linkages to increase producer income levels. The high mobile phones access provides the impetus for specific marketing strategy development based on mobile phone short message systems to reach the many dispersed producers simultaneously.

[1] Productive assets – are those that supports the production of goods in a business enterprise

The low access to internet services (0.8 percent) was consistent with our earlier expectation of poor infrastructure in the area.

4.1.3 Access to financial services within Mbeere district

Access to credit has the potential of improving rural economic development, increase access to information, manpower services and innovation. To assess the participation of financial institutions in the development of pearl millet value chain, the respondents were asked if they had access to capital from financial institutions. Table 6 provides a summary of the result.

Table 6: Respondents access to financial services within Mbeere district

Access to Financial Services	
Category of the Actor	**Percentage**
Farmers	90.83
Traders	56

The findings revealed that an estimated 91 percent of farmers' and56 percent of traders had access to financial services for their businesses (Table 6). This high percentage of producers accessing credit may be attributed to the fact that most farmers had collaterals (title deeds) required by commercial banks in lending. This might relate to the low membership to business association as shown in Table 10. Traders, on the other hand, make use of their market stalls as collateral in accessing financial services. However, this is a contradiction of the idea that Kenya's financial service providers are not interested in financing the agriculture sector.

4.1.4 Sources of startup capital for producers and traders

From Table 7, out of an estimated 91 percent of producers who accessed credit, 82 percent used informal sources like traders and personal businesses compared to formal sources (63.7 percent).

Table 7: Sources of startup capital for producers and traders

Sources of startup capital	Percentage of Access	
	Farmers	Traders
Formal banks	18.2	8
Family and friends	-	16
Own savings	-	52
Money lenders	-	8
Formal banks and own savings	-	12
Money lenders and own savings	-	4
Traders	18.2	-
Micro finance	18.1	-
Personal businesses	45.5	-
Total	**100**	**100**

Findings from Table 7 revealed that there are diverse sources of startup capital to producers and traders within the study area. From these results, friends, family members and own savings contributed 16, 12 and 52 percent respectively amongst traders. Amongst farmers, personal savings contributed 45.5 percent used formal banks, via other traders and micro finance sources each contributed 18.2 percent. This means that major sources of credit amongst respondents were non-institutional sources (money lenders, personal businesses, own savings, and via other traders). This is partly due to their administrative efficiencies and the flexibility in collateral or security requirements.

4.1.5 Main sources of information accessed by pearl millet producers

Knowledge of market information sources has a positive effect on participants' vertical and horizontal relations as it lowers transaction costs. In addition, this knowledge support dissemination of new materials related to pearl millet. For this reason, pearl millet producers were asked to identify the major sources of information they had and the findings are presented in Table 8. Results indicate that about 37 percent of the respondents received information via other farmers while only 20.2 percent of producers received information from the Ministry of Agriculture. The poor result recorded by the Ministry of Agriculture might be attributed to the language barrier as most information is packaged in English or Kiswahili which might not be understood by producers. However, 38.7 percent of producers did not have access to pearl millet information. This might be attributed to the low levels of earnings

common amongst small scale producers operating in arid and semi-arid lands. These results support the notion of strong social capital amongst farmers but a weaker relationship with buyers. Therefore, the use of a model farmer approach[2]to disseminate pearl millet information needs to be intensively used to facilitate efficient flow of information to individual farmers.

Table 8: Main sources of information accessed by pearl millet producers

Main source of information	Frequency	Percentage
Ministry of Agriculture	24	20.17
Non-Governmental Organizations	4	3.36
Via other farmers	44	36.97
Through buyers	1	0.84
No access to information	46	38.66
Total	**119**	**100.00**

4.1.6 Means of accessing market information by producers

Access to market information forms a key tenet to improved chain performance and income levels. For this reason, producers were asked to indicate means they use in accessing market information and the results are shown in Table 9. In general, mobile phones were the commonest means of accessing pearl millet daily prices (39.17 percent).However, 74.2 percent of producer had limited access to buyer information while 40 percent of producers had limited access to market day information despite these days being fixed twice a week. This contrasting result might be associated with the long distance these farmers had to cover to visit these markets and so they do not frequent these markets. In general, mobile phones were the common means of accessing market day information with radios acting as a useful asset in gathering buyers' information. The low access to internet might be related to the poor infrastructural development while the low penetration of magazines might be related to the low literacy levels of the households as shown in Table 3.In connection with the low access to internet services, there is need for producer training on internet use to increase access to information about pearl millet processors. However, the low usage of fellow farmers in

[2]A model farmer is a farmer with high agricultural expertise selected to lead farmer to farmer extension approaches

accessing daily prices might be attributed to farmers' notion that most of these farmers might be agents of urban based traders' and therefore would try to underestimate prices to get larger margin.

Table 9: Means of accessing market information

	Percentage of respondents		
	Daily prices	**Buyer information**	**Market days**
Mobile phones	39.17	5.83	32.5
Internet	0.83	2.5	0
Magazine	1.67	6.83	0
Radio	16.67	10.83	17.5
Via fellow farmers	1.67	5.83	9.17
Television	39.17	0	0
Limited access	1.83	74.17	40
Total	**100**	**100**	**100**

4.1.7 Social capital situation

Social capital is the ability of people to work in unison in promoting collective action, cooperation and coordination. From discussion with traders, there was high level of measurement cheating through the use of buying and selling containers. The use of un-standardized *gorogoro*[3] served as a way of extorting extra profits from producers. In fact, three different *gorogoro's* with varying sizes were identified (Figure 9) as one moves from production to consumption. Tins used for buying from farm gate had an estimated measurement of 3 kgs while those used for buying from rural agent or selling to other traders hold 2.5 kgs while tins for selling to final consumers had an estimated volume of 2 kgs. This implies that if a farmer sold three 90 kgs bags measured using 40 *gorogoro's* by retailers, he will loss 90 kgs which represent a significant loss. This weak relationship could be attributed to producers' limited education and the individualistic marketing decisions. Therefore, more training on the importance of collective action and trust building initiatives are recommended. Similar observations of inaccurate measurements during buying and incidences of collusion amongst intermediaries to fix prices and limit competition were also noted by Kirimi *et al.*, (2011) amongst Kenyan maize actors. Batt, (2003) also observed an

[3]*Gorogoro*- is a volumetric measure of grain

undervaluation of value added potatoes by traders to cost Vietnamese dong145 per kg due to lack of correct records and the confidentiality in reporting of market prices to conceal real profits.



Figure 9: Different containers used for measuring pearl millet grains- From left- 1st container for farmers estimated at 3kgs; 2nd for brokers (2.5kgs); 3rd for selling to consumers (2 kgs)

4.1.8 Analysis of actors' membership to an association

Associations support smallholder farmers in accessing efficient technologies for increased yield and market access. From the result (Table 10), only 24.2 percent of the interviewed farmers were members of a marketing association while 48 percent of traders were members of an association. This implies that most pearl millet actors did not benefit from collective action initiatives. It is interesting to note that the long distance between the production areas and final consumption points should have motivated collective action aimed at lowering the transport cost but it this did not happen. This therefore calls for pearl millet actors trainings on the importance of collective marketing actions in order to improve on their profitability.

Table 10: Membership to a business association

Membership to a business association		
Actor category	**Frequency**	**Percentage**
Farmers	29	24.2
Traders	12	48

4.2 Mapping of the pearl millet value chain and marketing channels

A marketing channel overcome the utility gaps dividing goods and services from consumers through moving pearl millet grains from production to final consumption. However, in order to achieve these functions, channel members must undertake functions like promotion, negotiation, risk taking and billing.

4.2.1 Final value added Products of pearl millet origin

Pearl millet value added products available in Mbeere district include: *Kimere*, *Kinaga* and *Uji*. *Kimere* is manually produced by dry milling using traditional grinding stone and followed by a series of millings as clean water is being added to reduce friction. The fluid like product usually undergoes decantation process to allow removal of flouting particles before it's finally fermented and consumed by a household. It is thicker in texture and consistency compared to *Uji* (porridge) and is a commonly used gruel as a food supplement for children below five years especially during weaning period. This product is homemade and no price is attached to it. Pearl millet *Uji* is a thin porridge produced through mechanical wet milling using hammer mills. The milled porridge is then boiled and sweetened before consumption. Uji is sold using a 500ml cup during market days in Ishiara and Siakago at Kshs 15 per 500ml. *Kinaga* is a thick, starchy like porridge prepared by adding water during the milling process until it reaches a thick consistency and is usually served cold without any additives. *Kinaga* is sold by old men and women using specified cups of 500ml at Kshs 50 throughout the week in Siakago and Ishiara markets (see appendix 1 for details).

4.2.2 Pearl millet marketing channels and Information flows

The analysis of pearl millet marketing structure revealed a network of inter-linkages between different actors: farmers, rural agents, traders (retailers and wholesalers), brokers and

processors (Figure 10). Four major marketing channel outlets through which a farmer can sell to include: local traders, small processors, and rural agents or directly to final consumers.

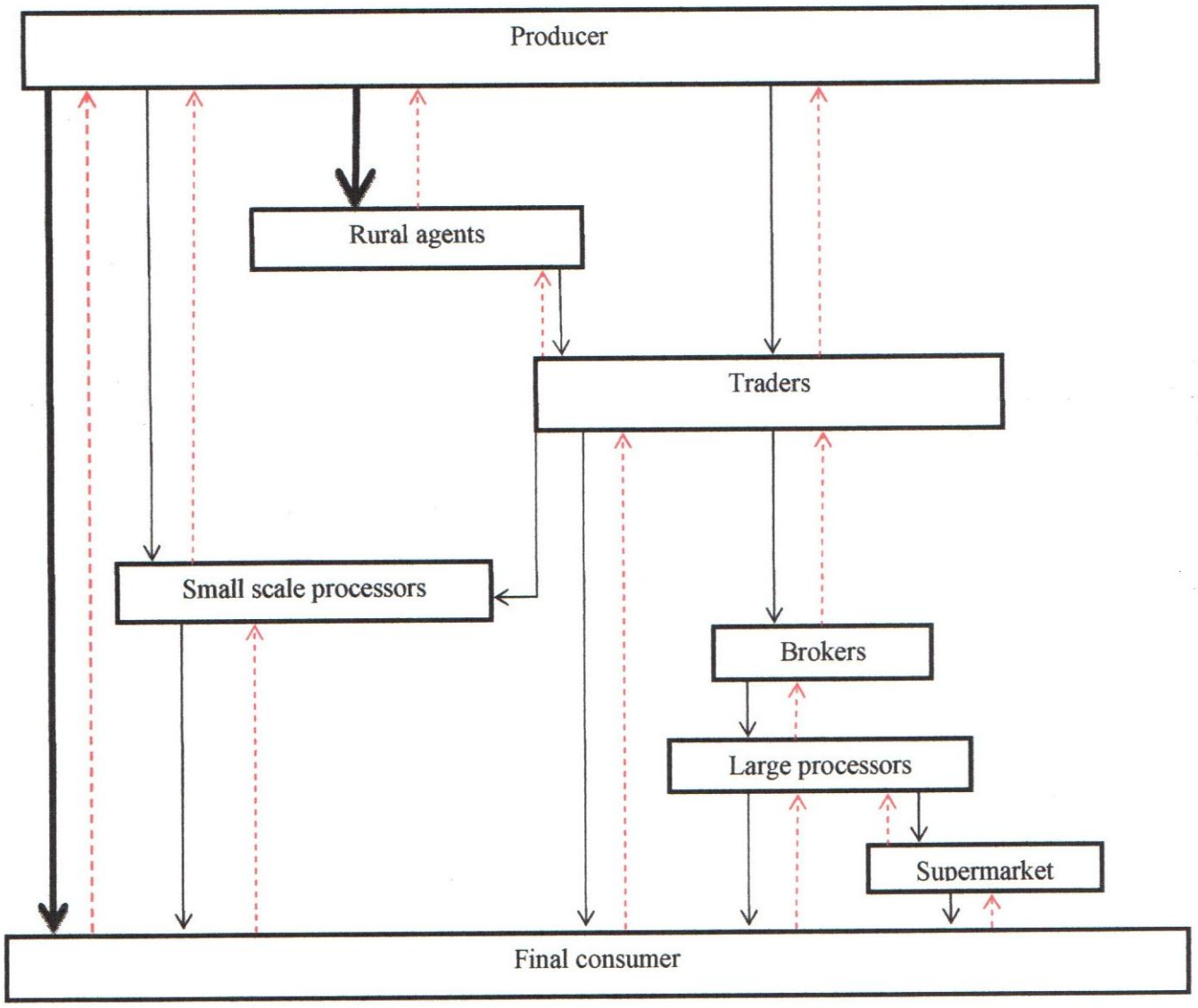


Figure 10: Marketing channels for pearl millet in Kenya

All the market participants are included within the rectangles while the arrows were used to depict the transfer of grain ownership from an actor to another. Value addition activities were found at producer levels (bulking and cleaning); processors (grinding of grains to flours and flour composites and wet porridge) while traders value addition activities involved storage

and limited milling. Discussions with pearl millet traders revealed limited value addition along the chain despite its potential for income improvement.

4.2.3 Distribution channels

A distribution channel is the transfer of a product title from producers to final consumers. Based on figure 11, six different distribution channels were identified within pearl millet markets. Processors (large or small) buy grains from traders and brokers before final sales to final consumers. The chain shows a centralized distribution system[4] with many intermediaries acting as links between producers and consumers.

In addition, these distribution channels were classified into: three level channels (channel 1st, 2nd and 3rd); a two level (4th channel); a one level (5th channel) and a zero level (6th channel) involving direct selling to consumers with little value addition.

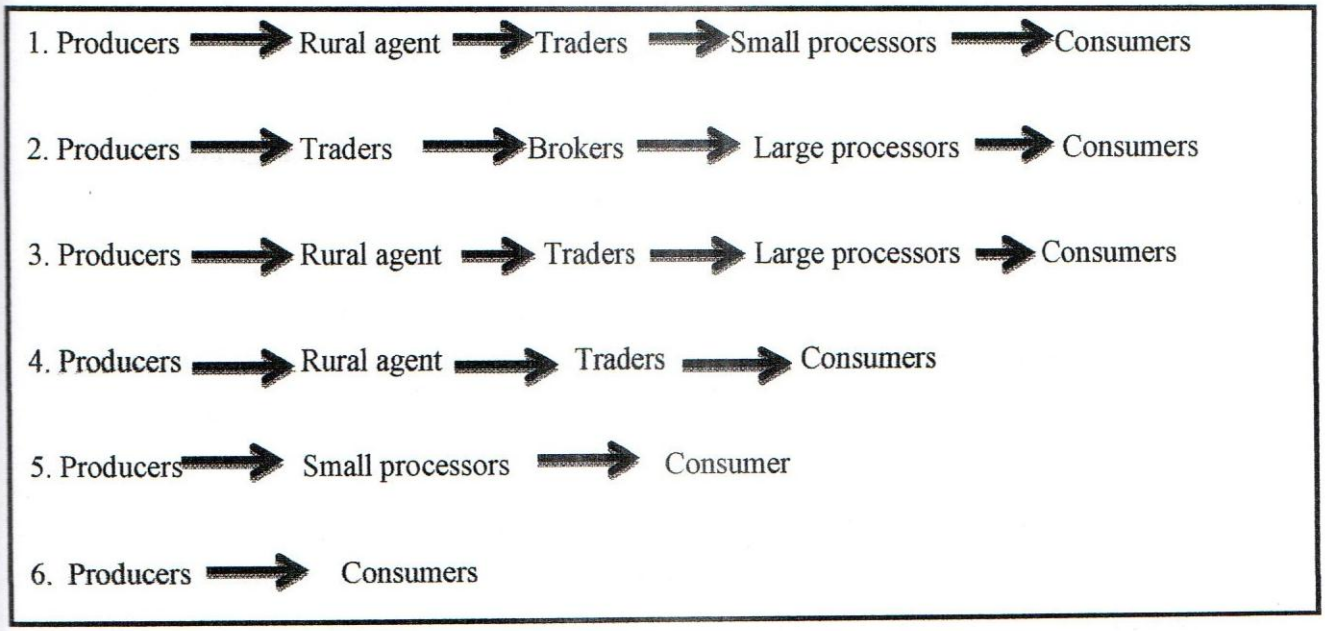


Figure 11: Different channel levels

Note: Arrows shows the flow of pearl millet from one level to another level

[4] Centralized distribution system is where deliveries from different suppliers are transported to a central location before distribution as a single full load.

The length of a marketing channel determines the gains by its participants with the shorter channels having higher producer returns. However, as the channel increases in length towards the final consumer, the lower the producer returns and the higher the inefficiency levels.

4.2.4 Analysis of value chain actors and their functions

All intermediaries perform a variety of negotiator functions ranging from assembling to provision of merchandising assistance to sellers. These roles arise from the nature of channel members' interactions and can be categorized into: supplier, customer and lateral relationships. The identified principal marketing agents responsible for pearl millet included: producers, rural agents, brokers, traders (retailers and wholesalers), processors, and transporters and consumers.

Producers

Pearl millet production is undertaken by numerous small growers who are geographically dispersed within the growing regions. These producers act as the initial link between other value chain actors; carry out transportation activities, sorting and cleaning of grains.

Commission agents

These are rural based actors working mainly for urban based traders. They do not have personal cash for purchases but are paid on commission basis. They coordinate functions like: buying of pearl millet from individual households, grain bulking and transportation and linking rural producers to urban traders. However, funds for pearl millet purchasing are advanced by urban traders

Brokers

These are specialized, urban based middlemen purchasing pearl millet grains and also act as a link between rural traders and urban based processors. They operate in towns buying pearl millet at discounted prices from traders or producers; undertake transportation and bulking activities, offer storage activities at specified warehouses to ensure steady grain for processors. In undertaking such functions, they maintain close links with producers, traders and processors.

Traders

Most of pearl millet traders operate individually but on limited occasions perform grain collection services for urban based brokers. They are responsible for retailing and wholesaling functions, grain bulking and arrangement of transportation of produce to next

level actors. These actors undertake limited value addition activities with most interviewed accepting the need for more training on value addition.

Loaders and off-loaders

They are responsible for transporting pearl millet from nearby main road to stores and back. Loading and off-loading activities are undertaken by men who use handcarts/wheel barrows which could penetrate small paths in the markets where trucks cannot easily pass. These actors operate as a cartel and as a result no trader can have independent loading and offloading arrangements within the markets of Siakago and Ishiara. They charge a standard price for their prices ranging between Kshs 20-30 per 120 kgs bag which traders consider as high in relation to the covered distance.

Packers and Processors

Pearl millet milling industry involved both small scale and large scale processors who are legally licensed to undertake milling and retailing functions. They are responsible for produce bulking, transportation to institutional buyers, processing and marketing functions. In addition, they are responsible for nationwide distribution through major outlets like Nakumatt, Uchumi and Chandarana supermarkets enroot final consumers. Large scale processors offered technical assistance in terms of grain cleaning and grading process training to brokers to ensure high grain quality. Small scaled processors were mainly local processors operating within the local settings and are supplied directly by individual farmers. They undertake only processing functions for local consumer demands.

Transporters

These agents undertake transportation business for traders and brokers. However, from rural areas, the use of animal drawn carts and motorcycles as a means of transport to nearby feeder roads was common. The prices charged by transporters were mainly pegged on distance travelled and fuel prices. However, they usually demand extra payment when extra assistance in loading and unloading is offered.

Consumers

The final users of pearl millet are individual household. Individual households buy both pearl millet in the form of flour of grains depending on their intended use of the product. However, purchases are made at supermarkets or from traders of processors selling points depending on the customers' preference.

4.3 Market performance

An efficient marketing system minimizes the cost of a marketing process; ensures greater returns to producers while at the same time provide final consumers with quality products and at a reasonable price. In measuring market performance, marketing margin and marketing efficiency analysis were employed.

4.3.1 Marketing margin analysis

A marketing margin is the difference between consumer price and what a producer gets. Therefore, the size of a marketing margin indicates structural efficiency of a marketing system. The findings show that farmers sold a 120 kg bag of pearl millet grains at an average price of between Kshs[5]2,800-3,500 (US$ 35- 43.75) while traders sold a 100 kg bag of millet grains to brokers and large scale processors at an average price of between Kshs 3,360-3,960 (US$ 42- 49.50). However, sales to small scale processors attracted a price range of between Kshs 4,860 - 6,860 (US$ 85.75) per 100 kg bag while final consumers paid a price range of Kshs 10,000-12,000per 100 kg. It is important to note that these figures are dependent on the form of pearl millet (processed or not) and the season under review (Table 11).

Therefore, the producer's share of consumer price for a bag of pearl millet grain was 34.5, 19.4, 19.4 and 40.8 percent for channel I, II, III and IV respectively. Middlemen share of consumers' payment of 65.5 percent (channel I) and 59.2 percent (channel IV) were considered adequate based on the function they undertake in comparison to other actors along the pearl millet value chain. However, the middlemen share in consumer price within channel II and III was high partly due to overestimation of costs to conceal real profit levels. Therefore, an in depth analysis of marketing cost is necessary.

4.3.2 Price spread analysis

In analyzing the price spread, estimates of cost of marketing and marketing margins were recorded. From the findings, there was large price spread within various marketing channels implying some level of exploitation of producers'. For example, the highest price spread (Kshs 11,600) was found in channel II while the lowest price spread (Kshs 4,060) was found in the IV channel (Table 11). However, when the price paid and received by an actor was considered, the highest gross marketing margin was observed in the IV channel with farm gate price constituting an estimated 41 percent of the final consumer price. The lowest return

[5] Kshs – Kenya Shillings

was recorded in channel III with a producer return of 19 percent. This implies that the final price of pearl millet will be more than triple as it reaches the final consumer. In general, traders, brokers and rural agents' shares of the final consumer prices were higher than producers which might be true when their marketing functions are considered. In conclusion, channel I and IV showed good potential for up scaling considering the high producer returns in comparison with other channels (Table 11).

Table 11: Marketing costs, margins and price spread per channel per 120 kgs bag of pearl millet

Particulars	Marketing channels				
	I	II	III	IV	V
Net producers price	3,200	2,800	3,600	2,800	4,200
Rural agent					
Buyingprice	3,200	-	3,600	2,800	-
Marketing margin	740	-	1180	500	-
Selling price	3,940		4,780	3,360	-
Traders					
Buying price	3,940	2,800	4,780	3,360	-
Marketing margin	1,100	1160	1200	3,500	-
Selling price	5,040	3,960	5,980	6,860	-
Brokers					
Buying price	-	3,960	5,980	-	-
Marketing margin	-	1,860	1,500	-	-
Selling price	-	5,820	7,480	-	-
Processors					
Buying price	5,040	5,820	7,480	-	-
Marketing margin	4,240	9,540	11,320	-	-
Selling price to consumers	9,280	14,400	18,800	6,860	4200
Price Spread	**6,080**	**11,600**	**15,200**	**4,060**	

Channel 1:- Producer- Rural agents- Traders- small processors- Consumers; **Channel 2:**- Producers-Traders- Brokers- Large processors- Final consumers; **Channel 3:**- Producers- Rural agents- Traders- Brokers- Large processors- Final consumers; **Channel 4:** producers- rural agent-traders- final consumers; **Channel 5:**- Producers- Final consumers

4.3.3 Average costs of pearl millet marketing

The average marketing costs of pearl millet incurred by different actors are presented in Table 12. These costs were mainly classified into: transportation, loading and unloading, market fees and charges, commission charged by actors, weighing and stitching charges, taxes, border charges, cost of chemicals and fixed related costs.

Larger variations in costs were observed within pearl millet marketing chains. On average, the highest variable cost was incurred by traders (Kshs 126.6 per 100kgs bag) while the lowest was incurred by processors (Kshs 90 per bag). However, on fixed costs, processors incurred an estimated Kshs 19,500 month with the lowest fixed costs being incurred by traders (Kshs 987.3 per month). Major cost component of traders and brokers were payment of illegal taxes to police roadblocks, commission charged by local authorities for transporting of pearl millet (cess charges) and import charges at the port of entry. Major variable costs incurred by processors were in transportation estimated at Kshs 375 and rent charges estimated at Kshs 45,000 per month under fixed costs. To reduce these costs and improve on the profitability of pearl millet business, processing plants need to be located within the production areas to lower on the high rent charges.

The calculation of marketing costs as a percentage of the total marketing costs are also shown (Table 12). Result indicate that, on average, total cost varies from an estimated 1.7 percent to 75.9 percent across different pearl millet marketing levels. Amongst the diverse components of costs, fixed costs; rent and operating licenses were the highest contributors while on variable costs cereal import taxes, municipal cess and police bribes were the dominant contributors. Rent charges contributed an estimated 75.9 percent (traders); 78.4 percent (brokers) and 57.6 percent (processors)of fixed costs while transport contributed an estimated 7.6 (traders), 13.8 percent (brokers) and 52.08 percent (processors) of variable costs.

Table 12: Estimated incidental costs for procuring a 100 kg bag of pearl millet disaggregated by actors

ITEMS OF COST	Traders		Brokers		Processors	
	Marketing cost	**% of variable cost**	**Marketing Cost**	**% of cost**	**Marketing cost**	**% of cost**
Variable costs						
Purchase price/kg	23	1.7	28	1.4	35	4.8
Loading fees/bag	30	2.2	30	1.5	50	6.9
Offloading fees/bag	28	2.0	30	1.5	50	6.9
Packing materials/bag	50	3.7	50	2.6	50	6.9
Weighing and stitching/bag	30	2.2	30	1.5	-	2.7
Market fees/bag	40	2.9	40	2.08	100	13.8
Import tax charge/bag	200	14.8	200	10.4	-	-
Tax and bribe costs/lorry	500	37.2	500	26.1	-	-
Commission charges/bag	350	26.0	700	36.5	-	-
Transportation/bag	102	7.6	266	13.8	375	52.08
Cost of chemicals/bag	40	2.9	40	2.08	40	5.5
Average variable costs[6]	**126.6**		**174**		**88.20**	
Fixed costs						
Rent charges	3,000	75.9	40,000	78.4	45,000	57.6
Security costs	199.2	5.0	2,500	4.9	12,000	15.4
Electricity costs	150	3.7	2500	4.9	15,000	19.2
License fees	600	15.2	6000	11.7	6000	7.6
Average fixed costs[7]	**987.3**		**12,750**		**19,500**	
Total costs	**1,113.6**		**12,924**		**19,590**	

[6] The average variable costs was calculated by adding all variable costs figures and dividing the amount with the number of variable cost items making up the sum of variable costs

[7] Average fixed costs are the sum of all the amounts of fixed cost elements divided by the number of individual elements making up the total sum.

4.3.4 Marketing efficiency analysis

Table 13: Marketing efficiency of different pearl millet marketing channels

Prices/Costs	Channel I	Channel II	Channel III	Channel IV
Value added	6,080	11,600	15,200	4,060
Cost of marketing				
Traders	1,392.60	1,392.60	1,392.60	1,392.60
Brokers	-	1,914	1,914	-
Large processors	-	940	940	-
Small processors	415	-	-	-
Total cost of marketing	**1,807.60**	**4,246.60**	**4,246.60**	**1,392.60**
Marketing Efficiency index	**3.36**	**2.70**	**3.54**	**2.90**

The findings of specific channel analysis indicates that channel III had the coefficient of marketing efficiency of 3.5 and was therefore more efficient than channel I (3.4); channel IV (2.9) while channel II was the least efficient with efficiency index of 2.7 (Table 13). Therefore, considering the margins and efficiency index, pearl millet marketing can be said to be efficiency and profitable. However, this result should be interpreted with caution as only variable costs was used in the analysis an apportioning of fixed costs per bag was not possible. However, Batt, (2003) observed an undervaluation of value added potatoes by traders to cost Vietnamese dong145 per kg as a result of lack of clear dealing records and confidentiality in reporting of market prices amongst traders to conceal real profits.

4.3.5 Factors affecting pearl millet retail marketing margin

In examining factors affecting the level of marketing margin received by traders, a multiple regression model was used (Table 14).

Table 14: Regression results of factors affecting retail marketing margin of pearl millet

Explanatory variables	Regression coefficient	Standard error
Age	0.004	0.061
Educational level	2.086**	1.021
Experience in marketing	-0.112	0.088
Processing	-7.064*	2.006
Credit access	1.609	1.740
Constant	23.801	7.701

*Significant at 1 percent; ** significant at 10 percent: Prob.> F = 0.005; R-squared = .562; Dependent variable was the marketing margin

The value of R^2 (coefficient of determination) of 0.56 implies that 56.2 % of the variation in pearl millet marketing margin was explained by the explanatory variables like age, education, experience in marketing, processing and access to credit. The F ratio was statistically significant at 5 percent level of probability and thus reaffirms the overall significance of the parameter estimates in the model.

Results from Table 14 reveal that educational level of respondents and whether an actor undertakes any processing before selling as significant in influencing an actor's marketing margin. Education is positive and significant at 10 percent level with a coefficient of 2.085 indicating that an increase in one year of schooling increases pearl millet traders marketing margin by 2.085 per kilogram, ceteris paribus. This implies that pearl millet marketing could not be learned informally. Therefore, having better education gives excellent business dealing advantage than otherwise to value chain participants. Contrary to this, Ugwumba (2009) and Ayoola and Zever (2010) found out that educational level to negatively affect households' level of maize marketing efficiency in Nigeria. They attributed their result to the fact that in Nigeria, maize could be acquired informally by any household without necessarily having better education.

Traders were asked if they undertake processing before selling their pearl millet. Result show a negative but significant at 5 percent indicating that an increase in household engagement in

processing before sales decreases retail marketing margin by 7.06 per kilogram. This implies that the cost of processing pearl millet was high and thus policies aimed at reducing the cost of processing was necessary in order to increase marketing margin. A similar finding of an inverse relationship between marketing costs and the efficiency of marketing was noted with Nigerian maize market participants (Ayoola and Zever, 2010).Contrarily, Ugwumba (2009) found a negative correlation between fresh maize marketing costs and actors' incomes form marketing.

Access to credit was positively related to pearl millet marketing margin although not significant at 5 percent level. This implies that marketers with large resources will sell more pearl millet and receive high margins compared to small marketers who are constrained by finance. A similar positive but insignificant finding was noted by Ugwumba 2009 with Nigerian maize marketers.

Although the age of the marketer was negatively correlated with the marketing margin, it was insignificant at 5 percent level of probability. In addition, the regression analysis showed that marketing experience had negative relationship with the marketing margin. However, it was insignificant at 5 percent level of probability.

4.4 Marketing constraints faced by traders

Pearl millet market actors were asked to identify major marketing constraints limiting their participation in the value chain. These constraints were classified into two major categories: processing or upgrading constraints (Table 15 and 16).

4.4.1 Traders processing constraints

Amongst the six processing constraints listed in Table 14, differences in consumer taste was rated the highest constraint by traders (40 percent), consumer concerns on the safety of value added pearl millet products at 20 percent while high marketing cost was the least (5 percent). This implies that pearl millet consumers were more concerned with the conditions of food they consume. Therefore, any improvement in processing should take care of differences in consumer taste and preference and the health requirements if the products are to be marketed effectively.

Table 15: Reasons for not processing pearl millet before selling

Specific constraint	Frequency	Percentage
Difference in consumer taste and preference	8	40.0
High marketing costs	1	5.0
Limited supply of pearl millet	3	15.0
Low demand by consumers	3	15.0
Lack of processing machines	1	5.0
Changing consumer demands and stringent health standards	4	20.0

4.4.2 Constraints to market upgrading initiatives

Value chain actors face diverse marketing challenges: lack of correct and timely market information, inappropriate insurance products, and limited knowledge concerning the benefits of warehouse receipts system and low precautionary savings. Using a 5 point Likert scale with 1 as Ineffective and 5 as most effective, traders were asked to rank their feeling about the four market upgrading constraints limiting effective market participation. Figure 12 provides a summary of the result.

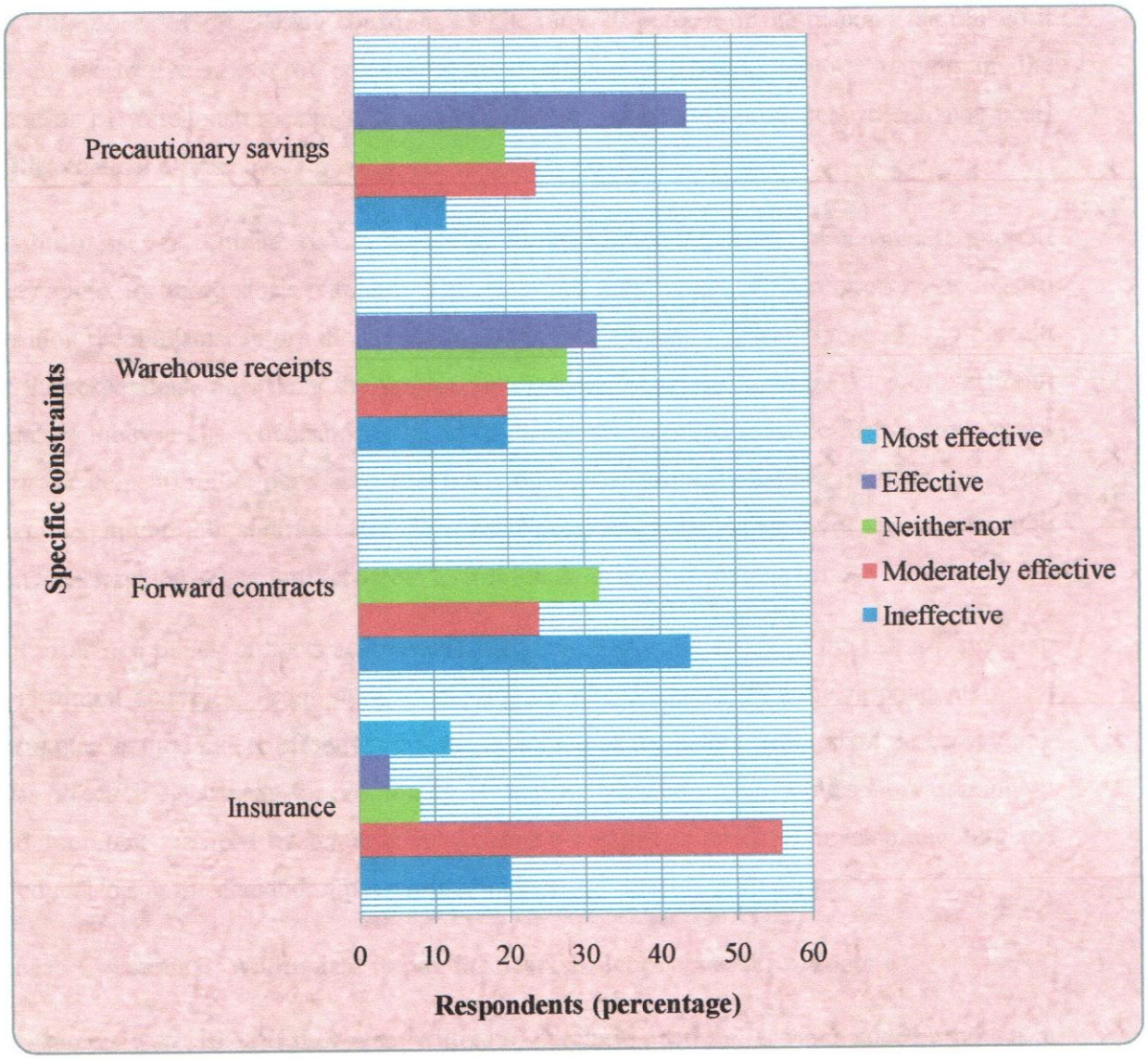


Figure 12: Effectiveness of market upgrading strategies by traders

First, the use of contractual agreements could help traders overcome the challenge of finance by linking producers, traders and processors. This is because, the use of forward contract ensures produce quality and consistency of supply throughout the year. In addition, it lowers the cost of transport for traders in cases where producers are sparsely located. From Figure 12, 44 percent of the sampled respondents noted that it was not an effective strategy; 24 percent accepted it a moderately effective strategy. This implies that more emphasis be put in promoting the use of contract farming to support smallholder farmers income levels.

To ensure continuous consumption of pearl millet all year round, efficient storage through the use of warehouse receipt system is necessary to get rid of middlemen. Out of the sampled respondents, 32 percent accepted the use of a warehouse receipt system as effective means of

solving processors marketing constraints while only 20 percent of the respondents ranked it as an ineffective means of enhancing chain efficiency. Therefore more training on the benefits of warehouse receipt system is needed for unsatisfied producers to enhance pearl millet channel efficiency.

As businesses face higher risk in day today dealings, they require larger savings to support their quest for more stock purchase. This increases their levels of precautionary savings to cushion them against future income losses. From our empirical result(Figure 12), 44 percent of the respondents noted that the low levels of precautionary savings was a major constraint limiting their purchase decisions while only 20 percent recorded it as ineffective strategy for large scale pearl millet purchases thus implying should bad state happen, pearl millet actors earnings might fall significantly. This conclusion calls for more involvement of credit schemes targeted at pearl millet actors to cushion them against income losses.

An insurance policy protects actors from financial losses as a result of the risk arising from agricultural activities. From study result (Figure 12), 56 percent of the respondents noted insurance as moderately effective tool in cushioning of the actors with only 4 percent noting it as effective mechanism for cushioning of pearl millet actors. This implies more training on the importance is need by actors while insurance companies needs to develop new targeted products to suit the demand of pearl millet traders.

4.5 Consumers' willingness to pay for pearl millet processed products

Consumers were asked if they were willing to purchase pearl millet value added products at the same price of Kshs 100 as Finger millet, Soya beans, White millet and Amaranth value added products. Those respondents who responded positively to first questions were further given the option of selecting different bids from 5 point bids of 10%, 20%, 25, 50% and 75%. Results are shown in Table 16.

4.5.1 Distribution of WTP responses

The percentage of the respondents who indicated their positive WTP decreased with increase in premium offered implying that an increase in price decreases demand levels (Table 16).

Table 16: Distribution of WTP responses

WTP category (%)	Frequency	Percentage
10 percent	23	32.86
20 percent	19	27.14
25 percent	14	20.00
50 percent	10	14.29
75 percent	4	5.71
Total	**70**	**100**

Out of the 70 positive respondents, 32.9% were willing to pay 10 percent while only 5.7% were willing to pay 75 percent price premium for pearl millet value added products. This result implies that consumers had a positive rating for pearl millet compared to substitute products like finger millets. In that way it can be used as a raw material in making products and therefore attract higher prices. Similar studies by Shukri and Awang- Noor (2012) in Malaysia reported 53.4 percent of their respondents as WTP RM 500 in comparison to 90.3 percent of respondents who were WTP RM 100 to acquire certified timber products. In addition, Kimenju and De Groote (2005) in Kenya found out that 50.3 percent of the respondents were willing to pay 5 percent while 39 percent were willing to pay a premium of 50 percent above the normal maize prices. Gunduz and Bayramoglu (2011), on the other hand, observed 81 percent of Turkish organic chicken consumers' were willing to pay price premiums. Out of these, 28, 29 and 10 percent were WTP less than 5 percent, 6-10 percent and more than 10 percent price premium respectively above the regular chicken prices.

4.5.2 Estimate of consumers mean willingness to pay

Based on the result from contingent valuation method, the mean WTP was estimated and is presented in Table 17. The result indicate that respondents were on average willing to pay Kshs.142representing a premium of 42% over the normal price of Kshs 100 for similar finger millet product. In general, consumers showed a positive willingness to pay for pearl millet value added product. These findings are similar to those of Padilla *et al.*, (2007) who estimated a mean WTP for Chilean consumers at 39 percent for officially certified labels on traditional food products. On the other hand, Nepal consumers were willing to pay between 40-60 percent for labeled tomatoes (Bhatta *et al.*, 2010). Loureiro and Umberger (2003) also observed that USA consumers were willing to pay 38 and 58 percent for certified steak and

Hamburger above the initial given prices respectively. It is important to note that the true position of the mean WTP might be lower than our mean WTP estimate partly due to the hypothetical nature of survey data used in the contingent valuation methodology. Therefore, these results should be interpreted with caution.

Table 17: Parameter estimates of mean WTP model

Variable	Coefficient estimate	Standard error	P- value
Constant (α)	9.235	1.662	0.000
Bid (ρ)	0.065	0.013	0.000
Mean WTP (α/ ρ)	142.077		

Number of observations = 100; Log likelihood = -63.862

4.5.3 Factors affecting consumer's willingness to pay for pearl millet value added products

A total of 100 respondents from Mbeere district were interviewed to support the analysis of the factors affecting consumers WTP. The main variables hypothesized to influence consumers WTP and used in logistic regression analysis included: a household head monthly income levels in Kshs(Income), level of respondents awareness of pearl millet value added product (Awareness), if the respondents have ever heard of pearl millet value added products (HeardProduct), total number of children below 12 years in a given household (NoChildren); Age of the buyer or household head (AgeofHH), the highest number of years a buyer/ household head have been in school (EducLevel) and the employment status of a household head/buyer (employment status). In addition, dummy variables like if the respondent was a household head or otherwise (HHhead) and whether the respondent or household head was male or female (Gender) were also included in the study (Table 18).

Table 18: Empirical result from estimated Logit model and their marginal effects

WTP	Coefficients	Standard Error	z	P>|z|	Marginal Effects
HHhead	-0.555	0.716	-0.78	0.438	-0.056
AgeofHH	0.080	0.029	2.76	0.006*	0.008
Gender	1.252	0.728	1.72	0.086***	0.127
EducLevel	-0.102	0.348	-0.29	0.769	-0.010
NoChildren	0.558	0.244	2.29	0.022**	0.057
Employmentstatus	0.238	0.277	0.86	0.390	0.024
Income	1.029	0.388	2.65	0.008*	0.105
Awareness	1.351	0.420	3.22	0.001*	0.138
HeardProduct	0.229	0.455	0.50	0.615	0.023
Constant	-10.540	3.136	-3.36	0.001	-

Statistics: -Number of observations = 100; Prob.> chi square = 0.0000; Log likelihood = -33.660; Pseudo R-squared = 0.4014; Likelihood ratio test of zero slope coefficients= 45.15; *: significant at 1%; **: significant at 5%; ***: significant at 10%

The findings of the maximum likelihood estimate for WTP a premium price is presented in Table 18. The model revealed a McFadden's R^2 statistic of 0.40 which is a reasonable value considering the cross sectional nature of data and therefore correctly predicted the actual choice of WTP premium by consumers (Kennedy, 1994; Govindasamy and Italia, 1999). Moreover, the calculated Chi square statistic of 0.000 was statistically significant indicating the statistical significant of the model in explaining the result. In general, five out of nine hypothesized factors were significant at 1 percent, 5 percent or 10 percent.

From the empirical result, the coefficient of households with children below 12 years old is positive sign and significant at 5 percent level (Table 18). This means that households with children below 12 years old were 5.6 percent more WTP premium prices than those without these children. This is because, households with children are more concerned with the nutritional values of food they give to children and pearl millet is perceived as one such category of food. This empirical result mirror those of Gao *et al.*, (2011) on USA fresh citrus consumers where they observed that households with children below 12 years tended to be in a pro quality cluster than perfectionist clusters. Because parents were more focused on fruit quality, they were willing to pay premium prices for quality fresh citrus fruits compared to those without children. In Turkey, Budak *et al.*, (2010) observed those producers with larger

herd sizes as more willing to pay premium prices than those with limited herd sizes to receive extension services due to their contribution to household income. In USA, Loureiro and Umberger (2003) observed a contradicting result as households with children portrayed a negative correlation with willingness to pay for beef products. Bhatta *et al.*, (2010) also noted a negative relationship between family size and willingness to pay for inorganic vegetables like tomatoes. This they attributed to the fact that a larger family size means more expenditure on foods and to cut down on these expenditures, they need to opt for cheaper food types.

Educational level attained by a given household directly affects a consumer's willingness to pay levels. Access to better education enhances the understanding of nutritional information; therefore, respondents with education should possess higher WTP. However, from empirical result (Table 18), the coefficient of the variable representing educational level was negative and had no significant role in influencing consumers' willingness to pay premiums. Those with higher education were 1.04 percent less likely to pay premium prices compared to those with low education. This result is consistent with the a priori assumption that as a person stays more in school, his/her willingness to pay for a premium price decreases. This is true because educated consumers think and judge between good and healthy food and which is not. Secondly, they might expect that it is government duty to provide these products free of charge and thus their unwillingness to pay premium prices. In addition, educated consumers are more likely to be in off farm employments and therefore might overemphasize the need for produce safety standards. These findings are similar to Budak *et al.*, (2010) who observed that highly learned Turkish producers' unwillingness to pay premium prices for extension services. Bhatta *et al.*, (2010) also observed a positive and significant result with Nepal inorganic vegetable consumers. However, they negate those of Owusu and Onfori (2012) findings that well educated Ghanaian organic food consumers' willingness to pay higher premiums compared to less educated consumers. In addition, they contrast studies of Loureiro and Umberger (2003) findings that a unit increases in the level of education increases the level of US consumers WTP premium for certified Hamburger.

According to economic theory, as household income increases, the probability of household willingness to pay also increases. From our empirical result (Table 18), a household's monthly income levels had a positive sign which was significant at 5 percent level with willingness to pay for pearl millet value added product. A unit increase in a household

monthly income increases its willingness to pay premium for pearl millet value added product by 10.5 percent. This is consistent with our earlier expectation that an increase in a household income levels had a direct and a positive effect on premium payment. These results are consistent with Kimenju and De Groote (2005) observation that Kenyan maize consumers with higher income levels (greater than Kshs. 50,000) were willing to pay premium prices than those with low incomes levels. Similarly, Owusu and Onfori, (2012) recorded that Ghanaian organic food consumers were willing to pay premium prices as monthly income levels increases. In addition, Govindasammy and Italia (2009) pointed out that USA households with earnings less than USA $30,000 were 16 percent less likely to pay premium compared to those earning over USA $ 70,000. However, Loureiro and Umberger (2003) observed in US that as income levels increases, households WTP decreases. This was because USA households considered their meat supply to be safe and thus no need for labeling.

In terms of gender, our empirical results showed that the coefficient was positive and statistically significant at 10 percent level with consumers' willingness to pay premium prices (Table 18).This indicates that male consumers were 12.7 percent more likely to pay premium prices for pearl millet value added products compared to female consumers. Haghiri and McNamara (2007) pointed out in Canada that male consumers' were more willing to pay premium prices than female counterpart for pesticide free produce. In China's urban cities, Lin *et al.*, (2005) found out that male Chinese consumers were more willing to purchase Soybean compared to female consumers. However, in USA, Govindasamy and Italia (2009) observed that male consumers were 12 percent less likely to pay 10 percent premium to acquire an organic produce. In South Carolina- USA, Carpio and Isengildina-Massa (2009) observed female consumers' as 44 percent more willing to pay an additional price to obtain animal products compared to male consumers. Loureiro and Umberger (2003) also observed female USA households as more willing to pay a premium for mandatory country of origin labeling programs.

Household heads are decision makers in a family, and therefore their age levels are important in making a purchase decision. From the a priori assumption, it was hypothesized that older household heads might not be willing to pay premium prices as they are in their retirement ages with little income. However, from the empirical results (Table 18), the coefficient for the age of household head has a positive and significant sign at 1 percent level. This indicates

that if a respondent was old, they were 0.8 percent more likely to pay higher price for pearl millet value added product compared to when the respondent was young. This implies that older consumers were more motivated in purchasing pearl millet value added products than younger consumers. This might be attributed to the long history of pearl millet in Mbeere district and so they had excellent knowledge in its benefits and uses.

Access to information increases the level of consumers' awareness by eliminating consumer suspicion. According to economic theory as level of consumer awareness increases, the higher their willingness to pay premium prices. From Table 18, the coefficient of consumer level of awareness was positive and significant at 1 percent level with willingness to pay. Therefore, consumers who were aware of the benefits of consuming pearl millet products were 13.7 percent more likely to pay a premium than those with limited information about it. This implies that consumers aware of healthy foods are motivated to in purchasing of the safe and healthy food items from the market. Bate *et al.*, (2007) on USA consumers' willingness to pay for multi ingredient processed organic foods observed no significant difference between aware and not aware consumers about national organic products seal. Pokou *et al.*, (2010) on Ivory Coast farmers' willingness to contribute to Tsetse fly control observed that farmers with better information on Tsetse fly symptoms and control increased their labour participation in its control mechanisms.

In addition, Govindasamy *et al.*, (2006) on Northeastern USA organic produce consumers concluded that higher price premium paid by consumers are a direct relationship with the level of awareness of the product's usefulness. Bhatta *et al.*, 2010 also observed a positive and significant result with Nepal inorganic vegetable consumption. However, other variables like household head (HHhead), employment status (Employmentstatus) and if consumers have ever heard of pearl millet value added products produced a statistically insignificant results (Table 18).

CHAPTER FIVE
CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study assessed the performance and efficiency of pearl millet market value chain in Mbeere District (production area) and the final markets of Kenya. Findings revealed that pearl millet marketing was dominated by young women aged between 41-53 years. Producers, on the other hand, had a higher level of educational compared to these young women (Table 4). Results further showed that pearl millet business was profitable despite poor coordination between producers and intermediaries (Figure 9). The most efficient channel was channel III (Producers- Rural agents- Traders- Brokers- Large processors- Final consumers) with an index of 3.54, followed by channel I (Producer- Rural agents- Traders- small processors- consumers) with index 3.36, channel IV (producers- rural agent- traders- final consumers) with index of 2.90 and lastly channel II (Producers-Traders- Brokers- Large processors- consumers) with index of 2.70. However, there was no value addition within channel IV. Within the above channels, findings revealed that brokers and traders incurred higher transport costs due to police bribes, municipal cess and import taxes. In addition, most millet actors were not members to any formal associations which might have limited their access to credit. Trader's marketing margin was positively influenced by age, educational level of an actor and access to credit but was negatively influenced by traders marketing experience and access to finance.

Third, pearl millet marketing was hindered by the high processing costs (40%); limited supply of grains (15%) and low demand for value added pearl millet products (15%). However, major procurement constraints included lack of targeted insurance products (56%), low levels of precautionary savings and limited use of contract agreements (44%) and the last limiting factor was the storage capacity (32%).

Finally, our results do recognize that 70% of Kenyan consumers were willing to show their appreciation of pearl millet value added product through payment of an additional amount estimated at 42% price premium to obtain pearl millet product. In terms of factors affecting consumers' WTP, results showed that households with a monthly income and children below 12 years and had prior knowledge of pearl millet were most likely to pay price premium. These results showed that Kenyan consumers' were willingness to pay premiums consistent

with their consumption behaviors. Therefore, to boost profits from this potential niche and lucrative market, these households should form the prime target of marketers.

5.2 Recommendation

In order to harness the existing opportunities in pearl millet market value chain, this study recommends the following. First, because pearl millet market actors are not well coordinated as evidenced from Figure 9, the government should enact policies aimed at linking producers' with processors to increase overall chain profitability. Such policies might be the formation of micro selling schemes, the use of contract agreements and setting up of an online marketing system to sensitize processors on the annual domestic production levels and supply sources.

Moreover, pearl millet marketing was a female dominated area, yet majority of these women are regarded as poor and less fortunate with limited access to collaterals in the society. Therefore, formulated policies should aim at empowering and improving the efficiency of their participation to improve their income potential. These policies might include provision of soft loans, trainings on value addition initiatives, modern packaging requirements, grain quality determination, final product presentation and market demand forecasting techniques.

Like other products, pearl millet products also received a price premium of 42 percent above its base price of Kshs 100 signifying high growth potential. However, limited studies targeting consumers' preference and willingness to pay for its products exist in Kenya. This study recommends that fast food marketers should be familiar with this price premium and adjust their marketing strategies to benefit from this niche market. Finally, empirical results also indicated that not all consumers were willing to pay equal price premium for pearl millet product. Marketers should therefore classify consumers into different groups according to their willingness to pay percentages and adopt matching marketing strategies to derive maximum benefit from these consumers.

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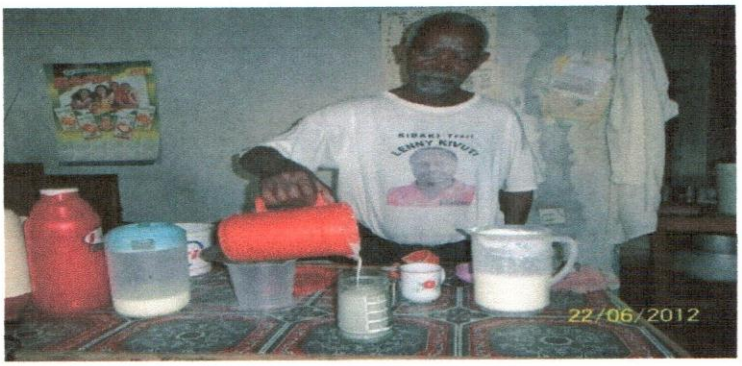
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APPENDICES

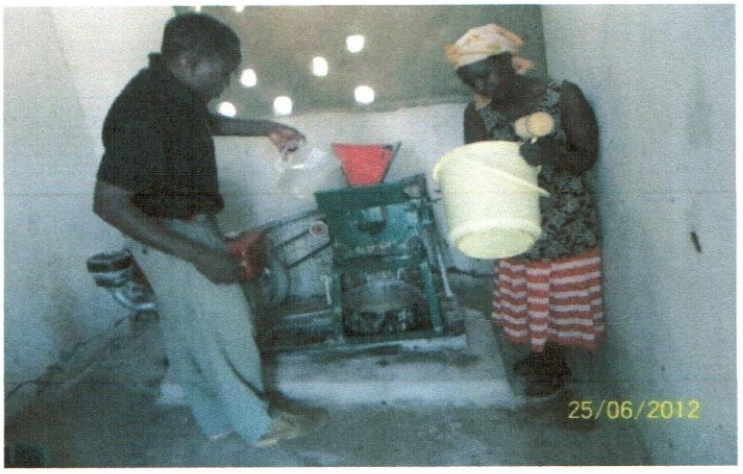
APPENDIX 1: Final products from Pearl millet



Ready to drink Kinaga



Kimere ready for consumption



Pearl millet Uji Preparation

APPENDIX 2: Questionnaire

Title: Analysis of Structure and Performance of Pearl Millet (*Pennisetum glaucum* (L.) R. Br.) Value Chain: A Case Study of Mbeere North District, Embu County, Kenya

This study is purely done for academic purposes only and is aimed at generating knowledge relevant for stakeholders in the pearl millet industry. Therefore, as a respondent you are requested to fill the below questionnaire and be guaranteed of the confidentiality of your given information.

Questionnaire Serial Number: .....

Name of the Actor: .....

Trader Type (1-Producer, 2-Community agent, 3-Retailer, 4-Wholesaler, 5-Broker, 6-Transporter 7-Others Specify..... [ ]

Market of Operation/ Office: .....

QUESTIONNAIRE FOR PEARL MILLET PRODUCERS

SECTION A: BACKGROUND INFORMATION

Age	Sex	Education levels (No. of years in school)	Household size (No. in a family)	Income sources	Year first grew pearl millet	Source of initial finance		Which assets do you have?		Information access		
						source	amount	Type	Cost	Type	Means	Source
[ ]	[ ]	[ ]	Adults (>35)years [ ] Children <18years[ ] Children (18-35) years [ ] Relatives [ ]	[ ]	[ ]	[]		[ ] [ ] [ ]	[ ] [ ] [ ]	[ ] [ ] [ ]	[ ] [ ] [ ] [ ]	[ ] [ ] [ ] [ ]

Codes: Sex; 1-Male2-Female: **Income source;** 1-Farming2-Employment3-Farming and employment4-Others: **Source of initial finance;** 1-Self2-Family/friend 3-Credit 4-Grant5-Others: **Asset endowment**; 1-Radio 2-bicycles 3-TV 4-Computer 5-Mobile phones: **Information Access**: **Type**; 1-daily prices 2-demand 3-buyers 4-market days 5-others: **Means**; 1-mobile 2-internet 3-magazines 4-radio 5-others: **Source;** 1-Ministry of Agriculture 2-NGOs 3-Other farmers 4-Buyers 5-others.

Background information (continuation)

Distance to				Distance to nearest road(Km)		Livestock enterprises				Land ownership			
Urban market		Local market		Tarmac	Murrum								
Distance	Time to reach (Min)	Distance	Time to reach(min)			Type	Number	Cost	Feed source	Type	size	Cost/acre if rented	% to pearl millet

Codes: Livestock type; 1-oxen 2-dairy cattle 3-local cattle 4-donkeys 5-camels 6-goats 7-sheep 8-pigs 9- poultry 10-others: **Feed source**; 1-commercial feeds 2-agro-industrial by products 3-cut and carry fodder 4-crop residues 5-others: **Land ownership type**; 1-communal 2-private 3-rented 4-others specify:

SECTION B: MARKET ACCESS

Buyers of your pearl millet	Variation in buyers (last 5 years)	If yes, continue			Pearl millet information			
		Actor	Number	Reason for the variation	Form in which millet is sold	price	What determines prices	Price setter
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
[ ]		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
[ ]		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
[ ]		[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Codes: Buyers of your pearl millet 1-other farmers 2-agent 3-wholesaler 4-retailer 5-processor 6-state marketing boards 7-local market 8-cooperatives 9-schools 10-other: **Variation in buyers (last 5 years);** 1-Yes 2-No: **Actor;** 1-agent 2-wholesalers 3-retailer 4-processor: **Reason for the variation;** 1-limited supply 2-low profit 3-stiff competition 4-high taxes/strict policies 5-low demand 6-others: **Form in which pearl millet is sold:** 1-grain2-flour3-grain and flour4-Uji 5-Kimere 6-Kinaga: **Price determinants;** 1-colour 2-nutritional value 3-packaging 4-taste 5-variety 6-other: **Price setter;** 1-consumer2-producer3-agent4-wholesaler5-retailer6-processor7-others.

SECTION C: MARKET ACCESS CONTINUED

Transport means to nearest market centre	Presence of high millet demand	If yes, why low prices	Millet price setter	Price guiding principles	Demand promotion strategies	Marketing				Pearl millet price	
										Month	Price
										Jan	
										Feb	
										March	
										April	
[ ]		[ ]	[ ]	[ ]	[ ]	Constraint	Rank	Opportunity	Rank	May	
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	June	
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	July	
		[ ]	[ ]	[ ]	[ ]	[ ]		[ ]	[ ]	August	
										Sept	
										October	
										November	
										December	

Codes: Means of Transport; 1-drought animals' 2-bicycle 3-motorbike 4-foot 5-public vehicle 6-own vehicle 7-hired transport 8-others: **High demand**; 1- Yes 2-No: **If yes, Why low prices**; 1-negative attitude 2-cartels 3-low quality 4-high supply 5-others: **Millet price setter**; 1-producers 2-agent 3-consumer 4-retailer 5-wholesaler 6-processor 7-others: **Price guiding principles**; 1-quality 2-texture 3-variety 4-nutritional value 5-packaging 6-others: **Demand Promotion Strategies;** 1-Cleaning 2-processing 3-bulking 4-mixing with other grains 5-lowering prices 6-cooperatives/farmer groups 7-sorting 8-others: **Marketing Constraints**; 1-low prices 2-limited demand 3-long distance 4-poor roads 5-poor

quality 6-negative attitudes 7-others: **Coping Strategies**; 1-contracts 2-promotion 3-high quality and yielding varieties 4-using agents 5-hire agents.

SECTION E: FINANCE, POLICY REGULATORY FRAMEWORK AND INSTITUTIONAL SUPPORT SERVICES

Do you have access finance	**If yes, what are the main sources**	**If no, what are the constraints**		**What are the Policies/regulations constraining farmers**		**What are the Policies/regulations needed to support farmers**		**Do you belong to any business association**	**If yes, what are the functions of the association**	
	[ ]	**Constraints**	**Rank**	**Policies**	**Rank**	**Policies**	**Rank**		**Function**	**1-Yes/2-NO**
	[ ]	[1]	[ ]	[1]	[ ]	[1]	[ ]		[1]	[ ]
[ ]	[ ]	[2]	[ ]	[2]	[ ]	[2]	[ ]	[ ]	[2]	[ ]
	[ ]	[3]	[ ]	[3]	[ ]	[3]	[ ]		[3]	[ ]
	[ ]	[4]	[ ]	[4]	[ ]	[4]	[ ]		[4]	[ ]
		[5]								
		[6]								

Codes: Access to Finance; 1-Yes 2-No; **Sources of Finance**: 1-banks 2-business 3-microfinance 4-Money lenders 5-other traders 6-others; **Constraints to Financial Access**:1- lack of information 2-complicated contracts 3-Inappropriate products 4-Negative attitudes towards farming 5-High risk of my operation 6-Small nature of my operation; **Policies Constraining Farmers**; 1-insurance 2-forward contracts 3-warehouse receipts 4-precautionary savings; **Policies Needed to Support Farming**; 1-contract farming 2-warehouse receipts 3-cooperative laws 4-simplifying contracts; **Membership to a Business Association**: 1-Yes 2-No; **Functions of Cooperative**: 1-Aggregation of supply and commercialization 2- contractual arrangement with processors 3-information and training 4-extension services; **Rankings;** 1-most effective 2-effective 3-neither effective nor ineffective 4-moderately effective 5-ineffective

QUESTIONNAIRE FOR PEARL MILLET TRADERS

SECTION A: BACKGROUND INFORMATION

start Date	Operation of the business	Age of the owner/operator	Source of startup capital				Educational level of the operator (No. of years in school)
			Source	Amount	Source of monthly repayment	Interest rate	
[ ]	[ ]	[ ]	[ ]				[ ]

Operation of the business; 1-part time 2-fulltime 3-fulltime and part time 4-others; **Source of startup capital**; 1-banks 2-friends/family 3-own savings 4-money lenders 5-cooperatives; **Source of monthly repayment**; 1-employment income 2-farming business 3-sale of livestock and crops

SECTION B: PEARL MILLET TRADING

Major source of Pearl millet	Varieties commonly sold	Transport system used	Transportation			
			Constraints	Rank	Copping strategies	Rank
			1.		1.	
			2.		2.	
			3.		3.	
			4.		4.	
			5.		5.	

Codes: source of pearl millet; 1-Motuobare 2-Kiritiri 3-Embu 4-Ishiara 5-Busia; **Varieties commonly sold**; 1-Kimbere 2-Kiraka 3-Ngendau 4-Magwenje 5-Macanavuau 6-GISATI (The ICRISAT) 7-KAT PM1 8-KAT PM2 9-KAT PM3 ; **Transport system used**; 1-Foot 2-Motorbike 3-drought cat for animal 4-Public transport 5-Hired transport; **Transport constraints**; 1- expensive 2-unavailability 3-low volumes 4-poor roads access 5-unaccesible farms 6-others: **Coping strategies**; 1-purchase own trucks 2- wait for farmers to bring 3-leave selling millet 4-contract farmers 5-others; **Rankings;** 1-most effective 2-effective 3-neither effective nor ineffective 4-moderately effective 5-ineffective

SECTION C: PROCESSING

1. Do you process pearl millet? [ ] 1- Yes 2-No.

2. If your answer to the above is no, please indicate the reasons for not processing (Tick where appropriate)

    1. To reduce costs
    2. Due to limitation in supply
    3. Due to low demand for processed products
    4. No machines to process
    5. Difference in consumer taste and preferences
    6. Others specify .....

3. If your answer to question 1 above is yes, please give reasons by ticking the choices below

    1. High demand from consumers
    2. To increase shelf life of the products form pearl millet
    3. To enhance marketability of pearl millet
    4. Others specify .....

4. If your answer to question 1 above is yes, what are your main products from processing of pearl millet?

    1. Flour
    2. Uji
    3. Kimere
    4. Githeri
    5. Others specify .....

SECTION D: MARKETING CHANNEL AND UTILIZATION

Main marketing channels		Buyers of pearl millet	Changes in buyers position	Reason for change	Policies	
Unit of measurement when buying	Unit of measurement when selling				Constraining traders	Benefiting traders
					Policy	policy
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
[ ]	[ ]	[ ]			[ ]	[ ]
[ ]	[ ]	[ ]				

Codes: Unit of measurement when buying and selling: 1-2kgs Gorogoro 2-2.5 kgs Gorogoro 3-3 kgs Gorogoro 4-25 kgs sacks 5-Debes (10kgs); **Buyers of pearl millet; 1**-farmers2- other retailers3- wholesalers 4- millers/processors 5- individuals' consumers 6- institutions like Nursery schools: **Changes in the position of buyers**; 1-Increasing 2-decreasing 3-no change; **Reason for change;** 1-adequate supply 2-high demand 3-Idle capacity 4-limited cash income 5-others specify: **Policies/regulation constraining traders;** 1- Yes 2-No: **Policies/regulation benefiting traders;**1-Yes 2-No

SECTION E: FINANCE, POLICY REGULATORY FRAMEWORK AND INSTITUTIONAL SUPPORT SERVICES

Do you have access finance	If yes, what are the main sources	If no, what are the constraints		What are the Policies/regulations constraining farmers		What are the Policies/regulations needed to support farmers		Do you belong to any business association	If yes, what are the functions of the association	
	[ ]	Constraints	Rank	Policies	Rank	Policies	Rank		Function	1-Yes/2-NO
	[ ]	[1]	[ ]	[1]	[ ]	[1]	[ ]		[1]	[ ]
[ ]	[ ]	[2]	[ ]	[2]	[ ]	[2]	[ ]	[ ]	[2]	[ ]
	[ ]	[3]	[ ]	[3]	[ ]	[3]	[ ]		[3]	[ ]
	[ ]	[4]	[ ]	[4]	[ ]	[4]	[ ]		[4]	[ ]
		[5]								
		[6]								

Codes: Access to Finance; 1-Yes 2-No; **Sources of Finance**: 1-banks 2-business 3-microfinance 4-Money lenders 5-other traders 6-others; **Constraints to Financial Access**:1- lack of information 2-complicated contracts 3-Inappropriate products 4-Negative attitudes towards farming 5-High risk of my operation 6-Small nature of my operation; **Policies Constraining Farmers**; 1-insurance 2-forward contracts 3-warehouse receipts 4-precautionary savings; **Policies Needed to Support Farming**; 1-contract farming 2-warehouse receipts 3-cooperative laws 4-simplifying contracts; **Membership to a Business Association**: 1-Yes 2-No; **Functions of Cooperative**: 1-Aggregation of supply and commercialization 2- contractual arrangement with processors 3-information and training 4-extension services; **Rankings;** 1-most effective 2-effective 3-neither effective nor ineffective 4-moderately effective 5-ineffective

SECTION D: MILLET INCOME AND COSTS

1. What is the current pearl millet (3kgs) buying price from farmers? Kshs.....
2. What is the current buying price of pearl millet (2.5kgs) from agents in your market of operation? Kshs.....
3. What is the current selling price of pearl millet (2 kgs) Gorogoro in your market of operation? Kshs.....

Marketing costs

Costs	**Location of market outlet (Km)**	**Unit price (kshs)**	**Total costs**
Personal fare		One way fare =	
Carrying 150 kgs bag of pearl millet			
Hiring security at the storage if any		Per month =	
Market access fees to the council		Per week =	
Interest on loans specific to millet		Per month =	
Transportation cost to the road		Per bag =	
Loading onto the carrier		Per bag =	
Unloading onto the carrier		Per bag =	
Transport from the nearby road to store		Per bag =	
Rent of storage space		Per month =	
Pesticide usage			

QUESTIONNAIRE FOR PEARL MILLET PROCESSORS

SECTION A: BACKGROUND AND SOURCE OF PEARL MILLET

Name of the company	Year started	Source of initial capital				Pearl millet functions undertaken	Source of pearl millet	Source areas		Any source changes in the last 5years
		Source	Amount	Monthly repayment	Interest rate			Source	price	

Codes:

Source of initial capital: 1-own savings 2-family/friends 3-banks 4-Saccos 5-Inherited 6-others: **Pearl millet functions you undertake**: 1-buying 2- distribution 3-bulking 4-selling 5-others: **Source of pearl millet:**1- Farmers 2- retailers 3- wholesalers 4-agents 5-others:**Source areas**: 1-Nyanza province 2-Western province 3-Rift valley 4-Central 5-Eastern 6-Coast 7-other specify: **Changes in the source area in the last 5 years**: 1-Yes 2-No.

SECTION B: PROCESSING AND PACKAGING

1. Do you undertake pearl millet processing? [ ] 1- Yes 2-No.

2. If your answer to the above is yes, please indicate the main processing constraints affecting your organization? (*Tick where appropriate)*

    1. Poor grain quality
    2. Low supply levels
    3. Low demand for processed products
    4. High processing costs
    5. Different consumer taste and preferences
    6. Lack of clean running water
    7. Tedious certification process
    8. Others specify .....

3. If your answer to question 1 above is yes, what are your main products from pearl millet processing?

    6. Flour
    7. Uji
    8. Kimere
    9. Githeri
    10. Others specify .....

4. Have ever attended any processing trainings? Yes No
5. If yes, was the training attended enough for effecting processing? Yes No
6. Are there policies supporting pearl millet processing? Yes No

7. Are there policies supporting pearl millet processing? Yes No

SECTION C: MARKETING

To whom do you sell your millet	Are there changes in buyer composition	Seasonal demand Variation	Transportation to company	Marketing	
		Month of low and high supply	Mode	Constraints	Coping strategies

Codes : To whom do you sell pearl millet flour; 1-retailers 2-consumers 3-wholesalers 4-confectionaries 5-feed manufacturers 6-others: **Are there changes in the composition of buyers**: 1-yes 2-No**Transport mode**: 1-Drought pulled animals 2-public transport 3-own transport 4-motor bike 5-bicycle 6-hired transport 7-other; **Marketing constraints**; 1-low demand 2-few traders 3-negative attitudes 4-others specify: **Coping strategies**; 1-low prices 2-aggressive promotion 3-diversification to other processing activities 4-open company run selling points 5-others.

SECTION D: FINANCE, POLICY REGULATORY FRAMEWORK AND INSTITUTIONAL ASSESSMENT

Do you have access finance	If yes, what are the main sources	If no, what are the constraints		What are the Policies/regulations constraining processors		What are the Policies/regulations needed to support processors		Do you belong to any business association	If yes, what are the functions of the association	
	[ ]	Constraints	Rank	Policies	Rank	Policies	Rank		Function	Ranks
	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]		[ ]	[ ]
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]		[ ]	[ ]
	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]		[ ]	[ ]

Codes: Access to Finance; 1-Yes 2-No; **Sources of Finance**: 1-banks 2-business 3-microfinance 4-Money lenders 5-other traders 6-others; **Constraints to Financial Access**:1- high risk 2-lack of information 3-complicated contracts 4-Inappropriate products 5-Negative attitudes towards farming 6-High risk of my operation 7-Small nature of my operation 8-others; **Policies Constraining Farmers**; 1-insurance 2-forward contracts 3-warehouse receipts 4-precautionary savings 5-others; **Policies Needed to Support Farming**; 1-contract farming 2-warehouse receipts 3-cooperative laws 4-simplifying contracts 5-others; **Membership to a Business Association**: 1-Yes 2-No; **Functions of Cooperative**: 1-Aggregation of supply and commercialization 2- contractual arrangement with processors 3- retailer and exporters 4-information and training 5-extension services 6- other; **Rankings;** 1-most effective 2-effective 3-neither effective nor ineffective 4-moderately effective 5-ineffective

SECTION D: MILLET INCOME AND COSTS

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Marketing costs

Costs	**Location of market outlet (Km)**	**Unit price (kshs)**	**Total costs**
Personal fare		One way fare =	
Carrying 150 kgs bag of pearl millet			
Hiring security at the storage if any		Per month =	
Market access fees to the council		Per week =	
Interest on loans specific to millet		Per month =	
Transportation cost to the road		Per bag =	
Loading onto the carrier		Per bag =	
Unloading onto the carrier		Per bag =	
Transport from the nearby road to store		Per bag =	
Rent of storage space		Per month =	

QUESTIONNAIRE FOR CONSUMERS

SECTION A: LEVEL OF AWARENESS OF PEARL MILLET PRODUCTS

1. What is your level of awareness of pearl millet processed products?
   None ☐ Low ☐ Sufficient ☐ Good ☐
2. Have you ever heard of pearl millet processed product?
   Never heard of it ☐ Heard of it <3 years ☐ Heard of it >3 years ☐
3. If the answer in 2 is yes, how did you get to know of the pearl millet products? *Please tick only one option*
   Media ☐ School ☐ Medical practitioner ☐ Consumer awareness campaigns ☐ Publications ☐ Friends ☐ mmunity members ☐

SCTION B: CONSUMER PREFERENCE AND ATTITUDE TOWARDS PEARL MILLET PRODUCTS

4. In a scale of 1-least preferred, 2, 3, 4 to 5-most preferred, please rank your consumption preference for the following course cereals indicating?

Type of cereal	Level of preference	Current price of the cereal/kg
Finger millet flour		
Pearl millet flour		
Soya bean flour		
White millet		
Amaranth		

5. What factors limits your choice of pearl millet processed products?
   - Limited knowledge Yes ☐ No ☐
   - Long preparation time Yes ☐ No ☐
   - Poor packaging Yes ☐ No ☐
   - Unavailability Yes ☐ No ☐
   - Traditional crop associated with poor people Yes ☐ No ☐

SECTION C: ASSESSING CONSUMER WILLINGNESS TO PAY

6. Scientists at Egerton and Nairobi Universities are developing a new product of pearl millet (Mwere/ Mawele) which contains additional nutrients and vitamins. Would you be willing to purchase this Mawele/Mwere if it were offered at the same price as finger millet, Amaranth, white millet or soy bean flours? Yes ☐ No ☐

   (If yes, go to question 7)

7. Would you be willing to purchase this Mwere/Mawele if it were offered at a price that is more than finger millet, Amaranth, white millet or soy bean flours?

   Yes ☐ No ☐

If yes, how much premium would you willing to pay? *Please randomly pick the premium bids at which you are willing to purchase it at?*

Premium bids offered	Yes	No
10%		
20%		
25%		
50%		
75%		

SECTION D: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS

8. Are you the household head of your family? Yes ☐ No ☐
9. What is the estimated age of the buyer or the household head (.....years)?
10. What is the gender of the buyer? Male ☐ Female ☐

11. What is the estimated education level of the household head if you are not the one? *Please tick the appropriate box*

Illiterate ☐ Primary level ☐ Secondary level ☐ Technical ☐ (Diploma) level ☐ Graduate (University) level ☐

12. What is the total number of children in your (the) household below the age of 12 years? .....

13. What is the employment status of the buyer (household head)? *Please tick the appropriate box*

Full time employed ☐ part time employed ☐ Unemployed ☐ House maker ☐ retired ☐ student ☐

14. What is the estimated average monthly income of the buyer (household head) in Kenya shillings? *Please tick one of the appropriate box below*

<10,000 ☐ 10001-25000 ☐ 25001- 40000 ☐ 40001-55000 ☐ 55001-70000 >70000 ☐

END

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