

**'AN ECONOMIC ANALYSIS OF CEREAL BANKS IN BUNGOMA AND
BUTERE-MUMIAS DISTRICTS OF WESTERN KENYA ''**

BY

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**A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENTS OF THE AWARD OF MSC. DEGREE IN AGRICULTURAL
ECONOMICS.**

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Declaration and Approval

1. Declaration

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

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2. Approval

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Dedication

To my late father who had promised better things to ensure my academic success which he did not live to fulfill, but my dear mother and the support of all extended family members set the foundation of what I am today. Great thanks to them all.

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However the opinions expressed and conclusions arrived at, are those of the author and are not affiliated to any institution.

Abstract

Cereal banking involves buying of cereals or grains during periods of lower prices, storing and selling out the stocks when prices are higher. In Kenya they were started with the aim of enhancing local food security and surplus marketing. Cereal banks are some of the interventions which have been tried using non-governmental approach although they have received mixed reactions about their performance especially on the issue of sustainability. Weaknesses in the analytical and empirical arguments for cereal banks have been highlighted. This study addressed some of these issues by analyzing the factors that influence farmer participation in cereal banking and effects of cereal banks on prices and food security. The study area comprised two districts in Western Kenya where cereal banks were initiated through support organizations. Analytical procedures included descriptive analysis of the socio-economic characteristics of the households studied and logistic regression of the socio-economic factors which were perceived to determine participation in cereal banking. The significant factors that were identified as determining participation in cereal banking include age, gender and farming experience of the household head; distance to the nearest market; household access to credit and selling to cereal banks. There was evident of weaknesses related to consistency and general performance of cereal banks, especially after the supporting organizations reduced their involvement. Recommendations suggested on how these institutions can be improved include government support to enhance financial capital, fair input markets and infrastructure development in agricultural potential rural areas and possibly the establishment of intermediary institutions which can assist farmers in various aspects of group management and activities.

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Acronymns

AFC	Agricultural Finance Corporation
KACE	Kenya Agricultural Commodity Exchange
Kgs	Kilograms
LRI	Likelihood Ratio Index
CDVMs	Categorical Dependent Variable Models
CBOs	Community Based Organizations
FAO	Food and Agricultural Organization of the United Nations
N	Sample size
NGO	Non-Governmental Organization
NCPB	National Cereals and Produce Board
SACCOs	Savings and Credit Co-operative societies
SACRED-Africa	Sustainable Agriculture Centre for Research, Extension and Development in Africa
ROP	Rural Outreach Program
ROSCAs	Rotating Savings and Credit Associations

CHAPTER 1

Introduction

1.1. Background

Cereal bank¹ concept is emerging as a community-based institution involving one or a group of villages engaged in stocking and management of the operations of acquiring, pricing and supplying grain. It involves buying grain or cereals² during periods of relatively lower prices, storing and selling the stocks when prices are higher. The cereal concept, which emerged after the droughts of the early 1980s, has become appealing to most Non-Governmental Organizations (NGOs), governments, and villagers. Cereal banks are also referred to as grain banks or seed banks. However, seed banks have some variation in that they are aimed at seed security and conservation of agro-biodiversity (Lewis and Mulvany, 1997).

There are several models of cereal banks. According to Kent (1998) the basic one is where a sponsoring agency, usually an NGO, helps finance the construction of a small warehouse to be used for cereal or grain storage. Typically, the sponsoring agency

¹ Cereal banks are village cooperatives that buy, store and sell grain with the intention of promoting food security and increasing farm incomes. It mainly works for both cereals and grains because they can withstand longer storage periods.

² A cereal is a crop that constitutes mainly carbohydrates. Crops classified as cereals include; maize, rice, wheat, sorghum and millets. This study will focus on the maize cereal (unmilled) which is the major crop that is collectively bulked, stored and traded in the study area. However, some authors use cereals and grains interchangeably.

provides construction materials and initial capital in form of either a grant or loan to start operations. The villagers provide unskilled labour and a cereal bank management committee is needed to carry out the operations. When cereals become scarce, and prices tend to be at their highest, the cereal bank sells its stock in the village. Revenues are used as a revolving fund to refinance the operation the following season or year. Some cereal banks are more active traders, buying and selling throughout the year while others operate on an in-kind basis whereby the banks lend their cereals out to their members in kind during the hunger season. The members are then supposed to repay these loans in kind after the harvest.

Kent (1998) identifies three forms of cereal bank situations and how they operate. He notes that some cereal banks are situated in fairly self-sufficient agricultural zones in which case they procure cereals locally, store, and sell locally. Others are situated in villages characterized with chronic cereals deficits in which case they purchase cereals from outside the villages and bring them back to sell locally. Others are located in villages characterized with significant cereal surpluses whereby they usually purchase grain in their own village, store, and sell it later to outsiders or even in same villages during scarcity periods.

Moers (1999) describes cereal banks as combinations of warehouse and financial institution where farmers can deposit their harvest and receive a receipt. By storing goods in the warehouse, the farmers can wait until prices have improved before selling their harvest on the market, and farmers can circulate the receipt as money. He further explains

that a cereal bank can have two arms; a warehouse and a rural credit bank. Cereal Banks are probably the earliest form of banking institutions. Thousands of years before Christ, the Egyptians already knew a system of paying receipts based on amounts of wheat deposited in a warehouse administered by the state. The value is determined by noting the quantity and quality and the year of the harvest. The farmer is thus insured against the dangers of robbery, fire, flood, drought and others. The high cost of storage is thus shared between many farmers paying small amounts (Moers, 1999).

In all countries grain trading systems serves two principle functions; distributing grain around the country to the places where it is most needed, and storing grain so that it can be distributed over time, that is, made available at the times when it is most needed. There are two dimensions of grain trading (Kent, 1998). Spatial arbitrage that involves moving grain over space or in other words transporting it between different locations: such as between surplus and deficit areas or between rural and urban centers. Temporal arbitrage which involves moving grain over time or in other words storing grain now to sell it at a later time. Temporal arbitrage is particularly important in regions that have one grain harvest season whereby harvested grain has to be stored to be consumed about six months later. The word arbitrage is used as the processes of moving grain over space and storage are motivated by differences in prices. Apart from the profit motives of traders, the result of spatial arbitrage is that grain is moved from areas where it is relatively abundant to areas where it is relatively scarce. The result of temporal arbitrage sometimes referred to as speculative storage is that grain becomes available throughout the year and not just immediately after harvest.

Marketing of farm produce has been one of the key constraints faced by smallholder maize farmers in Kenya. Since 1993 when the National Cereals and Produce Board (NCPB) ceased to set prices, control movements and bulk purchase of maize, alternate but inefficient market mechanisms have evolved. Marketing costs account for 40-60% of the retail price of maize. When the government controlled all aspects of maize marketing, information on spatial and temporal price variations was inconsequential to farmers. Now farmers need reliable and timely price discovery information (Daily Nation, 2004). Mukhwana *et. al.* (2005) explains that the situation of small scale farmers is made worse by the fact that they also lack business acumen, collective action, storage facilities, transport, market information, and capital to invest. He emphasizes that collective marketing groups or cereal banks should be run using business principles. Collective marketing has several benefits including improving income from produce sales which in turn reduces rural poverty, enhances adoption of new technologies and increased production. Other benefits include improving rural food security¹, stabilization of prices because price fluctuation is minimized; empowerment of farmers; improved access to market information and inputs; improved grain quality; improved labour utilization; lowering transaction costs and cutting out middlemen.

In Kenya, cereal banks were founded since 2002 when an international agency attempted to introduce the cereal banks model through four cooperating NGOs (Coulter, 2006). They had a dual purpose initiative of local food security and marketing of the surplus.

¹ Food security is defined as access by all people at all times to enough food for an active healthy life. In this study food security will be viewed as a question where all can have an equitable share of food available or produced with reference to maize crop.

They are common in Western Eastern Kenya and Nyanza province. In Eastern the most common are seed banks but one cereal bank was in operation in Makueni district¹. In Nyanza province, cereal banks were evident in Siaya District; for instance the Sauri Millennium villages' cereal bank² and others that are spearheaded by Sustainable Community-Oriented Development Program NGO. .

1.2 The problem statement

The overall national agricultural policy of Kenya is to achieve internal food self sufficiency, to maintain adequate levels of strategic reserves and to generate additional supplies for export. Land suitable for agricultural production is limited with less than 20% of Kenya's land area being suitable for intensive crop and livestock production (Kenya, 1989). Other areas are mainly arid and semi-arid yet agricultural production in Kenya is mainly rain fed. Rainfall reliability leads to the problem of seasonality in production which further influences the pricing of agricultural produce. Sometimes there are shortages in agricultural produce especially cereals due to rainfall unreliability, droughts or floods. Usually prices of agricultural commodities are highest during periods of scarcity and lowest during periods of glut. These factors lead to government intervention in various ways to ensure food security for all citizens. It includes food aid or relief, irrigation programmes and community based interventions. Cereal banks are some of community based interventions used to enhance food security, increase incomes and savings (FAO, 1994).

¹ Nthunguni community managed cereal bank supported by Practical Action-East Africa (Kisiangani E, 2005)

² SACRED NEWS Newsletter Vol. 9. No.1. January-June 2006.

Extensive research on cereal banks in the Sahelian¹ countries of West Africa by Kent in the 1990s revealed that cereal banks rarely work. The unsustainability problem of these cereal banks has been gaining recognition since the 1990s. Most of the grain storage banks work when a supporting or sponsoring agency is involved. However, when there is no external support most fall out of business and thus the question of sustainability. Research by Kent and Berg (1991) revealed that cereal banks are particularly popular in the Sahel whereby about 3,300 cereal banks had been established by 1991 and approximately 75% of them were out of business by 1998. Cereal banks have been established in other African countries albeit with variations in arrangements; including Kenya. It is important to find out whether cereal banks in Kenya fulfill some of the functions described in the background section. Understanding the social and economic factors of cereal banks may assist in knowing why problems exist and whether their promotion should be accentuated. This kind of community based organization is a vital intervention especially when food resources are scarce or when there is drought. The major concept of cereal banks is that they should have a beneficial role to play above the normal functioning of the private sector otherwise they would not be necessary. The problem is to find out why cereal banks have problems in fulfilling their functions of ensuring food security and stability of food prices.

¹ Countries in the Sahel include Senegal, Mali, Burkina Faso, Niger, Mauritania and Chad according to Gergely *et al*, 1990.

1.3 Justification of the study

Cereal banks are claimed enhance food security; reduction in transaction costs especially transport costs and relatively higher selling price increasing incomes for the producers. Cereal banks are also seen as a way to increase food aid impact (Kent, 1998). This is because food for relief activities can be procured from the cereal banks. Most of the objectives of cereal banks relate to providing better marketing services for farmers and consumers at village level. A strong justification for farmer organizations is their potential to play a critical role in both the delivery and coordination of services to smallholder producers (Dorward *et. al*, 2004). They can facilitate collective marketing of agricultural outputs that will help reduce transaction costs related to the marketing of agricultural inputs and small marketable surplus emanating from a large number of widely dispersed small producers. Collective marketing allows small-scale farmers to spread the costs of marketing, enhance their ability to negotiate for better prices, and improve their market power (Shiferaw *et. al*, 2006).

Reasons attributable to failure of cereal banks could be poor management, lack of resources to maintain the operations or lack of effective participation by members. In this regard, an analysis needs to be done to reveal some of the factors that lead to unsuccessful performance of cereal banks. Review on existing literature reveals no study that has analyzed quantitatively the social and economic factors that influence cereal banking. A detailed research of how they function and what improvements can be made is necessary.

1.4 Objectives of the study

The general objective is to analyze the functioning of cereal banks and suggest improvements in their role of alleviating food insecurity and increasing incomes among smallholder farmers.

Specific objectives include:

- 1) To describe the institutional arrangements of cereal banks in the study area.
- 2) To determine the factors that influence smallholder participation in cereal banking
- 3) To determine the effects of cereal banks on food security and price stability.

1.5 Research Questions

The key research questions posed in this study were the following:

1. What are the institutional arrangements of cereal banks/how do they function in Kenya?
2. What factors (socio-economic) influence smallholder producers to participate in cereal banking?
3. Do cereal banks increase vulnerability to food security or not?
4. Will the cereal bank model be able to achieve the commercially viable scale that would enable it to operate without subsidy?

1.6 Hypotheses

The statement of hypotheses is as follows:

1. That selected socio-economic factors do not influence participation in cereal banks.
2. That cereal banks do not enhance price stability.

CHAPTER 2

Literature Review

2.1 Development of cereal banks

The primary cause of low prices received by producers of cereals is the traditional price collapse at harvest. Farmers have a series of requirements at harvest, including repaying farm and household expenses incurred during the crop season like, taxes, school fees, marriages, naming ceremonies and funding migrating household members. Prices collapse because many farmers are compelled to sell at harvest due to lack of monetary liquidity. Merchants purchase and store at this time and take advantage of price recovery later. The farmer needs to wait and sell at least part of his/her harvest later. To put off the sale, the farmer needs credit or some other source of income and he needs to be able to store the crop and wait for the recovery (Ouendeba *et. al*, 2003). Price collapse can also happen due to good weather. According to Ouendeba *et. al*, (2003), basic staples have very inelastic demand. Good weather, (or technological change or both), can result in a complete collapse of the price. People can only eat so much of their basic staple. Once people with the ability to buy have bought enough of the product they do not want to eat any more. As there is no other market the price collapses. Drought and trader usury are other factors that can lead to innovation of cereal banks.

Cereal banks cut out the middle man's profit, provide more favorable prices for growers and consumers, even out the seasonal switchback in prices, and ensure that grain stores are available locally (Uemura, online 2006). More so they are one possible response to

the quest for food security. However, enabling people to cultivate, store and distribute their own food is the challenge.

2.2 Cereal banks and grain trading

Grain trading is a risky, difficult and competitive business (Kent, 1998). Buying grain right after the harvest, storing it and selling it during the hungry season is no guarantee of making a profit, or even breaking even. Even when prices rise between seasons, they must rise substantially for a cereal bank or a trader to cover his costs and make a profit. These costs include: purchase costs, warehousing costs, bagging costs, handling costs, management costs, the costs of physical losses due to pests, rotting, theft, and the interest costs or the opportunity cost of tying up one's money or resources. Promoters of cereal banks often try to ignore some of these costs when they calculate their profitability, resulting in false hopes for sustainability (Kent, 1989). Beyond the risks involved in grain speculation there are other factors that contribute to the failure of cereal banks. Kent (1998), found out that providing grain on credit often results in defaults that decapitalize cereal banks. Embezzlement by managers or administrators of cereal banks is another reason. Another reason for failure is bad decision making by cumbersome cereal bank committees constituted mainly by people with little expertise in grain trading. These committees have trouble competing with more agile and diversified private traders. Kent (1998), asserts that the positive side effects that cereal bank promoters predict rarely occur. Cereal banks rarely make a profit thus they rarely are in a position to subsidize other village activities, like literacy training. Occasionally cereal banks fund other activities but almost always by decapitalizing their own revolving funds. A cereal bank

can potentially harm a village's food security if it displaces private traders, breaks traditional relationships between traders and villages or keeps such relationships from developing as Kent puts it. Kent adds that there were cases in Mauritania and Northern Niger where subsidized cereal banks drove private traders out of business (essentially through unfair competition) leaving villagers precariously dependent on an unsustainable cereal bank for their food security. Kent posits that villagers' food security probably can be better served by encouraging dynamic, competitive trade links with other villages and regions.

2.3 Characteristics of rural storage and collective action

A complementary approach to loss reduction is to improve rural storage. Poor storage not only causes small farmers to lose crops to pests but to sell them early to avoid further loss; the pattern of early sale in turn drives seasonal price instability. The record with group or collective village initiatives is rather poor notwithstanding their considerable appeal among elements of the donor community. The development of family storage needs to be approached in a systematic manner, as a form of social marketing (Coulter, 2005). In this study an assessment of the availability of family storage structures in the study area was done.

Along the market and value chain, processors and traders are constrained by low quality grain, inadequate supply and high cleaning costs whereas market intermediaries in the supply chain face high assembly costs, high market risk and cash flow problems. These factors deprive farmers the underlying incentives to produce and supply quality and differentiated products with desirable market traits in addition to their inability to

penetrate high value niche markets (Jones *et al.*, 2002). This indicates that small-scale, dispersed and unorganized producers are unlikely to exploit market opportunities as they cannot attain the necessary economies of scale and lack bargaining power in negotiating prices. This reduces their ability to compete with well established large scale producers and farmers in more-favoured areas to harness available and emerging market opportunities (Johnson and Berdegue, 2004). One viable strategy for such producers would be to evolve new collective forms of organization that would help them reduce transaction costs and benefit from better bargaining power in marketing their produce and procuring production inputs of which cereal banks are purposed to achieve.

By producing large quantities of grain of a consistent quality, the large scale farmers have little difficulty attracting buyers that include millers. This ensures that they normally get better prices than most small scale farmers in Kenya would dream of. Since the liberalization of the Kenya grain sector in 1992, there has been an upsurge of middlemen who purchase farmers' grains at low prices. They are aided by the fact that farmers have realized that, as individuals, they have little or no say in prices offered by the middlemen for their produce and are forced to accommodate their offers. Through the cereal banks this disadvantage can be overcome if the cereal bank interventions are effective enough.

2.4 The role of middleman in cereal banking

The middleman is seen as both a friend and an enemy, depending on which side of the divide one belongs. Because he links farmer with the buyer of maize, bulks it to meet the miller's needs and transports the maize to the miller, his role in the marketing chain cannot be downplayed. The cereal banking project implemented by the Sustainable Agriculture Centre for Research, Extension and Development in Africa (SACRED-Africa) is an example of how small scale farmers are adopting collective marketing initiatives and strategies to market their produce profitably. Established in 2003, SACRED-Africa has facilitated the poor, illiterate rural farmers to carry out collective marketing through education and empowerment by establishing cereal banks in maize growing parts of Western Kenya (Mukhwana et.al, 2005).

In the early 1990s, the GTZ post harvest project in sub-Saharan Africa concentrated on small-scale farming and rural self-help activities with a focus on cereal banks in the Sahel. Reviews undertaken at that time indicated that most of the existing cereal banks were either economically unviable or nonfunctional (Berg & Kent, 1991 in Muck (1997). In 1993, surveys were conducted by responsible NGO's in Burkina Faso and Mali at three sites to evaluate cereal banks management and economics. Most of the banks were found to be operational technically, but economically they were bound to fail because of basic misconceptions in their design. Information on their economic performance was largely unavailable. In spite of these deficiencies, the data provided important information concerning the operation of cereal banks in the region. Advocates of the system claimed the information showed the banks could be successful when obvious

errors were corrected and adequate monitoring systems were put in place. Gunther and Muck (1995) as quoted in Muck, (1997) concluded that cereal banks could operate successfully. However, they felt that banks should consider and facilitate the needs of the users; provide social cohesion in the target village; provide human, financial, and technical resources with management support and be profitable. Since cereal banks are being implemented in Kenya it is necessary to find out whether these conditions are being or can be met.

An economic analysis of operational cereal banks in Burkina Faso by Sanfo emphasized the benefit of subsidies. He emphasized that community based cereal banks were not for profit, but for regulation of the cereal market and more secure access to food grain. Sanfo suggested that subsidies were justified because of the positive effects cereal banks had on the economies of remote rural areas and their contribution towards decentralizing food security (Sanfo (1996), in Muck (1997)).

Coulter (2006) cites that cereal banks are vulnerable to problems because of their heterogeneous nature of their membership which includes surplus and deficit producing members and also non-producers and the fact that they have objectives that cover both business and social functions. Despite this, they are being implemented in Kenya and hence the study to assess how they function and the determinants of farmer participation.

Tobin (1998) in a workshop on cereal banks, urged Catholic Relief Services (CRS) employees not to ignore the weaknesses in analytical and empirical arguments for cereal

banks. CRS is one of the NGO's in Kenya that promotes cereal banks. One major difficulty in collective action studies is to measure the level of collective action and how such group action contributes to final performance outcomes. Generally there are no standardized measures or indicators that can be used to assess the level, viability and effectiveness (performance) of collective action (Place et al. 2002).

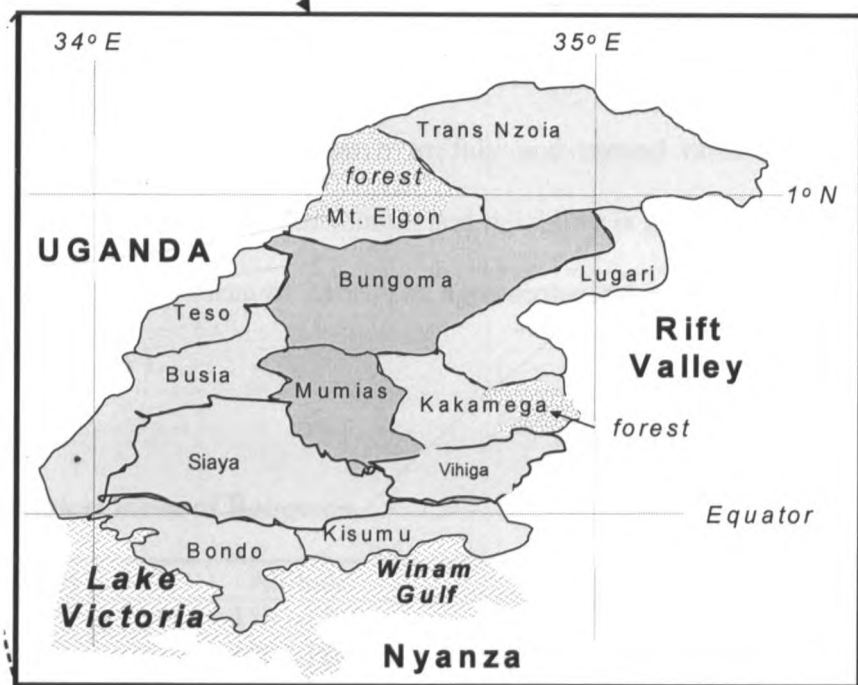
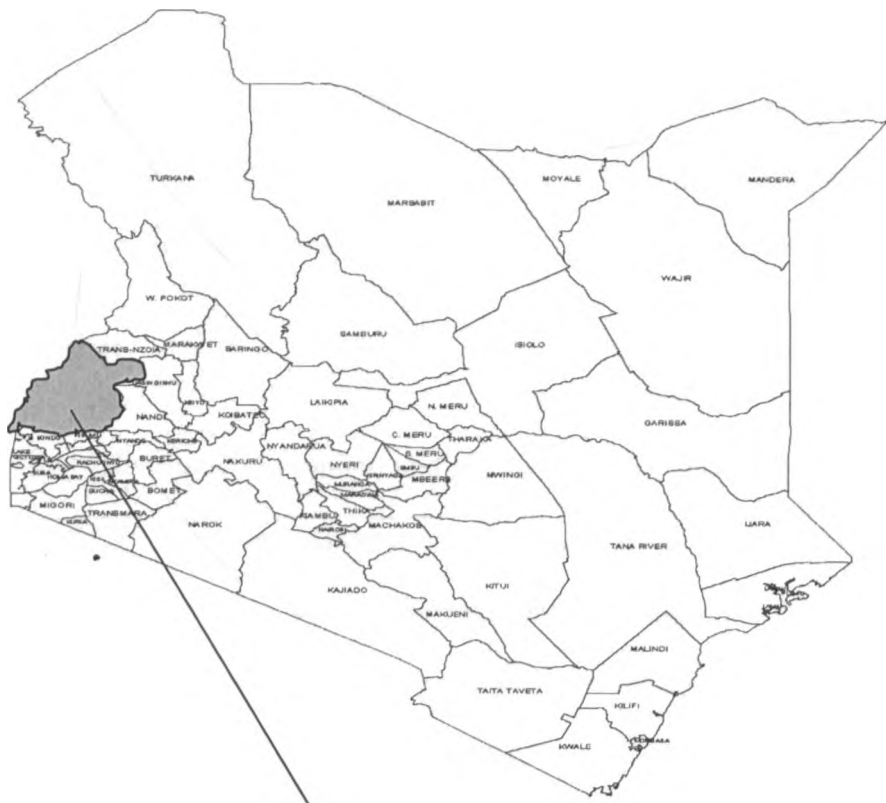
CHAPTER 3

Methodology

3.1 The area of study

Generally, Western region of the country is a high potential maize production zone according to Nyangito and Ndirangu, (1997). Specifically, Bungoma district is relatively a surplus maize production zone and Butere-Mumias is a deficit maize production area. The area of study will include these two districts.

Western Kenya is primarily comprised of small-scale farmers, many practicing subsistence agriculture. The area receives reliable, bimodal rainfall between 1,200mm to 2,000mm per year but is dominated by highly weathered, nutrient depleted soils. The farmers' main enterprise is maize-bean intercropping which serves as the household food supply but in the case of good years and larger farms, the maize is sold through complex and often unfair marketing chains (Woomer and Mukwhana, 2004). Average farm size is only 1.5ha (3.75 acres), but ranges in size from about 0.3 to 6 ha for different areas of the province. Twenty five cereal banks with 2,000 farmers in Western Kenya are supported by SACRED-Africa (Mukhwana *et al*, 2005). Apart from maize, local cereal banks in Western Kenya are integrating other non-perishable produce such as soya and common beans, sorghum, millet and even solar dried indigenous vegetables.



Source: Modified from Mukhwana *et al*, 2005 and <http://www.fao.org/ag/aGL/sw/wpnr/reports/y-sf/z-ke/ke-map/kempl12.pdf>. Accessed on 14th April, 2007.

Figure 1: A map of Kenya showing Western province

Districts in western Kenya are Kakamega, Bungoma, Busia, Butere-Mumias, Lugari/Malava, Mt. Elgon, Teso and Vihiga. Butere-Mumias is relatively a maize deficit production zone and Bungoma is a maize surplus zone and sometimes they form linkages such that Bungoma sells to Butere-Mumias.

3.1.1 Bungoma District

Bungoma district has 10 divisions, 44 locations and 108 sub locations. Four divisions out of the total were covered in this study. Bungoma has 3 National Cereals and Produce Board (NCPB) depots with a capacity of 805,000 bags, 330,000 bags and 70,000 bags respectively with the first one being in Bungoma town which is the district headquarter. Maize is the major cereal that is handled by the NCPB. Bungoma district has a total area of 2,063 km² with arable land of 1,838 km². Maize occupies the largest acreage in the district whereby it is grown as food and cash crop. The district experiences two rainy seasons with first rains starting in mid-March to July and second rains starting in September to October in which rainfall distribution and reliability is good. Temperatures range from 16⁰C to 30⁰C with a mean of 23⁰C. The agro-ecological zones for Bungoma district are explained in table 1.

Table 1: Agro- ecological zones of Bungoma

Agro-ecological Zones	Altitude	Rainfall
UM1	1500-1800	1000-1700mm
UM2	1500-1800	1000-1650mm
UM3-4	1500-1800	1000-1600mm
LM3	1200-1500	1000-1500mm
LM2	1200-1500	1000-1450mm
LM1	1200-1500	1000-1400mm

Source: Bungoma DAO report, 2003

The population density of the district is 514 persons per km², with 586, 621, 653 and 484 persons per km² in Chwele, Nalondo, Kimilili and Sirisia divisions respectively. The extension staff to farmer ratio in the district is 1: 825 (Bungoma DAO report, 2003). The district has ten cereal banks which were established with the support of SACRED-Africa. Their distribution covers all the divisions in the district.

3.1.2 Butere-Mumias district

The district covers an area of 939.3km² with 710km² being arable land. It lies between longitudes 34⁰21' East and 34⁰ 41' East, and latitudes 0⁰ 15' North and 0⁰ 29 'North of the equator and an altitude range of 1,240 to 1,641 masl. The district has 6 divisions of which only two (Butere and Khwisero) were included in the study area. The districts population density is 601 persons per km² with an average farm size of 3.5 acres and a poverty index of 61. The district has a bimodal rainfall pattern with long rains during February –July and short rains from August-November. The rainfall average range is 1,750mm per annum with peaks in March to May and August to September for long and short rains respectively. The temperature range is 23⁰ C - 29⁰ C. Soils are feral soils which range from sandy, loam to black cotton soils. The agro-ecological zones in the district are as shown in table 2.

Table 2: Agro-ecological zones of Butere-Mumias

Agroecological Zones	Approximate area (km ²)
UMI	3.75
LMI	933.55
LMII	2.0

Source: Mumias DAO report, 2005

The major food crops in the area are maize, beans, sweet potatoes, cassava, sorghum, millet and groundnuts. The major cash crop is sugarcane. The extension staff to farmer ratio is 1: 2828. The district has a NCPB depot at the district headquarters with a capacity of 180,000 bags (Butere-Mumias DAO report, 2005). The district has five cereal banks which were established with the support of Rural Outreach Program. They are distributed in two divisions of the district.

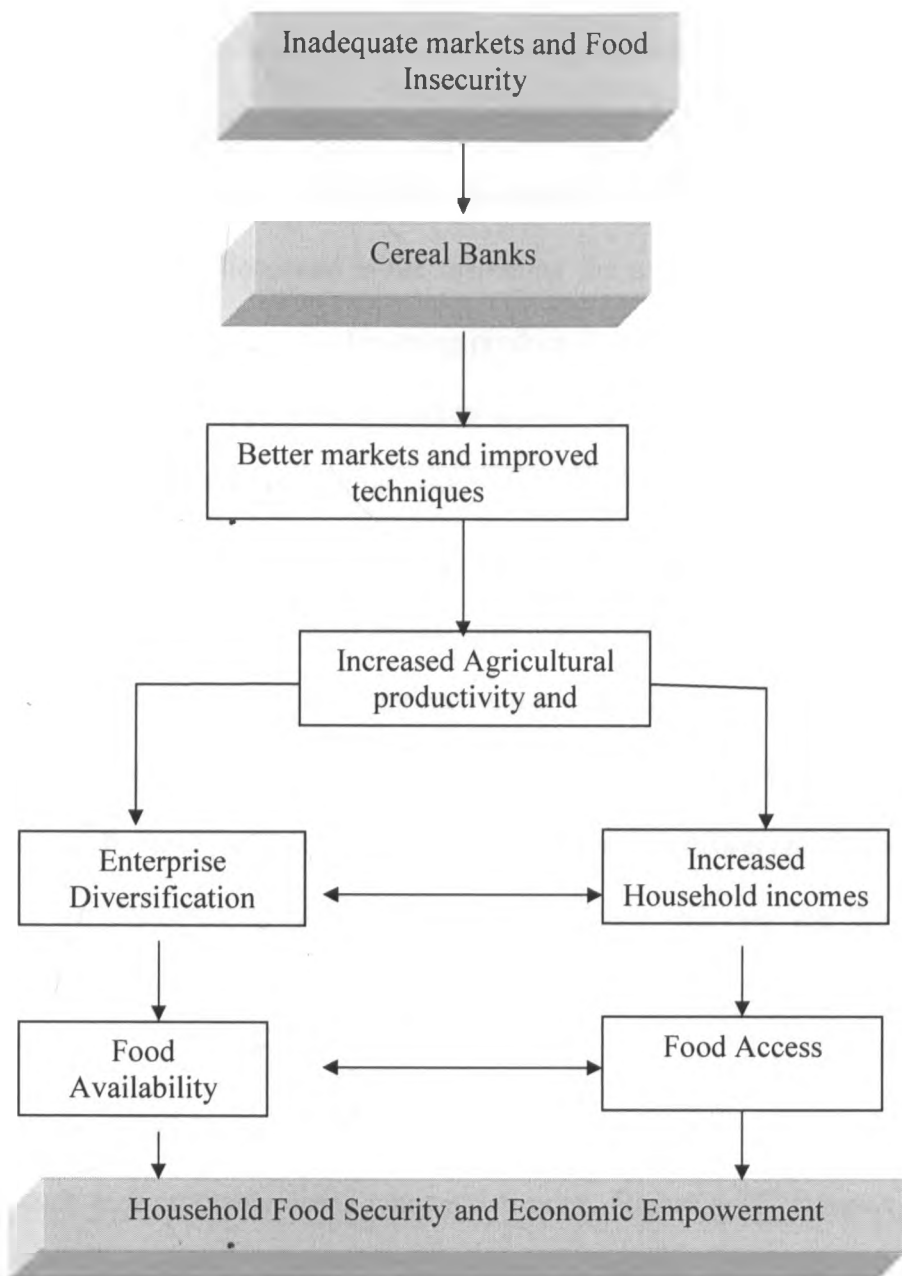
3.2 Conceptual framework

Cereal banks were initiated mainly to facilitate marketing of maize produce for smallholders because the marketing channels were inefficient for them especially after liberalization (Mukhwana et al, 2005). Cereal banks reduce transaction costs and enhance market opportunities leading to better markets for smallholder producers as illustrated in Figure 2. Cereal banks carry out the function of improving the quantity and quality standards of produce, which in turn impacts on better pricing.

Cereal banks create an avenue where smallholders can increase their awareness in terms of upcoming modern technologies and input and output markets (Mukhwana *et al*, 2005). Through proper group action even access to modern technologies and inputs can be made easier and members can acquire them at lower costs. Through adoption of modern agricultural techniques and inputs and given the cereal bank institution, agricultural productivity is improved. The increase in productivity translates to increased surplus which is marketed in a relatively efficient way through cereal banks leading to increased households incomes. These incomes can further be used to start other agricultural

enterprises. Income is therefore generated from such enterprises and this enables farmers to directly have access to other foods from the market through purchase. Income also serves to provide inputs for the production of other enterprises such as livestock and crop husbandry, promoting household enterprise diversification. Enterprise diversification provides an increased source of revenue which the farmer realizes from. Enterprise diversification not only secures the farmer with income but it also increases the household food basket and provides sufficient food and dietary diversity within the household, which ensures food availability at household level. Household food availability is highly linked to access because a household has access to that which is available (Maxwell *et al*, 1992).

Cereal banks enhance the availability of food stocks locally which means that the local residents can have access whenever they need to. However cereal banking has some cost implications which affect their operations and depending on whether there are benefits in such ventures or not will influence farmers' decision to join. In conclusion, various factors especially socio-economic determine whether farmers participate in such organizations or not. Some of the socioeconomic factors which may influence farmer participation were studied.



Source: Researcher's own source

Figure 2: Conceptual Framework of Cereal Banks

3.3 Theoretical framework

Dependence on rainfall leads to seasonality in agricultural production and this is the practice of most if not all smallholders especially in the study area. This in turn leads to fluctuations in supply and subsequently the price. On the other hand the agricultural producer faces transaction costs while marketing the produce. These transaction costs include the transportation costs of moving produce from the farm to point of sale, search costs for information on prices and markets and monitoring costs. Farmers prefer to sell where there are minimal transaction costs. The New Institutional Economics (Irin and Aysen, 2005), uses the neoclassical framework, but takes transactions as the unit of analysis, relaxes the hypothesis of perfect information and emphasizes the importance of institutions as a means to reduce high transaction costs. In this context transaction costs are specific to each seller thus implying that each household faces a different price rather than a single market price (Irin and Aysen, 2005). Transport costs are obviously some of the most important transaction costs (Escobal, 2001); and they are the ones to be considered in this study.

The producer especially the small scale one, needs working markets where he/she can sell the produce at a profitable and a competitive price. Higher profit margins translate to increased incomes for the producer. The producer maximizes profit subject to the price of output. The theory of cost minimization through economies of scale can be achieved collectiveness like in cereal banking. This is due to the fact that collective action leads to lower average costs and thus increased benefits. Marketing groups strengthens producers' bargaining power and may also be in a position to offer its members other benefits such

as lower costs of transportation as a result of shared and bulk transport, as well as better market information. The costs per unit of produce marketed can be reduced by selling produce on a large scale (Kahan, 2004). Despite the several benefits that accrue from cereal banking, there are cost implications attached to them and if the costs are more than the benefits then it leads to failure.

Ordinary least square method (OLS) is probably the most widely used statistical methodology in existence. This method has been highly successful in solving problems with a continuous dependent variable. Given the nature of the dependent variables used in this study (categorical nature), the procedure has a tendency to create problems. If there are no restrictions placed on the values of the independent variables, the predicted values of the outcome variables may possibly exceed either of the limiting values of 1 or 0. The classical regression assumption of heteroscedasticity of the error term is also likely to be violated, especially if the proportions in the total sample are close to either 0 or 1. According to Kleinbaum (1994) this difficulty may be seen in connection with the bivariate equation:

$$Y = \alpha + \beta x + \mu \dots\dots\dots (1),$$

and obviously generation to the multivariate case. If the Y value for any given individual must be either 0 or 1, and yet X may vary continuously, then the disturbance term cannot be normal and will of necessity be a function of X, contrary to the assumptions required by ordinary least square. The advantage of probit and logit models is that the probabilities are bound between 0 and 1. Moreover they compel the disturbance terms to be homoscedastic because the forms of probability functions depend on the distribution of

the difference between the error terms associated with one particular choice and another (Irungu, 1999). The core difference between logit and probit models lies in the distribution of errors. The logit model uses the standard logistic while probit model uses the standard normal distribution. In general, logit models reach convergence in estimation fairly well. Some (multinomial) probit models may take a long time to reach convergence, although the probit works well for bivariate models (Park, 2005). Thus the method of estimation has been strongly guided by the form of the dependent variable considered in this study and Logit model was preferred over the probit model.

Regression analysis technique is important because it provides valid results that can be relied upon with degrees of statistical confidence. Logistic regression, on the other hand, is a predictive analysis which uses binomial probability theory. It is a more general analysis, because the independent variable is not restricted to a categorical outcome variable only nor is the model limited to a single independent variable. Kleinbaum (1994) describes logistic regression as a mathematical modeling approach that can be used to describe the relationship of several independent variables to a categorical dependent variable. The logistic regression model is simply a non-linear transformation of the linear regression. The logarithmic transformation in this model stabilizes the variance if the standard deviation in the original scale varies directly as the mean. This study used logistics regression due to its relevance and strength in dealing with the categorical dependent variable which has independent variables that are both categorical and continuous. (Shatland and Bartona, Online) stresses the consensus that logistic regression

is a very powerful, convenient and flexible statistical tool. A typical logistic regression model is of the form:

$$\text{Log} [p/(1-p)] = \beta_0 + \beta_1 X_1 + \dots + \beta_k X_k \dots\dots\dots(2)$$

The advantages of the logistic model include imposing a flexible non-linear relationship, imposing for threshold and interaction effects and it also allows for examination of social interaction.

In a study by Gray and Kraenzle (1998) on member participation in agricultural co-operatives, regression analysis was used to assess how various member characteristics influence participation activities. Demographics like age, education attainment and off-farm employment were among factors considered. Also farm size and type were considered in that study whereby it was found out that farmers with larger farms were more involved in dairy co-operatives. Some of these factors were considered in this study to see whether they influenced smallholder participation in cereal banking.

However, like many other models, logistic models are subject to certain weaknesses which can be solved without reference to the nature of variables, be it outcome or explanatory. The following are mechanisms which can be used to ensure that all possible pitfalls are detected according to Bolokang (2006):

- a) Likelihood test ratio to test for omitted variables
- b) Wald statistics to exclude irrelevant variables
- c) Wald and model chi-square statistics to detect errors in the functional form
- d) Test to check for multicollinearity

However, in this case only the test for multicollinearity was done.

The availability and access aspects of food security were the ones considered in this study. The utilization aspect was beyond the scope of this study. The number of months the study population purchased maize and where they bought were the major indicators that addressed the food security issue. The maize price data on trends was inadequate but the available data was used to assess the issue of maize price stability for the periods that cereal banks were in operation.

3.4 Data requirements

The demographic variables data included age, gender, education level and major occupation of the household head. Data on socioeconomic variables included farm sizes, credit sources and access, farming experience, marketing channels used, maize price information, membership to CBO's, distance to nearest market centres, sources of income for the household and also the level of agricultural knowledge in the household. Data on characteristics and how the cereal banks function such as sources of stock; periods of procuring and selling; elements of costs in managing the cereal banks; age categories of members; group sizes; sources of group credit and maize buying and selling prices were also collected.

3.5 Empirical model

The formation of the empirical model was influenced by the hypothesis that selected socio-economic factors do not influence participation in cereal banks. Considering participation as an endogenous variable, the following empirical model was fitted into main survey data:

$$\begin{aligned} \text{MEMBERSH}_i = & \beta_0 + \beta_1 \text{AGEHH} + \beta_2 \text{FEXPHH} + \beta_3 \text{EDLEVHH} + \beta_4 \text{MRKTDIST} + \\ & \beta_5 \text{GENDHH} + \beta_6 \text{MARSTATH} + \beta_7 \text{HHINCOME} + \\ & \beta_8 \text{CBOMEMBE} + \beta_9 \text{HHSIZE} + \beta_{10} \text{DEPENDAN} + \beta_{11} \text{TRAINCA} + \\ & \beta_{12} \text{GETSHHCR} + \beta_{13} \text{FARMSIZE} + \beta_{14} \text{STORE} + \beta_{15} \text{OUTLET5} + \\ & \beta_{16} \text{CBOUTLET} + \varepsilon_i \end{aligned}$$

The dependent variable MEMBERSH_i is whether one is a member or non-member of a cereal bank and ε_i is the error term. The independent variables were mainly social household head characteristics since household head was assumed to be the main decision maker for the matters pertaining to farming and other household issues. Ruthenberg, (1985) indicates that it appears an acceptable simplification to treat the 'farmer' as an individual manager making decisions on behalf of his family. Therefore the socioeconomic characteristics of the 'farmer' can influence the decisions that he makes. Household economic variables such as farm size, availability of credit and distance to markets are important determinants of whether a 'farmer' can join collective action groups.

The definitions of the explanatory variables that were hypothesized to influence participation in cereal banking are as shown in table 3.

Table 3: Definition of variables

Variable Name	Description	Expected sign <i>apriori</i>
MEMBERSH	Membership to cereal bank(1=member, 0=non-member)
AGEHH	Age of the household head (years)	+
FEXPHH	Farming experience of the household head (years)	+
EDLEVHH	Education level of the household head (years)	+
MRKTDIST	Distance to the nearest market in kilometers	+
GENDHH	Gender of the household head (1=male, 0=female)	+
MARSTATH	Marital status of the household head (1=married, 0=other)	+
HHINCOME	Household income source, whether its on farm or off farm (1=off-farm sources available, 0=on-farm sources only) .	+
CBOMEMBE	Membership to any CBOs or Self Help Group (1=yes, 0=no)	+
HHSIZE	Number of persons in household	—
DEPENDAN	Persons dependent on Household head	—
TRAINCA	Whether someone in household is trained in collective action/co-operation (1=yes, 0=no)	+
GETSHHCR	Whether the household seeks credit or not (1=yes, 0=no)	+
FARMSIZE	Total farm acreage for the household	+
STORE	Whether there is a produce storage structure in the farm (1=yes, 0=no)	+
OUTLET5	Maize sold to cereal bank in Kgs	+
CBOUTLET	Whether one sells through cereal bank or not (1=yes, 0=no)	+

3.6 Data sources

Individual and focused group interviews were the sources of primary data. Since the interviews were face to face the observation method also played an important role in that it was used to validate the households and also group responses. For instance one could see the stores which had no stock and the infection by pests. The larger grain borer pest was a big threat to cereal banking.

Secondary data and other relevant information were sourced from various publications and reports on the subject matter, journals, Ministry of Agriculture reports and online sources.

3.7 The data collection process

A combination of sampling techniques were used to arrive at the final sample since each survey entail a unique sampling design (Patel *et al*, 2004) .Multistage sampling procedure was applied from the province level, district level to divisions, then location and sub locations. Following the concentration of cereal banks in Kenya, Western province was chosen purposively for the study. Bungoma and Butere-Mumias districts were purposively chosen for the study because they had a higher number of cereal banks. The target population was small scale producers both members and non-members of cereal banks.

The sample size was highly guided by the resources that were available for the study. Ten members of each cereal bank group were selected using systematic sampling since a list of members for each cereal bank was in existence and it had no relationship with the topic under study. The coin was tossed to determine the starting point from the list with the Head standing for the first member and the Tail for the second in the list of the members. The sampling interval was determined using the formula:- $N/n = k$

Whereby: N = the total number of members per cereal bank which varied depending on the number that constituted each cereal bank.

n = the units to be picked from each sample which was 10

k = the sampling interval in which every k^{th} item was chosen from the list after determining the starting point by tossing the coin.

Five groups were covered in Butere- Mumias district and four groups in Bungoma. However, only the management was interviewed for one group in Bungoma because members failed to turn up for the focused group interviews. Forty and 44 members were covered in Bungoma and Butere-Mumias respectively.

Purposive sampling¹ was used to select ten non-members in each division where a cereal bank was located and was covered in this study. The criteria were that a farmer should be a grower of maize and sells some and him or she came from the division where the cereal bank was located. A total of 38 non-members were interviewed in Bungoma and 50 in Butere-Mumias. The location of the cereal bank that was selected for the study dictated the division to choose the cereal bank non-members from. The divisions covered in Bungoma were Sirisia, Chwele, Kimilili and Nalondo in which units covered were distributed in 24 sub-locations. Butere and Khwisero divisions were covered in Butere-Mumias district with the study units covering 11 sub-locations.

Key informant interviews were done to get an overview of how the cereal banks were organized and how they work in general. A reconnaissance survey was done in order to master the area of study and also to draw a plan for the data collection process. The individual farmer interviews questionnaire was pre-tested and few adjustments made before using it. The questions were semi-structured.

¹ A sampling technique that allows the researcher to use cases that have the required information with respect to the objectives of his/her study. Therefore cases of subjects are hand picked because they are informative or they possess the required characteristics (Mugenda,O and Mugenda A, 1999. pg.50)

Focused group interviews were administered first using an interview guide. The researcher with the assistance of Ministry of Agriculture staff conducted the focused group interviews. This was followed by individual interviews by visiting all sampled members and non members of cereal banks. Three enumerators assisted in carrying out the household interviews.

Focused group interviews were met with inconveniences whereby in some cases the interviews could be postponed because group members could not turn up to constitute a quorum and some not turning up completely. In one of them, only some leaders were met after members failed to honor scheduled appointments for two days and in two others they failed to convene completely. This was a major problem in Bungoma district and thus explains the low coverage. There was also a case where respondents were hostile and we were sent away in one of the villages. They claimed that researchers just collect information from them yet no benefits on their side.

3.8 Data Analysis

Data collected were inputted and processed in SPSS 15.0 computer software and analyzed. Ms Excel was used to analyze maize price data. Limdep program (NLOGIT 3.0) was used to carry out the binary logistic regression.

CHAPTER 4

Results and Discussions

4.1 Characterization of the studied households

Descriptive statistics were analyzed to know the significance of some social (education level, age etc) and economic (farm size, sources of credit etc) variables in the study. It has been seen that the household head characteristics influence the decision making process in the household. Among the household head factors studied are the age, education level, gender, marital status, and farming experience (Table 4).

Table 4: Summary Statistics of the Sample Farm Household's Socio-economic Attributes

Variable	Mean (sd)			t	ρ -Value
	Member	Non-member	All		
Age of household head in years	55.91	47.30	52.38	2.84	0.006
Education level of household head in years	8.71	10.43	9.56	-1.73	0.09
Farming experience of household head	17.52	13.13	15.92	1.51	0.14
Household size	10.00	10.06	9.93	-0.07	0.95
Household farm acreage	6.41	6.69	6.64	-0.17	0.87
Crops acreage	4.76	4.69	4.81	0.06	0.95
Maize acreage (2006)	2.73	3.03	3.03	-0.39	0.69
Distance to market in Kms	3.13	3.26	3.17	-0.23	0.82

Source: summarized from computer output

There was a significant difference ($P \leq 0.1$) for age of household head for both members and non-members (Table 4). This indicates that the heads of households for cereal bank members included mainly the older generation. Age is an important factor since it affects the efficiency of carrying out farm activities. It is already known that older household

heads have more experience in farming and so they make better farming decisions. Again, younger household heads may be more innovative and less risk averse (Salasya et al, 2007).

The education level of household head in years was significant ($P \leq 0.1$). The larger the number of education years meant the higher the education level. The results indicate that most household heads had attained the primary level of education which is estimated to be 7 or 8 years depending on the education system that was used. The average years of education for non-members was indicating that most had attained secondary level leading to a conclusion that literacy level of the cereal bank non-members was relatively superior compared to members.

There was no significant difference in household size for both member and non-members. The average household size in the sampled households was ten members per household. The maximum figure on household size represented polygamous household which had 35 household members. The mean of dependants below 14 years was higher compared to other age categories which was 3.4. It was found out that most dependants (31%) assisted with farm labour and only 6% assisted through cash remittances. Sixty five percent of the households sampled said that a member in the household had taken a course or trained in an agricultural related field showing a significant difference in those that have some agricultural knowledge.

The farm size in acreage was not significantly different. The farm enterprise was the primary source of employment for most of the households with 55% relying on it as the

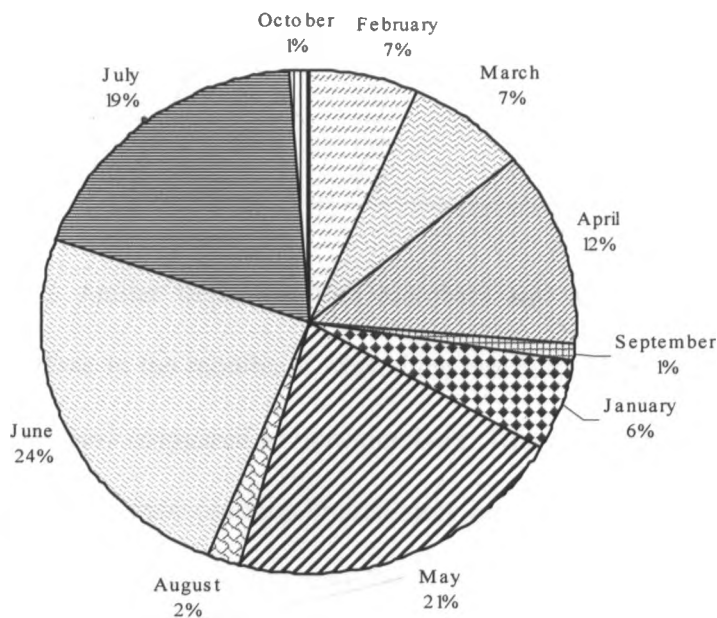
major source of household income. Land is a major source of livelihood for smallholder farmers in the region. However the land sizes were all skewed to the left indicating the relatively small size of farms available to the households which could be due to inheritance or selling reasons. The economic implication of the prevalence of small land holdings among the majority of the farmers is that household farm incomes cannot be increased through expansion of cultivated area but only through improved land productivity and value adding technologies on produce. This could be achieved, among others, by efficient use of resources such as fertilizer or labor, technological advancement and reduction in post harvest losses.

The distance to the nearest market in Kms, crops acreage and also maize acreage were not significantly different. The area allocated to maize was almost equal to the total crop area in the year 2006, indicating the importance of maize in the region. Most households had less than 5 acres under maize in the mentioned year.

It was found out that there was a high level of collective action in the area studied since 67% of household had membership to community based organizations. These community-based organizations assume many forms such as self-help groups, women groups, farmer groups, local development or environmental associations; that occupy important roles within the community.

The average annual number of months during which the households had enough maize to feed their families reasonably well was considered as the food security indicator. It was

found out that the mean period that the maize harvest for the sampled households was enough to meet household demand was 7 months with a minimum of one and a half and a maximum of 11 months; translating to a 5 months maize deficit in a household in the year. A multiple response was done to indicate the periods when the concerned households purchased food the most. The results for both members and non-members are shown in figure 3.



Source: Authors survey, 2007

Figure 3: Maize buying to meet household demand in year 2006

Since the average maize deficit was 5 months we can see from the figure 3, the hunger months range from March to July in the study area. The most critical period was the month of June because it's when most households were buying food (maize). The average price for the maize purchased by various households to meet the demand was 16 ksh per kilogram. The comparison between members and non-members is indicated in table 5.

Table 5: Maize buying for members and non-members

Month	Member Responses		Non-member responses	
	Count	Percent	Count	Percent
January	12	7.4	2	2.0
February	12	7.4	4	4.0
March	12	7.4	7	7.0
April	18	11.0	14	14.0
May	28	17.2	24	24.0
June	34	20.9	27	27.0
July	30	18.4	17	17.0
August	4	2.5	1	1.0
September	2	1.2	1	1.0
October	2	1.2	1	1.0
November	3	1.8	1	1.0
December	6	3.7	1	1.0

Table 5 shows a similar trend for both members and non-members. Most of maize purchases were done in the months of May, June and July. However, most of the buying was done by members compared to non-members. This could indicate that the members invariably sell most of their produce immediately after harvesting to meet their financial obligations. Similar observation has been made by Kent (1998) on his discussion about forced sales as one of the justification for cereal banks.

The major channels from which they bought the maize for consumption include open air markets, cereal banks and neighboring farmers with each response having 33%, 27% and 14% respectively. Thus we can say that cereal banks are important in that they were ranked second among other channels that farmers got stocks of food during hunger months confirming the hypothesis that cereal banks enhance food security at local level.

Storage infrastructure in the area was not much a problem with 77% of the households stating that they had a produce storage structure in the farm even if it was a room in the living house. The transport infrastructure was poor in the study area with weather road having the highest percentage (57%) followed by murrum roads (33%) then tarmac 3%. Others used a combination of the road types with 4% using tarmac and weather road and 2 and 1% for murrum and weather road and tarmac and murrum respectively.

Most of the households received maize market price information prior to selling (83%) , indicating high awareness level by the smallholder producers probably due to the liberalization of the maize sector. However when the respondents were asked their knowledge on how maize prices are set, 47% said that the price is market driven, 39% said that they negotiated with buyers , 8% said the prices are dictated by buyers and 6% said they don't know. A multiple response count was done on the question on sources of maize market price information whereby 29% said they got information on maize prices from neighboring farmers, 18%, 12%, 11%, respectively from radio, government extension officers, non-governmental extension officers like SACRED-Africa and 9% from the open air market. This explains the importance of farmer to farmer information exchange in the study area.

Fifty one percent of the households interviewed said that they had never sourced credit while 49% sourced credit. Since some households sought credit from various sources, a

multiple response was done which gave the following results based on respondents who sourced credit (Table 6).

Table 6: Sources of credit

Credit source types	Members	Non-members	Total Number of responses	Percent of responses
Agricultural Finance Corporation (AFC)	3	3	6	6.4
Commercial banks	1	3	4	4.3
SACCOs	10	12	22	23.4
Micro-finance institutions	7	5	12	12.8
Moneylenders/friends	2	3	5	5.2
ROSCAs/ Merry go round	34	11	45	47.9
Total responses	57.1	42.9	-	100

Source: Authors survey, 2007

Table 6 indicates that farmers rely on ROSCAs or merry go rounds (48%) for financial needs followed by SACCOs (23%) and Micro-finance institutions respectively. The results in table 6 also indicate that the members of cereal banks sourced credit more than non-members. The reason could be that the members are already involved in group activities and therefore have a higher level of awareness. The mainstream source of agricultural credit, the Agricultural Finance Corporation had only 6%. The most commonly used mode of transporting produce to cereal banks and rural traders/shopkeepers was the bicycle/bodaboda having 68% and 77% respectively. The major transport mode of delivering maize to schools and large scale millers was the trucks or lorries.

A question on the perceptions of the cereal bank members about various benefits that accrue from cereal banking as an institution was asked and the results are shown in table 7.

Table 7: The frequency of cereal bank perceived benefits

Perceived Benefits	Frequency of whether benefits are received or not		Highest frequency rank
	<i>Yes</i>	<i>No</i>	
Cereal bank improves farmer access to market	49	34	2 (12)
Cereal bank improves farmer access to credit	38	45	3 (7)
Cereal bank offers higher prices	23	61	1 (9)
Cereal bank provides farm inputs	15	68	3 (4)
Cereal bank improves household food security	55	27	1 (15)
Cereal bank enables working with other farmers	71	13	3 (20)
Cereal bank enhances social status	69	15	3 (14)
Cereal banks are for political gain	10	72	2 (1)
Cereal bank enhances education or training	77	5	1 (26)

Values in parentheses are the counts of those who ranked. The ranks were three with 1 being the most important.

Source: Author's survey, 2007

Table 7 shows that there are some benefits that accrue from cereal banking as an institution, in fact the counts of those who agreed that they receive some benefits are higher than those who do not. According to the rankings, education or training factor of cereal bank, improved household food security and relatively higher produce prices were ranked as the most important factors. This fact from the farmer's responses confirms the hypothesis that cereal banking enhances food security at the local level. Improvement of

access to market and enabling farmers to work together were other important factors that are enhanced through cereal banking.

Several maize marketing outlets for farmers in the area studied exist. The farmers were found to be selling maize through the outlets shown in figure 4 during the year 2006:

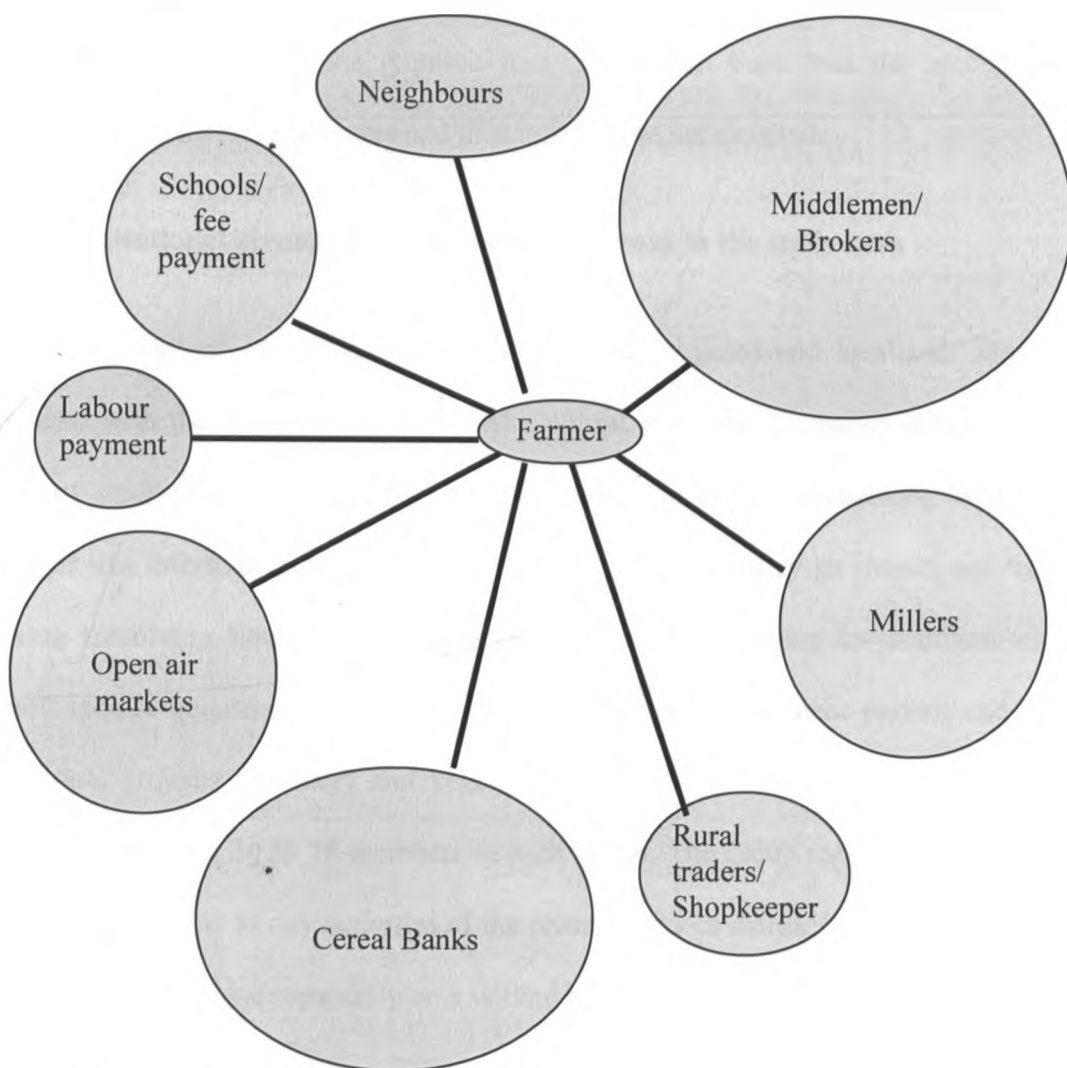


Figure 4: Maize marketing outlets for farmers

The major market outlets for small-scale producers in the study area were the middlemen or the brokers, followed by cereal banks and open air markets respectively (Figure 4). The major outlets used explain the importance of transaction costs in determining the point of sale for the producers. These major outlets are mainly located close to the proximity of the producers. It was found out that some pay for farm labor using the maize or other farm produce. In addition some sell to schools or pay fees for their children using the produce equivalent to the required fees. The cereal bank was the second most important outlet for maize farmers and thus it should be accentuated.

4.2 Institutional arrangements of the cereal banks in the study area

The arrangement of cereal bank institution is more targeted and localized. They are registered with the Ministry of Social and Cultural Services. Its mainly managed by a group of small-scale farmers who sometimes combine the cereal banking with other activities like informal group based rural financing such as merry go rounds and 'table' banking (revolving fund from member contributions for loaning to members which doesn't require collateral, has low interest rate and short repayment period) and other agricultural projects like dairy and vegetable farming. The membership of the groups studied ranged from 10 to 78 members in each group. The group members are the ones who manage the day to day activities of the cereal banks or stores. It was found out that cereal banks operate independently on a willing buyer, willing seller basis.

However the cereal bank initiative was introduced in the area by NGOs which trained the locals on the management and the benefits that would accrue from such kind of

organization. They also provided the initial inputs or requirements of starting the cereal banks especially the starting capital. They also searched markets for the smallholders during the initial stages. The cereal bank innovation can lead to economies of scale mainly through organizational input, resulting to a remunerative marketing channel for smallholders. The groups mainly try to minimize start up costs by trying to use the available resources; for example all the groups rented a store (idle shops) in the markets where they are located avoiding construction costs. It was disappointing to find out that after the supporting agencies withdrew, the institution has not been performing well. The stock they were handling diminished with time, mismanagement problems arose, some (two evidenced) went to an extent of closing down and others were still in operation but with no stock. Most were still struggling with management problems. Management problems included things like time unconsciousness, default debts including members failing to pay loaned maize and to some extent corrupt leaders who lead to misappropriation of group funds. Actually in one cereal bank group, two former leaders were put on trial. The presence of the supporting organization saw the cereal banks selling even regionally in the country but after the reduction in support they sold only locally.

4.3 Focused Group Interviews results.

Table 8 gives an outline of the groups that were contacted during the study and their characteristics.

Table 8: The groups included in the study

District	Group name	Year started	Number of farmers	Gender composition	
				Male	Female
Bungoma	Simanna	2004	40	25	15
	Sirisia	2003	36	19	17
	Chwele	2003	67	47	20
	Nalondo	2003	78	54	24
Butere- Mumias	Indukusi ¹	1997	30	3	27
	Bidii-Shiroza ²	1998	23	3	20
	Bidii-Mutoma ³	2001	10	4	6
	Mulembe ⁴	1982	18	4	14
	St. Veronicah ⁵	2004	24	5	19

¹ Started cereal bank project in 2006

² Started cereal bank project in 2005

³ Started cereal bank project in 2006

⁴ Started cereal bank project in 2003

⁵ Started cereal bank project in 2005

Source: Author's survey, 2007

The groups from Bungoma were introduced by SACRED-Africa and those of Butere-Mumias by Rural Outreach Project NGOs (Table 8). They assisted them establish maize storage and market information centers, provided maize processing equipment and a modest loan that enabled them to begin trading maize. Each group took a different approach that is adjusted for agro-ecological and socioeconomic conditions. The ones from Butere-Mumias are women groups with the male counterparts being mainly the spouses of some of the women and they refer to them as project managers. The cereal banking project was introduced to the already existing groups as opposed to those of Bungoma which were started with the aim of cereal banking. Thus this explains the higher number of females in Butere-Mumias groups.

Table 9: The age categories of cereal bank members

Age bracket	A	B	C	D	E	F	G	H	I	Total
<20	0	0	0	-	0	0	0	0	0	0
20-30years	0	3	0	-	1	0	0	1	2	7
31-40years	2	6	10	-	7	6	1	3	6	41
41-50years	5	5	20	-	4	11	7	4	10	66
>50years	6	7	37	-	1	6	2	10	6	75
Total	13	21	67		13	23	10	18	24	189

Codes: A- Simanna B- Sirisia C- Chwele D- Nalondo E- Indukusi F- Bidii-Shirota G- Bidii-Mutoma H- Mulembe I- St. Veronica

The dash indicates that the data was not available plus in some groups not all members were present.

Source: Author's survey, 2007

Deductions from table 10 show that the older farmers constitute the members who form cereal bank groups. This could be because the younger generation is engaged in other activities apart from farming and therefore less likely for them to join cereal banks. Also most of the group leaders were retirees indicating that most retirees in the area practice agriculture and they make best managers for the groups because of their higher knowledgeable status.

The membership to the cereal bank groups was open to all households with the exception of one group in Butere-Mumias. The Bidii-Mutoma cited lack of transparency among many members leading to mismanagement of group activities and thus they agreed not to admit new members in their group. One characteristic of the group is that it is made up of couples with two members from different households. The major criteria followed in order for one to join the groups are that an aspiring member should be able pay registration fees and shares and should be ready to adhere to the set constitution.

The stated objectives for formation of the cereal bank groups included poverty reduction through farming as a business, food security for the community, technical knowledge or training in business and other agricultural skills, welfare activities and to avoid exploitation by middlemen or controlling cereal prices. When asked whether they had achieved their stated objectives, majority of the cereal bank groups reported that they had achieved them while some partly and others did not. All groups in Butere-Mumias attained their objectives compared to those in Bungoma. The reasons given for the achievements included commitment by the members, application of the knowledge acquired through seminars and workshops and transparency among members. The reasons for non-achievement of the objectives included lack of credit or loans being stopped by supporting agency, lack of ready markets or stiff competition from other traders in the market, lack of own facilities like store, transport means and other requirements, poor cereal bank leadership and lack of commitment by members.

The cereal banks had executive committees that were elected through a non-secret vote counting process and given the responsibility of running the affairs of the cereal banks on behalf of the members. The membership of these committees included the chairperson, vice chairperson, secretary, vice secretary, treasurer, vice treasurer, marketing representative and a varying number of ordinary members mostly two in number. The mean annual executive meetings were 12 in number in most of the groups. Annual general meeting is held once annually in all the groups. Some groups have general meeting normally held once a month. Special general meetings are called upon whenever need arises. Time spent during various meetings in the group varied but the average was

two hours. When the members were asked about the valuation of time spent in meetings, they gave varied estimations meaning that they didn't care much about the time they spend in meeting. The estimated cost among the groups ranged from Ksh.20 to Ksh.200 for an hour spent in meetings.

An important aspect of governance of cereal banks is their constitution (by-laws) that defines the norms of operations, the roles and responsibilities of various organs and members versus the management that oversees the running of the cereal banks on behalf of members. Most of the cereal banks had written by-laws governing the running of their activities. The major rules and regulations included in the constitution across all groups were: registration a must for every member, attendance and time conscious in group meetings, transparency and accountability, members to be fully committed and not to disclose group secrets. All the groups indicated that there are penalties for members who violate the groups' by-laws. It was stated that those members who violated the by-laws were either fined or expelled, especially if they were repeat offenders.

About credit facilities for the groups, all the groups reported that they would like to borrow credit but are hindered by the requirements such as collateral. All the groups in Bungoma started the cereal banking well with loans from SACRED-Africa NGO. They received the loans from 2003 to 2006. However in 2006 the amounts were smaller because the NGO was winding up its activities. The credit was in cash and also in-kind because the NGO was giving them some of the initial equipments to start the cereal banks. The cash was to be repaid with 10% interest and most were able to repay. Some delayed repayment especially the amounts they were given lastly. Only one group had

managed to source a loan with the AFC whereby the members agreed their individual land holdings to be the collateral. The groups in Butere-Mumias (not all) sourced their loans from ROP with one getting a grant of Ksh.20, 000. ROP also gave them credit in-kind mostly farm inputs like fertilizers and seeds, which they were to repay with 2% interest and most of the members had not paid yet. The credit in form of cash was to be paid back with a 10% interest like that of SACRED-Africa. The Bungoma groups got larger amounts of loans although varying among groups and yearly; ranging from Ksh.50, 000 to 330,000 as opposed to those of Butere-Mumias (Ksh.20, 000 – 80,000).

The incentives reported for member participation in cereal banking included borrowing or loaning maize from cereal bank enhancing food security, technical knowledge and skills from agricultural and business trainings, exchange of ideas/keeping members busy, controlling of cereal prices and dividends. The constraints that were reported to hamper the performance of cereal banks are lack of enough capital especially financial, inadequate markets or competition from other traders, transportation problem, inconsistency in stocks and sometimes lack of, quality and quantity limitations e.g. reduction in quantity due to drying or removing the unwanted matter from the procured maize, storage pests especially the larger grain borer and to some extent lack of transparency and laxity of members.

The major elements of costs of managing cereal banks are the store rental charges, security costs, license fees and pesticides. Others include the equipments needed in the store such as gunny bags, plates, maize sieves and so on which require replacement

occasionally. The general duties in the stores are normally carried out by the members following a duty roster.

The major reasons given by members about ensuring the sustainability of the cereal bank activities is that the members be more committed to the groups by following the rules and regulations strictly, capacity building on regular basis and sourcing of loans to maintain their activities. The groups were further asked whether they had any future plans. Several of them indicated their willingness to broaden operations by expanding into other related activities. The results suggest that the cereal banks intend to diversify more into linked activities where they have gained experience and skills. For instance, most reported that they need to construct their own store, rent or purchase land and diversify their operations to other crops especially legumes such as beans, green grams and soybeans. Others mentioned forward linkages such as procuring a posho mill and process maize and other cereals locally.

4.4 Determinants of farmer participation

In this study correlation coefficient matrix was established to check for covariation among the explanatory variables and some were found to be correlated and they were excluded in the analysis. This was done to avoid the problem of multicollinearity.

Farmer participation in collective action groups is an endogenous variable (Shiferaw et al 2006). An econometric model was estimated to determine the effects of some socio-economic variables influencing farmer participation in cereal banking. Binary logit model which is a categorical dependent variable model was run using the LIMDEP computer econometric software (SPSS is not currently recommended for CDVMs; Park (2005). The model adopts the Maximum Likelihood Estimation method using the standard logistic probability distribution. The binary logit model is represented as:

$$\text{Prob}(y=1|x) = \frac{\exp(x\beta)}{1 + \exp(x\beta)} = \Lambda(x\beta) \dots \dots \dots (3),$$

where Λ indicates a link function, the cumulative standard logistic probability distribution function.

This study identified 13 independent variables which are classified as categorical and continuous variables. The continuous variables take any numerical value in a real interval when measured accurately while categorical variables take a numerical value of one or zero. The regression results for factors determining participation in cereal banks are indicated in table 12.

Table 10: Regression results of factors determining farmer participation

Variable	Maximum likelihood estimates			Marginal effects		
	Coefficient	Standard error	t-ratio	Coefficient	Standard error	t-ratio
ONE (intercept)	-0.236	1.297	-0.182	-0.001	0.008	-0.190
AGEHH	-0.045**	0.022	-2.074	-0.000**	0.000	-0.714
FEXPHH	0.082***	0.021	3.858	0.001***	0.001	0.768
EDLEVHH	0.001	0.057	0.015	0.530	0.000	0.015
MRKTDIST	0.342***	0.101	3.396	0.002***	0.002	0.922
GENDHH	-1.557**	0.732	-2.128	-0.020**	0.028	-0.706
HHINCOME	-0.729*	0.433	-1.682	-0.005*	0.006	-0.729
CBOMEMBE	0.001	0.002	0.586	0.000	0.137	0.472
HHSIZE	0.002	0.039	0.049	0.000	0.000	0.049
TRAINCA	1.296*	0.686	1.889	0.015*	0.021	0.711
GETSHHCR	1.305**	0.425	3.068	0.009**	0.012	0.740
FARMSIZE	-0.008	0.033	-0.254	-0.000	0.000	-0.259
STORE	-0.009	0.083	-0.112	-0.000	0.001	-0.106
CBOULET	2.436***	0.608	4.009	0.043***	0.056	0.779

Log likelihood function = -78.03

Restricted Log likelihood = -114.53

Degrees of freedom = 13

Likelihood ratio index/McFadden's $R^2 = 0.318$

Model size = 172 Observations

Hosmer-Lemeshow chi-squared = 9.29

*, **, *** significant at ≤ 0.1 , ≤ 0.05 and ≤ 0.01 respectively

Source: Author's survey, 2007

To measure the goodness-of-fit in qualitative response models, Greene (1993) suggested the use of the Likelihood Ratio Index (LRI). The LRI (also called McFadden (1974) R^2 or pseudo R^2) is analogous to the R^2 in a conventional regression. It was computed from the following formula:

$$LRI = 1 - \ln L / \ln L_0$$

This measure has an intuitive appeal in that it is bounded by zero and one. If all the slope coefficients are zero, then it equals zero. There is no way to make LRI equal 1, although one can come close and it has been suggested that this finding is indicative of a "perfect

fit” and that LRI increases as the fit of the model improves. Empirical evidence suggests that LRI usually lies between 0.2 and 0.4 (Jarvis, 1990 quoted by Mbata, 1997). The same was used by Irungu, (1999) in his analysis. In this model the LRI was 0.32 indicating that the model was fit (Table 12). The farm size, availability of storage facility, education level of the household head, membership to CBO’s, the size of the household and whether anyone in the household had acquired training in collective action were not significant in determining participation in cereal banking. The significant variables are explained below.

Age of the household head (AGEHH)

Age of the household head (continuous) was found to have a negative relationship with participation in cereal banking and it was significant ($p < 0.05$) as is shown in Table 12. Although this observation was not expected *a priori* this tendency can be attributed to other factors. It may indicate that relatively younger farmers are more likely to have information on new marketing strategies and have greater demand for incomes. Therefore it leads to a suggestion that relatively younger farmers are more likely to participate in cereal banking since they are more innovative and relatively higher incomes are expected from the collective action embodied in cereal banks.

Farming experience of the household head (FEXPHH)

Farming experience of the household head (continuous variable) was found to have a positive relationship with participation in cereal banking and it was highly significant ($P \leq 0.01$) as shown in table 12. The positive coefficient which was expected *a priori*, indicates that farmers with more farming experience are more likely to join marketing associations including cereal banks. This observation agrees with human capital theory which states that farmers become less risk averse as they gain experience (Welch, 1979). Farming experience also improves farmers' knowledge about farming thus increasing their efficiency including economic efficiency (Jamison and Lau, 1982). Therefore, the results indicate that as the farmer gains experience the likelihood of joining or participating in cereal banking is very high.

Distance to the nearest market centre (MRKTDIST)

The distance to the nearest market (continuous variable) centre was highly significant as shown in table 12. It had a positive coefficient as it was hypothesized that the larger the distance to the nearest market centre, the more likely for the farmer to participate in cereal banking. This is because longer distance to the market translates to higher transaction costs to the farmer and thus joining cereal bank leads to reduction of these costs through economies of scale. Therefore the distance to the market influences participation in cereal banking.

Gender of the household head (GENDHH)

The gender of the household head which was a categorical variable had a negative estimate which was not expected *a priori* (Table 12). The negative relationship opposes the hypothesized decision that males are more likely to have better access to information and services than females. The estimate indicates the significance of the female gender in participating in community level organizations such as the cereal banks.

Source of household income (HHINCOME)

This variable had a negative relationship with participation in cereal banking as indicated in Table 12 which was not expected *a priori*. It was found to be slightly significant ($P \leq 0.1$). This finding suggests that with more households relying on on-farm income sources only, the less likely for them to participate in cereal banking probably because it takes longer for cash payments (income) to come by as delayed payments is a characteristic of cereal banks.

Training in collective action (TRAINCA)

This variable stands for whether someone in the household was trained in collective action or co-operation (Table 12). It was slightly significant ($P \leq 0.1$) with a positive coefficient meaning that those with some knowledge on importance of collective action were more likely to participate in cereal banking.

Whether the household seeks credit or not (GETSHHCR)

This binary variable was found to be significant with a positive relationship to participation in cereal banking as it was hypothesized (Table 12). This means that a household that has access to credit is more likely to join a cereal bank since temporal arbitrage is one of the cereal bank characteristics and so the credit can keep the household moving as they wait for the returns from selling through cereal banks. This aspect enables the small-scale producers to reap higher benefits from their produce through scale economies.

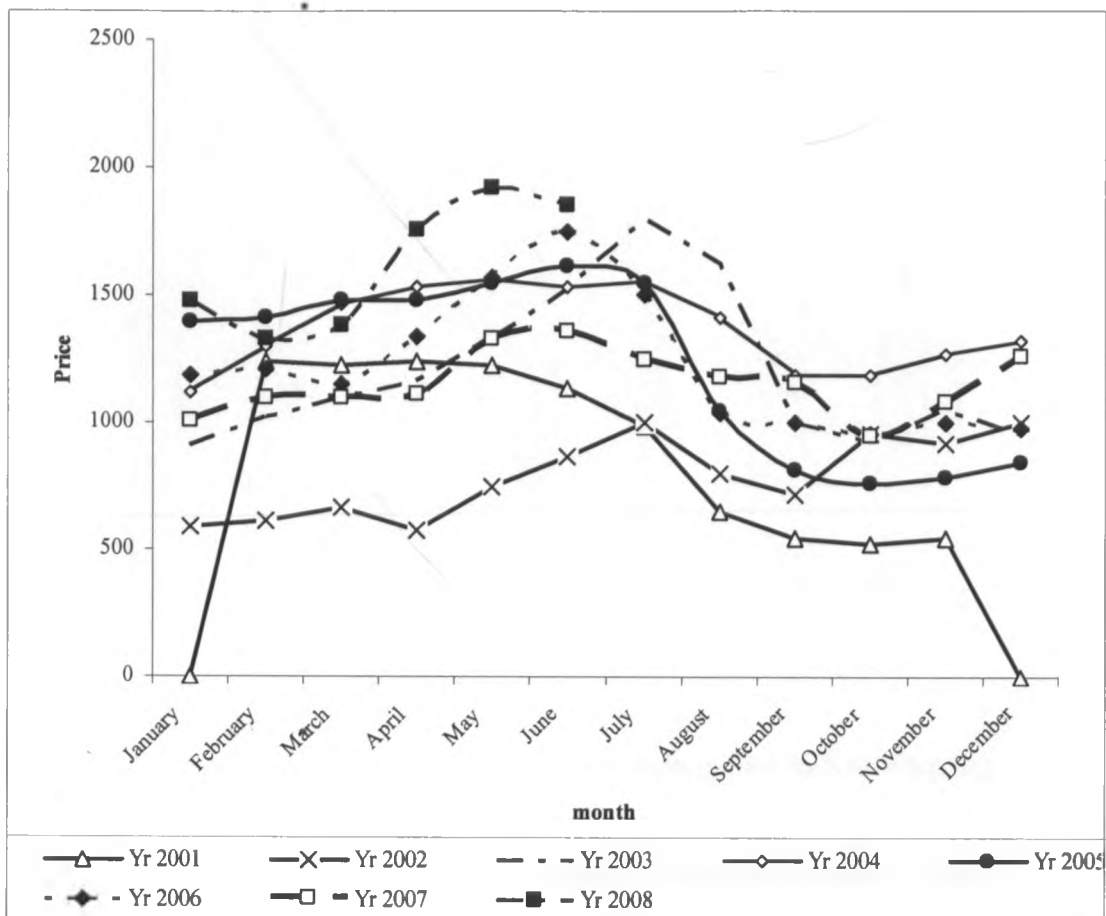
Whether the household sells through cereal bank or not (CBOUTLET)

This is a binary variable which shows a positive relationship with participation in cereal banking (Table 12), and it was highly significant ($P \leq 0.01$). It was an exogenous variable since both members and non-members were free to sell their produce to the cereal banks. This suggests that selling through cereal bank encourages one to become a member since one will become conversant with the operations of cereal banking. This can be explained by the fact that most cereal banks buy maize in small quantities and probably delayed but better payments after deliveries.

4.5 Stability of Prices in Relation to Cereal Banks

One of the objectives in this study was to check whether cereal banking contributes to improved stability of maize prices. Laby's (2007) suggested the possibility that commodity market quantities and prices are often random. The randomness is implied generally and the nature of the price fluctuations varies as they are observed and their likely causes in the long, medium and short run. In the long-term, shocks in commodity markets may be due to natural catastrophes, structural market changes or political/military interventions. In the medium term, shocks may happen due to political forces, cataclysmic factors and market forces or the national economic conditions. In the short run, shocks in commodity markets occur mainly due to financial factors. It was hypothesized that cereal banks contribute to increased maize price stability mainly through temporal and spatial arbitrage.

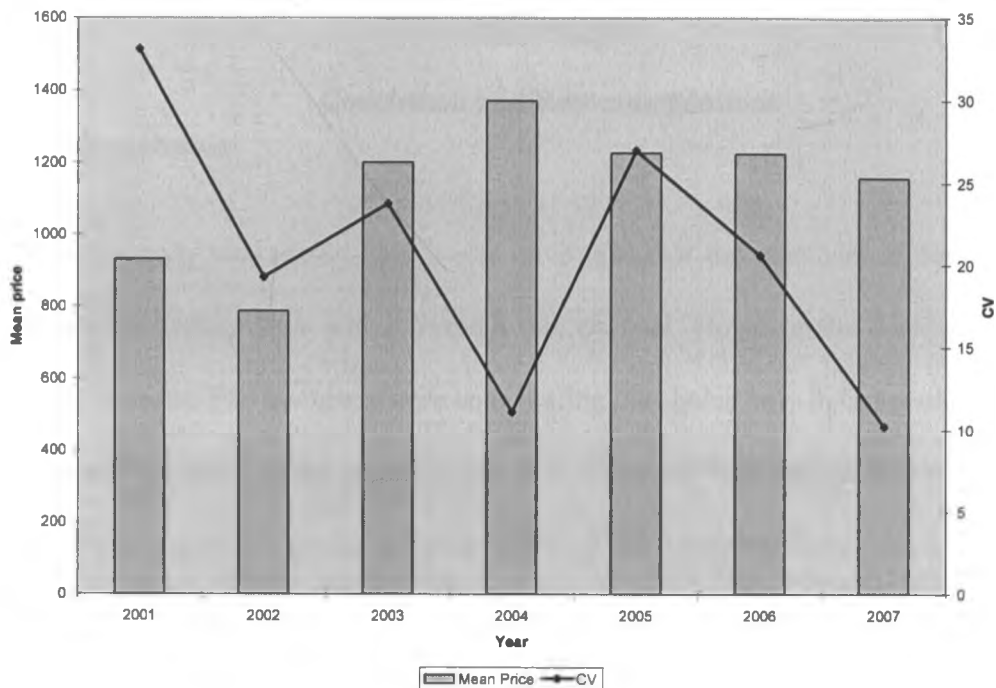
The data to address this was inadequate because only the data for Bungoma district was available however it was considerable data. The data that was available covers the period when cereal banks were in operation. The produce prices offered by cereal banks go hand in hand with the prevailing market prices. They normally discount the prevailing market prices ranging from 1.5% to 3%. Thus the Bungoma municipal market prices were used since price data from cereal banks were difficult to attain due to lack of consistency and hence unreliability. The price data for the main central market in Bungoma district was used. The wholesale maize prices indicate some degree of fluctuation as shown in figure 5.



Data source: KACE (2008)

Figure 5: Mean monthly maize prices for Bungoma main market in Ksh/90kg bag.

The mean wholesale price for maize for the main market in Bungoma is as shown in figure 6.



Data source: KACE (2008) •

Figure 6: Mean annual maize prices in Bungoma main market in Ksh/90kg bag

The fluctuating trend could be due to a combination of different factors (Figure 5).

During the period when cereal banks were very active (year 2003, 2004 and 2005), the coefficients of variation (CV) which indicate the price variability varied (Figure 6). If the year 2004 is considered since it was most active year in that most cereal banks were started in 2003; then with 11.13% coefficient of variation it implies that cereal banks can enhance price stability *ceteris paribus* (Figure 6). The overall Coefficient of Variation (from year 2001-2007) was 19%. However, the effect of cereal banks on price stabilization is unlikely to be evident with the data used here considering that even comparisons between the two areas cannot be made.

CHAPTER 5

Conclusion and Recommendations

5.1 Conclusion

Before the study was undertaken, it was envisaged that the members of the cereal bank groups were selling their maize through this channel. However the findings showed it was not the case. The members were contributing the shares only in terms of maize which constituted the stock of the groups. Although the cereal bank option was open to all the members as a marketing channel only a few of the members were found to be selling through it. It was found out to be mainly a business enterprise with some groups especially from Butere-Mumias having other social activities. The major reason for the members not to sell through cereal bank could be because of delayed payments.

The groups were doing well at the time when the supporting agency was providing loans and overseeing the activities of the cereal banks. They could even attain some dividends after paying the loans. But immediately the supporting agency reduced their involvement in terms of capital and management assistance, some of the groups' performance started declining. For instance some groups down trended such that during the time of study there were no stocks. It's like others had closed completely, because one could only see the signboards indicating their existence. Others were engulfed in mismanagement and corrupt practices such that efforts of trying to convene them for a meeting were fruitless. Also before they were selling to distant profitable markets in urban areas but after the NGOs withdrew this has not been the case. This indicates the prevalence of dependency syndrome which could be attributed to the way these institutions were started. However

Ambrose (online, 2006) emphasized the fact that even poorly implemented development projects imparts some skills or resources; the NGOs have had made some impact through trainings and capital support they rendered to these groups. Thus they can still manage these activities on their own.

Cereal banks are maize price takers rather than setters. This is because they determine their selling price depending on the prevailing market price. Mostly they lower their unit price by one shilling or so. This enables them to be able to compete with other traders but it's not so much encouraging because they have to take cautions not to operate at a loss. To mitigate such conditions it is recommended that probably they can sign contracts with big markets and prepare for a specific market from time of purchasing stock.

The significant factors that were found to influence participation in cereal banks were the age, gender and farming experience of the household head; the distance to the market; source of household income ; access to credit for the household; training in collective action and whether one sells through the cereal bank or not.

The analysis presented here has shown that the cereal bank institution is feasible and useful but it requires farmer organization and coordination mechanisms at a higher scale to exploit scale economies. Also collective bulking and storage are essential for meeting market demand and for development of forward contracts with processors. If they can secure such contracts then it means larger profit margins and increased incomes for the poor.

In summary, the difficulties that were found to be inherent in cereal banking include; the complexity of decision making by managing committees and the risks linked to collective stock piling like physical and to some extent value losses. The requirement for the viability of these enterprises is that people in charge of their management should master the essential functions of supply, stockpiling, selling and financial management to improve their coordination and efficiency.

5.2 Recommendations

Working capital was found to be a constraint to the progress of the cereal banks. One of the recommendations is that the government can look for ways of providing credit to the groups engaging in such enterprises because this institution in itself is important in the grassroots. Since households which had access to credit were found to be positively correlated with participation in cereal banking, credit facilities should be provided and promoted because it means small-holder farmers can use the cereal bank channel instead of the sometimes exploitative middlemen for sale of their produce. Cereal banks have the aspect of drought preparedness and mitigation measures, they reduce the risk of excessive price fluctuations in regions not well served by the private sector markets. Credit availability can make the cereal banks provide partial payments for deposited grain which can enhance access to capital at farm level. The immediate payment to poorer farmers can also provide them additional incentive to participate in this venture. The government can seek means of linking farmers to micro finance institutions to provide farmers with credit and capital to enhance their production potentials and facilitate investment in small enterprises.

Given the nascent nature of farmer institutions, there is need to have probably intermediary institutions that can assist them in registration, negotiations, contract enforcement, quality improvement and transportation services. The NGOs assisted in all these and the groups were progressing well although it was only short term. Therefore, institutions that can assist in these but geared towards the longer term can be developed.

The female gender was highly involved in cereal banking. Therefore, the cereal banks should be promoted to enhance the involvement of the female gender especially in the rural areas in the economic development of the country.

Another policy implication is the legal and policy issues for collective marketing as in the case of these cereal bank projects. It was observed that the cereal banks were unlikely to prosper in a “business as usual” policy environment. They lack the legal status as business enterprises, so they can neither sue nor be sued in case of any liability. This makes them unqualified for loans. Those in Butere-Mumias combined cereal banking with other projects and they were progressing relatively well compared to those of Bungoma.

The input markets should be fair for smallholder farmers such that when coupled with adoption of improved agricultural technologies will increase farm production leading to increased marketable surplus.

The cereal bank institution was found to be important outlet for smallholder farmers in the interior areas. Distance to the market was found to be influential in support of cereal banks, since the further away from the market, the more the participation in cereal banks. It is recommended that government policy must be aimed at enhancing infrastructure development in rural areas especially in high agricultural potential areas. This is because most of the groups looked forward for diversification of their collective activities mainly to include processing. It is believed that well designed infrastructure can be a longer term strategy for increased agriculture and economic development.

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Appendix

Checklist for cereal bank management (key informants)

1. What are the roles of cereal bank management
2. Provision of data on volume of trade by the cereal banks for the last five years (can give official reports where I can extract some of the information).
3. Cereal bank maize price trends during the operations period depending on the buying agent
4. *Maize price trends in the open air market for the last five years (to be collected from District Agricultural Office).
NB: price trends will be collected on a monthly basis.
5. Do you handle only maize for consumption or also seed maize? If seed maize available is it improved or hybrid varieties.
6. What policy support is needed for the proper functioning of cereal banks/do you feel the Government should help in any way?
7. What are the elements of costs of cereal banks? (running costs)
- 8.

Time of receiving maize	Amount received	Receiving price	Amount sold	Selling price	Time of selling	Where sold

9. *How much do buyers pay for it (what is the temporal difference in cost)
10. *What price is paid to farmers or what do you give farmers

Questionnaire on an Economic Analysis of Cereal Banks in Bungoma and Butere-Mumias

Enumerator's names _____ Date of the interview _____ 2007
 District _____ Division _____
 Location _____ Sub location _____

a). Respondent Characteristics

1. Respondent names _____
2. Position in the household _____
3. Respondent. 1. Age (years) _____
2. Gender _____ 1. male 0. female
4. Marital status
1. Single 2. Married 3. Widowed 4. Divorced 5. Other
5. Education level in years _____

NB. Adult education is equivalent to 1 year of education. Std 4 is 4 years of education.

6. Farming experience in years _____

b). Household characteristics

1. If respondent is not the household head, indicate the household head characteristics as follows:

a) Age in years. _____

b) Gender _____ 1. male 0. female

2. Marital status of the household head

1. Single 2. Married 3. Widowed 4. Divorced 5. Other

3. Education level of the household head in years

NB. Adult education is equivalent to 1 year of education. Std 4 is 4 years of education.

4. Farming experience of the household head in years _____

5. Main occupation of the household head _____

- 1. Self-employed on-farm
- 2. Self-employed off-farm
- 3. Farming + business
- 4. Farming+ formal employment
- 5. Formal employment
- 6. Other.....

6. a) Is the household head a member of any community based organization or self-help group/s? 1. Yes 0. No

b) If yes, specify the group/ organization _____

c) Name the position held in the group/s _____
 1. If leader (chairman, secretary or treasurer, etc) 0. If member

7. a) What is the household size? _____

b) What are the age brackets of the household members?

Age options	Number
Children 0-14 years	
Teenagers 15-21 years	
Young adults 22-39 years	
Middle aged 40-64 years	
Elders 65-100 years	

c) How many household members are dependent on the household head? _____

d) How many of the dependants assist with farm work?

Cash remittances _____ Labor assistance _____

8. a) Has any household member taken part in training or a course in any agricultural related field? 1. Yes 0. No

b) If yes, what was the area of training? _____

- | | |
|----------------------------|-----------------------------------|
| 1. Agronomy/Crop husbandry | 2. Livestock production |
| 3. Health/Nutrition | 4. Forestry |
| 5. Marketing | 6. Collective action/co-operation |
| 7. Other (specify) | |
-

9. Household budget

Item consumed	Quantity per day/weekly (D/W)	Price (Ksh)	Total amount
Maize			
Beans			
Rice			
Wheat			
Other grains			
Other cereals			
Cassava			
Sweet potato			
Carrots			
Sugar			
Tea			
Milk			
Cooking fat/oil			
Beef			
Fish			
Chicken			
Eggs			
Potatoes			
Tomatoes			
Vegetables			
Soap/detergents			
Cosmetics/lotions & Oils			
Salt			
Kerosene			
Other (specify)			

b) Other household expenditure: (Specify period; Daily, Weekly, Monthly, Termly or Yearly)

Item	Amount in Ksh.(D/W/M/T/Y)
School fees	
Medical fees	
Clothing	
Household utensils/appliances	
Travelling/ leisure	
Other, specify	

c) What are the sources of income for the household?

Income source	Amount in Ksh. for year 2006
1. Sale of crops.....	
2. Livestock.....	
3. Salary from regular employment	

4. Remittances	
5. Income from other non-farm employment	
6. Income from agricultural wages	
7. Bursary	
8. Other, specify.....	

10. What are the sources of credit to the household? (Circle all that apply)

1. Agricultural finance corporation (AFC)
2. Commercial banks
3. SACCOs
4. Micro-finance
5. Moneylenders/friends
6. ROSCAs/merry go rounds
7. Other (specify) _____
8. None

11. a) What is the total farm size in acres? _____
 b) What acreage is allocated to crops from the total farm size? _____
 c) Is maize among the crops grown? 1. Yes 0. No
 d) If yes, what acreage was allocated to maize crop in 2006? _____
 e) What cropping system did you use? _____
 1. Mono cropping 2. Mixed cropping 3. Both

d). Timing of farm activities

Month	Activity(codes)	Month	Activity(codes)
January		July	
February		August	
March		September	
April		October	
May		November	
June		December	

- Activity codes: 1. Ploughing/land preparation 2. Planting
 3. Weeding 4. Harvesting
 5. Shelling 6. Other
 (specify).....

12. a) For maize farmer, answer the following

- i) What was the amount of maize harvested in 2006?
 1. First season. _____ kgs 2. Second season. _____ kgs
- ii) Was the harvested amount enough to meet your home consumption requirements?
 1. Yes 0. No

- b) If yes, i) what was consumed at home? _____ kgs
 ii) What was given to relatives, friends as gifts or donations
 _____ kgs
 iii) What remained after consumption and giving out? _____ kgs

- c) i) If insufficient harvest, for how many months was the harvest enough to meet the household demand? _____
- ii) How much maize in kgs did you buy to meet the remaining balance? _____
- iii) Please specify the month/s in which you bought maize for home consumption.
(Codes: 1-12 for January to December)
- _____

iv) Where did you buy the maize?

1. Open air market
2. NCPB
3. rural trader/shopkeeper
4. neighbouring farmer
5. cereal bank
6. Other, specify

v) What was the cost of purchased maize cereal in Ksh. (if known?) _____

vi) How many kgs of maize did you receive as gifts/food aid? _____

13. a) Do you have a farm produce storage structure in the farm? 1. Yes 0. No

b) If yes, what quantity of produce does it hold in Kgs/bags? _____

14. What is the distance to your nearest market centre in Kms? _____

15. What is the status of the road to your nearest market centre?

1. Tarmac
2. Murram
3. Weather road

16. a) Do you receive maize market price information prior to sales?

1. Yes
0. No

b) If yes, what is/are your source(s) of the information? *(Circle all that apply)*

1. Radio *(Rank three major sources)* _____
2. Television
3. Newspapers
4. Extension publications
5. Mobile phone
6. Neighboring farmer/s
7. Government extension officer/s
8. Non Governmental extension officer/s
9. Other (Specify).....

c) How is maize price set during the sales?

1. We negotiate with buyers
2. It is market driven
3. It is dictated by buyers
4. Other (Specify).....



17. Where did you take/sell the maize that remained after consumption and giving out **in 2006**?

Marketing Outlet	Amount Specify units.	Unit Selling price	Transport mode (Codes)	Distance to outlet (Kms)	Bagging costs	Transport costs	Loading /offloading costs	Farm gate price	Other costs
1. Local middlemen/brokers									
2. Open air market									
3. National Cereals and Produce Board									
4. Large scale commercial millers									
5. Cereal bank									
6. Rural traders/shopkeepers									
7. Other, (Specify)									

Transport mode codes: 1. Truck/lorry 2. Public /matatu 3. Ox-cart 4. Bicycle/bodaboda 5. Wheel barrow 6. Other (specify).....

NB: Gorogoro = 2 kgs, Bag = 45 gorogoros,

18. a) Final price received by the producer after selling through the cereal bank. _____

b) Final price received by the producer after selling through the NCPB _____

19. If outlet is cereal bank, why did you choose to sell through this channel?

Perceived cereal bank benefit	Benefit received (1. Yes 0. No)	Rank 3. (1=most important)
Improves my access to market		
Improves my access to credit		
Offers higher prices		
Provision of agricultural inputs like fertilizer, seeds and chemicals		
Improves household food security		
To work with other farmers		
To enhance social status		
For political gain		
Education / training		
Other (specify).....		

Thank you very much!!