The Implications of Grain Market Liberalization on On-Farm Maize Storage in Kenya

by

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Abstract

This thesis presents a financial analysis of on-farm grain storage from a farmers perspective in Kenya using storage investment and farm budget data from Nandi district. The study emphasizes the implications of the agricultural market liberalization process being undertaken by the government. To reduce operating subsidies to the National Cereals and Produce Board, the government has encouraged improved on-farm storage structures. The results show that improved storage structures significantly increases income. However, the traditional store show a marginally profitable benefit/cost ratio equal to one possibly explaining the low adoption of improved structures by farmers. The small returns from the traditional stores could be a trade-off for the risk involved.

Risk averse farmers might continue to use the traditional store. Although the post-harvest losses for individual farmer are small, the country aggregate involves large losses. One recommendation would be to pursue extension programmes which will reduce the on-farm post-harvest losses for those farmers who continue to use traditional stores. Alternatively, a price premium for high quality grain could provide an incentive to use improved practices. Finally, the farmers could be encouraged to start cost-efficient cereal banks which will spread out storage costs amongst many farmers.

The success of the market reform process depends on the government providing a favourable environment for private traders, for example improved infrastructure, market information systems, credit and reduced trade barriers. This could lead to more integrated local markets and the dampening of seasonal price differentials within the country hence the less the likelihood of non-competitive market situations arising.

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Chapter I

1.1 General Overview

The agricultural sector has been emphasized as the mainstay of Kenya's economy in all post-colonial development plans. The sector contributes 27 percent, the highest compared to other sectors, to total gross domestic product (GDP) (Appendix A, Table 1). The 1989/93 development plan reiterated the centrality of the sector in the country's development strategies for the rest of the century.

Over the years, maize production has predominated and is Kenya's staple food. On average, it provides about 40 percent of the total calories and nearly 40 percent of the protein (World Bank, 1990). Maize is widely grown using traditional and commercial modes of production. It is estimated that 80 percent of the total maize production comes from small scale-farmers who retain 62 percent (Development Plan, 1989/93) of their produce for subsistence consumption and speculative market purposes. The problem facing small-scale farmers is that even after relatively good harvests, the poorer segments of the farm population are usually not able to maintain sufficient food stocks due to financial obligations compelling them to sell too large a quantity of their harvest (Schmidt, 1979)[1].

The Kenyan government has a long history of enacting policies aimed at stabilizing domestic maize prices (Winter-Nelson, 1992). As in many other developing countries, Kenya's policy seems to have been motivated by multiple desires to enhance food security for poor consumers, to improve the production environment for small-scale

farming, and to demonstrate political leadership in this sensitive area (Timmer, 1989). Government intervention occurs in grain production and marketing in two major ways. First, producer and consumer prices are determined and set by the government annually and secondly, by adjustment in net imports and government-held stocks to enforce the pre-set domestic price levels.

The government, before market reform, set prices for the purchase and sale of maize to and from National Cereals and Produce Board (NCPB)[2] depots. Producer-price determination was conducted by the Ministry of Agriculture, Livestock Development, Marketing and Supplies (MALMS) in conjunction with the Ministry of Planning and National Development (MPND) and the Office of the President (OP). The price were based upon, among other factors, the cost of maize production (Ministry of Agriculture, 1992). The mandatory price was announced before the beginning of the planting period each year and became effective at the beginning of the harvest period that year. Corresponding selling prices at each level of the marketing chain, including that of sifted maize meal, were also set by the government, again becoming effective after the first harvest of that year.

One of the key reasons for Government intervention is to maintain some degree of internal self-sufficiency for the staple food[3]. The world market for yellow maize is quite stable. But Kenyans have a strong preference for white maize, whose world price is much more unstable as compared to yellow maize (Maritim, 1985). Appendix A, Table 2 shows that Kenya experiences periodic large, weather-induced shifts in the domestic

maize supply (Pinckney, 1988). Dryland maize production is very sensitive to the amounts and timing of rainfall. As a result, the government justifies the need for intervention to meet self-sufficiency in white maize.

The other reason for intervention in the agricultural sector is that of food security. The World Bank defines food security as "access by all people at all times to enough food for an active and healthy life" (World Bank, 1988). Food insecurity takes many forms. A broad distinction has often been made between "transitory" insecurity (arising from the effect of intermittent risks), and "chronic" insecurity (associated with poverty and the continuing inability of many households to meet their food requirements because of lack of purchasing power) (IGADD, 1990). Both types of insecurity are currently being experienced in Kenya given the bad economic situation facing the country and the structural adjustment programmes (SAPs) requirement of the World Bank (WB) and the International Monetary Fund (IMF).

In the past decade, Kenya viewed the established public sector reserve stocks as an instrument of food security policy. In setting them up, little attention was paid to their appropriateness or cost effectiveness in improving food security. The improvement of food security depends crucially on the nature of the food security problem, the type of risks faced and the location and characteristics of the insecure population. Food stocks are not a solution for food insecurity, and are indeed of little relevance to several important food insecure groups whose purchasing power is low. The government established the reserve stocks paying little attention to organizational and management aspects, as result

a the government has had to subsidize the operations of the NCPB. Therefore, little has been achieved as far as the food security objective is concerned through the NCPB.

In most years Kenya has been self-sufficient in maize production. The dominant feature in the price structure for maize is the wide differential between import (KSh 515) and export (Ksh 277) prices (Appendix A, Table 3 and 4) (Pinckney, 1988), due to the relatively large domestic and international transportation costs. This presents a problem when maize alternates from being an export to an import crop. The official price in most cases is between the import and export price.

Recently, Kenya has embarked on a maize market liberalization programme whose aim is to achieve internal self-sufficiency in maize production and maintain strategic reserves (Development Plan, 1989/93). The Cereal Sector Reform Program (CSRP) commissioned by the government in 1986, recommended the liberalization of cereal and bean marketing based on anticipated gains in pricing efficiency. The CSRP also recommended major structural changes in the NCPB to reduce the sizable operating subsidies from the government and endorsed policies to liberalize agricultural markets.

There has been an emphasis to take into account on-farm and private sector storage activities in order to reach an appropriate definition of the public sector reserve stocking function. This shift in emphasis gains importance from two sources: first, it has always been a weakness of reserve stocking studies that they have tended to disregard the private sector; and second, the structural adjustment has emphasized increased reliance on private grain marketing systems through the on-going market liberalization.

The SAPs requirements emphasize competitive markets, for example, the use of private stockholding to meet food requirements. The requirement to remove the state operated NCPB will have some major implications on the country's food security. Kenya has no private storage operators to take over the NCPB operations during the market reform process, therefore transition problems are bound to occur.

1.2 Statement of the Problem

The government has set a national goal of maize self sufficiency and food security (Government of Kenya, 1981 and 1986). In pursuit of this goal, the government has maintained tight control over the maize market over time. The public sector marketing agencies like NCPB and regulatory structures have been used to strengthen the government's ability to control prices. In Kenya the regulatory controls include restriction of maize movement across district boundaries (Appendix A: Figure 1) through permit requirements, and the fixing of maize and maize meal prices by law.

Less attention was paid to organizational and management aspects of public sector reserve stocks in Kenya. As a result, the Government has had to meet the NCPB's operating costs with subsidies in order to satisfy both urban (and rural) consumers' demand for cheap basic food, as well as the maize producers' demand for high farm-gate prices, whilst simultaneously preventing excessive maize surpluses which can, usually, be exported only at great losses (Pinckney, 1988). The dual nature of food prices, as incentives to producers and determinants of the real income to consumers, what Timmer, Falcon and Pearson (1983) call the "food price dilemma", often requires conflicting

strategies in attempting to increase food production and consumption at the same time. These traditional interventions have not achieved the intended objectives of self-suffiency and food security.

Through the structural adjustment requirements the government has implemented a gradual grain market reform. Proponents of market reform justify it for three reasons (Duncan and Jones, 1993). First, are there economic costs to the agricultural and other sectors resulting from pricing and marketing intervention. Secondly, the parastatal marketing agencies have accrued unsustainable financial losses and finally, the failure of traditional forms of intervention to achieve their objectives. Market reform (for example the removal of movement controls on traders[4]) has increased private maize marketing.

The government's conflicting strategies have led to the argument that the country would be better off with a competitive private sector grain market. The objectives of the market reform process include, among other things, the withdrawal of the inefficient state marketing agencies. The state agency in Kenya has been involved in the procuring, storage and distribution of grain. There have been few incentive for the private sector to participate in storage. The state agency withdrawal, as argued by Thompson and Terpend (1993), is bound to have some transitional problems which have to be addressed.

The government, in its effort to reduce the transitional problems during the grain market reform process, has embarked on encouraging farmers to adopt technologically improved on-farm storage (Development plan, 1989-93). Recent research studies show that traditional on-farm storage experiences grain losses as high as 26 percent of total production. Translated into monetary terms the losses present sizable reductions in

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farmers' anticipated income and diminish the amount of foodgrain available to sustain families until the next harvest. The studies show that improved storage reduced post-harvest losses from 26 percent to 4.5 percent, a tremendous saving in grain (IGADD, 1990).

Maize is a commodity that can be preserved and stored quite well for a long time in relatively simple structures. Traditionally, most farmers leave maize, after physiological maturity (35 percent moisture content), in the field for natural drying until the moisture content is reduced to approximately 18 percent. At physiological maturity the grain has maximum dry matter, but the moisture content is too high for storage. The drying and storage dual purpose functions of the improved structures solve this problem.

The decision to invest or not to invest in storage structures depends entirely on the farmer. Are the maize losses financially significant enough to the farmer to invest in improved storage? Farmers will invest in an improved storage if there are financial incentives to do so. This study focuses on the financial analysis of the different on-farm storage improvement alternatives and how the investment partial budget impacts on the farm household. This is bound to have some implications on the government policy on storage and food security during the market liberalization process.

1.3 Area of Study

The study was carried out in Nandi district and covered Kapsabet and Mossop divisions. This selection was based on three main reasons: First, Nandi district is a surplus producing area (Appendix A: Figure 2), with most of the land classified as medium to

high potential and maize is the staple food in the area. The district is located in the Rift valley province, which is the backbone of maize production in Kenya. Secondly, the district represent different agro-ecological (Appendix A: Figure 3) and soils zones, providing different agricultural and storage practices. Thirdly, the district borders maize deficit areas in Western and Nyanza provinces. As a result, a parallel market has been operating illegally between these areas for a long time.

The governments of Sweden, Denmark and the United States in conjunction with the Ministry of Agriculture have had programmes related to grain storage including; the Rural Structures Unit (RSU) - Swedish International Development Agency (SIDA) and the On-Farm Grain Storage project (OFGS) - United States Agency for International Development (USAID) (Appendix A: Figure 4). The main objective of the two programmes is to improve post-harvest practices to reduce losses. Post-harvest packages have been developed for extension purposes. The RSU operated in Nandi with little success due to low adoption rates for improved post-harvest management. The projects wound up due to financial constraints from donor countries.

1.4 The Scope and Organization of the Study

Maize storage in Kenya is carried on at both the producer level and by the marketing board. On-farm storage is mainly for household food requirements and for speculative purposes in the local markets. Emphasis on storage in Kenya had focused on the public grain stock reserve for a long time. But emphasis has recently shifted to the farm level storage to try and reduce government subsidies to the NCPB.

The economic performance of the on-farm improved stores can be evaluated through an analysis of benefits and costs involved. This study will analyze both the technological and economic aspects of on-farm storage and the implications of liberalization of the cereal sector on farm level food security. The following specific questions were investigated:

(1) How does government involvement in the grain sector affect on-farm storage?

(2) What are the existing and potential methods of maize storage and what are the problems involved with storage?

(3) Is improved on-farm storage financially feasible?

(4) What are the improved storage investment implications to the farmer?

(5) What are the on-farm storage investment implications for the country's food security?

This thesis is organized into five chapters. Chapter 2 outlines the literature review on the policy implications of the government involvement in the grain sector and its impact on storage practice. The chapter also reviews actual and potential maize drying and storage systems at the household level. Chapter 3 outlines the methodology and methods used in the financial analysis. Chapter 4 outlines the empirical results. Chapter 5 outlines the interpretation and implications of the empirical results, limitations, policy implications, conclusions and recommendations for further research on the subject.

Chapter II

Policy and Storage Systems Review

2.1 The Impact of Policy on Storage Activities

Policy, in its various forms, has an important influence on the development of storage and reserve stocking systems. This influence occurs at a number of levels ranging from the national economic environment to specific policy settings or regulations. Its effects, for good or bad, affect the activities of individuals and institutions involved, or potentially involved, in the storage of food commodities. This chapter reviews briefly some of the major mechanisms through which policy, and particularly food marketing policy, interact with food storage activities.

The following elements of policy are identified as being of particular relevance to the development of storage systems:

(a) food storage activities regulations;

(b) domestic marketing of basic food commodities regulations;

(c) the setting and maintaining of official prices;

(d) the external trading in basic food commodities, nationally and internationally, regulations;

(e) the licensing and taxing the grain trading activities;

(f) the management of public sector reserve stocks, for example, the rotation and retirement of older stocks;

(g) macroeconomic management as it affects inflation rates and interest rates and exchange rates.

(a) The food storage activity regulation.

In Kenya there are explicit restrictions on the volume of grain that individuals (especially private traders) may hold in store. The legal status of food storage activities is poorly defined, leading to periodic confiscations, seizures and police harassment. Such restrictions can clearly have a major effect on food grain storage, activities are either suppressed or pushed onto a parallel market, usually with severe implications for market prices of the commodities concerned. In most cases such regulations can be assumed to have the effect of reducing the supply of food storage services undertaken by the restricted categories.

(b) The domestic marketing of basic food commodities.

The regulatory framework for the domestic marketing of cereals in Kenya is a closely regulated system. Internal movement of produce is tightly controlled. For example, a movement permit which applies to all cereals and pulses, is required in order to ship cereals. While the specific impact of such systems depends on their implementation, their general effect is to restrict the flow of private trade between surplus and deficit areas within the country. This in turn tends to widen the differentials in market prices between different locations. Such controls have an important effect on the extent of private sector storage, in that they limit the markets onto which stored grain can be profitably delivered. The rise in inter-locational price differential in this situation is a sign that grain flows have been restricted.

Price variability is inherent in the private marketing of agricultural products in Kenya (Pinckney, 1988). This is because of the seasonal nature of output, difficulties in adjusting production to demand under uncertain weather, and low price elasticities for basic food grains. Due to these low elasticities of demand, the consumption of basic food is almost constant throughout the year and, as a result, even small fluctuations in yields tends to be associated with large variations in prices. Where commodity markets are narrow, price fluctuations are magnified by speculative activities. Sharp price increases after the bulk of a seasonal crop has moved into wholesale channels discourage purchasing by consumers without benefiting the producers.

Whereas official prices (pan-seasonal pricing) remained constant in Kenya throughout the marketing season, the opposite was true for the parallel market prices. Keeler et al (1982) noted that within-year price movements on the parallel markets demonstrate that the prices faced by consumers on these markets climb consistently throughout the year. Price variations are also observed spatially as a function of transport costs. Furthermore, prices differ for different forms of the same product to reflect processing costs.

Price variability, like in the parallel market of food grain in Kenya (Schmidt, 1979 and Maritim, 1985), stimulates storage and processing demand in the rural and urban areas. This is due to the fact that seasonal prices must rise to cover the costs of storage for the storer to arbitrage. Experience has taught farmers that the prices in the parallel market

vary during the planting season, peaking during the pre-harvest season. However, a rational farmer will decide to store grain only if total additional revenues exceed storage costs.

(c) Setting and maintaining official prices.

In Kenya the government was involved in the setting of official consumer prices and attempts are made to support producer prices for major domestic cereals, but open market pricing took effect July 1994. The primary form the price setting takes is the regulation of the buying and selling prices used by public agencies. There are strong theoretical reasons for expecting official price structures to influence private sector storage activities as a result of their effect in the profitability of seasonal and inter-regional arbitrage.

If the margin between official producer and consumer prices is less than the full marketing costs of a private trader, including the full seasonal storage costs, then public pricing will tend to discourage storage for purposes of inter-seasonal arbitrage by farmers and traders. Similar arguments apply to the effect of public pricing in the removal or reduction of inter-annual price variation, which, in a market dominated by a cereal economy, provides the incentive basis for the inter-annual storage of grain by farmers and traders.

When the price structure is pan-seasonal, the timing of sales by farmers to marketing agencies becomes an important consideration for farmers. If the price is invariant during the marketing year then the farmer has no incentive to delay deliveries,

on the contrary, will deliver at the earliest opportunity. This has the effect of bunching public sector purchases heavily into the immediate period of the harvest and overburdening the limited public sector storage capacity.

The second major aspect of pricing which affects storage is that of spatial differentiation, or the lack of it (pan-territorial prices). The imposition of a pan-territorial price across regions within a country can easily remove the profitability of the private sector arbitrage where transport costs cannot be fully recovered. In practice this is a more important consideration limiting the incentive for on-farm storage than the question of pan-seasonal price structures. Pan-territorial prices tend, of course, to encourage retention for personal consumption in deficit locations, but this is a secondary effect, since, almost by definition, such areas have no surpluses to store.

The NCPB in conjunction with the Ministry of finance, has attempted to set the producer price between its export and import parity levels. Even when the official price falls within the wide cif-fob band, the price and movement controls fragment the market, increase marketing costs, and encourage maize production in inappropriate areas (Heyers, 1976c; de Wilde, 1984). Pan-territorial pricing creates distortions in producer incentives and inefficient production patterns since prices do not reflect the difference in transport costs among surplus areas. Similarly, by dampening seasonal variation in the consumer price of maize, the system discourages private storage.

(d) External trading in basic food commodities.

External trade in cereals and other basic foods was heavily regulated until July 1994 in Kenya. This has an effect on an international scale comparable to the effect of movement controls within the country. Deficit regions are encouraged to undertake their own storage to meet local requirements, but there is a discouragement of the generation and stocking of surplus produce to meet anticipated market opportunities across the borders.

Food aid brought into the country has a tendency to create problems for the local grain holders. Food aid tends to lower prices of grain and makes storing not a worthwhile venture as there is uncertainty about when the Government will flood the market with food aid.

(e) Licensing and taxing the grain trade.

There is some local taxation of traded grain, which is 2-4 percent local taxation on amount of traded grain in Kenya (Ministry of Agriculture, 1992). In addition licensing fees and such items as the advance payment requirement of tax from trade income can form significant barriers to the free flow of goods between surplus and deficit areas. These factors have an effect directly analogous to the imposition of movement controls on produce - they raise the cost and lower the profitability of spatial arbitrage, and in this way they discourage the retention and storage of grain by farmers and traders to meet anticipated subsequent market requirements.

(f) The management of public sector reserve stocks.

The existence and management of public sector reserve stocks can be expected to modify private storage decisions as traders and farmers adjust their expectations about the future course of market prices and the associated profitability of current storage activities. This is natural since the very purpose of establishing a security reserve is to limit the variability of market prices when food is in short supply. The key question for public policy is the need to establish an appropriate level of price variability which will allow some degree of inter-temporal storage to be profitable, without undue consumer price fluctuation.

In addition, the system used for the rotation and retirement of older stocks from a public reserve stock system will also affect private storage decisions. Where the managers of the reserve are prone to abrupt sales of large volumes of the old stock for rotation purposes, private expectations of future market prices will be de-stabilized, the risks associated with inter-temporal private storage will be increased, and the supply of private sector storage will be reduced.

(g) Effects of inflation, interest and exchange rates.

The principal factor driving private sector storage for the market (either on-farm or by traders) is the anticipated increase in the market value of the stored product in excess of the full costs of storage. Macroeconomic conditions can crucially affect such expectations through their effect on inflation and interest rates. Under inflationary conditions, money becomes a poor store of value. Grain, by contrast, tends to maintain

its real value, in addition to a seasonal real price rise. Highly inflationary conditions accordingly encourage the producer (and the trader) to retain the product rather than to release early onto the market, where the requirement for cash is distributed over the year. As regards to interest rates, real interest rates (that is after allowing for inflation) tend to be negative, especially for traders who are borrowing from formal sector sources. The informal credit markets, mostly used in Kenya, usually maintain positive real interest rates. This factor makes investment in stored grain doubly attractive and tends to promote on-farm and trader storage. The unpredictable swings in exchange rate and currency devaluation have similar impacts on maize storage for export purposes due to high uncertainties.

2.2 Price Policy Implications and the Market Reform Process

A major component of the SAPs consists of agricultural price policy reforms. Price policy has an effect on agricultural supply and food consumption. The dual nature of food prices as incentives to producers and determinants of the real income to consumers, what Timmer et al (1983) call the "food price dilemma", often requires conflicting strategies in attempting to increase food production and consumption at the same time. Higher commodity prices encourage production, discourage consumption, and reduce imports.

In contrast, "cheap food" policies have the opposite effect; they encourage consumption, discourage production and increase imports (Timmer et al, 1983). That is, cheap food policies increase consumers' real income and thus improve "exchange entitlement". To simultaneously increase food production and consumption, therefore,

would require a dual price policy of subsidizing both producers and consumers. Technological change may offer a way out of this dilemma by allowing the production of plentiful food supplies while maintaining the profitability of agriculture.

Food prices affect net producers and consumers differently. In the argument for increased food prices in developing countries, policy makers have generally assumed that the vast majority of farmers were net sellers of food. Increased food prices, therefore, would benefit the rural majority and hurt the urban minority (Weber and Jayne, 1988). The study on maize production in Zimbabwe by Weber and Jayne empirically showed that only 45 percent of the households in the 1984/85 season were net sellers of maize, and 10 percent of the total households accounted for 70 per cent of the sales. Similar results in which less than 50 percent of the households being net grain sellers were also observed in studies in Mali, Senegal and Rwanda. It is currently understood that increased food prices do not exclusively benefit all rural households since a significant number of farmers are net buyers for some portion of their food need. Therefore, the strategy of making "prices right" in Africa may hurt some of the rural population whom policy-makers have previously assumed to benefit from improved rural-urban terms of trade.

Another area of price policy effect on agriculture concerns the magnitude of supply response to incentive prices. In the 1950s and early 1960s, the discussion revolved around the argument of whether farmers in the developing countries were in fact rational decision-makers who would respond to incentives (Behrman, 1968). Poor farmers were assumed to be poor because they were not sufficiently rational to take advantage of the existing economic opportunities or future changes in the economic environment. Schultz

(1964) challenged development professionals with the concept that farmers in developing countries were "poor but efficient". That is farmers were maximizing their utilities given their constraints, and that there were no alternative ways of reallocating their resources which could increase their welfare.

In Kenya, there has been a dilemma on the right pricing policy given that the government would like to satisfy both the consumer and the producer. For storage policies there has been a broad tendency to shift to policies which involve a larger and more explicit role for private sector marketing agents in storage and other marketing activities. The policy shift has been most pronounced in the 1980s. The cereal sector reform program (CRSP), commissioned by the government in 1986, recommended the liberalization of cereal and bean marketing based on the anticipated gains in pricing efficiency. The CRSP also recommended major structural changes in the NCPB to reduce its sizable operating subsidies from the government. Likewise, the National development plan, 1989-93, endorsed policies to liberalize agricultural markets.

The first step in this direction took place in 1990 when minor cereals (millet and sorghum) and other crops were de-scheduled (Legal notice No. 509) and there was a reduction of marketing restrictions on private traders' maize movement between districts (Legal Notice No. 508). In 1992, the quantity of maize authorized for free movement was doubled to 88 bags (Legal Notice No. 80). This was expected to allow for a faster movement of grain between deficit and surplus regions and avoid price fluctuations of maize in deficit regions.

The government has regulated the cereal market for a long time. The on-going liberalization process suffers occasional set-backs when the Government reverts back to its regulative mode. For example, maize movement controls were reinstated in late 1992, as reported, to protect consumers from escalating maize meal prices. In summary,

(a) no one may transport maize between districts without a permit.

(b) permits specifying the quantities and destination of maize to be moved may be obtained from any NCPB office at a fee of KSh 20.

In practice, the official producer prices have sought to achieve self-sufficiency through the maintenance of incentives to producers, whilst the NCPB selling price and retail prices have been set on a cost plus basis (Appendix A: Table 5). The NCPB depot sale price is set on the basis of NCPB's unit costs (which comprise 30% of the depot buying price) and those costs associated with NCPB's strategic functions (maintenance of strategic reserves). An important negative result occurs here in that the strategic costs and the high unit costs related to NCPB's inefficiency are passed onto consumers. It's interesting to note the squeezing of price margins from 109.65 in 1985/86 to 67.42 in 1991/92 (Appendix A: Table 6) has further increased operating financial losses to NCPB. This has lead to increased subsidization to the consumers to maintain affordable maize meal prices.

To be successful, reforms of the agricultural sector must occur within an economy-wide adjustment program. A proposed sequence (Duncan and Jones, 1993) involves: when relaxing controls on imports of critical agricultural inputs; devaluing to reach and maintain a competitive exchange rate; undertaking priority infrastructure rehabilitation;

initiating reforms to domestic financial, labour, and land markets; undertaking agricultural liberalization; and finally undertaking external trade liberalization. The sequence is designed to ensure that appropriate incentives are in place and resources available are priced at scarcity values, to allow the agricultural sector to respond to reforms.

2.3 Review of Existing Household Level Post-harvest Systems

In recent years questions of food reserve stocks have typically been treated as relating exclusively to the public sector and attention has been concentrated on the appropriate magnitude and operating rules for the publicly held reserve stocks. This should not be considered an acceptable procedure, since privately held stocks greatly exceed those held by the public institutions. The privately held stocks constitute a "hidden reserve" which is in fact the principal guarantee of food security for many households. Ignoring the "hidden reserve" leads to inappropriate recommendations for the public sector. It is important therefore that on-farm storage or "hidden reserve" be given the attention it deserves.

Normally "storage" is considered to be the period the grain is kept in a specific structure (grain store). In a wider sense storage starts when the kernels have stopped accumulating nutrients at physiological maturity at around 35 percent moisture content. Harvesting at this level will mean maximum yield of nutrients and dry matter. The question is then how to store the produced nutrients until the grain is sold or consumed. For a rural household this includes storing from the field to the cooking pot or the market. In order to store well, the moisture must be reduced to a safe level. Also the kernels must

be separated from the straw and cleaned in order to reduce bulkiness. Then the dry grain can be kept in containers for longer periods. The magnitude of storage bulk depends on a number of factors like weather damage, physically lost grains and pests which attack and cause deterioration of the grain in the field, in the store and during marketing.

Post-harvest activities can be considered to be those activities that centre on the handling of grain after harvest, including the storage of an agricultural produce. These activities can be grouped as:

(a) pre-storage includes; harvesting, transportation, drying, shelling, chemical application and bagging.

(b) storage

(c) post-storage includes, grinding, milling, packaging and cooking.

Grain temperature and moisture content are two factors which farmers can use to control deterioration during storage. High moisture content and high grain temperature shortens recommended storage time due to increased deterioration. In the tropics, however, temperature control is too expensive (refrigeration). Hence, drying will be the most effective and appropriate method. There are many different systems used for drying of grain, and they can be classified into two main categories; natural and artificial drying systems.

2.3.1 Post-harvest Drying Systems.

Natural drying systems.

Natural drying may be divided in three principal approaches:

(a) drying in the field before harvest.

(b) drying in shallow layers exposed to the sun and wind on a surface which prevents moisture from the ground reaching the produce.

(c) drying in or on a structure which has open sides to permit air movement through the bulk.

Field drying.

The method of leaving the crop standing or stooking in the field is popular in areas where maturity of the crop coincides with the beginning of a dry season. However, a crop left unharvested is exposed to attack by insects, birds, rodents, wild animals, strong winds and occasional rain showers which can damage and reduce the crop considerably. The new high yielding varieties of maize are much more susceptible to damage from the environment than the traditional maize varieties. For instance a hybrid maize-cob has less leaf cover than the traditional varieties and therefore is more open to attack by insects and birds.

Field drying of the crop will also delay the clearing of the field. This should be taken into consideration in areas where the field should be prepared for a second rainy season or where the humidity is high enough at the end of the growing season to allow for an additional crop.

Shallow layer natural drying.

With shallow layer natural drying the harvested crop is spread on hard surfaced ground, on roofs or purposely built platforms or trays. Exposed to the sun, the crop will dry fairly quickly depending on the humidity of the air. The produce should be stirred frequently to ensure even drying. The disadvantage of the method is that the crop has to be brought in or covered every evening or before rain. The labour may be reduced considerably by placing the crop on a plastic or tarpaulin sheet for easy handling or a platform/tray covered by, for instance, transparent plastic.

Ventilated structures for natural drying.

Very small producers may suspend bundles of the crop from trees or poles so they are freely exposed to the air. With larger quantities the harvested crop may be heaped on platforms or racks and topped by a layer of straw for cob-maize. Since the drying depends on the free flow of air through the crop, the heap should be made as open as possible.

The next step is to have a more permanent ventilated structure in which the crop may be heaped for drying but be well protected from rain. For maize the tradition is to leave the crop in the field until the moisture content has fallen to about 18 percent and then continue the drying of the maize on the cob with or without the husk (sheath), in a granary which most commonly has the shape of a circular woven basket placed on a platform 1-3 feet above the ground. The pre-drying in the field in normally necessary because the basket is too tightly woven or too wide to allow for sufficient ventilation.

The "two step" drying worked well with traditional farming systems where the farmer used the maize with good sheath cover and could break new farmland regularly. The high increase in population experienced in Kenya has resulted in scarcity of good land which forces the farmer to use the same land for the same crop year after year. In most cases this will lead to an accumulation of pests. With the high susceptibility to insect attack of most improved high yielding varieties the crop has to be harvested as early as possible, just after maturity, and moved away from the field for quick drying and safe storage. For maize, the circular traditional granary may still be used with some modification. The basket has to be loosely woven or made with at least 40 percent air space and with varying width up to 150 cm depending on the humidity. The restriction on width makes it economical to build the drying structure in a rectangular shape as soon as production exceeds the yield of 5-9 bags. An example is the ventilated maize crib (Appendix A: Figure 5), used mostly for drying and storing maize on the cob without the husk.

The crib can be constructed in many different ways but two factors are important for the drying effect; the width and the length. The width may vary from 60cm in humid areas to 180 cm in semi arid areas. The walls should not limit the airflow through the maize requiring that at least 40 per cent of wall area should be openings. In areas with rodents the floor should be lifted 90 cm above the ground and the legs fitted with rat-guards. The drying rate depends on the relative humidity of the air and the air velocity. The capacity of the crib is dependent on section length. The length should face the general direction of prevailing winds.

Artificial drying.

If the air humidity is too high to allow grain to be dried by natural means and storage does not facilitate further drying, it is necessary to dry the produce by using forced air or heat or the two in combination. Various local methods have been developed. In some areas storage is restricted to the amount that can be dried with a heat supply similar to that available from a kitchen fire. Thus, panicles of maize stored on horizontal grids are dried by heat from a fire which is lit underneath the grid and the heap is turned occasionally to prevent the development of mould. The problem is that the grain receives a characteristic odour and smell when exposed directly to smoke and hot dry air.

2.3.2 Storage systems.

The process of storage on-farm can be divided into a temporary part and a more permanent part. The former includes the time in the field, during harvest, threshing, winnowing, cleaning and the final preparation before storage, and the latter relates to the time the grain is lying in the store awaiting to be consumed or sold. The household will start to consume the new grain when it has reached physiological maturity (i.e., green maize) and it will carry on during the whole harvesting period. The fresh produce will have a superior taste compared to the remainder in the storage.

Usually the maize which is not shelled and disposed of immediately is stored on the cobs, with or without the husks on, in granaries for home consumption and/or sale. The structures used for storage vary in both size and mode of construction from area to area.

Basket granary.

On small farms, a round basket-type structure with storage capacity of up to 10 bags of maize on cobs is extensively used. This is made of woven wooden twigs placed on a low platform and has a thatched roof.

Improved basket granary.

The improved basket granary can be used for drying of maize on the cob as well as storage of bagged dry shelled maize. It consists of a raised platform fitted with a frame that supports the roof under which a woven basket is placed. The open weaving of the fabric allows for air circulation through the cobs, thus drying out the cobs. Early harvested maize can be dried from about 30 percent MC to 13 percent MC in less than 60 days.

A basket, which is 1.5 m in diameter and 1.75 m high can hold approximately 11 bags each 90 kg of dry shelled maize. The rat guards on the posts, which support the raised platform, provide good protection against rodents unlike traditional granaries.

Square or Rectangular stores.

On larger farms the storage structures are constructed more solidly and have the shape and size of a small dwelling house. The building material can be off-cuts, sisal flower stems or large woven mats fixed to a wooden frame. The rectangular shaped stores are for multi-purpose use with a capacity of about 100 bags of maize on cobs, and are

generally raised higher above the ground than the basket type structure and are often roofed with corrugated iron sheets.

Silos.

Silos for grain storage can be constructed from a variety of materials and may store the bulk of grain or be divided into several compartments (bins). The most common shape is circular because this makes the best use of the strength of materials to resist the pressure exerted on the walls by the grain. Additional strengthening by reinforcement is required in larger silos.

A proper silo should meet the following requirements; prevent reinfestation by pests, keep grain dry and cool, be easy to construct using locally available materials, be inexpensive, be durable, be easy to repair and maintain, and be easy to load, empty and clean out.

Bag storage.

Grain stored in bags is easy to inspect and there will be some air circulation inside the cluster of bags which will dry and cool the grain. Therefore grain can be stored at a slightly higher moisture content in bags (13-14 percent) than in silos (12-13 percent) without risk of "hotspots" developing.

It is preferable to stack bags on a platform raised off the floor and away from walls. This prevents bagged grain from taking up moisture from the ground or the floor.

Bag storage that is well arranged will allow air to circulate, allow maximum utilization of space, maintain hygienic conditions, facilitate inspection and ensure stable and firm stacks.

Ventilated Crib.

The ventilated crib is a dual purpose structure (drying and storing) like the improved basket granary. The shape and size have already been discussed in the drying section above.

2.4 Pre-harvest and Post-harvest Losses

Basically, farmers fight two kinds of losses, pre-harvest and post-harvest losses. Pre-harvest losses (field losses) happen between sowing and just before harvesting. This is seen from seed loss, poor crop stand or incomplete filling of kernels. Post-harvest losses occur between harvesting and just before the crop is consumed. In this context, the loss is intended to mean all that amount of produce that is not eaten by human beings. Thus, theft does not constitute a loss but rather a transfer of ownership. If the farmer intentionally feeds animals with grain this is only a change of use. But if the animals unintentionally ate the farmer's grain then it constitutes a loss.

There are five categories of losses that can affect the farmer. The first is weight loss which results from evaporation of moisture from grain, parts eaten by insects, rodents and birds, and spillage during transportation. A second loss category is food loss which is supplementary to the above loss. There is an actual loss of nutritive value of the

produce. Over exposure to the sun and high temperatures during artificial drying will destroy certain vitamins and cause oxidation of carotene. Weevils feed on the carbohydrate part of the maize grain, thereby removing a significant amount of the energy giving food from the farmers' use.

The third category is a quality loss (the above two losses represent quantity loss) in the produce and is generally based on the appearance - size, colour, texture, foreign matter, and smell or flavour. Any factors which affect the above are said to affect the quality. For example, chemical changes, grain respiration which increases moisture content, insect infestation and foreign matter will affect quality.

A fourth category is that of seed loss since the availability of good seed is recognized by all farming community irrespective of the level of farming. Despite this, seed loss continues to take place due to inadequate knowledge about factors causing poor germination and to poor storage facilities. The final loss is monetary loss when market prices fluctuate with time following the supply and demand pattern. At harvest time, prices are very low due to supply being greater than demand. Later prices increase as demand increases with reduced supply. A farmer with a poor storage structure will be forced to sell when prices are very low.

Schultz (1964) challenged development professionals with the concept that farmers in developing countries were "poor but efficient". That is farmers maximize utility given their budgetary constraints, and that there were no alternative ways of reallocating their resources which could increase welfare. Bearing this in mind, the battle to reduce grain losses becomes an inevitable challenge for most developing countries. The problems they

face include: an insufficient number of knowledgeable personnel with expertise to preserve and protect food, insufficient capital to provide the necessary handling and storage equipment for food; insufficient purchasing power to pay for the cost of proper protection (although many food loss reduction activities should pay for themselves because of the food saved); climatic conditions that favour the growth of insects, rodents and molds, and that accelerate the normal deteriorative changes that occur in stored foods; and in some countries there is a fatalistic attitude that severe losses in stored foods are inevitable and nothing can be done about it.

In general post-harvest losses follow a similar pattern particularly for field and storage losses. They are small at the beginning and accelerate over time. To get a proper estimate one needs to follow the loss over time as grain will be consumed and marketed. This has the effect that a high loss rate will affect a relatively small quantity at the end of the storage period (for example, a storage loss rate of 30 percent at the end of the storage period may mean an actual loss for a rural farmer of 10-12 percent). All aggregated post-harvest losses have been calculated on a monthly basis and added up to give the annual situation (Appendix A, Table 7) (Some and Kariungi, 1989). The estimates were prepared by cumulating over time specific categories of loss with characteristic loss rate over the post-harvest period, based on representative on-farm quantities in store. Since the quantity losses are all related to the maximum yield at physiological maturity it is possible to compare them. The losses were calculated when

they occur providing for greater precision. The total post-harvest losses occurring in on-farm storage as a percentage of production is 26 percent, converted to quantity amounts gives 578,000 tonnes annually, a considerable loss.

2.5 Welfare Implications and Related Studies

2.5.1 Welfare Implications of Commodity Storage

The main objective of literature on welfare implications of commodity storage is to deduce the welfare implications of price stabilization for producers, consumers and society as a whole. A common approach is to compare market performance without and with storage to stabilize price or some other variables. Hall (1970) suggests that the first objective of any storage scheme should be to increase the income of the farmers without necessarily inflating the price paid by consumers.

According to work done by Helmberger and Weaver (1977), inter-temporal equilibrium is determined for a competitive market when private inventories are held. Production and storage decisions respond to rational expectations of uncertain prices. Competitive equilibrium maximizes gains to society. Programs that stabilize price either completely or partially generate benefits to producers and losses to buyers relative to competitive equilibrium.

Deviations between actual and expected prices would likely cause considerable financial stress among farmers. Further, differences between expected and actual prices are found to be much greater in the absence of competitive storage. Therefore a competitive storage industry depends on the certainty (uncertainty) of current and

expected future prices. Though arbitragers do not expect gains from competitive storage they could expect gains from non-competitive storage levels.

The net gains to society are maximized when storage is practised in a competitive manner. These gains are in the form of the reduced unearned increments by speculators, that is, the reduction in the difference between producer and retail prices in excess of storage costs.

2.5.2 Related Studies in On-Farm Grain Storage

Many scholars have taken the trouble to study the technological and/or economic aspects of on-farm grain storage in general. The following is an outline of the different approaches used in economic studies of on-farm storage.

There are a lot of technological discussions about on-farm storage and factors accelerating and impeding crop spoilage of various sorts, and of particular storage systems. Trend analysis of the variation of prices between seasons have also been highlighted. These trends have been compared to storage costs so as to estimate benefits accruing from storage over time. Both financial and economic appraisal of farm level storage improvements have been carried out elsewhere.

Boxall, et al., (1978) carried out research on the prevention of farm level food grain storage losses in India. In this study, the pattern of storage and a technological appraisal of the observed traditional structures were carried out. The structure and pattern of storage losses were studied and were used as the basis for the determination of social

benefit-cost ratios of improving storage structures. A similar approach was adopted by Greenly (1982), and Lipton (1982).

Mphuru and Maro (1975) and Ashimogo (1988) carried out studies of on-farm storage in Morogoro and Iringa and Kilosa regions of Tanzania, respectively. In these studies harvesting and preparatory stages of the crop harvests before storage, and methods of storage including steps taken by farmers in reducing storage losses caused by rodents and insect pests are described.

Inter-temporal price movements and returns to storage studies have also been undertaken by a number of authors notably: Vankataramanan and Muraldharan (1972), Hays and McCoy (1978), Helmberger and Akinyosoye (1984), and Monterosso, et al., (1985). Based on time series data, trend analyses were carried out to assess the variation of prices through time intra-seasonally and inter-seasonally. Some of these studies were carried out using simple linear regressions. Others used non-linear seasonal regression models to get the best estimates of price trends. For example, Vankataramanan and Muraldharan (op. cit.) used such a model to explain the differences between the grain price at harvest time and the price during a lean period within a season and between seasons for a period of 5 years in primary and secondary markets in India.

In Kenya most studies have been centred around post-harvest losses, for example, Some and Kariungi (1989), Inter-governmental authority on drought and development (IGADD) (1989). Another is a socio-anthropological study by Bahemuka, (1985) on improved crib stores for small scale farmers in Western Kenya for the on-farm storage project.

The emphasis in this study is the effect of the cereal sector grain market reforms, especially the withdrawal of the NCPB, which will impact on on-farm maize storage and the country's food security. The study mainly covers the financial analysis of the improved storage to see if there is a financial incentive for the farmers to invest in improved storage structures.

The specification as regards methodology adopted for this study is outlined in Chapter 3.

Chapter III

Methodology and Model Framework

3.1 Overview on Method of Analysis

The on-farm maize storage evaluation encompasses two major aspects. First to identify primary storage structures used at the farm-level, and secondly to determine financial costs and returns which farmers could derive from investing on storage improvements.

Farmod is a Food and Agricultural Organization of the United Nations (FAO) package used for agricultural project analysis. Farmod does the following (Farmod manual, 1993):

(a) accepts data for prices, production technologies, area models, family household activities and resources, and farmer participation rates;

(b) accepts phases of production models into area and family household models.

(c) phases area and family household models into sub-projects;

(d) calculates production, input use and income for production, area, family household, sub-projects and project models;

(e) analyzes labour use by gender and time;

(f) converts financial costs to economic costs for economic analysis; and

(g) calculates rates of return and summary measures of financial incentives and economic viability.

For this analysis Farmod is used to analyze the potential on-farm investment by individual farmers from a financial perspective. The economic analysis was not necessary

because the effect of on-farm storage on society is beyond the scope of this thesis. The emphasis is on the financial impact of storage investment from an individual farmer's perspective.

Farmod produces six principal tables for a family household model. The tables present the project impact on the family resource use and income. The first is the financial budget, which incorporates: gross value income from field crops and residues; production costs derived from purchased inputs and hired labour; cash flow before financing, which is derived from the difference between the gross value of production and outflows - a negative value means the project is not viable; sources of finance and loan repayments derived from disbursements of short term credit and management of cash transfers from one year to the next; transfers from previous period derived from cash held over to meet farmers own contribution to current year production costs; cash flow after financing derived from deducting the net impact of financing from cash flow before financing; incremental residual value of the transfer to the next period which is the cash balance for the household at the end of the analysis and represents final value of the family's working capital; farm family benefit after financing which is the amount of cash the family has for its own use after production and financing costs are paid - if any value is negative the project is not viable; returns per family-day of labour which measure the average income that the family earns working on the farm; net present value (NPV) and the internal rate of return (IRR) which are calculated on the basis of the family incremental farm family benefits after financing.

The credit analysis calculates short term debt and cash-carry forward requirement. Short-term debt refers to the funds the family can borrow to help in production costs. Cash-carry forward is the amount the family must carry forward to meet the proportion of costs it has to contribute.

The labour budget calculates the amount of labour the family must hire each year. Labour requirements are calculated from the cropping patterns. The family labour available is the amount of labour available each month. In this study the amount of labour is assumed to remain constant over the project. Hired labour is the amount of labour hired to resolve the shortages between labour required and family labour available. Family labour use is the difference between labour required and hired labour. Unused labour is the excess between labour required and family labour available.

The production and inputs show total production and input use from cropping patterns and input-output coefficients for each crop. This is used to develop the farm budget. Main production and byproducts represent the total production for each crop. Purchased inputs are the total input requirements for all crop production. Labour is the total labour required for all crop production.

The cropping patterns specify how the land is used with and without the project. Three options are shown, one, "without" project using existing technology, two, "with" project using existing technology and "with" project use of new technology. Finally the production technology summary summarizes yield and input for the crop models on which the family household is built.

Capital investment decisions are difficult to reverse once implemented. Annual cash-flows estimates, which take into account annual investment costs, plus annual operating receipts less annual operating costs, are projected for the economic life of the project. This investment analysis ignores accounting interest expenses (covered in the discounting process to obtain the IRR or NPV) and depreciation (assumed not relevant because investment is made at time zero) (see technical notes to chapter 4 for formulas).

3.2 Financial Analysis of On-Farm Maize Storage

In order to use Farmod, it is necessary to develop specific information for input. Farm budgets drive the entire analysis and considerable detailed information is necessary for their development.

3.2.1 Data and assumptions.

The budgets are presented in Kenya shillings per acre. The numeraire is the change in income of the unit expressed in Kenya shillings. An acre, rather than hectare, is a unit most farmers use. Budgets do not include land investment costs but land rental value is used as the opportunity cost of land. Off-farm agricultural wage is used as the opportunity cost of family labour. Therefore profits should be interpreted as returns to land and labour. The measures are per season or per crop year, a fact that must be taken into account when comparing profitabilities. The base year, the 1992/93 crop season, has an important impact on cost and revenues estimates, and these budgets may or may not

be viewed as representative of other years. This base year was chosen because it represented a "normal" crop season.

Yields are the district estimates from secondary data available. Yields vary greatly across the country over time. According to remote sensing data, yields in the 1980's ranged from 0.72 metric tonnes per hectare in marginal areas to over 3.6 metric tonnes per hectare in high potential areas. It is difficult to generalize about the trend in maize yield because of the variability in weather patterns and inconsistencies between data sources. In most years, average yields in the more productive regions have been 2-2.5 metric tonnes per hectare, but drought reduces yields to very low levels.

Output prices are difficult to determine, since this parameter changes throughout the year depending on who buys the crop. In the case of maize sold to NCPB the 1992/93 prices were used. For maize sold to the private market the average price collected by the marketing division of the Ministry of Agriculture from different markets in the country was used.

Fixed inputs were calculated for those inputs with a useful life of more than one year. The annualized cost is calculated using the annual payment required to repay the cost of the fixed input at the end of its useful life. The storage investment ignores depreciation and interest as discussed above.

The prevalent short-term interest rate of 19 percent (FAO, 1993) is assumed to be an estimate of the opportunity cost of capital. In some cases where capital is subsidized the interest rate can be as low as 5 percent and in informal capital markets it can be as high as 100 percent (Pearson et al, 1992).

Working capital is the opportunity cost of holding capital needed to purchase supplies and services for production of the commodity. It is calculated using the opportunity cost of capital (19%) and the farmers cash outlays for all purchased inputs and hired labour. Gittinger (1982) suggests that for annual crops the incremental working capital as a percentage of incremental operating expenditure is 80-100%.

Farm labour wages were taken as the going wage in the principal labour market for unskilled agricultural labour. Collier and Lal (1986) argued that small-holders use more hired labour per hectare than do large scale farmers. Agricultural demand for seasonal and casual labour coincides with peaks during land preparation and planting, weeding, and harvesting. Hired labour is calculated using the local 1993 unskilled labour rate. In favourable agro-ecological zones wages are as high as Ksh 35 per day (approximately 8 hours). The wage differentials between agro-ecological zones are large in proportional terms, but seem smaller when measured in absolute terms (about US$ 1 per day). The official wage rate for agricultural labour is KSh 1,225 annually in the early 1990's. Using official wage rates overestimates wages when there is over-supply of labour and underestimates when labour is in short supply. Family labour is also valued at the same rate, because it is assumed that agricultural farm labour is the alternative for the family farm. In many situations, family labour may not be able to find employment as an alternative to working on the family farm, and the opportunity cost for family labour maybe less than the market wage.

Purchased input prices were taken from local stockist, whichever was more commonly used. Maize seed is based on the 1992/93 input prices. The seeding rate is 10

kg per acre for both small and large scale farmers as recommended by the extension agents. The fertilizer rate (Di-ammonium phosphate (DAP)) is 175 kg per acre and 150 kg per acre for calcium ammonium nitrate (CAN).

Storage costs comprise annual repair costs, interest tied up in the stored grain, and material losses of grain. High inflation reduces the usefulness of book values as a measure of the fixed costs of production. Use of book values as a measure underestimates the actual (opportunity) cost of production by failing to reflect the true opportunity cost of fixed assets. Current replacement costs are used to overcome this problem.

Storage losses are estimates of maize losses from research estimates. Field losses (physiological maturity to harvest) is estimated at 16% and storage losses (harvest and over storage period) is estimated at 10%. Improved crib storage reduces these losses from levels as high as 26% for traditional storage to 4.5% of amount stored (IGADD, 1990). Different loss estimates are available from field to store losses.

Benefits of a loss reduction program are the level of grain losses saved through storage improvement and the increased price as a result of storing for sale at higher prices when maize is in short supply. Other intangible benefits include using the field for other purposes when crops are removed (for example grazing animals) because the farmer has more time to prepare the land.

Interest tied in capital (the cost of holding grain for eight months) is included in the storage costs using the opportunity cost of funds (19%). In the 1980's interest rates were controlled hence did not provide actual rates of returns to capital. In 1991, capital markets were largely deregulated and interest controls were removed. Self-finance and

informal capital markets are used widely. For example farmers use earnings from crops to finance dairy or invest off-farm through the banking system. The terms and conditions of informal loans are not known, but in medium and large towns money lenders charge annual equivalent rates of interest of 100-120 percent. Farmers rarely use money lenders, implying the rates represent an upper limit to the cost of capital.

Price of stored grain is assumed to rise from KSh 6.67 to KSh 9 over the season to cover the storage cost. The farmers who store will be able to get a higher price when the supply of maize is low. This price change leads to profits which could then be attributed to storage operations. Price sensitivity is evaluated to test for price uncertainty.

Cost of land is the rental value of land. In Kenya and Nandi district the land is owned and farmers have title deeds.

Pricing inputs and outputs in an economy being subjected to high domestic inflation and large currency devaluations is more difficult to deal with as time series data are of limited use in such a situation. This is solved by assuming constant prices, that is current prices will continue to apply. Hence inflation is assumed to affect most prices to the same extend so that prices retain the same general relations. Future prices are adjusted for anticipated relative price, not for the change in the general price level. The absolute values will be incorrect but the general relations will remain valid.

Chapter IV

Results and Discussion

4.1 Financial Analysis

4.1.1 General Characteristics

The small farms average 15 acres (7 ha) and are located primarily in the tea-dairy agro-ecological zone. The small farm activities include dairy, maize, and tea growing and are more diversified in activities. The average size of the household is approximately 5.51 persons. The cropping intensity[5] is approximately 98 percent for mixed farms keeping an improved stock of cattle.

The tea-dairy zone has a very good yield potential. The yield expectation for most crops is usually more than 80 percent of optimum (under field conditions). The altitude range is between 1,900 to 2,400 m above sea level and the annual mean temperature ranges from 15 to 18 °C. The average rainfall in this zone ranges from 1,500 to 2,000 mm. The first rains start at the end of February and normally the amount of rainfall ranges from 650 to 850 mm over 165 or more days. The second rains start normally at the end of July, normally range from 580-800 mm and last for approximately 190 to 200 days (Ministry of Agriculture, 1992). The soil fertility ranges from moderate to high.

Approximately 20 percent of the average 15 acres (7 ha) farm size is planted with annual crops (maize), 15 percent of the land is under perennial crops (tea), 60 percent is under pasture and 5 percent is woodland. Dairy production in this zone needs between 1.0 and 2.0 acres (0.4 and 0.8 ha) per livestock unit (LU). Between 70 to 90 percent of the cattle are of improved stock. For an improved stock the requirements are; under one year

require 0.25 LU, 1 to 2 years 0.5 LU, over 2 years 0.8 LU and cows 1.0 LU. The tea-dairy zone small farms have an average of 8.7 LU each requiring on average 1.2 acres (Farm Management Handbook, 1989). The relatively large farm size and the special interest of the farmers in extensive livestock enterprises make the expansion and/or introduction of labour intensive enterprises like pyrethrum, which likely would do well, unlikely in the near future in Nandi.

The large-scale farms on the other hand are primarily located in the dairy-maize zone of the district, with the main activities being dairy and maize cropping. The dairy-maize zone has good yield potential too. The altitude for this system is 1,900 to 2,300 m above sea level. The mean annual temperature ranges from 17.5 to 20.5 ^{0}c. The annual mean rainfall for this farming system is 1,280 to 1,650 mm. The first rains start normally at the end of March, the range from 500 to 680 mm and last for 140 or more days. The second rains start at the beginning of August, range from 500 to 600 mm and last for approximately 80 to 100 days.

The large farms are on average about 40 acres (18 ha). Dairy production requires 1.35 to 2.25 acres per livestock unit (0.6 to 1 ha). The requirement per LU is similar to the tea-dairy zone. The large-scale farms have approximately 20.4 LU which requires 30 acres, given that in this area one needs 1.5 acres per LU (Ministry of Agriculture, 1992).

4.1.1.1 Dairy Enterprise

Milk is an important part of the production system in Nandi district. Dairying is favoured by smallholders for a number of reasons. First, cash flows and labour demands are evenly distributed over the year, and cattle are a form of saving which may be sold in case of an emergency. Second, cows play a symbiotic role on the small farm, consuming farm by-products and providing manure to retain soil fertility. Third, the prevalence of dairy has strong cultural foundations because "in nearly all areas it is regarded as a sign of poverty to be entirely without cattle" (Heyer and Waweru, 1976). Of the milk produced 42 percent is sold, 48 percent is consumed by the farm family, 3 percent goes to hired labour, and 7 percent is consumed by calves (Economic survey, 1989).

Before market liberalization the government controlled both producer and consumer price levels and processing and distribution was dominated by a near monopoly, the Kenya Cooperative Creameries (KCC). Over 95 percent of all processed milk passes through the KCC. Thriving local markets for milk exist in most rural areas. In areas served by KCC, it is illegal to sell milk locally, but this regulation is largely ignored. Many farmers sell locally at prices much higher than they would receive from KCC. Local prices for milk tend to be 50 to 100 percent higher than prices in the formal market, reflecting the relatively large marketing costs required to link local markets with the KCC market. Relative dairy input prices, in the late 1980's and 1990's have increased by 33 percent, the official milk price by less than 12 percent (Agricultural annual report, 1992).

4.1.1.2 Maize Enterprise

The distribution of farm activities by large-scale farmers shows that they practise commercial maize production - most of them use tractors and other machinery for farm operations, so production is capital-intensive. The average size of household is 5.26 persons. Labour on the farm includes 3.4 family adults, 0.6 permanent hired labour and 2.4 children over 14 years of age. The cropping intensity, assuming a mixed farm with an improved cattle stock, is approximately 90 percent. Most of the small-scale farmers use oxen in their maize crop operations and, when financially able, farmers rent machinery. Maize requires nearly 12 months from planting until harvesting. The labour on farm include 2.6 family adults, 0.1 permanent hired labour and 1.3 children over 14 years old. Farmers sell 60 percent of what is produced. Household consumption is approximated at 900 kg of maize and 86 kg of beans per year.

The area planted to maize varies from year to year. During the 1992/93 season the planted area increased by 3.8 percent (Nandi District Annual report, 1993). Maize yields vary from year to year depending on the weather situation. In normal years the maize yield for large-scale farmers is between 20 and 24 bags an acre (Ministry of Agriculture, 1992). The official price for the 1992/93 crop season was KSh 600 per 90 kg bag (KSh 6.67 per kg) (NCPB, 1993). When maize is in short supply (just before the harvest) the price has risen to KSh 13.33 per Kg, double the NCPB price in the parallel market (Farmer survey, 1993). In maize deficit areas prices are reported to have risen as much as eight times higher than NCPB price (Pearson, et al, 1992).

Nandi district regularly produces maize surpluses. Most maize cropping systems are intercroped, mainly with beans. Pure stands of maize are found at high elevations (where beans do not do well) and on large-scale farms. Yields are highest in specialized or mechanized maize production farms which use over 100 kg per acre or more of chemical fertilizer, and intercrops are the exception rather than the rule.

4.1.1.3 Tea Enterprise

There are a number of large tea estates in Nandi cultivating approximately 7,500 hectares of tea yielding roughly a total of 10,500 metric tonnes of green leaves per annum. Small scale farmers possess roughly 1,500 ha of tea, approximately 1 acre (0.5 ha) per farm and harvesting about 3,200 kg of green leaves per acre per annum (1,400 kg per ha).

The Kenya Tea Development Authority (KTDA), formed in 1964, is responsible for all aspects of smallholder tea growing and marketing. The smallholders produce more than half the total tea output and account for 70 percent of total area in Kenya. This ratio applies to Nandi district as well. Tea is often a preferred crop to coffee, because the tea marketing system is less complicated and a higher proportion of tea sales revenue is returned to the farmers (even though tea processing costs as much or higher than coffee processing). In Nandi KTDA maintains tea nurseries and one processing factory. The producer price for tea in the 1992/93 season was KSh 4.70 per kg (Ministry of Agriculture, 1992).

4.1.2 Representative Cropping Systems.

Table 4,1 shows summary characteristics of representative cropping systems in Nandi district. Large-scale and small-scale high-input operation yields are about 2,250 and 1,350 kg/acre of maize, respectively. Both representative farms use tractors for most farm operations, although the small representative farms still use a substantial amount of labour, 71 days per acre compared to 22 days per acre by representative large farms. The difference in the yields is due to the fact that most small-scale farms intercrop as a rule and use less fertilizer (125 kg) per acre as compared to large farms (175 kg) per acre. The profits show that the large representative farms are more profitable, KSh 8,892 per acre compared to KSh 3,396 per acre for the small-scale representative farms.

The low-input operations for the large and small-scale representative farms show reduced yield. The large and small representative farms yield 1,620 and 990 kg per acre of maize, respectively. The difference between the high and low-input is due mainly to fertilizer application. The low-input large and small representative farms use low levels of fertilizer, about 50 and 35 kg per acre, respectively. The reduced fertilizer usage leads to reduced yields. The labour usage is similar for large representative farms at 22 days per acre, versus 71 and 112 days per acre for high-input and low-input small-scale, respectively. The other difference is the mode of operations. The low input small farms use oxen for most farm operations like ploughing, harrowing and planting. The profits for large and small farms are KSh 7,350 and KSh 2,611 per acre, respectively.

Table 4,1: Characteristics of representative cropping systems.

Crop	Yield kg per acre	Technology: Land Prep.	Technology: Labour days/ acre	Technology: Fert. kg per acre	Profit KSh/ acre
Maize (high-input)					
Small	1,350	Tractor	71	125	3,396
Large	2,250	Tractor	22	175	8,892
Maize (low-input)					
Small	990	Oxen	112	35	2,611
Large	1,620	Tractor	22	50	7,350
Tea					
Small	3,200	Manual	229	400	3,850

Dairy	No. of cows	Yield kg/ year	L.U[a] Per cow	Labour per cow	Feed cost[b]	Profit
Small	5	960	1.20	1.92	178	2,275
Large	15	2,200	1.70	0.64	268	2,605

Source: Nandi District Agricultural Annual Report, 1992/93.

a Land measure which includes pasture, pens, stalls, napier grass, and land in forage.
b Feed value includes napier grass and all purchased feed (dairy meal, bran, molasses etc).
Table 4,1 is used to create large and small-scale crop budgets Appendix B: 1-15.

Small-holder tea is the most labour and input intensive crop. The labour requirement is about 229 days per acre and fertilizer requirement is 400 kg per acre. These two inputs in a tea enterprise influence crop quality, which in turn affects the profit. The tea yield in Nandi district is about 3,200 kg per acre and given the tea price of KSh 4.70 per kg, gives a profit of KSh 3,850 per acre.

Dairy production in Nandi is mainly open-grazing, with a few zero-grazing units. The zero-grazing operations are more intensive in that animals are confined in units and all feed is brought to them. Open-grazing is a more extensive system requiring more land per cow than zero-grazing. The dairy operation in Table 4.1 uses an open-grazing system. The large and small representative farms are assumed to have 15 and 5 cows. The livestock unit requirement is slightly higher for the large farms, due to the fact that the large farms are found in a relatively drier part of the district. The labour requirement is higher in small representative farms as was the case for maize. The feeding cost per cow for the large representative farm is calculated at KSh 268 while for the small representative farm it is Ksh 178. The large representative farm uses more purchased feed than small representative farm. The profit per acre is not very different between large and small farms, KSh 2,605 and KSh 2,275 respectively.

4.1.3 Financial Payoff to Improved on-farm Storage.

A financial analysis was carried out to assess the financial impact of improved on-farm storage facilities for the potential investors (i.e., the farmers). In order to assess the financial impact it was assumed that the farmers would decide whether or not to invest in improved storage on the basis of financial payoff. It is unlikely, however, that many farmers in Nandi would conduct formal financial analysis such as described below. However, it is reasonable to presume that they would make decisions that they believe to be in their financial self-interest. Schultz (1964) in his seminal book Transforming Traditional Agriculture argued the concept that farmers in Least Developed Countries were "poor but efficient". That is farmers maximize their utilities given their constraints, and that there was no way of reallocating their resources to increase their welfare. So the formal analysis presented below is believed to provide a meaningful analysis of financial incentives affecting farmer's choices.

The financial impact was assessed on a small and large-scale farm basis. The small farm storage capacity is assumed to be twenty five (2,250 kg) and the large farm storage capacity is thirty five bags (3,150 kg) 90 kg bags. Three possibilities are analyzed. First, an improved structure investment where farmers are assumed to have an existing traditional structure; secondly, an improved storage investment assuming the farmer had no existing structure, that is now they sold all their crop at harvest time. Given that there currently is a very limited market for private storage in the region, this polar case is not an unreasonable scenario. Thirdly, a traditional structure investment assuming farmers

have no existing storage structure. The details of the costs and benefit derivations are provided in the technical notes at the end of this chapter.

The financial results table (for example, Table 4,2) shows the budget summary at three key points in time. The storage structures are assumed to have a useful life of ten years. The **present** (column 1 and 2) specifies the budget at the beginning of the project, the present existing (column 1) specifies the existing structure and present new (column 2) specifies the new investment, **future existing** (column 3) specifies the budget of existing structures without the project in the final year (i.e., 10^{th} year), and the **future new** (column 4) specifies the budget of the improved structures in the final year of the project. The fifth column shows the **percentage change**, which is the percentage increase or decrease of the incremental investment over the project's life. The analysis does not include financing cost, which will be included later in the farm partial budget analysis to see the effect of the investment on farmers' equity.

4.1.3.1 Improved structure compared to traditional structures.

The financial analysis looks at the costs and returns to a small and large-scale investor, assuming the farmer has an existing traditional structure. The revenue is comprised of two components: (1) the field and storage maize losses saved as a result of the storage improvement and (2) the increased revenue from sales when seasonal prices are higher. In Nandi, the approximate time between harvests is about eight months, therefore eight months is assumed to be the storage period. The price of grain is assumed to rise over the eight months from Ksh 6.67 to KSh 9 (Government of Kenya, 1993), a

65 percent increase. The field losses and storage losses are estimated at 16 percent and 10 percent respectively, for a total of 26 percent maize losses (Appendix A: Table 7). These losses are reduced from 26% to 4.5% (IGGAD, 1990) as a result of storage improvement. Technically some losses will occur even with an improved structure (for example spillage during threshing).

Table 4,2 shows a small-scale investment analysis (Appendix B: 16-19) of an improved storage structure assuming the farmer has an existing traditional store. The results show that improved storage increases revenue by 33%, compared to the existing traditional store, as a result of the rise in seasonal price and field and storage loss reduction. Operating costs (variable costs) increase by 1%. Labour costs increase with improvement by 150%, mainly from hiring expert artisans to do the construction, unlike the traditional store which could be constructed using family labour. The net income (before labour costs) and (after labour costs) is increased by about 86%. The NPV (IBLC) before financing costs is KSh 28,437 with an internal rate of return (IRR) of 141%. The NPV (IALC) before financing costs is KSh 27,839 with an IRR of 133%.

Table 4,3 shows the financial analysis result of costs and returns to a large-scale investor, assuming the farmer has an existing traditional structure. The results of the analysis (Appendix B: 28-31) show that the improved structure compared to an existing traditional storage increases the revenue by 34%. Operating costs (variable costs) decrease by 7% as a result of reduced maize losses. Labour costs increase with improvement by 200%, mainly from the hire of expert artisans.

The net income comparing an improved storage to the existing traditional store shows that net income (before labour) is increased by 87%. The net income (after labour costs) is increased by 85%. The NPV (IBLC) before financing costs is KSh 22,025 with an internal rate of return (IRR) of 136%. The NPV (IALC) before financing costs is KSh 20,792 with an IRR of 122%.

Table 4.2: Results for a small-scale improved storage structure investment in KSh per unit assuming the farmer has an existing store.

	Present Exist. First Year	Present new First Year	Future Exist. After 10	Future New After 10	Percentage Change
	(1)	(2)	(3)	(4)	(5)
Revenue	18,503	24,543	20,236	26,842	33
Fixed Costs	5,000	15,150	0	0	0
Variable Costs	11,650	11,786	12,742	12,890	1
IBLC[a]	1,853	(2,393)	7,494	13,952	86
Labour Costs	126	329	55	138	150
IALC[b]	1,727	(2,721)	7,439	13,814	86
NPV (IBLC)	28,437				
NPV (IALC)	27,839				
IRR (IBLC)	141				
IRR (IALC)	133				

Source: Appendix B: 16-19.

a IBLC Income before labour costs
b IALC Income after labour costs

Table 4.3: Results for a large-scale improved storage structure investment in KSh/unit assuming the farmer has an existing store.

	Present Exist. First Year	Present new First Year	Future Exist. After 10	Future New After 10	Percen-tage Change
	(1)	(2)	(3)	(4)	(5)
Revenue	25,384	34,033	27,762	37,221	34
Fixed Costs	8,334	25,250	0	0	0
Variable Costs	14,196	13,162	15,526	14,395	(7)
IBLC	2,856	(4,379)	12,236	22,826	87
Labour Costs	323	995	133	398	200
IALC	2,532	(5,374)	12,104	22,429	85
NPV (IBLC)	22,025				
NPV (IALC)	20,792				
IRR (IBLC)	136				
IRR (IALC)	122				

Source: Appendix B: 28-31.

() indicates negative
a IBLC Income before labour costs
b IALC Income after labour costs

Both small and large-scale farmers show a negative income for new technology in the first year. In subsequent years the income becomes positive. The farmer therefore must have the extra resources to finance the project in the first year of the investment.

4.1.3.2 Improved structure assuming the farmer has no store.

This section covers the financial analysis results for a small and large-scale investment on an improved structure assuming the farmer has no storage structure. The revenue is derived from increased seasonal price of stored grain over eight months and reduced field losses as a result of early harvesting and drying in the improved structure. This is compared to the option that farmer sells all the crop at harvest and buys later for consumption needs. The variable cost for the farmer who sells all grain will be the grain purchased for home consumption at a higher price.

Table 4,4 shows the financial analysis (Appendix B: 20-23) of costs and returns to a small-scale investor, assuming the farmer has no existing traditional structure. The results show that the improved structure increases revenue of 57%, as a result of reduced field losses and higher seasonal prices for maize sale. The operating costs (variable costs) increase by 11%, as a result of higher investment costs.

The net income (before and after labour costs) is increased by 162% and 160% respectively. The new technology income for the first year is negative, but subsequent years are positive. The NPV (IBLC) before financing is KSh 33,352 with an internal rate of return of 97%. The NPV (IALC) before financing is KSh 32,363 with an internal rate of return of 91%.

Table 4.4: Results for a small-scale improved storage structure investment in KSh/unit assuming farmer has no store.

	Present Exist. First Year	Present new First Year	Future Exist. After 10	Future New After 10	Percentage Change
	(1)	(2)	(3)	(4)	(5)
Revenue	15,158	23,725	16,578	25,947	38
Fixed Costs	0	15,150	0	0	0
Variable Costs	10,606	11,786	11,600	12,890	11
IBLC	4,551	(3,211)	4,978	13,057	162
Labour Costs	0	328	0	138	0
IALC	4,551	(3,540)	4,978	12,919	160
NPV (IBLC)	33,352				
NPV (IALC)	32,363				
IRR (IBLC)	97				
IRR (IALC)	91				

Source: Appendix B: 20-23.

() indicates negative
a IBLC Income before labour costs
b IALC Income after labour costs

Table 4.5 shows the financial analysis (Appendix B: 33-35) of costs and returns to a large-scale investor, assuming the farmer has no existing traditional structure. The results shows that the improved structure compared to no existing traditional store increases revenue by 57%. The improved storage structure operating costs (variable costs) increase by 14% as a result of higher investment costs.

Table 4,5: Results for a large-scale improved storage structure investment in KSh/unit assuming farmer has no storage structure.

	Present Exist. First Year	Present new First Year	Future Exist. After 10	Future New After 10	Percen-tage Change
	(1)	(2)	(3)	(4)	(5)
Revenue	21,221	33,215	23,209	36,327	57
Fixed Costs	0	25,250	0	0	0
Variable Costs	11,576	13,162	12,661	14,395	14
IBLC	9,644	(5,197)	10,548	21,931	108
Labour Costs	0	995	0	398	0
IALC	9,644	(6,192)	10,548	21,534	104
NPV (IBLC)		18,025			
NPV (IALC)		16,184			
IRR (IBLC)		71			
IRR (IALC)		64			

Source: Appendix B: 33-35.

() indicates negative
a IBLC Income before labour costs
b IALC Income after labour costs

The net income before labour for the improved storage is increased by 108%. The net income after labour is increased by 104%. The NPV (IBLC) before financing for an improved storage assuming no existing storage is KSh 18,025 with an IRR of 71%. The NPV (IALC) before financing for an improved storage assuming no existing storage is KSh 16,184 with an IRR of 64%.

4.1.3.3 Traditional storage assuming the farmer has no store.

Analysis of the financial feasibility of the traditional structure for both the small and large-scale farmer was done to give a basis for comparison. The assumption here is that the farmer invests in a traditional store, which is compared to the option of no storage, that is the farmer sells all the crop at harvest.

Table 4,6 shows the result of the analysis for a small investor (Appendix B: 24-27) investing in a traditional structure. The revenue for investing in a traditional store increases by 35%, when compared to the immediate sale of crop at harvest option. The variable costs are increase by 18% due to higher storage losses.

The net income (before labour costs) increases by 73% and the net income (after labour costs) increases 72% improvement compared to the no storage option. The NPV (IBLC) before financing is KSh 16,770 with an IRR of 205%. The NPV (IALC) before financing is KSh 16,379 with an IRR of 187%.

Table 4.6: Small-scale traditional storage structure investment in KSh/unit assuming the farmer has no storage structure.

	Present Exist. First Year	Present New First Year	Future Exist. After 10	Future New After 10	Percen-tage Change
	(1)	(2)	(3)	(4)	(5)
Revenue	15,158	20,453	16,578	22,369	35
Fixed Costs	0	5,000	0	0	0
Variable Costs	10,606	1,973	11,600	13,736	18
IBLC	4,551	(1,658)	4,978	8,632	73
Labour Costs	0	126	0	55	0
IALC	4,551	(1,784)	4,978	8,577	72
NPV (IBLC)		16,770			
NPV (IALC)		16,379			
IRR (IBLC)		205			
IRR (IALC)		187			

Source: Appendix B: 24-27.

a IBLC Income before labour costs
b IALC Income after labour costs

The NPV (IBLC) before financing of investing on a traditional store as compared no storage option is KSh 16,770 with an IRR of 205% and NPV (IALC) before financing is KSh 16,379 with an IRR of 187%.

Table 4,7 shows the result of the analysis for a large investor (Appendix B: 36-39) investing on a traditional structure assuming the farmer has no store (i.e sold all produce at harvest). The revenue for investing on a traditional store increases by 35% as a result

of increase in seasonal price. The variable costs are increased by 36% as a result of higher storage losses incurred.

Table 4.7: Large-scale traditional storage structure investment in KSh/unit assuming the farmer has no storage structure.

	Present Exist. First Year	Present new First Year	Future Exist. After 10	Future New After 10	Percen-tage Change
	(1)	(2)	(3)	(4)	(5)
Revenue	21,221	28,634	23,209	31,316	35
Fixed Costs	0	8,334	0	0	0
Variable Costs	11,576	15,712	12,661	17,183	36
IBLC	9,644	4,590	10,548	14,133	34
Labour Costs	0	323	0	133	0
IALC	9,644	4,266	10,548	14,000	33
NPV (IBLC)		13,334			
NPV(IBLC)		12,377			
IRR (IBLC)		66			
IRR (IALC)		59			

Source: Appendix B: 36-39.

a IBLC Income before labour costs
b IALC Income after labour costs

The net income (before labour costs) increases by 34% and the net income (after labour costs) increases by 33%. The NPV (IBLC) before financing costs is KSh 13,334 with an IRR of 66%. The NPV (IALC) before financing costs is KSh 12,377 with an IRR of 59%.

Table 4,8 is summary of the above discussion on the storage investment before financing. The improved structure, assuming no existing storage, shows the highest increase in revenue to the farmer, followed by the traditional alternatives and the improved storage assuming the farmer has an existing storage with similar increase. The traditional storage alternative shows a marked increase in variable costs, with the large-scale showing the highest increase. The improved storage alternatives show decreased variable costs.

Table 4,8: Storage investment percentage change summary.

	N/T		N/O		T/O	
Measure	SS	LS	SS	LS	SS	LS
Revenue (%)	33	34	57	57	35	35
Costs (%)	1	(7)	11	14	18	36
Income (%)	86	85	160	104	72	33

Source: Tables 4,2-4,7.

N/T - Improved storage assuming existing store.
N/O - Improves storage assuming no existing store
T/O - Traditional storage assuming no existing store
SS - Small-scale and LS - Large-scale

4.1.3.4 Partial budget simulation with investment effects.

The farm models describe the activities and resources controlled by the farm family. They are used to test if there is sufficient financial incentive for typical farms to participate in the project.

The farm financial budget shows gross value of production as the value of outputs and crop residues. Deducting on-farm consumption gives the net value of production and adding in off-farm employment gives the total inflows. Outflows consist of investment and operating purchased inputs and labour. Cash-flow before financing is the difference between inflows and outflows. The farm family benefits before financing is the cash-flow before financing plus on-farm consumption.

In this analysis the assumption is that the farmers finance the investment and production from their own sources in the first year. The credit analysis shows the cash carry-forward, specifying the condition for calculating the amount of cash the family must hold at the end of every year. Financing required from their own sources represents funds that the family must provide from its own resources to pay for the remainder of the production costs. Transfers from previous periods is the amount required to meet current production costs. This shows the basic problem farmers face in that they must pay for inputs and hired labour before harvest occurs. Transfer to next period is the amount of funds required for the next year production costs. The residual value of transfer to next period is the cash balance for the farm family at the end of the analysis, which represents the final value of the family's working capital. A deduction of net financing gives the

cash-flow after financing. A deduction of the change in net worth gives net farm-family benefits after financing.

The individual crop and investment budgets are aggregated to give a farm partial budget "with" and "without" the on-farm storage investment alternatives. These aggregations are based on the assumption that the farmer will not change enterprise combinations as a result of the storage investment. Therefore the incremental income NPV to the crop enterprise budgets is zero. Hence the NPV before financing without investment is zero (see Appendix B76).

Table 4,9 outlines the effect of the different storage investments alternatives on the farm family benefits after financing and production costs are met. The effects on small and large-scale farm investment were investigated. The three alternatives considered are; one, a comparison between an improved structure and the traditional storage (N/T) and, two, the comparison of an improved structure assuming no storage existing (N/O) and the comparison of a traditional store to no storage (T/O). The columns 1-3 show what the NPV's (KSh) are and column 4-6 show the IRR's (%). The NPV and the IRR for the budget are calculated on the basis of incremental net farm-family benefits after financing.

Column 1 and 4 shows the financial measures for an improved storage investment assuming the farmer has an existing traditional store. For both representative farm models this investment shows positive NPV. Column 4 shows the investment IRR calculation for both representative farm models. The large and small-scale farm model show an IRR of

135% and 127%. Therefore considering the NPV and IRR measures the investment is financially viable.

Column 2 and 5 show the financial measures for the improved storage assuming no existing storage alternative (farmer sells off all the crop at harvest and buys later). Column 2 shows NPV (KSh) and column 5 shows the IRR for both the small and large-scale representative farm models. The large-scale farms show a NPV (KSh) of 20,042 with an IRR of 57% and the small-scale farms show a NPV (KSh) of 20,656 with an IRR of 104%. Since both NPV's are positive and the IRR is much greater than the opportunity cost of capital both are financially viable.

Column 3 and 6 show the traditional storage alternative assuming no existing storage. Column 3 shows the NPV (KSh) and column 6 shows the IRR (%) for both large and small-scale representative farm model investment. The large-scale farms show a NPV (KSh) of 1,737 with an IRR of 26% and the small-scale farms show a NPV (KSh) of 10,318 with an IRR of 174%. Since both the NPV's are positive and the IRR's are both higher than the opportunity cost of capital, the investment is financially viable.

Table 4.9: Effect of storage investment alternatives on net farm-family benefits after financing.

	NPV (KSh)			IRR (%)		
Farm Type	N/T[a]	N/O[b]	T/O[c]	N/T	N/O	T/O
	(1)	(2)	(3)	(4)	(5)	(6)
Large-Scale[d]	28,395	20,042	1,737	135	57	26
Small-Scale[e]	17,277	20,656	10,318	127	104	174

a Comparison of improved storage with traditional storage.
b Comparison of improved storage with no storage existing.
c Comparison of traditional store with no storage existing.
d Appendix B73-75.
e Appendix B70-72.
(1 & 4) Appendix B: 70, 73.
(2 & 5) Appendix B: 71, 74.
(3 & 6) Appendix B: 72, 75.

Table 4.10 show annual returns to family-day of labour for the investment alternatives. Column (1) shows without investment and column 2-4 shows with investment considerations. Column (2) shows the improved storage assuming that the farmer has an existing traditional store, column (3) shows the improved storage assuming that the farmer has no existing storage structures and column (4) shows the traditional storage alternative.

Table 4.10: Farm annual returns (KSh) to family-day labour.

	Without Investment	With Investment		
		N/T[a]	N/O[b]	T/O[c]
Farm Types	(1)	(2)	(3)	(4)
Large-Scale High-Input[d]	1,365	1,045	1,387	1,369
Large-Scale Low-Input[e]	1,535	1,571	1,557	1,659
Small-Scale High-Input[f]	194	211	212	201
Small-Scale Low-Input[g]	74	82	80	75

Source: Appendix Table cited below.

a Comparison of improved storage with traditional storage.
b Comparison of improved storage with no existing storage.
c Comparison of traditional storage with no existing storage.
d Appendix B40-47.
e Appendix B48-55.
f Appendix B56-61.
g Appendix B62-69.
Columns (1 & 3) Appendix B: 44-45, 50-51, 58-59, 64-65.
Column (2) Appendix B: 40-41, 48-49, 56-57, 62-63.
Column (4) Appendix B: 46-47, 52-53, 60-61, 68-69.

The annual returns to family-day of labour, measures the average income that family members earn working on the farm. The going wage for agricultural labour in Kenya in the early 1990's was KSh 1,225 (International Labour office, 1993). Only the large-scale

farm models makes at least as much. This means that the small-scale family is better off working off the farm than on the farm. But there could be other factors motivating them to continue working on the farm (for example, food security).

In general, for all the representative farm models any alternative of storage investment increases annual returns to family labour. The large-scale low-input farm shows the highest returns and the small-scale low-input farm shows the lowest returns. This is due to the increased income resulting from storage improvements.

Table 4.11 shows summary financial efficiency measures (discounted measures) which measures financial incentive and economic viability for the different storage investments. Assuming the opportunity cost of capital is 19% and a 35% seasonal price increase, all the storage alternatives show positive NPV's with IRR's above the opportunity cost of capital before and after financing. The large-scale improved storage, assuming an existing storage, shows the highest NPV, IRR and benefit/cost ratio (B/C). The traditional storage shows the lowest of these measures. The small-scale improved storage, assuming no existing store on the other hand shows the highest NPV, but the traditional store shows the highest IRR and B/C before financing. The improved storage assuming no store show highest NPV and B/C while the traditional store shows the highest IRR after financing.

The results suggest a large-scale farmer with an existing store is better off investing in an improved structure considering the NPV, IRR and B/C ratio. On the other hand, for a small-scale farmer depending on existing methods, if the farmer has

no existing storage, would be better off investing in an improved storage if NPV and B/C ratio are given a higher priority than IRR. Investment on a traditional store is best if IRR is given a higher priority.

Table 4,11: Storage investment summary financial efficiency measures.

Type	NPV_{BF}[1]	IRR_{BF}	B/C_{BF}	NPV_{AF}[2]	IRR_{AF}	B/C_{BF}
SS N/T[3]	17,464	133	2.82	17,277	127	2.64
SS N/O[4]	19,939	93	3.15	20,656	104	4.69
SS T/O[5]	10,314	171	3.43	10,348	174	3.55
LS N/T[6]	27,696	122	3.51	28,395	135	4.81
LS N/O[7]	19,893	57	1.95	20,042	57	1.99
LS T/O[8]	3,625	38	1.22	1,737	26	1.07

Source: Appendix Tables cited below

(1) BF is before financing
(2) AF is after financing
(3) Appendix B: 70
(4) Appendix B: 71
(5) Appendix B: 72
(6) Appendix B: 73
(7) Appendix B: 74
(8) Appendix B: 75

Table 4,12 shows the switching values for small-scale storage investment alternatives at 19% opportunity cost of capital after financing. The switching value is the value an element would have to reach as a result of an unfavourable change causing the investment to no longer meet the minimum acceptable level of investment worth.

Table 4.12: Small-scale switching values at 19% opportunity cost of capital.

	Appraisal Value	Switching Value	Percent Change
Benefits N/T	27,818	10,541	(62)
Costs N/T	10,541	27,818	164
Benefits N/O	26,253	5,596	(79)
Costs N/O	5,596	26,253	369
Benefits T/O	14,413	4,065	(72)
Costs T/O	4,065	14,413	255

Source: Appendix B: 71-72.

The improved storage, assuming an existing traditional store, has a switching point if benefits decrease by 62% or if costs increase 164%. For the improved storage assuming no storage, switching occurs if benefits decrease by 79% or costs increase by 369% and for the traditional storage, assuming no storage, if benefits decrease by 72% or costs increase by 255.

Table 4,13 shows the switching values for large-scale storage investment at 19% opportunity cost of capital after financing. The improved storage, assuming existing traditional store, has a switching value if benefits decrease by 79% or costs increase by 381%. The improved storage, assuming no existing store, has switching values when benefits decrease by 50% or costs increase by 99%. The traditional store has switching values when benefits decrease by only 6% or costs increase by 7%. Large-scale improved

storage, assuming an existing store, is a more stable investment. For both the small and large-scale investments the element to which NPV appears to be more sensitive is the investment benefits[6].

Table 4.13: Large-scale investment switching values at 19% opportunity cost of capital.

	Appraisal Value	Switching Values	Percent Change
Benefits N/T	35,852	7,458	(73)
Costs N/T	7,458	35,852	381
Benefits N/O	40,274	20,232	(50)
Costs N/O	20,232	40,274	99
Benefits T/O	28,151	26,415	(6)
Costs T/O	26,415	28,151	7

Source: Appendix B: 73-75.

4.2 Sensitivity Analysis

Sensitivity analysis is an analytical technique to test systematically what happens to the earning capacity of a project if events differ from the estimates made about them in planning. It is a means of dealing with uncertainty about future events and values. For storage investment two variables are uncertain given market liberalization: first, is the assumption of a seasonal price increase and secondly the assumption of the opportunity cost of capital.

The prevalent short-term interest rate of 19 percent (FAO, 1993) is assumed to be an estimate of the opportunity cost of capital. In some cases where capital is subsidized the interest rate can be as low as 5 percent and in informal capital markets it can be as high as 100 percent.

Seasonal price increases determine some of the benefits to storage, the higher the price rise the higher the revenues. Prices in the analysis are assumed to rise from KSh 6.67 to KSh 9 (a 35% rise), which was the prevalent price rise in most of the parallel markets within the country during the 1992/93 season (Government of Kenya, 1993). Market prices are collected daily and published on a weekly basis for most of the major crops and vegetables for the major markets.

4.2.1 Small-Scale Storage Investment Sensitivity Analysis.

Table 4,14 shows the price sensitivity analysis for small-scale storage investments after financing. The improved storage, assuming the farmer has an existing traditional storage, shows a switching point at a price of KSh 6.50. The improved storage, assuming

no existing storage, shows the switching point at a price of KSh 7.50. The traditional storage, assuming no existing storage, shows the switching point at a price of KSh 8.00.

Table 4.15 shows the opportunity cost of capital sensitivity for small-scale storage investments after financing. The improved storage, assuming an existing traditional store, shows the switching point above a 100% discount rate. The improved storage, assuming no existing storage, shows the switching point at a 40% discount rate. The traditional storage, assuming no storage, shows its switching point above a 100% discount rate.

The above sensitivities show the small-scale improved storage investment, assuming an existing storage, is insensitive to variability in seasonal prices and the opportunity cost of capital. But it is worth noting that the traditional storage is quite stable given variability in opportunity cost of capital with a B/C ratio greater than 1.

Table 4,14: Price sensitivity results for small-scale.

Investment	Switching Point (KSh) (price)	NPV (KSh)	IRR (%)	B/C ratio
New/ Traditional	6.50	(1,549)	14	0.85
New/ No Storage	7.50	(2,833)	11	0.84
Traditional/ No Storage	8.00	(3,134)	(7)	0.73

Table 4,15: Discount rate sensitivity for small-scale.

Investment	Switching Point (%) (discount rate)	NPV (KSh)	IRR (%)	B/C ratio
New/ Traditional	100	635	127	1.11
New/ No Storage	40	(1,729)	26	0.90
Traditional/ No Storage	100	915	214	1.40

4.2.2 Large-Scale Storage Investment Sensitivity Analysis.

Table 4,16 shows a price sensitivity analysis for large-scale storage investment alternatives. The improved storage, assuming the farmer has an existing traditional storage, shows a switching point at a price of KSh 6.50. The improved storage, assuming no existing storage, shows a switching point at a price of KSh 7.50. The traditional storage, assuming no existing storage, shows a switching point at a price of KSh 8.50.

Table 4,16: Price sensitivity results for large-scale.

Investment	Switching Point (Price)	NPV (KSh)	IRR (%)	B/C ratio
New/ Traditional	6.50	(1,218)	16	0.84
New/ No Storage	7.50	(9,920)	57	0.97
Traditional/ No Storage	8.50	(7,111)	(14)	0.77

Table 4,17 shows opportunity cost sensitivity for large-scale storage investment. The improved storage, assuming an existing traditional store, shows a switching point at a 100% discount rate. The improved storage, assuming no existing storage, shows a switching point at a 60% discount rate. The traditional storage, assuming no storage, show its switching point at a 40% discount rate.

Table 4,17: Opportunity cost of capital sensitivity for large-scale.

Investment	Switching Point (%) (Discount rate)	NPV (KSh)	IRR (%)	B/C ratio
New/ Traditional	100	1,256	135	1.18
New/ No Storage	60	(464)	57	0.97
Traditional/ No Storage	40	(1,729)	26	0.90

The above discussion shows the large-scale improved storage, assuming an existing store, is insensitive to seasonal price and opportunity cost variability. This suggests that a farmer with an existing store, given variability in seasonal prices and opportunity cost of capital, is better off investing in an improved storage.

Technical Notes to Chapter IV

1) Store Investment:

(i) Revenue

(a) Storage losses are reduced from 26 percent to 4.5 percent (IGADD, 1990) as a result of the improvement. Small scale farmers can store upto 2,250 kg per year * 21.5 percent = 483.75 kg * KSh 9 per kg (price of maize after 8 months of storage) = KSh 4,353.75.

(b) Sale of stored produce at the end of the storage period to allow for the new crop. 2,250 kg * KSh 9 per kg = KSh 20,250.

(c) Farmer can choose not to have any storage structure hence sells all the produce at harvest time and buys back later. If he sells immediately the price is KSh 6.67 per kg and buys at KSh 9 per kg.

(ii) The capital costs include:

(a) The construction cost is broken down as follows, 10 cedar post @ KSh 30 = KSh 300; one truck of rafters and purlins (including trailer rental = KSh 200) = KSh 1,500; 2 trucks of timber off-cuts @KSh 3,000 = KSh 6,000; 10 iron sheets (30 gauge) @ KSh 700 = KSh 7,000 and miscleaneous cost (nails, wire mesh, wood preservatives, etc) = KSh 200. This gives a total of KSh 15,000.

(b) The Cost of labour include temporary labour include a qualified artisan and one unskilled labourer helper. The artisan is paid KSh 100 per day and the labourer is paid KSh 35 for 10 days for a total of KSh 1,350.

(iii) The variable costs per annum:

(a) Interest on stored produce based on the assumption that if the farmer sells the produce immediately after harvest, he might place the money in a bank and be paid some interest. This was calculated as: Value of produce at harvest * bank interest rate * storage period divided by 12 months (KSh 9,004.50 (15 bags * 90 Kg * KSh 6.67 per Kg) * 0.19 * 8 months divided by 12 months) for a total of KSh 1,104.60.

(b) Chemical costs are the insecticide used by most farmers (actellic 2 percent dust for storage hygiene and bag storage). A 5 kgbag of dust is priced at KSh 733 (KGGGU, 1993). The farmer uses 2 kg per store per year for a total KSh 293.20.

(c) The maintenance per annum include store loading, cleaning, sanitation, repair and dusting the store. It needs approximately 5 labour days * KSh 35 = KSh 175 + repair work KSh 275 for a total of KSh 450.

(d) Cost of new gunny bags KSh 20 * 25 bags = KSh 500.

(e) Estimated value of losses is calculated by assuming the store losses are 4.5% of total stored gives KSh 675.34 (0.045 * 2250 kg * KSh 6.67 per kg) or 26% for the traditional store.

(f) Grain purchased later for home consumption by farmers who choose to sell all their harvest at harvest time.

The cost per kg stored is:

(a) The total amount of produce stored per annum is 25 bags (25 * 90 kg = 2,250 kg).

(b) Total costs per kg of produce stored per annum is calculated by dividing the total cost by amount stored gives Ksh 9.70 per kg (KSh 8,706/900 kg) for a traditional store, KSh 10.60 (23,786/2250 kg) for an improved structure.

2) Small-scale dairy:

(i) Revenue:

(a) The cows produce an average of 7 litres per day * 5 cows = 35 litres per day. The cows produce milk for approximately 180 days in a year, for a total of 6,300 litres per year (35 litres per day * 180 days). Subtract 1,825 litres (5 litres per day * 365 days) consumed by the family. Subtract local sales of 1,095 litres (3 litres per day * 365 days). Milk to KCC is 3,380 litres per year (6,300 litres - 1,825 litres - 365 litres) at KSh 5 per litre = KSh 16,900 per year, divide by 10 acres gives KSh 1,690 per acre.

(b) Revenue from cull cows is calculated by assuming a average culling rate of 22.5% (productive life of cows in a breeding herd ranges from 3 years for intensive dairy herd to about 8 years for beef herds which converts to culling rate of 33% and 12% (Gittinger, 1982) * 5 cows approximately 1 cow. Assuming a cow gives approximately 410 kg of meat (Mattos and Uhl, 1994) at the price of Ksh 35 per kg = KSh 14,350 per year, which divided by 10 acre gives KSh 1.435 per acre.

(c) Bull calves are sold after 8 weeks. Assuming a calving rate of 70% (calving rates range from 50% in pastoral herd to 90% in well managed herds (Gittinger, 1982)) and given half heifers and half bull calves, 1.6 per year (70% * 5 cows = 4 calves * 0.5 = 2 bull calves - (20% (mortality rate) * 2) * KSh 3,500 per head = KSh 5,600 per year, divided by 10 acres gives KSh 560 per acre.

(d) Heifer calf culling is done after the selection of one to join the breeding herd, after mortality deduction 0.8 heifer is sold per year * KSh 5,000 = KSh 4,000 per year, divided by 10 acres gives KSh 400 per acre.

(ii) Annual depreciation costs:

(a) Annual cost of livestock assuming a cow initial cost is KSh 10,000 * 5 cows = KSh 50,000, with a useful life of 8 years and a salvage value of KSh 5,000. Using straight line depreciation gives KSh 6,875, divide by 10 acres gives KSh 687.50 per acre.

(b) Fencing has a life expectancy of 25 years. With 10 acre of grazing pasture divide into 5 paddocks of 2 acre each needs 500 metres of fence per acre = 5 km. A km of fence costs KSh 10,970 (600 posts @KSh 12 = KSh 7,200, 8 rolls of barbed wire @KSh 400 = KSh 3,200, 12 kg of staples at KSh 30 per kg = Ksh 360 and labour costs for 2 days for km * KSh 35 * 2 workers = KSh 360 per km). This gives a total of KSh 54,850 (5 km * KSh 10,970) for 10 acre, using straight line

(f) Grain purchased later for home consumption by farmers who choose to sell all their harvest at harvest time.

The cost per kg stored is:

(a) The total amount of produce stored per annum is 25 bags (25 * 90 kg = 2,250 kg).

(b) Total costs per kg of produce stored per annum is calculated by dividing the total cost by amount stored gives Ksh 9.70 per kg (KSh 8,706/900 kg) for a traditional store, KSh 10.60 (23,786/2250 kg) for an improved structure.

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(a) Annual cost of livestock assuming a cow initial cost is KSh 10,000 * 5 cows = KSh 50,000, with a useful life of 8 years and a salvage value of KSh 5,000. Using straight line depreciation gives KSh 6,875, divide by 10 acres gives KSh 687.50 per acre.

(b) Fencing has a life expectancy of 25 years. With 10 acre of grazing pasture divide into 5 paddocks of 2 acre each needs 500 metres of fence per acre = 5 km. A km of fence costs KSh 10,970 (600 posts @KSh 12 = KSh 7,200, 8 rolls of barbed wire @KSh 400 = KSh 3,200, 12 kg of staples at KSh 30 per kg = Ksh 360 and labour costs for 2 days for km * KSh 35 * 2 workers = KSh 360 per km). This gives a total of KSh 54,850 (5 km * KSh 10,970) for 10 acre, using straight line

depreciation method KSh 2,194 per year (KSh 54,850/25 years) and divided by 10 acre gives KSh 219.40 per acre.

(c) Milking sheds have a life expectancy of 10 years and initial cost of KSh 15,000. The annual depreciation (straight line) gives KSh 1,500 per year, divide by 10 gives KSh 150 per acre.

(d) Milk cans has a life expectancy of 5 years and the initial cost is KSh 6,000 and most farmers require 2 cans. The annual depreciation cost (straight-line) is KSh 2,400 (KSh 12,000/5), divide by 10 acres gives KSh 240 per acre.

(iii) The variable costs:

(a) Grazing land is priced at KSh 600 per acre per year, the opportunity cost of renting the land for cultivation.

(b) Napier grass and improved pasture costs KSh 590 (napier seedling and labour cost KSh 225 (150 per acre @KSh 1.50), and fertilizer used costs KSh 365 (one bags per acre).

(c) 1. Dairy meal needed is one bag per month (12 bags per year @ KSh 180) KSh 2,160, divided by 10 acres gives KSh 216 per acre.

(d) Salt lick consumption at 13.72 kg per head per year (Uhl, 1994) at KSh 15 per kg = KSh 205.80 * 5 cows = KSh 1,029 per year, divide by 10 acres = KSh 102.90 per acre.

(e) Disease control costs 1. Foot and mouth (2 shots per year @ KSh50 * 5 cows) costs KSh 500 per year. 2. Mastitis KSh 250 per year (5 cows * KSh 50). 3. Dipping is done 4 times a month (48 times per year * KSh 10 per head * 5 cows) costs KSh 2,400. 4. Deworming using Nilzan (2 times a year at 1/2 litre for 5 cows at the price of KSh 500 per litre) gives KSh 250 per year. This gives a total cost of KSh 3,400 per year, divide by 10 acres gives KSh 340 per acre.

(f) Dairy needs permanent hired labour paid KSh 800 per month, giving KSh 9,600 per year. This is divided by 10 acres to give KSh 960 per acre.

3) Small-scale Tea:

(i) Revenue

(a) Average yields for the tea bushes is 3,200 kg per acre per year and the price is KSh 4.70 per kg.

(ii) Annual depreciation costs,

(a) The establishment costs are KSh 18,400: 1. Seedling costs KSh 16,800 (1120 seedlings per acre @ KSh 15). 2. Land rental value KSh 600 per acre per year. 3. Labour requirement (5 workers for 10 days @ KSh 20 per day) KSh 1,000. The tea bushes have a useful life of 20 years and a salvage value of KSh 500, this gives annual depreciation of KSh 945 per year.

(b) Jembes for weeding costs KSh 400 with a useful life of 5 years (2 jembes (hoe) @ KSh 200). The annual depreciation is KSh 80 per year.

(c) Pruning secateurs costs KSh 1,750 (5 per acre @ KSh 350), with a useful life of 5 years. The annual depreciation costs is KSh 350 per year.

(iii) Variable costs;

(a) Fertilizer (NPK) for tea is KSh 3,000 (300 kg per acre @ KSh10 per kg).

(b) Weeding tea costs KSh 2,080 per year. 1. Edge weeding KSh 1,280 (64 days * KSh 20 per day). 2. Under weeding KSh 800 (40 days * KSh 20 per day).

(c) Fertilizer application costs KSh 720 (6 days * KSh 30 * 4 times).

(d) Tea pruning costs KSh 3,360 (1,120 bushes * KSh 3 per bush).

(e) Picking tea costs KSh 3,680 (184 days per year @ KSh 20).

(f) Delivery of baskets to the collection centres costs KSh 1,200 per year.

4) Small-scale maize:

(i) Revenue;

(a) Average maize yields for small scale farmers is 15 bags (90 kg) an acre (1,350 kg). The price for maize is KSh 6.67 per kg, gives a revenue of KSh 9,004.50 per year.

(b) Beans yield an average of 180 Kg per acre @ KSh 15 per kg giving an annual revenue KSh 2,700 per acre.

(c) Maize stalks are sold for livestock feed at the cost of KSh 250 per acre.

(d) Maize cobs sold mainly for fuel at the cost of KSh 150 per acre.

(ii) Variable costs;

(a) Oxen ploughing new land costs KSh 300 per acre (2 ploughs * KSh 150).

(b) Oxen harrowing new land costs KSh 200 per acre.

(c) Oxen planting costs KSh 200 per acre.

(d) Maize seed costs KSh 320 per acre (10 kg per acre * KSh 32 per kg of seed).

(e) Bean seeds costs KSh 300 per acre (15 kg per acre * KSh 20 per kg of seed).

(f) Fertilizer (DAP and CAN) depending on whether high input or low input (125 kg or 35 kg) at the price of KSh 10 per kg and KSh 12 for CAN.

Formal Mathematical Formulations of Discounted Measure of Project Worth (Gittinger, 1982)

Net present worth:

$$\sum_{t=1}^{t=n} \frac{B_t - C_t}{(1+i)^t} \qquad (1)$$

Internal rate of return:

$$\sum_{t=1}^{t=n} \frac{B_t - C_t}{(1+i)^t} = 0 \qquad (2)$$

Benefit-cost ratio:

$$\frac{\sum_{t=1}^{t=n} \frac{B_t}{(1+i)^t}}{\sum_{t=1}^{t=n} \frac{C_t}{(1+i)^t}} \qquad (3)$$

Net benefit-investment (N/K) ratio:

$$\frac{\sum_{t=1}^{t=n} \frac{N_t}{(1+i)^t}}{\sum_{t=1}^{t=n} \frac{K_t}{(1+i)^t}} \qquad (4)$$

In the four mathematical formulations,

B_t = benefit in each year

or (MacMillan, 1994)

$$B = \sum_t \frac{(Receipts_t - Expenses_t)}{(1+i)^t} \qquad (5)$$

Where t = 1 to ..... n

C_t = cost in each year

or (MacMillan, 1994)

$$C = \sum_t \frac{(Investment\ Cost_t)}{(1+i)^t}, \qquad (6) \quad for\ t = 1,...,n$$

or

$$C = InitialCost - \frac{SalvageValue}{(1+i)^t} \qquad (7)$$

N_t = incremental net benefit in year after has turned positive t = 1,2,...., n

K_t = incremental net benefit in initial years when stream is negative

n = number of years

i = interest (discount) rate.

Counter-checking results

Table T,1 Financial Analysis Summary using Format by Macmillan, J., 1994, Management for Researchers pp. 325-336.

	NPV	IRR	B/C
SS N/T	15,025	57	2.48
SS N/O	15,478	46	2.02
SS T/O	8,950	64	2.79
LS N/T	13,212	40	1.78
LS N/O	15,700	36	1.62
LS T/O	5,889	38	1.71

Source: Appendix B: 77-80.

Chapter V

Conclusions

5.1 Problem statement

The government has set a national goal of maize self sufficiency (Government of Kenya, 1981 and 1986). In pursuit of this goal and food security in general, the government has maintained tight control over the maize market over time. Movement of maize across district boundaries (Appendix 3, Figure 1) has been subject to permits and prices of maize and maize meal have been fixed by law. However as a result of recent structural adjustments the government has implemented gradual grain market liberalization and has slightly relaxed the movement controls on private traders.

Most of the maize handling, that is procuring, storing, and distributing, was done mainly by the NCPB, the state agency. Less attention was paid to the organizational and management aspects of public sector reserve stocks in Kenya. As a result, the Government has had to meet the NCPB's operating costs with subsidies in order to satisfy both urban (and rural) consumers' demand for cheap basic food, as well as the maize producers' demand for high farm-gate prices. The dual nature of food prices as incentives to producers and determinants of the real income to consumers, what Timmer, Falcon and Pearson (1983) call the "food price dilemma", often requires conflicting strategies in attempting to increase food production and consumption at the same time.

These conflicting strategies have led to the argument that the country might be better-off with a competitive private sector grain market. One of the objectives of the market liberalization process is the withdrawal of state marketing agencies. Although the

private traders have faced restrictions, and have contributed to the procurement and distribution of maize, the maize storage function has been solely provided by the state agency. The state agency withdrawal as argued by Thompson and Terpend (1993) is bound to have some transitional problems which have to be addressed.

The government, in its effort to reduce these transitional problems and food security problems during the maize market liberalization process, has embarked on the encouragement of farmers through extension programmes to adopt technologically improved on-farm storage (Development plan, 1989-93). Recent research studies show that traditional on-farm storage experience grain losses as high as 26 percent of the total production. Translated into monetary terms the losses present sizable reductions of farmers anticipated income and diminished the food-grain available to sustain families until the next harvest. The studies show also that the improved storage structure reduced post-harvest losses from 26 percent to 4.5 percent, a tremendous saving in maize (IGADD, 1990), which could be used by those facing food insecurity.

The decision to invest or not depends entirely on the farmer. Are the maize losses financially significant to the farmer? For farmers to invest on an improved storage there must be a financial incentive to do so. This study focuses on the financial analysis of the different on-farm storage improvement alternatives and how the partial budget impacts on the farm family assuming that the farmer finances the investment. This analysis will have implications on the government policy on storage and food security during the maize market liberalization process.

5.2 Principal empirical findings.

5.2.1 Storage Investment Financial results.

The results show all the three storage alternative investments are generally viable options (given the assumptions of price and opportunity cost of capital) for both large and small-scale farmers in Nandi district before and after financing. The positive NPV's and IRR's, generally above the opportunity cost of capital, imply that all the structures are financially viable and therefore farmers have a financial incentive to invest in any of the storage structures. In general, all the storage investment alternative improved the annual returns to labour as a result of increased revenues and income.

The results show that all the structures increased revenues to the farmer. The improved storage, assuming no existing store, showed the highest increase in revenue with the lowest being the traditional storage investment alternative. The improved storage showed reduced variable costs with small-scale improved storage, assuming no existing store, showing the highest reduction. The traditional storage alternatives showed increased variable costs with the large-scale option showing the highest increase as a result of higher grain losses. All the storage structures analyzed showed increased income to the farmer. The highest increase was shown by the improved storage, assuming no existing store investment, and the least being the traditional storage alternatives.

The benefit/cost ratios for small-scale farmers are highest when investing in an improved storage assuming no existing traditional storage facility. But also notable is the B/C ratio for small-scale farmers investing in a traditional store. The benefit/cost ratio for large-scale farmers is highest when investing in an improved storage, assuming an

existing store. Both the small and large-scale farmer, investing in a traditional storage, do break even in that the benefits offset the costs with a B/C ratio of 1. This could explain the reason why farmers in Nandi are not adopting the improved structures. The small returns from the traditional stores could be the trade-off for the risk involved in higher capital investment for the improved structures.

The small-scale benefits for the investment alternatives would have to be reduced by about 70 percent before the net present value falls to zero and the benefit-cost ratio is exactly 1. The large-scale benefits vary but the improved storage assuming an existing traditional store, has the highest reduction in benefits before the NPV falls to zero. In general for all investments the element to which NPV appears most sensitive is the benefits. The costs would have to be increased by a much higher percentage before the net present value falls to zero. There is one shortcoming with the sensitivity analysis. Whereas it gives the percentages of change it does not give the probability of occurrence.

The small-scale improved storage investment, assuming an existing storage, is insensitive to seasonal prices and the opportunity cost of capital. But it is worth noting that the traditional storage is quite stable given variability in opportunity cost of capital with a B/C ratio greater than 1.

The large-scale models show that the improved storage, assuming an existing store, is insensitive to seasonal price and opportunity cost uncertainty. This suggests that a farmer with an existing store, given variability in seasonal price and opportunity cost of capital, is better off investing in an improved storage.

5.3 Implications of Results.

When prices are uncertain, on-farm storage really is a form of a forward contract to meet the household's consumption needs. Therefore, even without the possibility of gain through seasonal price increase it may be rational for farmers to store grain for food security reasons. The analysis shows the different aspects relevant to farmer decisions when considering a storage investment. If increased revenue and income are the main objectives, the improved storage is a worthwhile investment. But since the traditional store shows positive NPV and B/C ratio equal to one, meaning a farmer benefits and does cover costs, a farmer who is risk averse to capital investment might opt to continue using the traditional store instead of investing in an improved structure.

In Kenya, there is no premium paid for maize quality. If buyers are willing to pay a premium price for quality grain, the farmers with traditional storage will not be able to compete with those with improved storage as their grain deteriorate much faster. One way therefore to increase incentives to adopt improved storage would be to place a premium for high quality maize grain.

The practice of selling the entire harvest and using the revenue to buy food during the planting season. This would appear a plausible alternative and some farmers do practice it maybe due to the fact that stored maize depreciates through storage losses or because farmers need immediate cash. The revenue from the sales if invested in the bank could earn positive interest, providing inflation does not exceed the interest rate. The analysis shows that the storage alternative, when compared to no storage, is still a better alternative for the farmers. This is due to the fact that the storage losses are offset by the

increased benefits. One problem facing farmers in developing countries like Kenya is that high inflation rates may lead to negative interest and hence lower the gains. Another problem is that the absence of rural capital markets makes on-farm storage especially attractive given viable commodity markets in which the farmer can sell the stored crop whenever a need arise.

Farmers who have a marketable surplus during the planting season can take advantage of the seasonal price difference. For farmers who have little or no surplus during the pre-harvest lean months arbitrage cannot be the principal storage motive. Net deficit farmers comprise a substantial proportion of the total farm households in Kenya. For these group of farmers food security is their motive for storage.

The results indicate that all the investment options are insensitive to discount rates lower than 40%. The argument, therefore, that farmers need to be subsidized with cheap credit does not hold. A farmer willing to invest in the improved storage can borrow at prevailling interest rate (20% in commercial banks) and still have a viable investment.

The financial results show that there are incentives for increased on-farm storage because all the options are viable and the government objective of increasing on-farm storage may be achieved. A possible problem arises if the farm and household are not treated separately. The study by Bahemuka (1985) showed that farmers ranked their priorities as follows: 90% of the farmers interviewed ranked children's education first, 74% ranked developing the farm second, 52% ranked building a modern home third, 44% ranked purchasing grade cattle fourth and 32% ranked building an improved storage fifth.

The low ranking of investing on an improved storage suggests possibly low adoption rates despite it being a profitable investment.

Farmers also have problems with some technical aspects of the improved storage structure commonly proposed for adoption. The height is considered too high, the flat roof is unfavourable in high rainfall areas, the support poles (Appendix A: Figure 7 (top photograph)) should extend up to the roof for more support in areas with strong winds, the side sticks should be narrower to avoid maize cobs falling off (Appendix A: Figure 7 (bottom photogragh)), reed mats should be used to avoid grain exposure, and the upper door is too high for female farmers who do most of the farm operations (Appendix A: Figure 6 (top photograph)). These problems hamper the adoption of the improved structure. Cultural aspects play a major role when farmers are deciding whether or not to adopt an improved structure. The technologist therefore must include these aspects when designing a suitable improved structures.

5.4 Policy Implications.

Most farmers in Nandi district have existing traditional stores. If they are risk averse they may opt to continue using their traditional stores. The storage losses, although fairly small for each individual farmers, in aggregate for the country cause large losses of grain. Therefore, the country will continue to experience high losses. One recommendation would be to pursue extension programmes which will reduce the post-harvest losses for those farmers who continue to use traditional stores.

The government needs to develop policy objectives, taking these results into consideration, in trying to reduce the transitional problems of maize market liberalization. The withdrawal of the state agency may encourage the private sector but the government must provide a favourable environment for this to happen. For example improved infrastructure, market information systems, credit to private traders, removal of trade barriers, will encourage more private trader involvement. This will lead to more integrated local markets and the dampening of seasonal price differential within the country and the less the likelihood of non-competitive market situations arising.

The government should not expect private traders to promote food-security objectives. Close monitoring could be used to avoid profit seeking traders from exploiting consumers in deficit areas. Alternatively, to avoid high monitoring costs and implementation problems, one suggestion to improve the food security throughout the country would be the development of cereal banks, suggested in Kat, Diop, and Gergeley (1993), operated by farmers. Maize would be purchased from surplus areas (or from within in normal years) immediately after harvest (when prices are lowest) and sold locally when required. This would allow the local farmers to pay less for their supplies as the cereal banks' storage costs would usually be lower than the seasonal market price differential.

The cereal banks could be a cost-efficient way of maintaining food security. Farmers would be able to run the cereal banks with little assistance if a realistic assessment of financial viability is carried out. The pooling together by farmers means storage costs are spread out unlike individual storing. The private traders will continue

the procurement, marketing and distribution of grain. A profitable price margin would have to be worked out and restrictions removed to make private trade financially viable.

If farmers are able to maintain their food security needs through the cereal banks, then the NCPB's role in the maintenance of the country's strategic reserve will not be required. The number of private traders will increase as trade becomes competitive and reduces the likelihood of "high rent" seeking.

Lastly, food stocks are not a solution to food security. Food insecure persons might not have the purchasing power to purchase the grain. The government should devise ways and means to provide purchasing power to these insecure groups. One suggestion would be the provision of a famine relief fund.

5.5 Limitations and suggestions for further research.

This study is not without limitations. One of the problems is that the budgets used were for the 1992/93 crop season which was relatively a normal year. It can be used therefore with that restriction in mind and hence can not be generalized for all years. For example, drought years would drastically reduce yields even in high potential areas like Nandi district.

The analysis used secondary data available to derive the representative farms which might not fit all the farms in the area. A primary study of each farm in the area would give a better approximation of the representative farms enterprise combinations.

Further research on the financial analysis of cereal banks and operational logistics is a natural progression of this thesis. The idea of cereal banks will be one alternative in trying to solve the transitional problems and the food security question in a liberalized market. The idea of famine relief fund should be investigated as an alternative solution to food security.

Endnotes

1. Usually, the demand for maize in a certain area exceeds the actual quantity traded by the NCPB depot as maize can also be purchased and sold at the local market or bartered. In addition, the 'effective demand' will generally be lower than the 'real demand' due to lack of purchasing power among those households that are not able, or willing, to wholly produce their own maize requirement.

2. The NCPB is a government monopoly marketing agency entrusted with storage and marketing of cereals. Its objectives included price and income stabilization for farmers, efficient and inexpensive nationwide distribution of commodities to consumers without Government subsidy and buyer of last resort. Due to its failure to meet the objectives there will be a gradual shift to liberalization to be carried out in five years. The functions of NCPB will be limited to the maintenance of strategic reserves and a buyer of last resort, thus leaving 75 per cent of the markets to private traders, millers and co-operative societies.

3. The feeding of Kenya's growing population will require increasing supplies of staple foods, principally cereals (maize, wheat, sorghum, millet, rice), pulses and tubers (peas, potatoes, beans), oilseeds (groundnut, sunflower, cashewnuts, macadamia, sim sim, castor seed etc.), fruits and vegetables, meat and meat products, dairy products, poultry and eggs, honey, and horticultural produce (Development plan, 1989-93).

4. Until very recently Kenya has maintained very tight controls on the storage and movement of grain, at least in principle. The limits imposed on the volume of grain that an individual may transport without a movement permit (which have varied from year to year) have acted as a major constraint to inter-district grain trade. In many years movement permit policy has been very restrictive so that private inter-district and inter-regional trade has been almost entirely illegal. In addition to the controls on movements there has been no provision (until 1989) for a private trader to hold and sell maize grain, except as a petty trader. Periodic harassment of traders and seizure of grain (the latest as recently as June 1989 in Nairobi) have ensured that holding of grain is viewed as a high risk trading activity anywhere other than on-farm. These measures have clearly limited the scope for the farmers and traders to hold and release grain to meet market requirements.

5. Cropping intensity is the total cultivated area on a farm divided by the total cropland. When there is multiple cropping, the cropping intensity may be greater than 1. Often reported as a percentage.

6. Note that Appendix B budget tables show a discrepancy in the financial measures derivation between the budget and the summary efficiency measures (Appendix B70-75) as a result of a specification error in Farmod version 1.21 and should be rectified in the

latest version 3.02. The financial summary measures gave the correct results and were used instead of the financial measures on the bottom of the budgets tables.

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APPENDIXES

Appendix A: Tables & Figures

Table 1: Sectoral investment 1989-93 (constant 1982 prices).

Sector	Additional Capital Required per unit of Output 1989/93 Kenya Pound[1] (million)	Average Annual Gross Investment 1989/93 Kenya Pound (Million)	Percentage Share in Fixed Investment 1989/93	Sector's Percentage Contribution to Total GDP
Agriculture	0.92	74.49	8.54	27.45
Fishing	0.42	1.49	0.17	0.86
Forestry	0.67	1.05	0.12	0.42
Mining and Quarrying	5.35	7.69	0.88	0.27
Manufacturing	1.80	115.85	13.28	13.11
Building	4.25	52.80	6.05	2.89
Finance and Insurance	0.77	17.22	1.97	7.19
Government Services	3.36	152.28	17.46	15.43

Source: Development Plan, 1989-93.

1 Kenya pound = 20 Kenya shillings.

Table 2: National maize area, hactarage and yields.

Year	Area (Million HA)	Production (Million Bags)	Yields (Bags per Ha)
1976/77	0.85	19.40	22.80
1977/78	1.00	23.10	23.10
1978/79	0.87	19.30	22.20
1979/80	1.94	17.80	18.90
1980/81	1.18	20.80	17.60
1981/82	1.25	28.00	22.60
1982/83	1.30	27.40	20.80
1983/84	1.24	24.40	19.70
1984/85	1.26	16.50	13.10
1985/86	1.37	26.50	19.30
1986/87	1.43	28.70	20.10
1987/88	1.41	24.00	17.00
1988/89	1.44	31.40	21.80
1989/90	1.42	30.30	21.10
1990/91	1.30	25.00	19.20

Source: Ministry of Agriculture, 1992.

Table 3: Export price for maize, Kenya.

Cost Component (per Ton)	KSh.
C.i.f U.S Gulf ports (US$)	104.50
Deduct unloading, freight and insurance at U.S Gulf port (US$)	40.00
Equal F.O.B. at the port of Mombasa (US$)	144.50
Convert at official exchange rate (IUS$=KSh 31)	3,239.50
Deduct tariffs (export duty)	22.45
Add subsidies	0.00
Deduct local port charges	38.25
Deduct freight to port of Mombasa	50.22
Equal export price in Mombasa	3,128.58
Deduct local transport from Mombasa to Nairobi	50.22
Equal export price in Nairobi (per 90 Kg bag)	277.05

Source: Own compilation using Gittinger, 1982 format.

Table 4: Import price for maize, Kenya.

Cost Component (per ton)	KSh.
F.o.b. U.S. Gulf ports (US$) (no.2 yellow maize bulk)	104.50
Add Freight charges US Gulf to Mombasa Add unloading at Mombasa Add insurance	43.00
Equals C.i.f. Mombasa (US$)	147.50
Convert foreign currency to domestic currency at official exchange rate (April 1992)	31.00
C.i.f. (Mombasa value unbagged (Ksh))	4,572.50
Add tariffs	0.00
Deduct subsidies	0.00
Add landing and port charges (plus cost of bags)	51.96
Add Local transport (port to Msa warehouse)	8.40
Add off-loading charges at the station	2.50
Add storage at Mombasa	3.25
Add miscellaneous	3.10
Equals Mombasa wholesale price per ton bagged	4,641.71
Equals Mombasa wholesale Price/90 Kg bag	417.75
Conversion allowance for yellow maize estimated premium (white Maize)	1.10
C.i.f./bag of white maize	459.53
Deduct loading to rail Msa	2.40
Deduct transportation cost to Nbi	50.22
Deduct off-loading in Nairobi	2.40
Equal C.i.f. Nbi	514.55

Source: Own compilation using Gittinger,1982 format.

Table 5: Official pricing of sifted maizemeal in Kenya, 1990/93 (Ksh).

Item	1992/93	1992/91	1991/90
1. Producer price unbagged	600.00	300.00	250.00
2. plus delivery to depot	44.00	44.00	41.00
3. Into-Depot price	644.00	344.45	291.00
4. plus insecticide	1.50	1.50	1.30
5. Insecticide, % of (4)	0.23	0.44	0.45
6. plus shrinkage, per 90 Kg	14.22	4.50	5.00
7. Shrinkage, % of (4)	2.21	1.31	1.72
8. plus interest, per 90 Kg	10.50	9.80	11.70
9. Interest, % of (4)	1.63	2.70	4.02
10. plus other overheads	40.00	40.00	40.20
11. Overheads, % of (4)	6.21	11.61	13.81
12. plus railage cost /90 Kg	56.20	45.00	33.00
13. Railage cost, % of (4)	8.73	13.06	11.34
14. NCPB total costs	122.42	100.80	91.20
15. Total cost, % of (4)	19.01	29.26	31.34
16. Less subsidy	97.00	86.68	62.20
17. Into-Mill price	669.42	358.57	320.00
18. plus miller's cost	81.08	70.51	52.98
19. less miller's recovery	34.02	34.02	26.49
20. Price of meal (24 Kg)	238.83	131.69	115.50
21. plus packaging	14.55	13.80	7.04
22. Exit-mill price (24 Kg)	253.38	145.49	122.54
23. plus wholesale margin	4.26	3.70	2.80
24. wholesale price (2 Kg)	21.47	12.43	10.45
25. plus retail margin	1.01	0.92	0.73
26. Consumer price (2 Kg)	22.48	13.35	11.18

Source: Government of Kenya Market Information System, 1993.

Table 6: Evolution of official maize price margins NCPB progression maize price margins 1984/85 to 1992/93.

Fiscal Year	Producer Price per bag (KSh)	Exit-Depot Price (KSh) (Nominal price)	Gross Margin (KSh)
1984/85	156.00	239.60	83.60
1985/86	175.00	284.65	109.65
1986/87	188.00	284.65	96.65
1987/88	188.00	284.65	96.65
1988/89	201.00	297.15	96.15
1989/90	221.00	320.80	99.80
1990/91	250.00	320.80	70.80
1991/92	300.00	358.57	58.57
1992/93	600.00	669.42	69.42

Source: Government of Kenya Market Information System, 1993.

Table 7: Post-harvest losses on-farm for maize in relation to production at physiological maturity.

Activity	Loss
1. Maize crop production (000's tonnes, estimated trend)	2,800
2. Grain produced stored on-farm (for subsistence and local Market sales)	
a. Percentage of production	74
b. Quantity stored (000's tonnes)	2,072
c. Quantity at physiological maturity (000's tonnes)	2,409
3. Present post-harvest losses on-farm from physiological maturity.	
a. Total Percentage loss	26
b. Quantity (000's tonnes)	578
c. Field drying percentage loss	12
d. Quantity (000's tonnes)	289
e.Harvesting/shelling/threshing/winnowing	4
f. Storage percentage loss	10
g. Quantity (000's tonnes)	241

Source: IGADD, Volume 1, 1990.

Figure 1: District boundaries

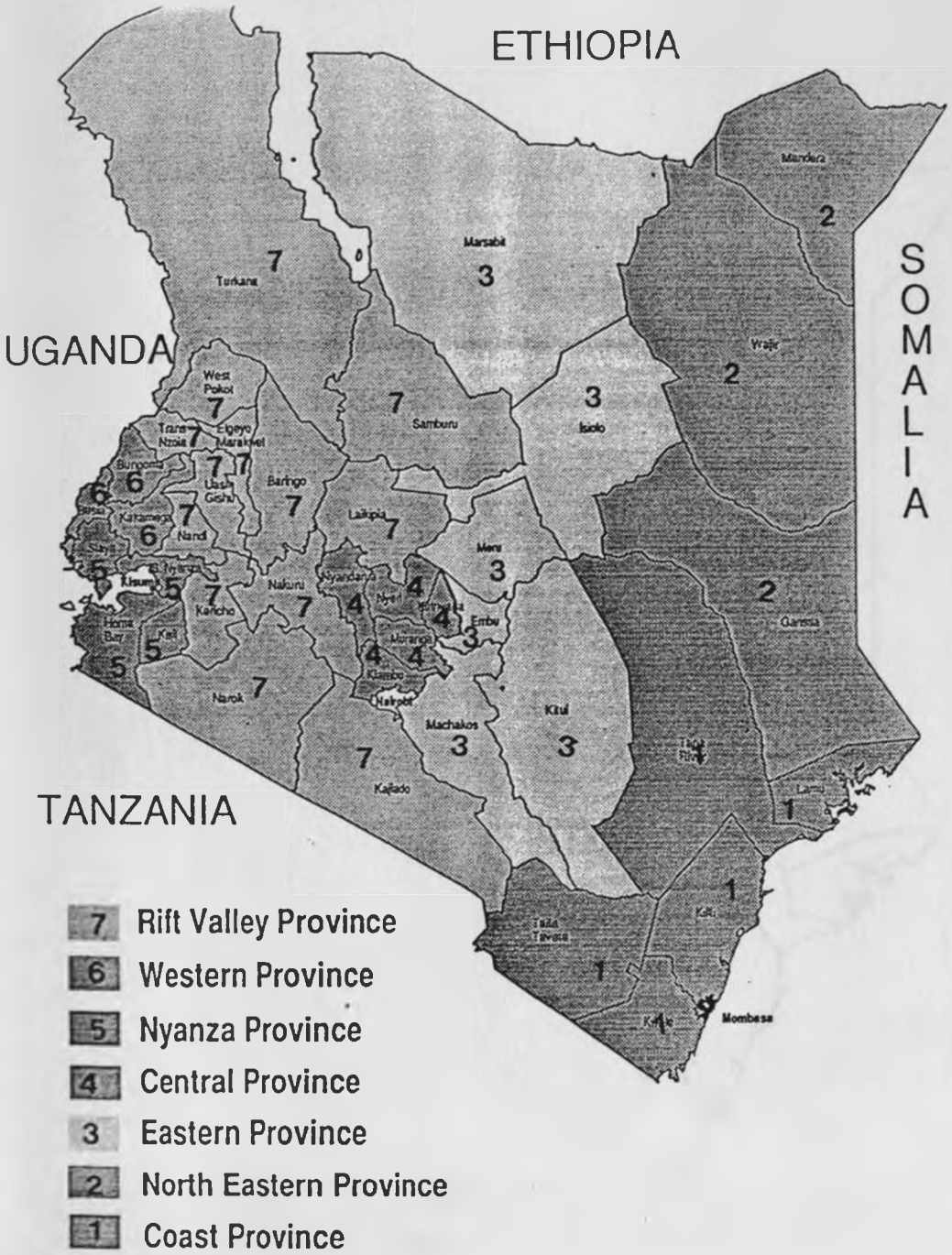

Figure 2: Surplus and deficit districts

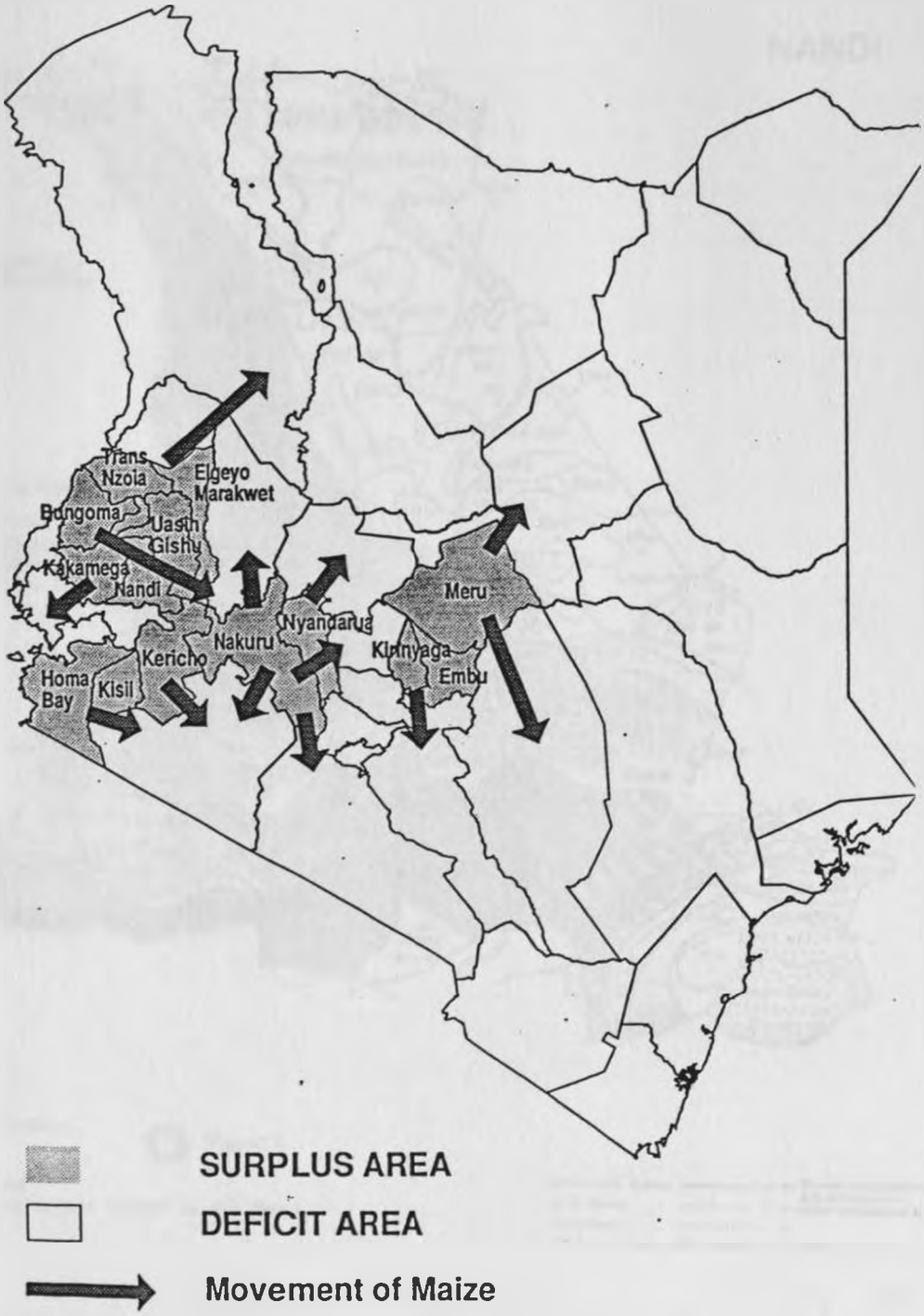

Figure 3: Nandi district agro-ecological map and legend

Figure 3: Legend

CLIMATE IN THE AGRO-ECOLOGICAL ZONES

Agro-Ecological Zone	Subzone	Altitude in m	Annual mean temperature in °C	Annual av. rainfall in mm	60 % reliability of rainfall[1] 1st rains in mm	2nd rains in mm	60 % reliability of growing period 1st rains[2] in days	2nd rains in days	Total[3] in days
UH 1 Sheep-Dairy Zone	vl i	Here Forest Reserve							
LH 1 Tea-Dairy Zone	p or two vl i or two	1 900–2 400	18.0–15.0	1 500–2 100 1 300–1 850	650–850 630–820	580–800 550–750	165 or more 155 or more	190–200 140–195	365 295–350
LH 2 Wheat/Maize-Pyrethrum Zone	vl/l or two	1 900–2 400	18.0–15.0	1 300–1 800	600–750	500–700	150 or more	90–135	240–285
LH 3 Wheat/Maize-Barley Zone	l/vl or two	1 900–2 300	18.0–15.7	1 280–1 650	500–680	500–600	140 or more	80–100	220–240
UM 1 Coffee-Tea Zone	p or two/three p or two vl i or two	1 500–2 000	20.5–17.5	1 800–2 100 1 700–2 000 1 500–1 850	750–850 700–780 650–750	650–800 630–780 550–700	160 or more 160 or more 150 or more	190–205 185–200 175–185	365 345–360 325–335
UM 2 Coffee Zone	vl i or two	Very small and transitional to 3, see Kericho							
UM 3 Marginal Coffee Zone	transitional	Very small, see Kericho or Bungoma							
UM 4 Sunflower-Maize Zone	l/vl or two	1 600–2 000	19.9–17.5	1 200–1 600	400–600	500–600	115 or more	115 or less	~230
LM 1 Lower Midland Sugar Cane Zone	p or two	Very small, see Kakamega							
LM 2 Marginal Sugar Cane Zone	l/m ⁓ (m/s)	1 200–1 500	22.3–20.9	1 200–1 580	560–700	500–600	170 or more	115–125	285–295

Figure 4: Post-harvest extension programmes

Figure 5: Ventilated maize crib

Figure 6: Grain Loading the Improved Storage

Figure 7: Improved Storage Construction

Appendix B: Budget Tables

Kenya
Small Scale On-Farm Maize Storage Analysis
Small Scale Maize Crop Model
YIELDS AND INPUTS
(Per Acre)

		January-November						
	Unit	Existing Technology 1 to 10	New Technology 1 to 10	Increments 1 to 10	Present 1	Future Existing 10	Future New 10	Percentage Change %
Main Production								
Maize	Kg	1,350	1,350	-	1,350	1,350	1,350	-
Beans	Kg	80	80	-	80	80	80	-
By Products								
Maize Stalks	acre	1	1	-	1	1	1	-
Maize Cobs	acre	1	1	-	1	1	1	-
Beans Stalks	acre	1	1	-	1	1	1	-
Operating								
Inputs								
Land Rent value	acre	1	1	-	1	1	1	-
Ploughing (tractor hire)	acre	1	1	-	1	1	1	-
Harrowing (tractor hire)	acre	1	1	-	1	1	1	-
Planting (tractor hire)	acre	1	1	-	1	1	1	-
Maize Seed	Kg	10	10	-	10	10	10	-
Bean seed	Kg	5	5	-	5	5	5	-
DAP Fertilizer	Kg	125	125	-	125	125	125	-
Can Fertilizer	Kg	100	100	-	100	100	100	-
Transport charges	bag	12	12	-	12	12	12	-
Labor								
Land Preparation	day	5	5	-	5	5	5	-
Harrowing	day	4	4	-	4	4	4	-
Planting	day	6	6	-	6	6	6	-
Bean Planting	day	2	2	-	2	2	2	-
Top Dressing	day	2	2	-	2	2	2	-
First Weeding	day	6	6	-	6	6	6	-
Dusting	day	1	1	-	1	1	1	-
Bean Harvesting	day	2	2	-	2	2	2	-
Second Weeding	day	6	6	-	6	6	6	-
Stooking	day	10	10	-	10	10	10	-
Harvesting	day	15	15	-	15	15	15	-
Shelling	day	12	12	-	12	12	12	-

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Kenya
Small Scale Cr.-Farm Maize Storage Analysis
Small Scale Maize Crop Model
FINANCIAL BUDGET
(In Kenya Shillings Per Acre)

January-Nov

	Existing Technology												
	1	2	3	4	5	6	7	8	9	10	1	2	3
Revenue													
Main Production													
Maize	9,094.5	9,185.5	9,277.3	9,370.1	9,463.8	9,558.5	9,654.0	9,750.6	9,848.1	9,946.6	9,094.5	9,185.5	9,277.3
Beans	484.8	489.6	494.5	499.5	504.5	509.5	514.6	519.8	525.0	530.2	484.8	489.6	494.5
Sub-total Main Production	9,579.3	9,675.1	9,771.9	9,869.6	9,968.3	10,068.0	10,168.7	10,270.4	10,373.1	10,476.8	9,579.3	9,675.1	9,771.9
By Products													
Maize Stalks	151.5	153.0	154.5	156.1	157.7	159.2	160.8	162.4	164.1	165.7	151.5	153.0	154.5
Maize Cobs	50.5	51.0	51.5	52.0	52.6	53.1	53.6	54.1	54.7	55.2	50.5	51.0	51.5
Beans Stalks	101.0	102.0	103.0	104.1	105.1	106.2	107.2	108.3	109.4	110.5	101.0	102.0	103.0
Sub-total Byproducts	303.0	306.0	309.1	312.2	315.3	318.5	321.6	324.9	328.1	331.4	303.0	306.0	309.1
Sub-total Revenue	9,882.3	9,981.2	10,081.0	10,181.8	10,283.6	10,386.4	10,490.3	10,595.2	10,701.2	10,808.2	9,882.3	9,981.2	10,081.0
Input costs													
Land Rent value	606.0	612.1	618.2	624.4	630.6	636.9	643.3	649.7	656.2	662.8	606.0	612.1	618.2
Ploughing (tractor hire)	606.0	612.1	618.2	624.4	630.6	636.9	643.3	649.7	656.2	662.8	606.0	612.1	618.2
Harrowing (tractor hire)	404.0	408.0	412.1	416.2	420.4	424.6	428.9	433.1	437.5	441.8	404.0	408.0	412.1
Planting (tractor hire)	505.0	510.1	515.2	520.3	525.5	530.8	536.1	541.4	546.8	552.3	505.0	510.1	515.2
Maize Seed	303.0	306.0	309.1	312.2	315.3	318.5	321.6	324.9	328.1	331.4	303.0	306.0	309.1
Bean seed	151.5	153.0	154.5	156.1	157.7	159.2	160.8	162.4	164.1	165.7	151.5	153.0	154.5
DAP Fertilizer	1,515.0	1,530.2	1,545.5	1,560.9	1,576.5	1,592.3	1,608.2	1,624.3	1,640.5	1,656.9	1,515.0	1,530.2	1,545.5
Can Fertilizer	1,010.0	1,020.1	1,030.3	1,040.6	1,051.0	1,061.5	1,072.1	1,082.9	1,093.7	1,104.6	1,010.0	1,020.1	1,030.3
Transport charges	181.8	183.6	185.5	187.3	189.2	191.1	193.0	194.9	196.9	198.8	181.8	183.6	185.5
Sub-total Input costs	5,282.3	5,335.1	5,388.5	5,442.4	5,496.8	5,551.8	5,607.3	5,663.3	5,720.0	5,777.2	5,282.3	5,335.1	5,388.5
Income (Before Labor Costs)	4,600.0	4,646.0	4,692.5	4,739.4	4,786.8	4,834.7	4,883.0	4,931.9	4,981.2	5,031.0	4,600.0	4,646.0	4,692.5
Labor costs													
Land Preparation	176.8	178.5	180.3	182.1	183.9	185.8	187.6	189.5	191.4	193.3	176.8	178.5	180.3
Harrowing	141.4	142.8	144.2	145.7	147.1	148.6	150.1	151.6	153.1	154.6	141.4	142.8	144.2
Planting	212.1	214.2	216.4	218.5	220.7	222.9	225.1	227.4	229.7	232.0	212.1	214.2	216.4
Bean Planting	70.7	71.4	72.1	72.8	73.6	74.3	75.0	75.8	76.6	77.3	70.7	71.4	72.1
Top Dressing	60.6	61.2	61.8	62.4	63.1	63.7	64.3	65.0	65.6	66.3	60.6	61.2	61.8
First Weeding	121.2	122.4	123.6	124.9	126.1	127.4	128.7	129.9	131.2	132.6	121.2	122.4	123.6
Dusting	20.2	20.4	20.6	20.8	21.0	21.2	21.4	21.7	21.9	22.1	20.2	20.4	20.6
Bean Harvesting	40.4	40.8	41.2	41.6	42.0	42.5	42.9	43.3	43.7	44.2	40.4	40.8	41.2
Second Weeding	121.2	122.4	123.6	124.9	126.1	127.4	128.7	129.9	131.2	132.6	121.2	122.4	123.6
Stooking	303.0	306.0	309.1	312.2	315.3	318.5	321.6	324.9	328.1	331.4	303.0	306.0	309.1
Harvesting	530.3	535.6	540.9	546.3	551.8	557.3	562.9	568.5	574.2	579.9	530.3	535.6	540.9
Shelling	303.0	306.0	309.1	312.2	315.3	318.5	321.6	324.9	328.1	331.4	303.0	306.0	309.1
Sub-total Labor costs	2,100.8	2,121.8	2,143.0	2,164.5	2,186.1	2,208.0	2,230.0	2,252.3	2,274.8	2,297.6	2,100.8	2,121.8	2,143.0
Income (After Labor Costs)	2,499.2	2,524.2	2,549.5	2,575.0	2,600.7	2,626.7	2,653.0	2,679.5	2,706.3	2,733.4	2,499.2	2,524.2	2,549.5

Income Before Labor: IRR = None, NPV = 0.00
Income After Labor: IRR = None, NPV = 0.00

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Kenya
Small Scale On-Farm Maize Storage Analysis
Small Scale Maize Crop Model
FINANCIAL BUDGET
(In Kenya Shillings Per Acre)

ember

New Technology							Increments	Present	Future Existing	Future New	Percentage Change
4	5	6	7	8	9	10	1 to 10	1	10	10	%
9,370.1	9,443.8	9,558.5	9,654.0	9,750.6	9,848.1	9,946.6	-	9,094.5	9,946.6	9,946.6	-
499.5	504.5	509.5	514.6	519.8	525.0	530.2	-	484.0	530.2	530.2	-
9,869.6	9,948.3	10,068.0	10,168.7	10,270.4	10,373.1	10,476.8	-	9,578.5	10,476.8	10,476.8	-
156.1	157.7	159.2	160.8	162.4	164.1	165.7	-	151.5	165.7	165.7	-
52.0	52.6	53.1	53.6	54.1	54.7	55.2	-	50.5	55.2	55.2	-
104.1	105.1	106.2	107.2	108.3	109.4	110.5	-	101.0	110.5	110.5	-
312.2	315.3	318.5	321.6	324.9	328.1	331.4	-	303.0	331.4	331.4	-
10,181.8	10,283.6	10,386.4	10,490.3	10,595.2	10,701.2	10,808.2	-	9,882.3	10,808.2	10,808.2	-
624.4	630.6	636.9	643.3	649.7	656.2	662.8	-	606.0	662.8	662.8	-
624.4	630.6	636.9	643.3	649.7	656.2	662.8	-	606.0	662.8	662.8	-
416.2	420.4	424.6	428.9	433.1	437.5	441.8	-	404.0	441.8	441.8	-
520.3	525.5	530.8	536.1	541.4	546.8	552.3	-	505.0	552.3	552.3	-
312.2	315.3	318.5	321.6	324.9	328.1	331.4	-	303.0	331.4	331.4	-
156.1	157.7	159.2	160.8	162.4	164.1	165.7	-	151.5	165.7	165.7	-
1,560.9	1,576.5	1,592.3	1,608.2	1,624.3	1,640.5	1,656.9	-	1,515.0	1,656.9	1,656.9	-
1,040.6	1,051.0	1,061.5	1,072.1	1,082.9	1,093.7	1,104.6	-	1,010.0	1,104.6	1,104.6	-
187.3	189.2	191.1	193.0	194.9	196.9	198.8	-	181.8	198.8	198.8	-
5,442.4	5,496.0	5,551.9	5,607.3	5,663.3	5,720.0	5,777.2	-	5,283.3	5,777.2	5,777.2	-
4,739.4	4,786.5	4,834.7	4,883.0	4,931.9	4,981.2	5,031.0	-	4,600.0	5,031.0	5,031.0	-
182.1	183.9	185.8	187.6	189.5	191.4	193.3	-	176.8	193.3	193.3	-
145.7	147.1	148.6	150.1	151.6	153.1	154.6	-	141.4	154.6	154.6	-
218.5	220.7	222.9	225.1	227.4	229.7	232.0	-	212.1	232.0	232.0	-
72.8	73.6	74.3	75.0	75.8	76.6	77.3	-	70.7	77.3	77.3	-
62.4	63.1	63.7	64.3	65.0	65.6	66.3	-	60.6	66.3	66.3	-
124.9	126.1	127.4	128.7	129.9	131.2	132.6	-	121.2	132.6	132.6	-
20.8	21.0	21.2	21.4	21.7	21.9	22.1	-	20.2	22.1	22.1	-
41.6	42.0	42.5	42.9	43.3	43.7	44.2	-	40.4	44.2	44.2	-
124.9	126.1	127.4	128.7	129.9	131.2	132.6	-	121.2	132.6	132.6	-
312.2	315.3	318.5	321.6	324.9	328.1	331.4	-	303.0	331.4	331.4	-
546.3	551.8	557.3	562.9	568.5	574.2	579.9	-	530.3	579.9	579.9	-
312.2	315.3	318.5	321.6	324.9	328.1	331.4	-	303.0	331.4	331.4	-
2,314.5	2,337.6	2,361.0	2,384.6	2,408.5	2,432.6	2,457.0	-	2,247.0	2,457.0	2,457.0	-
2,575.0	2,600.7	2,626.7	2,653.0	2,679.5	2,706.3	2,733.4	-	2,499.2	2,733.4	2,733.4	-

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Kenya
Small Scale On-Farm Maize Storage Analysis
Small Holder Tea Crop Model
YIELDS AND INPUTS
(Per Acre)

		January-November						
	Unit	Existing Technology 1 to 10	New Technology 1 to 10	Increments 1 to 10	Present 1	Future Existing 10	Future New 10	Percentage Change %
Yields	Kg	3,200	3,200	-	3,200	3,200	3,200	-
Investment								
Inputs								
Establishment costs	acre	1	1	-	1	1	1	-
Jembes	acre	1	1	-	1	1	1	-
Prunning Secateur	acre	1	1	-	1	1	1	-
Labor								
Tea establishment costs	day	8	8	-	8	8	8	-
Operating								
Inputs								
Fertilizer (NPK)	Kg	400	400	-	400	400	400	-
Transport to collection centre	Kg	3,200	3,200	-	3,200	3,200	3,200	-
Labor								
Edge weeding tea	day	8	8	-	8	8	8	-
Under weeding tea	day	15	15	-	15	15	15	-
Fertilizer application	day	2	2	-	2	2	2	-
Top dressing	day	2	2	-	2	2	2	-
Tea prunning	day	18	18	-	18	18	18	-
Tea picking	day	184	184	-	184	184	184	-

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Kenya
Small Scale On-Farm Maize Storage Analysis
Small Holder Tea Crop Model
FINANCIAL BUDGET
(In Kenya Shillings Per Acre)

	Existing Technology										Ja	
	1	2	3	4	5	6	7	8	9	10	1	2
Revenue	15,190.4	15,342.3	15,495.7	15,650.7	15,807.2	15,965.3	16,124.9	16,286.2	16,449.0	16,613.5	15,190.4	15,342.3
Input costs												
Investment costs												
Establishment costs	954.5	964.0	973.6	983.4	993.2	1,003.1	1,013.2	1,023.3	1,033.5	1,043.9	954.5	964.0
Jembes	80.8	81.6	82.4	83.2	84.1	84.9	85.8	86.6	87.5	88.4	80.8	81.6
Pruning Secateur	151.5	153.0	154.5	156.1	157.7	159.2	160.8	162.4	164.1	165.7	151.5	153.0
Sub-total Investment Costs	1,186.8	1,198.6	1,210.6	1,222.7	1,234.9	1,247.3	1,259.8	1,272.4	1,285.1	1,297.9	1,186.8	1,198.6
Operating Costs												
Fertilizer (NPK)	4,040.0	4,080.4	4,121.2	4,162.4	4,204.0	4,246.1	4,288.5	4,331.4	4,374.7	4,418.5	4,040.0	4,080.4
Transport to collection centre	1,616.0	1,632.2	1,648.5	1,665.0	1,681.6	1,698.4	1,715.4	1,732.6	1,749.9	1,767.4	1,616.0	1,632.2
Sub-total Operating Costs	5,656.0	5,712.6	5,769.7	5,827.4	5,885.7	5,944.5	6,004.0	6,064.0	6,124.6	6,185.9	5,656.0	5,712.6
Sub-total Input costs	6,842.8	6,911.2	6,980.3	7,050.1	7,120.6	7,191.8	7,263.7	7,336.4	7,409.7	7,483.8	6,842.8	6,911.2
Income (Before Labor Costs)	8,347.7	8,431.1	8,515.4	8,600.6	8,686.6	8,773.5	8,861.2	8,949.8	9,039.3	9,129.7	8,347.7	8,431.1
Labor costs												
Investment costs												
Tea establishment costs	202.0	204.0	206.1	208.1	210.2	212.3	214.4	216.6	218.7	220.9	202.0	204.0
Operating Costs												
Edge weeding tea	161.6	163.2	164.8	166.5	168.2	169.8	171.5	173.3	175.0	176.7	161.6	163.2
Under weeding tea	303.0	306.0	309.1	312.2	315.3	318.5	321.6	324.9	328.1	331.4	303.0	306.0
Fertilizer application	40.4	40.8	41.2	41.6	42.0	42.5	42.9	43.3	43.7	44.2	40.4	40.8
Top dressing	40.4	40.8	41.2	41.6	42.0	42.5	42.9	43.3	43.7	44.2	40.4	40.8
Tea pruning	363.6	367.2	370.9	374.6	378.4	382.1	386.0	389.8	393.7	397.7	363.6	367.2
Tea picking	3,716.8	3,754.0	3,791.5	3,829.4	3,867.7	3,906.4	3,945.5	3,984.9	4,024.8	4,065.0	3,716.8	3,754.0
Sub-total Operating Costs	4,625.8	4,672.1	4,718.8	4,766.0	4,813.6	4,861.8	4,910.4	4,959.5	5,009.2	5,059.2	4,625.8	4,672.1
Sub-total Labor costs	4,827.8	4,876.1	4,924.9	4,974.1	5,023.8	5,074.1	5,124.9	5,176.1	5,227.9	5,280.1	4,827.8	4,876.1
Income (After Labor Costs)	3,519.9	3,555.0	3,590.6	3,626.5	3,662.8	3,699.4	3,736.4	3,773.8	3,811.5	3,849.6	3,519.9	3,555.0

Income Before Labor: IRR = 0.0%, NPV = 0.00
Income After Labor: IRR = 0.0%, NPV = 0.00

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Kenya
Small Scale On-Farm Maize Storage Analysis
Small Holder Tea Crop Model
FINANCIAL BUDGET
(In Kenya Shillings Per Acre)

nuary-November

New Technology								Increments	Present	Future Existing	Future New	Percentage Change
3	4	5	6	7	8	9	10	1 to 10	1	10	10	%
15,495.7	15,650.7	15,807.2	15,965.3	16,124.9	16,286.2	16,449.0	16,613.5	-	15,190.4	16,613.5	16,613.5	-
973.6	983.4	993.2	1,003.1	1,013.2	1,023.3	1,033.5	1,043.9	-	954.5	1,043.9	1,043.9	-
82.4	83.2	84.1	84.9	85.8	86.6	87.5	88.4	-	80.8	88.4	88.4	-
154.5	156.1	157.7	159.2	160.8	162.4	164.1	165.7	-	151.5	165.7	165.7	-
1,210.6	1,222.7	1,234.9	1,247.3	1,259.8	1,272.4	1,285.1	1,297.9	-	1,186.8	1,297.9	1,297.9	-
4,121.2	4,162.4	4,204.0	4,246.1	4,288.5	4,331.4	4,374.7	4,418.5	-	4,040.0	4,418.5	4,418.5	-
1,640.5	1,665.0	1,681.6	1,698.4	1,715.4	1,732.6	1,749.9	1,767.4	-	1,616.0	1,767.4	1,767.4	-
5,761.7	5,827.4	5,885.7	5,944.5	6,004.0	6,064.0	6,124.6	6,185.9	-	5,656.0	6,185.9	6,185.9	-
6,980.3	7,050.1	7,120.6	7,191.8	7,263.7	7,336.4	7,409.7	7,483.8	-	6,842.8	7,483.8	7,483.8	-
8,515.4	8,600.6	8,686.6	8,773.5	8,861.2	8,949.8	9,039.3	9,129.7	-	8,347.7	9,129.7	9,129.7	-
206.1	208.1	210.2	212.3	214.4	216.6	218.7	220.9	-	202.0	220.9	220.9	-
164.8	166.5	168.2	169.8	171.5	173.3	175.0	176.7	-	161.6	176.7	176.7	-
309.1	312.2	315.3	318.5	321.6	324.9	328.1	331.4	-	303.0	331.4	331.4	-
41.2	41.6	42.0	42.5	42.9	43.3	43.7	44.2	-	40.4	44.2	44.2	-
41.2	41.6	42.0	42.5	42.9	43.3	43.7	44.2	-	40.4	44.2	44.2	-
370.9	374.6	378.4	382.1	386.0	389.8	393.7	397.7	-	363.6	397.7	397.7	-
3,791.5	3,879.4	3,867.7	3,906.4	3,945.5	3,984.9	4,024.8	4,065.0	-	3,716.4	4,065.0	4,065.0	-
4,719.8	4,766.0	4,811.6	4,861.8	4,910.4	4,959.5	5,009.1	5,059.2	-	4,625.8	5,059.2	5,059.2	-
4,924.8	4,974.1	5,023.8	5,074.1	5,124.8	5,176.1	5,227.8	5,280.1	-	4,827.8	5,280.1	5,280.1	-
3,590.6	3,626.5	3,662.8	3,699.4	3,736.4	3,773.8	3,811.5	3,849.6	-	3,519.9	3,849.6	3,849.6	-

Kenya
Small Scale On-Farm Maize Storage Analysis
Small scale dairy Crop Model
YIELDS AND INPUTS
(Per Acre) /a

		January-November						
		Existing Technology	New Technology	Increments	Present	Future Existing	Future New	Percentage Change
	Unit	1 to 10	1 to 10	1 to 10	1	10	10	%
Main Production								
Milk to KCC	Litre	960	960	-	960	960	960	-
Milk local sales	Litre	100	100	-	100	100	100	-
Cul_ Cows	acre	1	1	-	1	1	1	-
Heifer calves	acre	1	1	-	1	1	1	-
Bull calves	acre	1	1	-	1	1	1	-
By Products								
Cattle waste	acre	1	1	-	1	1	1	-
Investment								
Inputs								
Livestock	acre	1	1	-	1	1	1	-
Fencing	acre	1	1	-	1	1	1	-
Milking sheds	acre	1	1	-	1	1	1	-
Milk cans	acre	1	1	-	1	1	1	-
Feeding Buckets	acre	1	1	-	1	1	1	-
Labor								
Fencing and maintenance	day	10	10	-	10	10	10	-
Dairy permanent labour	acre	1	1	-	1	1	1	-
Operating								
Grazing land	acre	1	1	-	1	1	1	-
Napier grass	acre	1	1	-	1	1	1	-
Dairy Meal	acre	1	1	-	1	1	1	-
salt lick	acre	1	1	-	1	1	1	-
dipping	acre	1	1	-	1	1	1	-
Disease control	acre	1	1	-	1	1	1	-
Drugs and chemicals	acre	0.75	0.75	-	0.75	0.75	0.75	-

\a 5 cows on 10 acres of land.

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Kenya
Small Scale On-Farm Maize Storage Analysis
Small scale dairy Crop Model
FINANCIAL BUDGET
(In Kenya Shillings Per Acre) /a

	January-November													
	Existing Technology													
	1	2	3	4	5	6	7	8	9	10	1	2	3	4
Revenue														
Main Production														
Milk to KCC	4,848.0	4,896.5	4,945.4	4,994.9	5,044.8	5,095.3	5,146.2	5,197.7	5,249.7	5,302.2	4,848.0	4,896.5	4,945.4	4,994.9
Milk local sales	303.0	306.0	309.1	312.2	315.3	318.5	321.6	324.9	328.1	331.4	303.0	306.0	309.1	312.2
Cull Cows	1,449.4	1,463.8	1,478.5	1,493.3	1,508.2	1,523.3	1,538.5	1,553.9	1,569.4	1,585.1	1,449.4	1,463.8	1,478.5	1,493.3
Heifer calves	404.0	408.0	412.1	416.2	420.4	424.6	428.9	433.1	437.5	441.8	404.0	408.0	412.1	416.2
Bull calves	565.6	571.3	577.0	582.7	588.6	594.5	600.4	606.4	612.5	618.6	565.6	571.3	577.0	582.7
Sub-total Main Production	7,570.0	7,645.6	7,722.1	7,799.3	7,877.3	7,956.1	8,035.7	8,116.0	8,197.2	8,279.1	7,570.0	7,645.6	7,722.1	7,799.3
By Products														
Cattle waste	60.6	61.2	61.8	62.4	63.1	63.7	64.3	65.0	65.6	66.3	60.6	61.2	61.8	62.4
Sub-total Revenue	7,630.6	7,706.9	7,783.9	7,861.8	7,940.4	8,019.8	8,100.0	8,181.0	8,262.8	8,345.4	7,630.6	7,706.9	7,783.9	7,861.8
Input costs														
Investment costs														
Livestock	694.4	701.3	708.3	715.4	722.6	729.8	737.1	744.5	751.9	759.4	694.4	701.3	708.3	715.4
Fencing	221.2	223.4	225.6	227.9	230.2	232.5	234.8	237.1	239.5	241.9	221.2	223.4	225.6	227.9
Milking sheds	151.5	153.0	154.5	156.1	157.7	159.2	160.8	162.4	164.1	165.7	151.5	153.0	154.5	156.1
Milk cans	242.4	244.8	247.3	249.7	252.2	254.8	257.3	259.9	262.5	265.1	242.4	244.8	247.3	249.7
Feeding Buckets	20.2	20.4	20.6	20.8	21.0	21.2	21.4	21.7	21.9	22.1	20.2	20.4	20.6	20.8
Sub-total Investment Costs	1,329.7	1,343.0	1,356.4	1,370.0	1,383.7	1,397.5	1,411.5	1,425.6	1,439.8	1,454.2	1,329.7	1,343.0	1,356.4	1,370.0
Operating Costs														
Grazing land	606.0	612.1	618.2	624.4	630.6	636.9	643.3	649.7	656.2	662.8	606.0	612.1	618.2	624.4
Napier grass	595.9	601.9	607.9	614.0	620.1	626.3	632.6	638.9	645.3	651.7	595.9	601.9	607.9	614.0
Dairy Meal	218.2	220.3	222.5	224.8	227.0	229.3	231.6	233.9	236.2	238.6	218.2	220.3	222.5	224.8
salt lick	103.9	105.0	106.0	107.1	108.1	109.2	110.3	111.4	112.5	113.7	103.9	105.0	106.0	107.1
dipping	242.4	244.8	247.3	249.7	252.2	254.8	257.3	259.9	262.5	265.1	242.4	244.8	247.3	249.7
Disease control	151.5	153.0	154.5	156.1	157.7	159.2	160.8	162.4	164.1	165.7	151.5	153.0	154.5	156.1
Drugs and chemicals	181.8	183.6	185.5	187.3	189.2	191.1	193.0	194.9	196.9	198.8	181.8	183.6	185.5	187.3
Sub-total Operating Costs	2,099.7	2,120.7	2,141.9	2,163.3	2,184.9	2,206.8	2,228.9	2,251.2	2,273.7	2,296.4	2,099.7	2,120.7	2,141.9	2,163.3
Sub-total Input costs	3,429.4	3,463.6	3,498.3	3,533.3	3,568.6	3,604.3	3,640.3	3,676.7	3,713.5	3,750.6	3,429.4	3,463.6	3,498.3	3,533.3
Income (Before Labor Costs)	4,201.2	4,243.2	4,285.6	4,328.5	4,371.8	4,415.5	4,459.7	4,504.3	4,549.3	4,594.8	4,201.2	4,243.2	4,285.6	4,328.5
Labor costs														
Fencing and maintenance	303.0	306.0	309.1	312.2	315.3	318.5	321.6	324.9	328.1	331.4	303.0	306.0	309.1	312.2
Dairy permanent labour	1,818.0	1,836.2	1,854.5	1,873.1	1,891.8	1,910.7	1,929.8	1,949.1	1,968.6	1,988.3	1,818.0	1,836.2	1,854.5	1,873.1
Sub-total Labor costs	2,121.0	2,142.2	2,163.6	2,185.3	2,207.1	2,229.2	2,251.5	2,274.0	2,296.7	2,319.7	2,121.0	2,142.2	2,163.6	2,185.3
Income (After Labor Costs)	2,080.2	2,101.0	2,122.0	2,143.2	2,164.7	2,186.3	2,208.2	2,230.3	2,252.6	2,275.1	2,080.2	2,101.0	2,122.0	2,143.2

Income Before Labor: IRR = 0.0%, NPV = 0.00
Income After Labor: IRR = 0.0%, NPV = 0.00
\a 5 cows on 10 acres of land.

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Kenya
Small Scale On-Farm Maize Storage Analysis
Small scale dairy Crop Model
FINANCIAL BUDGET
(In Kenya Shillings Per Acre) /a

New Technology						Increments	Present	Future Existing	Future New	Percentage Change
5	6	7	8	9	10	1 to 10	1	10	10	%
5,044.8	5,095.3	5,146.2	5,197.7	5,249.7	5,302.2	-	4,848.0	5,302.2	5,302.2	-
315.3	318.5	321.6	324.9	328.1	331.4	-	303.0	331.4	331.4	-
1,508.2	1,523.3	1,538.5	1,553.9	1,569.4	1,585.1	-	1,419.4	1,585.1	1,585.1	-
420.4	424.6	428.9	433.1	437.5	441.8	-	404.0	441.8	441.8	-
588.6	594.5	600.4	606.4	612.5	618.6	-	565.6	618.6	618.6	-
7,877.3	7,956.1	8,035.7	8,116.0	8,197.2	8,279.1	-	7,570.0	8,279.1	8,279.1	-
63.1	63.7	64.3	65.0	65.6	66.3	-	60.6	66.3	66.3	-
7,940.4	8,019.8	8,100.0	8,181.0	8,262.8	8,345.4	-	7,630.6	8,345.4	8,345.4	-
722.6	729.8	737.1	744.5	751.9	759.4	-	694.4	759.4	759.4	-
230.2	232.5	234.8	237.1	239.5	241.9	-	221.2	241.9	241.9	-
157.7	159.2	160.8	162.4	164.1	165.7	-	151.5	165.7	165.7	-
252.2	254.8	257.3	259.9	262.5	265.1	-	242.4	265.1	265.1	-
21.0	21.2	21.4	21.7	21.9	22.1	-	20.2	22.1	22.1	-
1,383.7	1,397.5	1,411.5	1,425.6	1,439.8	1,454.2	-	1,329.7	1,454.2	1,454.2	-
630.6	636.9	643.3	649.7	656.2	662.8	-	606.0	662.8	662.8	-
620.1	626.3	632.6	638.9	645.3	651.7	-	595.9	651.7	651.7	-
227.0	229.3	231.6	233.9	236.2	238.6	-	218.2	238.6	238.6	-
108.1	109.2	110.3	111.4	112.5	113.7	-	103.9	113.7	113.7	-
252.2	254.8	257.3	259.9	262.5	265.1	-	242.4	265.1	265.1	-
157.7	159.2	160.8	162.4	164.1	165.7	-	151.5	165.7	165.7	-
189.2	191.1	193.0	194.9	196.9	198.8	-	181.8	198.8	198.8	-
2,184.9	2,206.8	2,228.9	2,251.2	2,273.7	2,296.4	-	2,099.7	2,296.4	2,296.4	-
3,568.6	3,604.3	3,640.3	3,676.7	3,713.5	3,750.6	-	3,429.4	3,750.6	3,750.6	-
4,371.8	4,415.5	4,459.7	4,504.3	4,549.3	4,594.8	-	4,201.2	4,594.8	4,594.8	-
315.3	318.5	321.6	324.9	328.1	331.4	-	303.0	331.4	331.4	-
1,891.8	1,910.7	1,929.8	1,949.1	1,968.6	1,988.3	-	1,818.0	1,988.3	1,988.3	-
2,207.1	2,229.2	2,251.5	2,274.0	2,296.7	2,319.7	-	2,121.0	2,319.7	2,319.7	-
2,164.7	2,186.3	2,208.2	2,230.3	2,252.6	2,275.1	-	2,080.2	2,275.1	2,275.1	-

Kenya
On-Farm Maize Storage Analysis
MAIZE Crop Model
YIELDS AND INPUTS
(Per Acre)

		January-November						
	Unit	Existing Technology 1 to 10	New Technology 1 to 10	Increments 1 to 10	Present 1	Future Existing 10	Future New 10	Percentage Change %
Yields	Kg	1,620	1,620	-	1,620	1,620	1,620	-
By Products								
Maize Stalks	acre	1	1	-	1	1	1	-
Maize Cobs	acre	1	1	-	1	1	1	-
Operating								
Inputs								
Land Rent value	acre	1	1	-	1	1	1	-
Tractor Plough	acre	1	1	-	1	1	1	-
Maize seed	Kg	8	8	-	8	8	8	-
Planter Hire	acre	1	1	-	1	1	1	-
DAP Fertilizer	bag	50	50	-	50	50	50	-
CAN fertilizer	bag	50	50	-	50	50	50	-
Tractor to store	acre	1	1	-	1	1	1	-
Sheller Hire	bag	1	1	-	1	1	1	-
Gunny bags	bag	10	10	-	10	10	10	-
Labor								
Land Preparation	day	1	1	-	1	1	1	-
Planting	day	3	3	-	3	3	3	-
Spraying	day	1	1	-	1	1	1	-
Top Dressing	day	3	3	-	3	3	3	-
Dusting	day	3	3	-	3	3	3	-
Harvesting	day	5	5	-	5	5	5	-
Shelling	day	4	4	-	4	4	4	-
weighing and loading	day	2	2	-	2	2	2	-

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Kenya
On-Farm Maize Storage Analysis
MAIZE Crop Model
FINANCIAL BUDGET
(In KSh Per Acre)

January-Nov

	Existing Technology												
	1	2	3	4	5	6	7	8	9	10	1	2	3
Revenue													
Main Production													
Maize	10,913.5	11,022.6	11,132.8	11,244.1	11,356.6	11,470.1	11,584.9	11,700.7	11,817.7	11,935.9	10,913.5	11,022.6	11,132.8
By Products													
Maize Stalks	151.5	153.0	154.5	156.1	157.7	159.2	160.8	162.4	164.1	165.7	151.5	153.0	154.5
Maize Cobs	101.0	102.0	103.0	104.1	105.1	106.2	107.2	108.3	109.4	110.5	101.0	102.0	103.0
Sub-total Byproducts	252.5	255.0	257.6	260.2	262.8	265.4	268.0	270.7	273.4	276.2	252.5	255.0	257.6
Sub-total Revenue	11,166.0	11,277.6	11,390.4	11,504.3	11,619.3	11,735.5	11,852.9	11,971.4	12,091.1	12,212.0	11,166.0	11,277.6	11,390.4
Input costs													
Land Rent value	606.0	612.1	618.2	624.4	630.6	636.9	643.3	649.7	656.2	662.8	606.0	612.1	618.2
Tractor Plough	606.0	612.1	618.2	624.4	630.6	636.9	643.3	649.7	656.2	662.8	606.0	612.1	618.2
Maize seed	141.4	142.8	144.2	145.7	147.1	148.6	150.1	151.6	153.1	154.6	141.4	142.8	144.2
Planter Hire	404.0	408.0	412.1	416.2	420.4	424.6	428.9	433.1	437.5	441.8	404.0	408.0	412.1
DAP Fertilizer	606.0	612.1	618.2	624.4	630.6	636.9	643.3	649.7	656.2	662.8	606.0	612.1	618.2
CAN fertilizer	505.0	510.1	515.2	520.3	525.5	530.8	536.1	541.4	546.8	552.3	505.0	510.1	515.2
Tractor to store	303.0	306.0	309.1	312.2	315.3	318.5	321.6	324.9	328.1	331.4	303.0	306.0	309.1
Sheller Hire	353.5	357.0	360.6	364.2	367.9	371.5	375.2	379.0	382.8	386.6	353.5	357.0	360.6
Gunny bags	218.2	220.3	222.5	224.8	227.0	229.3	231.6	233.9	236.2	238.6	218.2	220.3	222.5
Sub-total Input costs	3,743.1	3,780.5	3,818.3	3,856.5	3,895.0	3,934.0	3,973.3	4,013.1	4,053.2	4,093.7	3,743.1	3,780.5	3,818.3
Income (Before Labor Costs)	7,422.9	7,497.1	7,572.1	7,647.8	7,724.3	7,801.5	7,879.6	7,958.3	8,037.9	8,118.3	7,422.9	7,497.1	7,572.1
Labor costs													
Land Preparation	40.4	40.8	41.2	41.6	42.0	42.5	42.9	43.3	43.7	44.2	40.4	40.8	41.2
Planting	121.2	122.4	123.6	124.9	126.1	127.4	128.7	129.9	131.2	132.6	121.2	122.4	123.6
Spraying	30.3	30.6	30.9	31.2	31.5	31.8	32.2	32.5	32.8	33.1	30.3	30.6	30.9
Top Dressing	60.6	61.2	61.8	62.4	63.1	63.7	64.3	65.0	65.6	66.3	60.6	61.2	61.8
Dusting	60.6	61.2	61.8	62.4	63.1	63.7	64.3	65.0	65.6	66.3	60.6	61.2	61.8
Harvesting	202.0	204.0	206.1	208.1	210.2	212.3	214.4	216.6	218.7	220.9	202.0	204.0	206.1
Shelling	141.4	142.8	144.2	145.7	147.1	148.6	150.1	151.6	153.1	154.6	141.4	142.8	144.2
weighing and loading	70.7	71.4	72.1	72.8	73.6	74.3	75.0	75.8	76.6	77.3	70.7	71.4	72.1
Sub-total Labor costs	727.2	734.5	741.8	749.2	756.7	764.3	771.9	779.7	787.5	795.3	727.2	734.5	741.8
Income (After Labor Costs)	6,695.7	6,762.7	6,830.3	6,898.6	6,967.6	7,037.2	7,107.6	7,178.7	7,250.5	7,323.0	6,695.7	6,762.7	6,830.3

Income Before Labor: IRR = None, NPV = 0.00
Income After Labor: IRR = None, NPV = 0.00

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New Technology							Increments	Present	Future Existing	Future New	Percentage Change
4	5	6	7	8	9	10	1 to 10	1	10	10	%
11,244.1	11,356.6	11,470.1	11,584.9	11,700.7	11,817.7	11,935.9	-	10,913.5	11,935.9	11,935.9	-
156.1	157.7	159.2	160.8	162.4	164.1	165.7	-	151.5	165.7	165.7	-
104.1	105.1	106.2	107.2	108.3	109.4	110.5	-	101.0	110.5	110.5	-
260.2	262.8	265.4	268.0	270.7	273.4	276.2	-	252.5	276.2	276.2	-
11,504.3	11,619.3	11,735.5	11,852.9	11,971.4	12,091.1	12,212.0	-	11,166.0	12,212.0	12,212.0	-
624.4	630.6	636.9	643.3	649.7	656.2	662.8	-	606.0	662.8	662.8	-
624.4	630.6	636.9	643.3	649.7	656.2	662.8	-	606.0	662.8	662.8	-
145.7	147.1	148.6	150.1	151.6	153.1	154.6	-	141.4	154.6	154.6	-
416.2	420.4	424.6	428.9	433.1	437.5	441.8	-	404.0	441.8	441.8	-
624.4	630.6	636.9	643.3	649.7	656.2	662.8	-	606.0	662.8	662.8	-
520.3	525.5	530.8	536.1	541.4	546.8	552.3	-	505.0	552.3	552.3	-
312.2	315.3	318.5	321.6	324.9	328.1	331.4	-	303.0	331.4	331.4	-
364.2	367.9	371.5	375.2	379.0	382.8	386.6	-	353.5	386.6	386.6	-
224.8	227.0	229.3	231.6	233.9	236.2	238.6	-	218.2	238.6	238.6	-
3,856.5	3,895.0	3,934.0	3,973.3	4,013.1	4,053.2	4,093.7	-	3,743.1	4,093.7	4,093.7	-
7,647.8	7,724.3	7,801.5	7,879.6	7,958.3	8,037.9	8,118.3	-	7,422.9	8,118.3	8,118.3	-
41.6	42.0	42.5	42.9	43.3	43.7	44.2	-	40.4	44.2	44.2	-
124.9	126.1	127.4	128.7	129.9	131.2	132.6	-	121.2	132.6	132.6	-
31.2	31.5	31.8	32.2	32.5	32.8	33.1	-	30.3	33.1	33.1	-
62.4	63.1	63.7	64.3	65.0	65.6	66.3	-	60.6	66.3	66.3	-
62.4	63.1	63.7	64.3	65.0	65.6	66.3	-	60.6	66.3	66.3	-
208.1	210.2	212.3	214.4	216.6	218.7	220.9	-	202.0	220.9	220.9	-
145.7	147.1	148.6	150.1	151.6	153.1	154.6	-	141.4	154.6	154.6	-
72.8	73.6	74.3	75.0	75.8	76.6	77.3	-	70.7	77.3	77.3	-
749.2	756.7	764.3	771.9	779.7	787.5	795.3	-	727.2	795.3	795.3	-
6,898.6	6,967.6	7,037.2	7,107.6	7,178.7	7,250.5	7,323.0	-	6,695.7	7,323.0	7,323.0	-

Kenya
On-Farm Maize Storage Analysis
DAIRY Crop Model
YIELDS AND INPUTS
(Per Acre)

		January-November						
		Existing Technology	New Technology	Increments	Present	Future Existing	Future New	Percentage Change
	Unit	1 to 10	1 to 10	1 to 10		10	10	%
Main Production								
Milk to KCC	Litre	1,800	1,800	-	1,800	1,800	1,800	-
Milk local sales	litre	60	60	-	60	60	60	-
Cull Cows	acre	1	1	-	1	1	1	-
Heifer calves	acre	1	1	-	1	1	1	-
Bull calves	acre	1	1	-	1	1	1	-
By Products								
Cattle Waste	acre	1	1	-	1	1	1	-
Investment								
Inputs								
Livestock	acre	1	1	-	1	1	1	-
Fencing	acre	1	1	-	1	1	1	-
Milking sheds	acre	1	1	-	1	1	1	-
Milk cans	acre	1	1	-	1	1	1	-
Feeding Buckets	acre	1	1	-	1	1	1	-
Labor								
Dairy permanent labour	day	24	24	-	24	24	24	-
Operating								
Inputs								
Grazing land	acre	1	1	-	1	1	1	-
Napier grass	acre	1	1	-	1	1	1	-
salt lick	acre	1	1	-	1	1	1	-
dipping	acre	1	1	-	1	1	1	-
Disease control	acre	1	1	-	1	1	1	-
Drugs and chemicals	acre	1	1	-	1	1	1	-
Dairy Meal	acre	1	1	-	1	1	1	-
Labor								
Dairy casual labour	day	20	20	-	20	20	20	-

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Kenya
On-Farm Maize Storage Analysis
DAIRY Crop Model
FINANCIAL BUDGET
(In KSh Per Acre)

January-Nov

	Existing Technology												
	1	2	3	4	5	6	7	8	9	10	1	2	3
Revenue													
Main Production													
Milk to KCC	9,090.0	9,180.9	9,272.7	9,365.4	9,459.1	9,553.7	9,649.2	9,745.7	9,843.2	9,941.6	9,090.0	9,180.9	9,272.7
Milk local sales	333.3	336.6	340.0	343.4	346.8	350.3	353.8	357.3	360.9	364.5	333.3	336.6	340.0
Cull Cows	2,195.7	2,217.7	2,239.9	2,262.3	2,284.9	2,307.7	2,330.8	2,354.1	2,377.7	2,401.4	2,195.7	2,217.7	2,239.9
Heifer calves	454.5	459.0	463.6	468.3	473.0	477.7	482.5	487.3	492.2	497.1	454.5	459.0	463.6
Bull calves	757.5	765.1	772.7	780.5	788.3	796.1	804.1	812.1	820.3	828.5	757.5	765.1	772.7
Sub-total Main Production	12,831.0	12,959.4	13,088.9	13,219.8	13,352.0	13,485.6	13,620.4	13,756.6	13,894.2	14,033.1	12,831.0	12,959.4	13,088.9
By Products													
Cattle Waste	60.6	61.2	61.8	62.4	63.1	63.7	64.3	65.0	65.6	66.3	60.6	61.2	61.8
Sub-total Revenue	12,891.6	13,020.6	13,150.8	13,282.3	13,415.1	13,549.2	13,684.7	13,821.6	13,959.8	14,099.4	12,891.6	13,020.6	13,150.8
Input costs													
Investment costs													
Livestock	694.4	701.3	708.3	715.4	722.6	729.8	737.1	744.5	751.9	759.4	694.4	701.3	708.3
Fencing	221.2	223.4	225.6	227.9	230.2	232.5	234.8	237.1	239.5	241.9	221.2	223.4	225.6
Milking sheds	151.5	153.0	154.5	156.1	157.7	159.2	160.8	162.4	164.1	165.7	151.5	153.0	154.5
Milk cans	242.4	244.8	247.3	249.7	252.2	254.8	257.3	259.9	262.5	265.1	242.4	244.8	247.3
Feeding Buckets	50.5	51.0	51.5	52.0	52.6	53.1	53.6	54.1	54.7	55.2	50.5	51.0	51.5
Sub-total Investment Costs	1,360.0	1,373.6	1,387.3	1,401.2	1,415.2	1,429.3	1,443.6	1,458.1	1,472.6	1,487.4	1,360.0	1,373.6	1,387.3
Operating Costs													
Grazing land	606.0	612.1	618.2	624.4	630.6	636.9	643.3	649.7	656.2	662.8	606.0	612.1	618.2
Napier grass	1,212.0	1,224.1	1,236.4	1,248.7	1,261.2	1,273.8	1,286.6	1,299.4	1,312.4	1,325.5	1,212.0	1,224.1	1,236.4
salt lick	138.6	140.0	141.4	142.8	144.2	145.6	147.1	148.6	150.1	151.6	138.6	140.0	141.4
dipping	323.2	326.4	329.7	333.0	336.3	339.7	343.1	346.5	350.0	353.5	323.2	326.4	329.7
Disease control	555.5	561.1	566.7	572.3	578.1	583.8	589.7	595.6	601.5	607.5	555.5	561.1	566.7
Drugs and chemicals	343.4	346.8	350.3	353.8	357.3	360.9	364.5	368.2	371.9	375.6	343.4	346.8	350.3
Dairy Meal	727.2	734.5	741.8	749.2	756.7	764.3	771.9	779.7	787.5	795.3	727.2	734.5	741.8
Sub-total Operating Costs	3,905.9	3,944.9	3,984.4	4,024.2	4,064.5	4,105.1	4,146..	4,187.6	4,229.5	4,271.8	3,905.9	3,944.9	3,984.4
Sub-total Input costs	5,265.8	5,318.5	5,371.7	5,425.4	5,479.7	5,534.4	5,589.8	5,645.7	5,702.1	5,759.2	5,265.8	5,318.5	5,371.7
Income (Before Labor Costs)	7,625.8	7,702.1	7,779.1	7,856.9	7,935.4	8,014.8	8,094.9	8,175.9	8,257.7	8,340.2	7,625.8	7,702.1	7,779.1
Labor costs													
Investment costs													
Dairy permanent labour	484.8	489.6	494.5	499.5	504.5	509.5	514.6	519.8	525.0	530.2	484.8	489.6	494.5
Operating Costs													
Dairy casual labour	404.0	408.0	412.1	416.2	420.4	424.6	428.9	433.1	437.5	441.8	404.0	408.0	412.1
Sub-total Labor costs	888.8	897.7	906.7	915.7	924.9	934.1	943.5	952.9	962.4	972.1	888.8	897.7	906.7
Income (After Labor Costs)	6,737.0	6,804.4	6,872.4	6,941.1	7,010.6	7,080.7	7,151.5	7,223.0	7,295.2	7,368.2	6,737.0	6,804.4	6,872.4

Income Before Labor: IRR = 0.0%, NPV = 0.00
Income After Labor: IRR = 0.0%, NPV = 0.00

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New Technology							Increments	Present	Future Existing	Future New	Percentage Change
4	5	6	7	8	9	10	1 to 10	1	10	10	%
9,365.4	9,459.1	9,553.7	9,649.2	9,745.7	9,843.2	9,941.6	-	9,090.0	9,941.6	9,941.6	-
343.4	346.8	350.3	353.8	357.3	360.9	364.5	-	333.3	364.5	364.5	-
2,262.3	2,284.9	2,307.7	2,330.8	2,354.1	2,377.7	2,401.4	-	2,195.7	2,401.4	2,401.4	-
468.3	473.0	477.7	482.5	487.3	492.2	497.1	-	454.5	497.1	497.1	-
780.5	788.3	796.1	804.1	812.1	820.3	828.5	-	757.5	828.5	828.5	-
13,219.8	13,352.0	13,485.6	13,620.4	13,756.6	13,894.2	14,033.1	-	12,831.0	14,033.1	14,033.1	-
62.4	63.1	63.7	64.3	65.0	65.6	66.3	-	60.6	66.3	66.3	-
13,282.3	13,415.1	13,549.2	13,684.7	13,821.6	13,959.8	14,099.4	-	12,891.6	14,099.4	14,099.4	-
715.4	722.6	729.8	737.1	744.5	751.9	759.4	-	694.4	759.4	759.4	-
227.9	230.2	232.5	234.8	237.1	239.5	241.9	-	221.2	241.9	241.9	-
156.1	157.7	159.2	160.8	162.4	164.1	165.7	-	151.5	165.7	165.7	-
249.7	252.2	254.8	257.3	259.9	262.5	265.1	-	242.4	265.1	265.1	-
52.0	52.6	53.1	53.6	54.1	54.7	55.2	-	50.5	55.2	55.2	-
1,401.2	1,415.2	1,429.3	1,443.6	1,458.1	1,472.6	1,487.4	-	1,360.0	1,487.4	1,487.4	-
624.4	630.6	636.9	643.3	649.7	656.2	662.8	-	606.0	662.8	662.8	-
1,248.7	1,261.2	1,273.8	1,286.6	1,299.4	1,312.4	1,325.5	-	1,212.0	1,325.5	1,325.5	-
142.8	144.2	145.6	147.1	148.6	150.1	151.6	-	138.6	151.6	151.6	-
333.0	336.3	339.7	343.1	346.5	350.0	353.5	-	323.2	353.5	353.5	-
572.3	578.1	583.8	589.7	595.6	601.5	607.5	-	555.5	607.5	607.5	-
353.8	357.3	360.9	364.5	368.2	371.9	375.6	-	343.4	375.6	375.6	-
749.2	756.7	764.3	771.9	779.7	787.5	795.3	-	727.2	795.3	795.3	-
4,024.2	4,064.5	4,105.1	4,146.2	4,187.6	4,229.5	4,271.8	-	3,905.9	4,271.8	4,271.8	-
5,425.4	5,479.7	5,534.4	5,589.8	5,645.7	5,702.1	5,759.2	-	5,265.9	5,759.2	5,759.2	-
7,856.9	7,935.4	8,014.8	8,094.9	8,175.9	8,257.7	8,340.2	-	7,625.8	8,340.2	8,340.2	-
499.5	504.5	509.5	514.6	519.8	525.0	530.2	-	484.8	530.2	530.2	-
416.2	420.4	424.6	428.9	433.1	437.5	441.8	-	404.0	441.8	441.8	-
915.7	924.9	934.1	943.5	952.9	962.4	972.1	-	888.8	972.1	972.1	-
6,941.1	7,010.6	7,080.7	7,151.5	7,223.0	7,295.2	7,368.2	-	6,737.0	7,368.2	7,368.2	-

Kenya
Small Scale On-Farm Maize Storage Analysis
Storage Investment Activity
YIELDS AND INPUTS

		January-November									
		Existing Technology		New Technology							
			2 to		2 to	Increments		Present	Future Existing	Future New	Percentage Change
	Unit	1	10	1	10	1	2 to 10	1	2	2	9
Main Production											
Maize Stored	Kg	900	900	2,250	2,250	1,350	1,350	900	900	2,250	150
Maize Immediate Sale	Kg	1,350	1,350	-	-	-1,350	-1,350	1,350	1,350	-	-
Maize saved-loss reduction	Kg	135	135	450	450	315	315	135	135	450	233
Investment											
Inputs											
Store Construction Cost	unit	0.33	-	1	-	0.67	-	0.33	-	-	-
Labor											
Store construction labour	day	3	-	8	-	5	-	3	-	-	-
Operating											
Inputs											
Interest on capital	unit	0.1	0.1	1	1	0.9	0.9	0.1	0.1	1	900
Cost of insecticide	unit	0.25	0.25	1	1	0.75	0.75	0.25	0.25	1	300
Annual maintenance costs	unit	0.1	0.1	1	1	0.9	0.9	0.1	0.1	1	900
Cost of gunny bags	unit	0.5	0.5	1	1	0.5	0.5	0.5	0.5	1	100
Value of maize losses	Kg	450	450	101.25	101.25	-348.75	-348.75	450	450	101.25	-78
Home Consumption	Kg	900	900	900	900	-	-	900	900	900	-
Labor											
Storage Handling labour	day	2	2	5	5	3	3	2	2	5	150

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	Existing Technology												
	1	2	3	4	5	6	7	8	9	10	1	2	3
Revenue													
Maize Stored	8,181.0	8,262.8	8,345.4	8,428.9	8,513.2	8,598.3	8,684.3	8,771.1	8,858.9	8,947.4	20,452.5	20,657.0	20,863.6
Maize Immediate Sale	9,094.5	9,185.5	9,277.3	9,370.1	9,463.8	9,558.5	9,654.0	9,750.6	9,848.1	9,946.6	-	-	-
Maize saved-loss reduction	1,227.2	1,239.4	1,251.8	1,264.3	1,277.0	1,289.7	1,302.6	1,315.7	1,328.8	1,342.1	4,090.5	4,131.4	4,172.7
Sub-total Revenue	18,502.7	18,687.7	18,874.6	19,063.3	19,254.0	19,446.5	19,641.0	19,837.4	20,035.8	20,236.1	24,543.0	24,788.4	25,036.3
Input costs													
Investment costs													
Store Construction Cost	4,999.5	-	-	-	-	-	-	-	-	-	15,150.0	-	-
Operating Costs													
Interest on capital	192.0	193.9	195.9	197.8	199.8	201.8	203.8	205.8	207.9	210.0	1,920.0	1,939.2	1,958.6
Cost of insecticide	74.0	74.8	75.5	76.3	77.0	77.8	78.6	79.4	80.2	81.0	296.1	299.1	302.1
Annual maintenance costs	45.5	45.9	46.4	46.8	47.3	47.8	48.2	48.7	49.2	49.7	454.5	459.0	463.6
Cost of gunny bags	126.3	127.5	128.8	130.1	131.4	132.7	134.0	135.4	136.7	138.1	252.5	255.0	257.6
Value of maize losses	3,031.5	3,061.8	3,092.4	3,123.4	3,154.6	3,186.2	3,218.0	3,250.2	3,282.7	3,315.5	682.1	688.9	695.8
Home Consumption	8,181.0	8,262.8	8,345.4	8,428.9	8,513.2	8,598.3	8,684.3	8,771.1	8,858.9	8,947.4	8,181.0	8,262.8	8,345.4
Sub-total Operating Costs	11,650.2	11,766.7	11,884.4	12,003.3	12,123.3	12,244.5	12,367.0	12,490.6	12,615.5	12,741.7	11,786.2	11,904.0	12,023.1
Sub-total Input costs	16,649.7	11,766.7	11,884.4	12,003.3	12,123.3	12,244.5	12,367.0	12,490.6	12,615.5	12,741.7	26,936.2	11,904.0	12,023.1
Income (Before Labor Costs)	1,853.0	6,921.0	6,990.2	7,060.1	7,130.7	7,202.0	7,274.0	7,346.8	7,420.2	7,494.4	-2,393.2	12,884.4	13,013.2
Labor costs													
Investment costs													
Store construction labour	75.8	-	-	-	-	-	-	-	-	-	202.0	-	-
Operating Costs													
Storage Handling labour	50.5	51.0	51.5	52.0	52.6	53.1	53.6	54.1	54.7	55.2	126.3	127.5	128.8
Sub-total Labor costs	126.3	51.0	51.5	52.0	52.6	53.1	53.6	54.1	54.7	55.2	328.3	127.5	128.8
Income (After Labor Costs)	1,726.7	6,870.0	6,938.7	7,008.1	7,078.1	7,148.9	7,220.4	7,292.6	7,365.5	7,439.2	-2,721.4	12,756.9	12,884.4

Income Before Labor: IRR = 141.4%, NPV = 28,436.91
Income After Labor: IRR = 133.3%, NPV = 27,838.92

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Kenya
Small Scale On-Farm Maize Storage Analysis
Storage Investment Activity
FINANCIAL BUDGET
(In Kenya Shillings)

January-November

New Technology							Increments								
4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9
21,072.2	21,283.0	21,495.8	21,710.7	21,927.8	22,147.1	22,368.6	12,271.5	12,394.2	12,518.2	12,643.3	12,769.8	12,897.5	13,026.4	13,156.7	13,288.3
-	-	-	-	-	-	-	-9,094.5	-9,185.5	-9,277.3	-9,370.1	-9,463.8	-9,558.5	-9,654.0	-9,750.6	-9,848.1
4,214.4	4,256.6	4,299.2	4,342.1	4,385.6	4,429.4	4,473.7	2,863.4	2,892.0	2,920.9	2,950.1	2,979.6	3,009.4	3,039.5	3,069.9	3,100.6
25,286.7	25,539.5	25,794.9	26,052.9	26,313.4	26,576.6	26,842.3	6,040.3	6,100.7	6,161.7	6,223.3	6,285.6	6,348.4	6,411.9	6,476.0	6,540.8
-	-	-	-	-	-	-	10,150.5	-	-	-	-	-	-	-	-
1,978.1	1,997.9	2,017.9	2,038.1	2,058.5	2,079.0	2,099.8	1,728.0	1,745.2	1,762.7	1,780.3	1,798.1	1,816.1	1,834.3	1,852.6	1,871.1
305.1	308.2	311.2	314.4	317.5	320.7	323.9	222.1	224.3	226.6	228.8	231.1	233.4	235.8	238.1	240.5
468.3	473.0	477.7	482.5	487.3	492.2	497.1	409.1	413.1	417.3	421.4	425.7	429.9	434.2	438.6	442.9
260.2	262.8	265.4	268.0	270.7	273.4	276.2	126.3	127.5	128.8	130.1	131.4	132.7	134.0	135.4	136.7
702.8	709.8	716.9	724.1	731.3	738.6	746.0	-2,349.4	-2,372.9	-2,396.6	-2,420.6	-2,444.8	-2,469.3	-2,494.0	-2,518.9	-2,544.1
8,428.9	8,513.2	8,598.3	8,684.3	8,771.1	8,858.9	8,947.4	-	-	-	-	-	-	-	-	-
12,143.3	12,264.7	12,387.4	12,511.3	12,636.4	12,762.7	12,890.4	135.9	137.3	138.7	140.1	141.5	142.9	144.3	145.7	147.2
12,143.3	12,264.7	12,387.4	12,511.3	12,636.4	12,762.7	12,890.4	10,286.4	137.3	138.7	140.1	141.5	142.9	144.3	145.7	147.2
13,143.4	13,274.8	13,407.5	13,541.6	13,677.0	13,813.8	13,951.9	-4,146.1	5,963.4	6,023.0	6,083.3	6,144.1	6,205.5	6,267.6	6,330.3	6,393.6
-	-	-	-	-	-	-	126.3	-	-	-	-	-	-	-	-
130.1	131.4	132.7	134.0	135.4	136.7	138.1	75.8	76.5	77.3	78.0	78.8	79.6	80.4	81.2	82.0
130.1	131.4	132.7	134.0	135.4	136.7	138.1	202.0	76.5	77.3	78.0	78.8	79.6	80.4	81.2	82.0
13,013.3	13,143.4	13,274.9	13,407.6	13,541.7	13,677.1	13,813.9	-4,448.1	5,886.9	5,945.8	6,005.2	6,065.3	6,125.9	6,187.2	6,249.1	6,311.6

	Present	Future Existing	Future New	Percentage Change
10	1	10	10	%
13,421.2	8,181.0	8,947.4	22,368.6	150.0
-9,946.6	9,094.5	9,946.6	-	9.0
3,131.6	1,227.2	1,342.1	4,473.7	233.0
6,606.2	18,502.7	20,236.1	26,842.3	33.0
-	4,999.5	-	-	-
1,889.8	192.0	210.0	2,099.8	900.0
242.9	74.0	81.0	323.9	300.0
447.4	45.5	49.7	497.1	900.0
138.1	126.3	138.1	276.2	100.0
-2,569.5	3,031.5	3,315.5	746.0	-78.0
-	8,181.0	8,947.4	8,947.4	-
148.7	11,650.2	12,741.7	12,890.4	1.0
148.7	16,649.7	12,741.7	12,890.4	1.0
6,457.5	1,853.0	7,494.4	13,951.9	86.0
-	75.8	-	-	-
82.8	50.5	55.2	138.1	150.0
82.8	126.3	55.2	138.1	150.0
6,374.7	1,726.7	7,439.2	13,813.9	86.0

Kenya
Small Scale On-Farm Maize Storage Analysis
Storage Investment Activity
YIELDS AND INPUTS

		January-November								
		Existing Technology	New Technology		Increments		Present	Future Existing	Future New	Percentage Change
	Unit	1 to 10	1	2 to 10	1	2 to 10	1	10	1	%
Main Production										
Maize Stored	Kg	-	2,250	2,250	2,250	2,250	-	-	2,250	-
Maize Immediate Sale	Kg	2,250	-	-	-2,250	-2,250	2,250	2,250	-	-
Saved Field Losses	Kg	-	360	360	360	360	-	-	360	-
Investment										
Inputs										
Store Construction Cost	unit	-	1	-	1	-	-	-	-	-
Labor										
Store construction labour	day	-	8	-	8	-	-	-	-	-
Operating										
Inputs										
Interest on capital	unit	-	1	1	1	1	-	-	1	-
Cost of insecticide	unit	-	1	1	1	1	-	-	1	-
Annual maintenance costs	unit	-	1	1	1	1	-	-	1	-
Cost of gunny bags	unit	-	1	1	1	1	-	-	1	-
Value of maize losses	Kg	360	101.25	101.25	-258.75	-258.75	360	360	101.25	-72
Home Consumption	unit	-	900	900	900	900	-	-	900	-
Maize Bought	unit	900	-	-	-900	-900	900	900	-	-
Labor										
Storage Handling labour	day	-	5	5	5	5	-	-	5	-

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	Existing Technology												
	1	2	3	4	5	6	7	8	9	10	1	2	3
Revenue													
Maize Stored	-	-	-	-	-	-	-	-	-	-	20,452.5	20,657.0	20,863.6
Maize Immediate Sale	15,157.6	15,309.2	15,462.2	15,616.9	15,773.0	15,930.8	16,090.1	16,251.0	16,413.5	16,577.6	-	-	-
Saved Field Losses	-	-	-	-	-	-	-	-	-	-	3,272.4	3,305.1	3,338.2
Sub-total Revenue	15,157.6	15,309.2	15,462.2	15,616.9	15,773.0	15,930.8	16,090.1	16,251.0	16,413.5	16,577.6	23,724.9	23,962.1	24,201.8
Input costs													
Investment costs													
Store Construction Cost	-	-	-	-	-	-	-	-	-	-	15,150.0	-	-
Operating Costs													
Interest on capital	-	-	-	-	-	-	-	-	-	-	1,920.0	1,939.2	1,958.6
Cost of insecticide	-	-	-	-	-	-	-	-	-	-	296.1	299.1	302.1
Annual maintenance costs	-	-	-	-	-	-	-	-	-	-	454.5	459.0	463.6
Cost of gunny bags	-	-	-	-	-	-	-	-	-	-	252.5	255.0	257.6
Value of maize losses	2,425.2	2,449.5	2,474.0	2,498.7	2,523.7	2,548.9	2,574.4	2,600.2	2,626.2	2,652.4	682.1	688.9	695.8
Home Consumption	-	-	-	-	-	-	-	-	-	-	8,181.0	8,262.8	8,345.4
Maize Bought	8,181.0	8,262.8	8,345.4	8,428.9	8,513.2	8,598.3	8,684.3	8,771.1	8,858.9	8,947.4	-	-	-
Sub-total Operating Costs	10,606.2	10,712.3	10,819.4	10,927.6	11,036.9	11,147.2	11,258.7	11,371.3	11,485.0	11,599.9	11,786.2	11,904.0	12,023.1
Sub-total Input costs	10,606.2	10,712.3	10,819.4	10,927.6	11,036.9	11,147.2	11,258.7	11,371.3	11,485.0	11,599.9	26,936.2	11,904.0	12,023.1
Income (Before Labor Costs)	4,551.4	4,596.9	4,642.8	4,689.3	4,736.2	4,783.5	4,831.4	4,879.7	4,928.5	4,977.8	-3,211.3	12,058.1	12,178.7
Labor costs													
Investment costs													
Store construction labour	-	-	-	-	-	-	-	-	-	-	202.0	-	-
Operating Costs													
Storage Handling labour	-	-	-	-	-	-	-	-	-	-	126.3	127.5	128.8
Sub-total Labor costs	-	-	-	-	-	-	-	-	-	-	328.3	127.5	128.8
Income (After Labor Costs)	4,551.4	4,596.9	4,642.8	4,689.3	4,736.2	4,783.5	4,831.4	4,879.7	4,928.5	4,977.8	-3,539.5	11,930.6	12,049.9

Income Before Labor: IRR = 86.9%, NPV = 33,352.06
Income After Labor: IRR = 91.4%, NPV = 32,363.06

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Kenya
Small Scale On-Farm Maize Storage Analysis
Storage Investment Activity
FINANCIAL BUDGET
(In Kenya Shillings)

January-November

New Technology							Increments							
4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
21,072.2	21,283.0	21,495.8	21,710.7	21,927.8	22,147.1	22,368.6	20,452.5	20,657.0	20,863.6	21,072.2	21,283.0	21,495.8	21,710.7	21,927.8
-	-	-	-	-	-	-	-15,157.6	-15,309.2	-15,462.2	-15,616.9	-15,773.0	-15,930.8	-16,090.1	-16,251.0
3,371.6	3,405.3	3,439.3	3,473.7	3,508.5	3,543.5	3,579.0	3,272.4	3,305.1	3,338.2	3,371.6	3,405.3	3,439.3	3,473.7	3,508.5
24,443.8	24,688.2	24,935.1	25,184.5	25,436.3	25,690.7	25,947.6	8,567.3	8,653.0	8,739.5	8,826.9	8,915.2	9,004.3	9,094.4	9,185.3
-	-	-	-	-	-	-	15,150.0	-	-	-	-	-	-	-
1,978.1	1,997.9	2,017.9	2,038.1	2,058.5	2,079.0	2,099.8	1,920.0	1,939.2	1,958.6	1,978.1	1,997.9	2,017.9	2,038.1	2,058.5
305.1	308.2	311.2	314.4	317.5	320.7	323.9	296.1	299.1	302.1	305.1	308.2	311.2	314.4	317.5
468.3	473.0	477.7	482.5	487.3	492.2	497.1	454.5	459.0	463.6	468.3	473.0	477.7	482.5	487.3
260.2	262.8	265.4	268.0	270.7	273.4	276.2	252.5	255.0	257.6	260.2	262.8	265.4	268.0	270.7
702.8	709.8	716.9	724.1	731.3	738.6	746.0	-1,743.1	-1,760.6	-1,778.2	-1,795.9	-1,813.9	-1,832.0	-1,850.4	-1,868.9
8,428.9	8,513.2	8,598.3	8,684.3	8,771.1	8,858.9	8,947.4	8,181.0	8,262.8	8,345.4	8,428.9	8,513.2	8,598.3	8,684.1	8,771.1
-	-	-	-	-	-	-	-8,181.0	-8,262.8	-8,345.4	-8,428.9	-8,513.2	-8,598.3	-8,684.3	-8,771.1
12,143.3	12,264.7	12,387.4	12,511.3	12,636.4	12,762.7	12,890.4	1,180.0	1,191.9	1,203.7	1,215.7	1,227.9	1,240.2	1,252.6	1,265.1
12,143.3	12,264.7	12,387.4	12,511.3	12,636.4	12,762.7	12,890.4	16,330.0	1,191.9	1,203.7	1,215.7	1,227.9	1,240.2	1,252.6	1,265.1
12,300.5	12,423.5	12,547.7	12,673.2	12,799.9	12,927.9	13,057.2	-7,762.6	7,461.2	7,535.8	7,611.2	7,687.3	7,764.2	7,841.8	7,920.2
-	-	-	-	-	-	-	202.0	-	-	-	-	-	-	-
130.1	131.4	132.7	134.0	135.4	136.7	138.1	126.3	127.5	128.8	130.1	131.4	132.7	134.0	135.4
130.1	131.4	132.7	134.0	135.4	136.7	138.1	328.3	127.5	128.8	130.1	131.4	132.7	134.0	135.4
12,170.4	12,292.1	12,415.0	12,539.2	12,664.6	12,791.2	12,919.1	-8,090.9	7,333.7	7,407.1	7,481.1	7,555.9	7,631.5	7,707.8	7,784.9

9	10	Present 1	Future Existing 10	Future New 10	Percentage Change 9
22,147.1	22,368.6	-	-	22,368.6	-
-16,413.5	-16,577.6	15,157.6	16,577.6	-	9.0
3,543.5	3,579.0	-	-	3,579.0	-
9,277.2	9,370.0	15,157.6	16,577.6	25,947.4	57.0
-	-	-	-	-	-
2,079.0	2,099.8	-	-	2,099.8	-
320.7	323.9	-	-	323.9	-
492.2	497.1	-	-	497.1	-
273.4	276.2	-	-	276.2	-
-1,887.6	-1,906.4	2,425.2	2,652.4	746.0	-72.0
8,858.9	8,947.4	-	-	8,947.4	-
-8,858.9	-8,947.4	8,181.0	8,947.4	-	9.0
1,277.7	1,290.5	10,606.2	11,599.9	12,890.4	11.0
1,277.7	1,290.5	10,606.2	11,599.9	12,890.4	11.0
7,999.4	8,079.4	4,551.4	4,977.8	13,057.2	162.0
-	-	-	-	-	-
136.7	138.1	-	-	138.1	-
136.7	138.1	-	-	138.1	-
7,862.7	7,941.4	4,551.4	4,977.8	12,919.1	160.0

Kenya
Small Scale On-Farm Maize Storage Analysis
Storage Investment Activity
YIELDS AND INPUTS

		January-November								
		Existing Technology	New Technology		Increments		Present	Future Existing	Future New	Percentage Change
	Unit	1 to 10	1	2 to 10	1	2 to 10	1	10	2	%
Main Production										
Maize Stored	Kg	-	2,250	2,250	2,250	2,250	-	-	2,250	-
Maize Immediate Sale	Kg	2,250	-	-	-2,250	-2,250	2,250	2,250	-	-
Investment										
Inputs										
Store Construction Cost	unit	-	0.33	-	0.33	-	-	-	-	-
Labor										
Store construction labour	day	-	3	-	3	-	-	-	-	-
Operating										
Inputs										
Interest on capital	unit	-	0.1	0.1	0.1	0.1	-	-	0.1	-
Cost of insecticide	unit	-	0.25	0.25	0.25	0.25	-	-	0.25	-
Annual maintenance costs	unit	-	0.1	0.1	0.1	0.1	-	-	0.1	-
Cost of gunny bags	unit	-	0.5	0.5	0.5	0.5	-	-	0.5	-
Value of maize losses	Kg	360	585	585	225	225	360	360	585	63
Maize Bought	unit	900	-	-	-900	-900	900	900	-	-
Home Consumption	unit	-	900	900	900	900	-	-	900	-
Labor										
Storage Handling labour	day	-	2	2	2	2	-	-	2	-

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	Existing Technology												
	1	2	3	4	5	6	7	8	9	10	1	2	3
Revenue													
Maize Stored	-	-	-	-	-	-	-	-	-	-	20,452.5	20,657.0	20,863.6
Maize Immediate Sale	15,157.6	15,309.2	15,462.2	15,616.9	15,773.0	15,930.8	16,090.1	16,251.0	16,413.5	16,577.6	-	-	-
Sub-total Revenue	15,157.6	15,309.2	15,462.2	15,616.9	15,773.0	15,930.8	16,090.1	16,251.0	16,413.5	16,577.6	20,452.5	20,657.0	20,863.6
Input costs													
Investment costs													
Store Construction Cost	-	-	-	-	-	-	-	-	-	-	4,999.5	-	-
Operating Costs													
Interest on capital	-	-	-	-	-	-	-	-	-	-	192.0	193.9	195.9
Cost of insecticide	-	-	-	-	-	-	-	-	-	-	74.0	74.8	75.5
Annual maintenance costs	-	-	-	-	-	-	-	-	-	-	45.5	45.9	46.4
Cost of gunny bags	-	-	-	-	-	-	-	-	-	-	126.3	127.5	128.8
Value of maize losses	2,425.2	2,449.5	2,474.0	2,498.7	2,523.7	2,548.9	2,574.4	2,600.2	2,626.2	2,652.4	3,941.0	3,980.4	4,020.2
Maize Bought	8,181.0	8,262.8	8,345.4	8,428.9	8,513.2	8,598.3	8,684.3	8,771.1	8,858.9	8,947.4	-	-	-
Home Consumption	-	-	-	-	-	-	-	-	-	-	8,181.0	8,262.8	8,345.4
Sub-total Operating Costs	10,606.2	10,712.3	10,819.4	10,927.6	11,036.9	11,147.2	11,258.7	11,371.3	11,485.0	11,599.9	12,559.7	12,685.3	12,812.1
Sub-total Input costs	10,606.2	10,712.3	10,819.4	10,927.6	11,036.9	11,147.2	11,258.7	11,371.3	11,485.0	11,599.9	17,559.2	12,685.3	12,812.1
Income (Before Labor Costs)	4,551.4	4,596.9	4,642.8	4,689.3	4,736.2	4,783.5	4,831.4	4,879.7	4,928.5	4,977.8	2,893.3	7,971.7	8,051.4
Labor costs													
Investment costs													
Store construction labour	-	-	-	-	-	-	-	-	-	-	75.8	-	-
Operating Costs													
Storage Handling labour	-	-	-	-	-	-	-	-	-	-	50.5	51.0	51.5
Sub-total Labor costs	-	-	-	-	-	-	-	-	-	-	126.3	51.0	51.5
Income (After Labor Costs)	4,551.4	4,596.9	4,642.8	4,689.3	4,736.2	4,783.5	4,831.4	4,879.7	4,928.5	4,977.8	2,767.1	7,920.7	7,999.9

Income Before Labor: IRR = 204.5%, NPV = 16,770.42
Income After Labor: IRR = 187.3%, NPV = 16,379.41

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Kenya
Small Scale On-Farm Maize Storage Analysis
Storage Investment Activity
FINANCIAL BUDGET
(In Kenya Shillings)

January-November

New Technology							Increments							
4	5	6	7	8	9	10	1	2	3	4	5	6	7	8
21,072.2	21,283.0	21,495.8	21,710.7	21,927.8	22,147.1	22,368.6	20,452.5	20,657.0	20,863.6	21,072.2	21,283.0	21,495.8	21,710.7	21,927.8
-	-	-	-	-	-	-	-15,157.6	-15,309.2	-15,462.2	-15,616.9	-15,773.0	-15,930.8	-16,090.1	-16,251.0
21,072.2	21,283.0	21,495.8	21,710.7	21,927.8	22,147.1	22,368.6	5,294.9	5,347.9	5,401.4	5,455.4	5,509.9	5,565.0	5,620.7	5,676.9
-	-	-	-	-	-	-	4,999.5	-	-	-	-	-	-	-
197.8	199.8	201.8	203.8	205.8	207.9	210.0	192.0	193.9	195.9	197.8	199.8	201.8	203.8	205.8
76.3	77.0	77.8	78.6	79.4	80.2	8..0	74.0	74.8	75.5	76.3	77.0	77.8	78.6	79.4
46.8	47.3	47.8	48.2	48.7	49.2	49.7	45.5	45.9	46.4	46.8	47.3	47.8	48.2	48.7
130.1	131.4	132.7	134.0	135.4	136.7	138.1	126.3	127.5	128.8	130.1	131.4	132.7	134.0	135.4
4,060.4	4,101.0	4,142.0	4,183.4	4,225.3	4,267.5	4,310.2	1,515.8	1,530.9	1,546.2	1,561.7	1,577.3	1,593.1	1,609.0	1,625.1
-	-	-	-	-	-	-	-8,181.0	-8,262.8	-8,345.4	-8,428.9	-8,513.2	-8,598.3	-8,684.3	-8,771.1
8,428.9	8,513.2	8,598.3	8,684.3	8,771.1	8,858.9	8,947.4	8,181.0	8,262.8	8,345.4	8,428.9	8,513.2	8,598.3	8,684.3	8,771.1
12,940.3	13,069.7	13,200.4	13,332.4	13,465.7	13,600.4	13,736.4	6,953.5	1,973.0	1,992.8	2,012.7	2,032.8	2,053.1	2,073.7	2,094.4
12,940.3	13,069.7	13,200.4	13,332.4	13,465.7	13,600.4	13,736.4	6,953.0	1,973.0	1,992.8	2,012.7	2,032.8	2,053.1	2,073.7	2,094.4
8,132.0	8,213.3	8,295.4	8,378.4	8,462.2	8,546.8	8,632.2	-1,650.1	3,374.9	3,408.6	3,442.7	3,477.1	3,511.9	3,547.0	3,582.5
-	-	-	-	-	-	-	75.8	-	-	-	-	-	-	-
52.0	52.6	53.1	53.6	54.1	54.7	55.2	50.5	51.0	51.5	52.0	52.6	53.1	53.6	54.1
52.0	52.6	53.1	53.6	54.1	54.7	55.2	126.3	51.0	51.5	52.0	52.6	53.1	53.6	54.1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

9	10	Present 1	Future Existing 10	Future New 10	Percentage Change 1
22,147.1	22,368.6	-	-	22,368.6	-
-16,413.5	-16,577.6	15,157.6	16,577.6	-	9.0
5,733.6	5,791.0	15,157.6	16,577.6	22,368.6	35.0
-	-	-	-	-	-
207.9	210.0	-	-	210.0	-
80.2	81.0	-	-	81.0	-
49.2	49.7	-	-	49.7	-
136.7	138.1	-	-	138.1	-
1,641.3	1,657.8	2,425.2	2,652.4	4,310.2	62.0
-8,858.9	-8,947.4	8,181.0	8,947.4	-	9.0
8,858.9	8,947.4	-	-	8,947.4	-
2,115.3	2,136.5	10,606.2	11,599.9	13,736.4	18.0
2,115.3	2,136.5	10,606.2	11,599.9	13,736.4	18.0
3,618.3	3,654.5	4,551.4	4,977.8	8,632.2	73.0
-	-	-	-	-	-
54.7	55.2	-	-	55.2	-
54.7	55.2	-	-	55.2	-
3,563.6	3,599.3	4,551.4	4,977.8	8,577.0	72.0

Kenya
On-Farm Maize Storage Analysis
Storage Investment Activity Model
YIELDS AND INPUTS

January-November

	Unit	Existing Technology 1	Existing Technology 2 to 10	New Technology 1	New Technology 2 to 10	Increments 1	Increments 2 to 10	Present 1	Future Existing 2	Future New	Percentage Change %
Main Production											
Maize Stored	Kg	900	900	3,150	3,150	2,250	2,250	900	900	3,150	250
Maize Immediate Sale	Kg	2,250	2,250	-	-	-2,250	-2,250	2,250	2,250	-	-
Maize saved-loss reduction	Kg	225	225	594	594	369	369	225	225	594	164
Investment											
Inputs											
Store Construction Cost	unit	0.33	-	1	-	0.67	-	0.33	-	-	-
Labor											
Store construction labour	day	8	-	25	-	17	-	8	-	-	-
Operating											
Inputs											
Interest on capital	unit	0.5	0.5	1	1	0.5	0.5	0.5	0.5	1	100
Maintenance cost per annum	unit	0.5	0.5	1	1	0.5	0.5	0.5	0.5	1	100
Cost of gunny bags	unit	0.5	0.5	1	1	0.5	0.5	0.5	0.5	1	100
Cost of insecticide	unit	0.5	0.5	1	1	0.5	0.5	0.5	0.5	1	100
Value of maize losses	unit	594	594	141.75	141.75	-452.25	-452.25	594	594	141.75	-76
Home Consumption	unit	900	900	900	900	-	-	900	900	900	-
Labor											
Storage handling labour	day	4	4	12	12	8	8	4	4	12	200

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Kenya
On-Farm Maize Storage Analysis
Storage Investment Activity Model
FINANCIAL BUDGET
(In KSh)

	Existing Technology											
	1	2	3	4	5	6	7	8	9	10	1	2
Revenue												
Maize Stored	8,181.0	8,262.8	8,345.4	8,428.9	8,513.2	8,598.3	8,684.3	8,771.1	8,858.9	8,947.4	28,633.5	28,919.8
Maize Immediate Sale	15,157.6	15,309.2	15,462.2	15,616.9	15,773.0	15,930.8	16,090.1	16,251.0	16,413.5	16,577.6	-	-
Maize saved-loss reduction	2,045.3	2,065.7	2,086.4	2,107.2	2,128.3	2,149.6	2,171.1	2,192.8	2,214.7	2,236.9	5,399.5	5,453.5
Sub-total Revenue	25,383.8	25,637.7	25,894.0	26,153.0	26,414.5	26,678.7	[illegible]	27,214.9	27,487.0	27,761.9	34,033.0	34,373.3
Input costs												
Investment costs												
Store Construction Cost	8,332.5	-	-	-	-	-	-	-	-	-	25,250.0	-
Operating Costs												
Interest on capital	1,344.0	1,357.4	1,371.0	1,384.7	1,398.5	1,412.5	1,426.7	1,440.9	1,455.3	1,469.9	2,687.9	2,714.8
Maintenance cost per annum	227.3	229.5	231.8	234.1	236.5	238.8	241.2	243.6	246.1	248.5	454.5	459.0
Cost of gunny bags	265.1	267.8	270.5	273.2	275.9	278.6	281.4	284.2	287.1	290.0	530.3	535.6
Cost of insecticide	176.8	178.5	180.3	182.1	183.9	185.8	187.6	189.5	191.4	193.3	353.5	357.0
Value of maize losses	4,001.6	4,041.6	4,082.0	4,122.9	4,164.1	4,205.7	4,247.8	4,290.3	4,333.2	4,376.5	954.9	964.5
Home Consumption	8,181.0	8,262.8	8,345.4	8,428.9	8,513.2	8,598.3	8,684.3	8,771.1	8,858.9	8,947.4	8,181.0	8,262.8
Sub-total Operating Costs	14,195.7	14,337.7	14,481.0	14,625.8	14,772.1	14,919.8	15,069.0	15,219.7	15,371.9	15,525.6	13,162.1	13,293.7
Sub-total Input costs	22,528.2	14,337.7	14,481.0	14,625.8	14,772.1	14,919.8	15,069.0	15,219.7	15,371.9	15,525.6	38,412.1	13,293.7
Income (Before Labor Costs)	2,855.6	11,300.0	11,413.0	11,527.1	11,642.4	[illegible]	11,876.4	11,995.2	12,115.1	12,236.3	-4,379.2	21,079.5
Labor costs												
Investment costs												
Store construction labour	202.0	-	-	-	-	-	-	-	-	-	631.3	-
Operating Costs												
Storage handling labour	121.2	122.4	123.6	124.9	126.1	127.4	128.7	129.9	131.2	132.6	363.6	367.2
Sub-total Labor costs	323.2	122.4	123.6	124.9	126.1	127.4	128.7	129.9	131.2	132.6	994.9	367.2
Income (After Labor Costs)	2,532.4	11,177.6	11,289.4	11,402.3	11,516.3	11,631.5	11,747.8	11,865.2	11,983.9	12,103.7	-5,374.0	20,712.3

Income Before Labor: IRR = 136.1%, NPV = 22,025.44
Income After Labor: IRR = 121.5%, NPV = 20,791.83

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Kenya
On-Farm Maize Storage Analysis
Storage Investment Activity Model
FINANCIAL BUDGET
(In KSh)

January-November

New Technology								Increments						
3	4	5	6	7	8	9	10	1	2	3	4	5	6	7
29,209.0	29,501.1	29,796.1	30,094.1	30,395.0	30,699.0	31,006.0	31,316.0	20,452.5	20,657.0	20,863.6	21,072.2	21,283.0	21,495.8	21,710.7
-	-	-	-	-	-	-	-	-15,157.6	-15,309.2	-15,462.2	-15,616.9	-15,773.0	-15,930.8	-16,090.1
5,508.0	5,563.1	5,618.7	5,674.9	5,731.6	5,789.0	5,846.8	5,905.3	3,354.2	3,387.8	3,421.6	3,455.8	3,490.4	3,525.3	3,560.6
34,717.0	35,064.1	35,414.8	35,769.0	36,126.7	36,487.9	36,852.8	37,221.3	8,649.1	8,735.6	8,823.0	8,911.2	9,000.3	9,090.3	9,181.2
-	-	-	-	-	-	-	-	16,917.5	-	-	-	-	-	-
2,742.0	2,769.4	2,797.1	2,825.1	2,853.3	2,881.8	2,910.7	2,939.8	1,344.0	1,357.4	1,371.0	1,384.7	1,398.5	1,412.5	1,426.7
463.6	468.3	473.0	477.7	482.5	487.3	492.2	497.1	227.3	229.5	231.8	234.1	236.5	238.8	241.2
540.9	546.3	551.8	557.3	562.9	568.5	574.2	579.9	265.1	267.8	270.5	273.2	275.9	278.6	281.4
360.6	364.2	367.9	371.5	375.2	379.0	382.8	386.6	176.8	178.5	180.3	182.1	183.9	185.8	187.6
974.1	983.9	993.7	1,003.6	1,013.7	1,023.8	1,034.0	1,044.4	-3,048.7	-3,077.1	-3,107.9	-3,139.0	-3,170.4	-3,202.1	-3,234.1
8,345.4	8,428.9	8,513.2	8,598.3	8,684.3	8,771.1	8,858.9	8,947.4	-	-	-	-	-	-	-
13,426.7	13,560.9	13,696.6	13,833.5	13,971.9	14,111.6	14,252.7	14,395.2	-1,033.6	-1,043.9	-1,054.4	-1,064.9	-1,075.5	-1,086.3	-1,097.2
13,426.7	13,560.9	13,696.6	13,833.5	13,971.9	14,111.6	14,252.7	14,395.2	-1,033.6	-1,043.9	-1,054.4	-1,064.9	-1,075.5	-1,086.3	-1,097.2
21,290.3	21,503.2	21,718.3	21,935.5	22,154.8	22,376.4	22,600.1	22,826.1	-7,234.8	9,779.5	9,877.3	9,976.1	10,075.9	10,176.6	10,278.4
-	-	-	-	-	-	-	-	429.3	-	-	-	-	-	-
370.9	374.6	378.4	382.1	386.0	389.8	393.7	397.7	242.4	244.8	247.3	249.7	252.2	254.8	257.3
370.9	374.6	378.4	382.1	386.0	389.8	393.7	397.7	671.7	244.8	247.3	249.7	252.2	254.8	257.3
20,919.4	21,128.6	21,339.9	21,553.3	21,768.8	21,986.5	22,206.4	22,428.5	-7,906.4	9,534.7	9,630.1	9,726.4	9,823.6	9,921.9	10,021.1

Kenya
On-Farm Maize Storage Analysis
Storage Investment Activity Model
FINANCIAL BUDGET
(In KSh)

8	9	10	Present 1	Future Existing 10	Future New 10	Percentage Change %
21,927.8	22,147.1	22,368.6	8,181.0	8,947.4	31,316.0	250.0
-16,251.0	-16,413.5	-16,577.6	15,157.6	16,577.6	-	9.0
3,596.2	3,632.1	3,668.5	2,045.3	2,236.9	5,905.3	164.0
9,273.0	9,365.8	9,459.4	25,383.8	27,761.9	37,221.3	34.0
-	-	-	8,332.5	-	-	-
1,440.9	1,455.3	1,469.9	1,344.0	1,469.9	2,939.8	100.0
243.6	246.1	248.5	227.3	248.5	497.1	100.0
284.2	287.1	290.0	265.1	290.0	579.9	100.0
189.5	191.4	193.3	176.8	193.3	386.6	100.0
-3,266.4	-3,299.1	-3,332.1	4,001.6	4,376.5	1,044.4	-76.0
-	-	-	8,181.0	8,947.4	8,947.4	-
-1,108.1	-1,119.2	-1,130.4	14,195.7	15,525.6	14,395.2	-7.0
-1,108.1	-1,119.2	-1,130.4	22,528.2	15,525.6	14,395.2	-7.0
10,381.2	10,485.0	10,589.8	2,855.6	12,236.3	22,826.1	87.0
-	-	-	202.0	-	-	-
259.9	262.5	265.1	121.2	132.6	397.7	200.0
259.9	262.5	265.1	323.2	132.6	397.7	200.0
10,121.3	10,222.5	10,324.7	2,532.4	12,103.7	22,428.3	85.0

Kenya
On-Farm Maize Storage Analysis
Storage Investment Activity Model
YIELDS AND INPUTS

		January-November								
		Existing Technology	New Technology		Increments		Present	Future Existing	Future New	Percentage Change
	Unit	1 to 10	1	2 to 10	1	2 to 10	1	10	2	%
Main Production										
Maize Stored	Kg	-	3,150	3,150	3,150	3,150	-	-	3,150	-
Maize Immediate Sale	Kg	3,150	-	-	-3,150	-3,150	3,150	3,150	-	-
Saved Field Losses	Kg	-	504	504	504	504	-	-	504	-
Investment										
Inputs										
Store Construction Cost	unit	-	1	-	1	-	-	-	-	-
Labor										
Store construction labour	day	-	25	-	25	-	-	-	-	-
Operating										
Inputs										
Interest on capital	unit	-	1	1	1	1	-	-	1	-
Maize Purchased	Kg	900	-	-	-900	-900	900	900	-	-
Home Consumption	Kg	-	900	900	900	900	-	-	900	-
Maintenance cost per annum	unit	-	1	1	1	1	-	-	1	-
Cost of gunny bags	unit	-	1	1	1	1	-	-	1	-
Cost of insecticide	unit	-	1	1	1	1	-	-	1	-
Value of maize losses	unit	504	141.75	141.75	-362.25	-362.25	504	504	141.75	-72
Labor										
Storage handling labour	day	-	12	12	12	12	-	-	12	-

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	Existing Technology											
	1	2	3	4	5	6	7	8	9	10	1	2
Revenue												
Maize Stored	-	-	-	-	-	-	-	-	-	-	28,633.5	28,919.8
Maize Immediate Sale	21,220.6	21,432.8	21,647.1	21,863.6	22,082.2	22,303.1	22,526.1	22,751.4	22,978.9	23,208.7	-	-
Saved Field Losses	-	-	-	-	-	-	-	-	-	-	4,581.4	4,627.2
Sub-total Revenue	21,220.6	21,432.8	21,647.1	21,863.6	22,082.2	22,303.1	22,526.1	22,751.4	22,978.9	23,208.7	33,214.9	33,547.0
Input costs												
Investment costs												
Store Construction Cost	-	-	-	-	-	-	-	-	-	-	25,250.0	-
Operating Costs												
Interest on capital	-	-	-	-	-	-	-	-	-	-	2,687.9	2,714.8
Maize Purchased	8,181.0	8,262.8	8,345.4	8,428.9	8,513.2	8,598.3	8,684.3	8,771.1	8,858.9	8,947.4	-	-
Home Consumption	-	-	-	-	-	-	-	-	-	-	8,181.0	8,262.8
Maintenance cost per annum	-	-	-	-	-	-	-	-	-	-	454.5	459.0
Cost of gunny bags	-	-	-	-	-	-	-	-	-	-	530.3	535.6
Cost of insecticide	-	-	-	-	-	-	-	-	-	-	353.5	357.0
Value of maize losses	3,395.3	3,429.2	3,463.5	3,498.2	3,533.2	3,568.5	3,604.2	3,640.2	3,676.6	3,713.4	954.9	964.5
Sub-total Operating Costs	11,576.3	11,692.1	11,809.0	11,927.1	12,046.3	12,166.8	12,288.5	12,411.4	12,535.5	12,660.8	13,162.1	13,293.7
Sub-total Input costs	11,576.3	11,692.1	11,809.0	11,927.1	12,046.3	12,166.8	12,288.5	12,411.4	12,535.5	12,660.8	38,412.1	13,293.7
Income (Before Labor Costs)	9,644.3	9,740.8	9,838.2	9,936.5	10,035.9	10,136.3	10,237.6	10,340.0	10,443.4	10,547.8	-5,197.3	20,253.3
Labor costs												
Investment costs												
Store construction labour	-	-	-	-	-	-	-	-	-	-	631.3	-
Operating Costs												
Storage handling labour	-	-	-	-	-	-	-	-	-	-	363.6	367.2
Sub-total Labor costs	-	-	-	-	-	-	-	-	-	-	994.9	367.2
Income (After Labor Costs)	9,644.3	9,740.8	9,838.2	9,936.5	10,035.9	10,136.3	10,237.6	10,340.0	10,443.4	10,547.8	-6,192.1	19,886.0

Income Before Labor: IRR = 71.2%, NPV = 18,024.62
Income After Labor: IRR = 64.3%, NPV = 16,184.31

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Kenya
On-Farm Maize Storage Analysis
Storage Investment Activity Model
FINANCIAL BUDGET
(In KSh)

January-November

New Technology								Increments						
3	4	5	6	7	8	9	10	1	2	3	4	5	6	7
29,209.0	29,501.1	29,796.1	30,094.1	30,395.0	30,699.0	31,006.0	31,316.0	28,633.5	28,919.8	29,209.0	29,501.1	29,796.1	30,094.1	30,395.0
-	-	-	-	-	-	-	-	-21,220.6	-21,432.8	-21,647.1	-21,863.6	-22,082.2	-22,303.1	-22,526.1
4,673.4	4,720.2	4,767.4	4,815.1	4,863.2	4,911.8	4,961.0	5,010.6	4,581.4	4,627.2	4,673.4	4,720.2	4,767.4	4,815.1	4,863.2
33,882.5	34,221.3	34,563.5	34,909.2	35,258.2	35,610.8	35,966.9	36,326.6	11,994.3	12,114.2	12,235.3	12,357.7	12,481.3	12,606.1	12,732.1
-	-	-	-	-	-	-	-	25,250.0	-	-	-	-	-	-
2,742.0	2,769.4	2,797.1	2,825.1	2,853.3	2,881.8	2,910.7	2,939.8	2,687.9	2,714.8	2,742.0	2,769.4	2,797.1	2,825.1	2,853.3
-	-	-	-	-	-	-	-	-8,181.0	-8,262.8	-8,345.4	-8,428.9	-8,513.2	-8,598.3	-8,684.3
8,345.4	8,428.9	8,513.2	8,598.3	8,684.3	8,771.1	8,858.9	8,947.4	8,181.0	8,262.8	8,345.4	8,428.9	8,513.2	8,598.3	8,684.3
463.6	468.3	473.0	477.7	482.5	487.3	492.2	497.1	454.5	459.0	463.6	468.3	473.0	477.7	482.5
540.9	546.3	551.8	557.3	562.9	568.5	574.2	579.9	530.3	535.6	540.9	546.3	551.8	557.3	562.9
360.6	364.2	367.9	371.5	375.2	379.0	382.8	386.6	353.5	357.0	360.6	364.2	367.9	371.5	375.2
974.1	983.9	993.7	1,003.6	1,013.7	1,023.8	1,034.0	1,044.4	-2,440.4	-2,464.8	-2,489.4	-2,514.3	-2,539.5	-2,564.9	-2,590.5
13,426.7	13,560.9	13,696.6	13,833.5	13,971.9	14,111.6	14,252.7	14,395.2	1,585.8	1,601.7	1,617.7	1,633.9	1,650.2	1,666.7	1,683.4
13,426.7	13,560.9	13,696.6	13,833.5	13,971.9	14,111.6	14,252.7	14,395.2	26,835.8	1,601.7	1,617.7	1,633.9	1,650.2	1,666.7	1,683.4
20,455.8	20,660.4	20,867.0	21,075.6	21,286.4	21,499.3	21,714.2	21,931.4	-14,841.6	10,512.5	10,617.6	10,723.8	10,831.1	10,939.4	11,048.8
-	-	-	-	-	-	-	-	631.3	-	-	-	-	-	-
370.9	374.6	378.4	382.1	386.0	389.8	393.7	397.7	363.6	367.2	370.9	374.6	378.4	382.1	386.0
370.9	374.6	378.4	382.1	386.0	389.8	393.7	397.7	994.9	367.2	370.9	374.6	378.4	382.1	386.0
20,084.9	20,285.7	20,488.6	20,693.5	20,900.4	21,109.4	21,320.5	21,533.7	-15,836.4	10,145.3	10,246.7	10,349.2	10,452.7	10,557.2	10,662.8

8	9	10	Present 1	Future Existing 10	Future New 10	Percentage Change %
30,699.0	31,006.0	31,316.0	-	-	31,316.0	-
-22,751.4	-22,978.9	-23,208.7	21,220.6	23,208.7	-	9.0
4,911.8	4,961.0	5,010.6	-	-	5,010.6	-
12,859.5	12,988.1	13,117.9	21,220.6	23,208.7	36,326.6	57.0
-	-	-	-	-	-	-
2,881.8	2,910.7	2,939.8	-	-	2,939.8	-
-8,771.1	-8,858.9	-8,947.4	8,181.0	8,947.4	-	9.0
8,771.1	8,858.9	8,947.4	-	-	8,947.4	-
487.3	492.2	497.1	-	-	497.1	-
568.5	574.2	579.9	-	-	579.9	-
379.0	382.8	386.6	-	-	386.6	-
-2,616.4	-2,642.6	-2,669.0	3,395.3	3,713.4	1,044.4	-72.0
1,700.2	1,717.2	1,734.4	11,576.3	12,660.8	14,395.2	14.0
1,700.2	1,717.2	1,734.4	11,576.3	12,660.8	14,395.2	14.0
11,159.2	11,270.8	11,383.5	9,644.3	10,547.8	21,931.4	108.0
-	-	-	-	-	-	-
389.8	393.7	397.7	-	-	397.7	-
389.8	393.7	397.7	-	-	397.7	-
10,769.4	10,877.1	10,985.9	9,644.3	10,547.8	21,533.7	104.0

Kenya
On-Farm Maize Storage Analysis
Storage Investment Activity Model
YIELDS AND INPUTS

		January-November								
		Existing Technology	New Technology		Increments		Present	Future Existing	Future New	Percentage Change
	Unit	1 to 10	1	2 to 10	1	2 to 10	1	10	2	6
Main Production										
Maize Stored	Kg	-	3,150	3,150	3,150	3,150	-	-	3,150	-
Maize Immediate Sale	Kg	3,150	-	-	-3,150	-3,150	3,150	3,150	-	-
Investment										
Inputs										
Store Construction Cost	unit	-	0.33	-	0.33	-	-	-	-	-
Labor										
Store construction labour	day	-	8	-	8	-	-	-	-	-
Operating										
Inputs										
Interest on capital	unit	-	0.5	0.5	0.5	0.5	-	-	0.5	-
Maintenance cost per annum	unit	-	0.5	0.5	0.5	0.5	-	-	0.5	-
Cost of gunny bags	unit	-	0.5	0.5	0.5	0.5	-	-	0.5	-
Cost of insecticide	unit	-	0.5	0.5	0.5	0.5	-	-	0.5	-
Value of maize losses	unit	504	819	819	315	315	504	504	819	63
Maize Purchased	Kg	900	-	-	-900	-900	900	900	-	-
Home Consumption	unit	-	900	900	900	900	-	-	900	-
Labor										
Storage handling labour	day	-	4	4	4	4	-	-	4	-

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	Existing Technology											
	1	2	3	4	5	6	7	8	9	10	1	2
Revenue												
Maize Stored	-	-	-	-	-	-	-	-	-	-	20,633.5	20,919.8
Maize Immediate Sale	21,220.6	21,432.8	21,647.1	21,863.6	22,082.2	22,303.1	22,526.1	22,751.4	22,978.9	23,208.7	-	-
Sub-total Revenue	21,220.6	21,432.8	21,647.1	21,863.6	22,082.2	22,303.1	22,526.1	22,751.4	22,978.9	23,208.7	20,633.5	20,919.8
Input costs												
Investment costs												
Store Construction Cost	-	-	-	-	-	-	-	-	-	-	8,332.5	-
Operating Costs												
Interest on capital	-	-	-	-	-	-	-	-	-	-	1,344.0	1,357.4
Maintenance cost per annum	-	-	-	-	-	-	-	-	-	-	227.3	229.5
Cost of gunny bags	-	-	-	-	-	-	-	-	-	-	265.1	267.8
Cost of insecticide	-	-	-	-	-	-	-	-	-	-	176.8	178.5
Value of maize losses	3,395.3	3,429.2	3,463.5	3,498.2	3,533.2	3,568.5	3,604.2	3,640.2	3,676.6	3,713.4	5,527.4	5,572.5
Maize Purchased	8,181.0	8,262.8	8,345.4	8,428.9	8,513.2	8,598.3	8,684.3	8,771.1	8,858.9	8,947.4	-	-
Home Consumption	-	-	-	-	-	-	-	-	-	-	8,181.0	8,262.8
Sub-total Operating Costs	11,576.3	11,692.1	11,809.0	11,927.1	12,046.3	12,166.8	12,288.5	12,411.4	12,535.5	12,660.8	15,711.5	15,868.6
Sub-total Input costs	11,576.3	11,692.1	11,809.0	11,927.1	12,046.3	12,166.8	12,288.5	12,411.4	12,535.5	12,660.8	24,044.0	15,868.6
Income (Before Labor Costs)	9,644.3	9,740.8	9,838.2	9,936.5	10,035.9	10,136.3	10,237.6	10,340.0	10,443.4	10,547.8	4,589.5	13,051.3
Labor costs												
Investment costs												
Store construction labour	-	-	-	-	-	-	-	-	-	-	202.0	-
Operating Costs												
Storage handling labour	-	-	-	-	-	-	-	-	-	-	121.2	122.4
Sub-total Labor costs	-	-	-	-	-	-	-	-	-	-	323.2	122.4
Income (After Labor Costs)	9,644.3	9,740.8	9,838.2	9,936.5	10,035.9	10,136.3	10,237.6	10,340.0	10,443.4	10,547.8	4,266.3	12,928.9

Income Before Labor: IRR = 65.7%, NPV = 13,334.07
Income After Labor: IRR = 59.3%, NPV = 12,377.28

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Kenya
On-Farm Maize Storage Analysis
Storage Investment Activity Model
FINANCIAL BUDGET
(In KSh)

January-November

New Technology								Increments						
3	4	5	6	7	8	9	10	1	2	3	4	5	6	7
29,209.0	29,501.1	29,796.1	30,094.1	30,395.0	30,699.0	31,006.0	31,316.0	28,633.5	28,919.8	29,209.0	29,501.1	29,796.1	30,094.1	30,395.0
-	-	-	-	-	-	-	-	-21,220.6	-21,432.8	-21,647.1	-21,863.6	-22,082.2	-22,303.1	-22,526.1
29,209.0	29,501.1	29,796.1	30,094.1	30,395.0	30,699.0	31,006.0	31,316.0	7,412.9	7,487.0	7,561.9	7,637.5	7,713.9	7,791.0	7,868.9
-	-	-	-	-	-	-	-	8,332.5	-	-	-	-	-	-
1,371.0	1,384.7	1,398.5	1,412.5	1,426.7	1,440.9	1,455.3	1,469.9	1,344.0	1,357.4	1,371.0	1,384.7	1,398.5	1,412.5	1,426.7
231.8	234.1	236.5	238.8	241.2	243.6	246.1	248.5	227.3	229.5	231.8	234.1	236.5	238.8	241.2
270.5	273.2	275.9	278.6	281.4	284.2	287.1	290.0	265.1	267.8	270.5	273.2	275.9	278.6	281.4
180.3	182.1	183.9	185.8	187.6	189.5	191.4	193.3	176.8	178.5	180.3	182.1	183.9	185.8	187.6
5,628.3	5,684.5	5,741.4	5,798.8	5,856.8	5,915.4	5,974.5	6,034.3	2,122.1	2,143.3	2,164.7	2,186.4	2,208.2	2,230.3	2,252.6
-	-	-	-	-	-	-	-	-8,101.0	-8,262.8	-8,345.4	-8,428.9	-8,513.2	-8,598.3	-8,684.3
8,345.4	8,428.9	8,513.2	8,598.3	8,684.3	8,771.1	8,858.9	8,947.4	8,101.0	8,262.8	8,345.4	8,428.9	8,513.2	8,598.3	8,684.3
16,027.3	16,187.5	16,349.4	16,512.9	16,678.0	16,844.8	17,013.3	17,183.4	4,135.1	4,176.5	4,218.3	4,260.5	4,303.1	4,346.1	4,389.6
16,027.3	16,187.5	16,349.4	16,512.9	16,678.0	16,844.8	17,013.3	17,183.4	12,467.7	4,176.5	4,218.3	4,260.5	4,303.1	4,346.1	4,389.6
13,181.8	13,313.6	13,446.7	13,581.2	13,717.0	13,854.2	13,992.7	14,132.7	-5,054.8	3,310.5	3,343.6	3,377.1	3,410.8	3,444.9	3,479.4
-	-	-	-	-	-	-	-	202.0	-	-	-	-	-	-
123.6	124.9	126.1	127.4	128.7	129.9	131.2	132.6	121.2	122.4	123.6	124.9	126.1	127.4	128.7
123.6	124.9	126.1	127.4	128.7	129.9	131.2	132.6	323.2	122.4	123.6	124.9	126.1	127.4	128.7
13,058.1	13,188.7	13,320.6	13,453.8	13,588.4	13,724.2	13,861.5	14,000.1	-5,378.0	3,188.1	3,220.0	3,252.2	3,284.7	3,317.6	3,350.7

8	9	10	Present 1	Future Existing 10	Future New 10	Percentage Change %
30,699.0	31,006.0	31,316.0	-	-	31,316.0	-
-22,751.4	-22,978.9	-23,208.7	21,220.6	23,208.7	-	9.0
7,947.6	8,027.1	8,107.4	21,220.6	23,208.7	31,316.0	35.0
-	-	-	-	-	-	-
1,440.9	1,455.3	1,469.9	-	-	1,469.9	-
243.6	246.1	248.5	-	-	248.5	-
284.2	287.1	290.0	-	-	290.0	-
189.5	191.4	193.3	-	-	193.3	-
2,275.1	2,297.9	2,320.9	3,395.3	3,713.4	6,034.3	62.0
-8,771.1	-8,858.9	-8,947.4	8,181.0	8,947.4	-	9.0
8,771.1	8,858.9	8,947.4	-	-	8,947.4	-
4,433.4	4,477.8	4,522.6	11,576.3	12,660.8	17,183.4	36.0
4,433.4	4,477.8	4,522.6	11,576.3	12,660.8	17,183.4	36.0
3,514.2	3,549.3	3,584.8	9,644.3	10,547.8	14,132.7	34.0
-	-	-	-	-	-	-
129.9	131.2	132.6	-	-	132.6	-
129.9	131.2	132.6	-	-	132.6	-
3,384.2	3,418.1	3,452.3	9,644.3	10,547.8	14,000.1	33.0

Kenya
On-Farm Maize Storage Analysis
Large Scale Mixed Farm Crop Model
CREDIT ANALYSIS
(In KSh)

	Without Project										January-November
	1	2	3	4	5	6	7	8	9	10	1
Cash Carry Forward											
Production Costs	356,801.8	351,750.0	355,267.5	358,820.2	362,408.4	366,032.5	369,692.8	373,389.7	377,123.6	380,894.9	373,357.4
Contribution from own savings	-	-	-	-	-	-	-	-	-	-	21,607.4
Financing required from own sources	356,801.8	351,750.0	355,267.5	358,820.2	362,408.4	366,032.5	369,692.8	373,389.7	377,123.6	380,894.9	351,750.0
Carry Forward %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Transfer from Previous Period	351,750.0	351,750.0	355,267.5	358,820.2	362,408.4	366,032.5	369,692.8	373,389.7	377,123.6	380,894.9	351,750.0
Transfer to Next Period	351,750.0	355,267.5	358,820.2	362,408.4	366,032.5	369,692.8	373,389.7	377,123.6	380,894.9	380,894.9	350,950.9

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Kenya
On-Farm Maize Storage Analysis
Large Scale Mixed Farm Crop Model
CREDIT ANALYSIS
(In KShl

With Project								
2	3	4	5	6	7	8	9	10
350,950.9	354,460.4	358,005.0	361,585.1	365,200.9	368,852.9	372,541.5	376,266.9	380,029.6
-	-	-	-	-	-	-	-	-
350,950.9	354,460.4	358,005.0	361,585.1	365,200.9	368,852.9	372,541.5	376,266.9	380,029.6
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
350,950.9	354,460.4	358,005.0	361,585.2	365,200.9	368,852.9	372,541.5	376,266.9	380,029.6
354,460.4	358,005.0	361,585.1	365,200.9	368,852.9	372,541.5	376,266.9	380,029.6	380,029.6

Kenya
On-Farm Maize Storage Analysis
Large Scale Mixed Farm Crop Model
FINANCIAL BUDGET (AGGREGATED)
(In KSh)

	Without Project									January- 10
	1	2	3	4	5	6	7	8	9	
Main Production										
Outputs	514,880.3	520,029.1	525,229.4	530,481.7	535,786.5	541,144.4	546,555.8	552,021.4	557,541.6	563,117.0
By Products										
Crop Residues	4,343.0	4,386.4	4,430.3	4,474.6	4,519.3	4,564.5	4,610.2	4,656.3	4,702.8	4,749.9
Gross Value Of Production	519,223.3	524,415.6	529,659.7	534,956.3	540,305.9	545,708.9	551,166.0	556,677.7	562,244.5	567,866.9
On-Farm Consumption										
Outputs	9,216.3	9,308.4	9,401.5	9,495.5	9,590.5	9,686.4	9,783.2	9,881.1	9,979.9	10,079.7
Net Value Of Production	510,007.1	515,107.1	520,258.2	525,460.8	530,715.4	536,022.6	541,382.8	546,796.6	552,264.6	557,787.2
Off Farm Employment										
Labour Input	10,302.0	10,405.0	10,509.1	10,614.2	10,720.3	10,827.5	10,935.8	11,045.1	11,155.6	11,267.1
INFLOWS	520,309.1	525,512.2	530,767.3	536,075.0	541,435.7	546,850.1	552,318.6	557,841.8	563,420.2	569,054.4
Production Cost										
Investment										
Purchased Inputs										
Livestock	20,831.3	21,039.6	21,250.0	21,462.5	21,677.1	21,893.9	22,112.8	22,333.9	22,557.3	22,782.8
Fencing	6,635.7	6,702.1	6,769.1	6,836.8	6,905.1	6,974.2	7,043.9	7,114.4	7,185.5	7,257.4
Milking sheds	4,545.0	4,590.5	4,636.4	4,682.7	4,729.5	4,776.8	4,824.6	4,872.9	4,921.6	4,970.8
Milk cans	7,272.0	7,344.7	7,418.2	7,492.3	7,567.3	7,642.9	7,719.4	7,796.6	7,874.5	7,953.3
Feeding Buckets	1,515.0	1,530.2	1,545.5	1,560.9	1,576.5	1,592.3	1,608.2	1,624.3	1,640.5	1,656.9
Store Construction Cost	8,332.5	-	-	-	-	-	-	-	-	-
Sub-Total Purchased Inputs	49,131.5	41,206.9	41,619.0	42,035.2	42,455.6	42,880.1	43,308.9	43,742.0	44,179.4	44,621.2
Hired Labor										
Labour Input	57,469.0	57,839.7	58,418.1	59,002.2	59,592.3	60,188.2	60,790.1	61,398.0	62,012.0	62,632.1
Sub-total Investment Costs	106,600.5	99,046.6	100,037.1	101,037.4	102,047.8	103,068.3	104,099.0	105,140.0	106,191.4	107,253.3
Operating										
Purchased Inputs										
Variable Inputs	237,960.2	240,339.8	242,743.2	245,170.6	247,622.3	250,098.5	252,599.5	255,125.5	257,676.8	260,253.6
Hired Labor										
Labour Input	12,241.2	12,363.6	12,487.2	12,612.1	12,738.2	12,865.6	12,994.3	13,124.2	13,255.5	13,388.0
Sub-total Operating Costs	250,201.4	252,703.4	255,230.4	257,782.7	260,360.6	262,964.2	265,593.8	268,249.8	270,932.2	273,641.6
Sub-Total Production Cost	356,801.8	351,750.0	355,267.5	358,820.2	362,408.4	366,032.5	369,692.8	373,389.7	377,123.6	380,894.9
OUTFLOWS	356,801.8	351,750.0	355,267.5	358,820.2	362,408.4	366,032.5	369,692.8	373,389.7	377,123.6	380,894.9
Cash Flow Before Financing	163,507.2	173,762.2	175,499.8	177,254.8	179,027.3	180,817.6	182,625.8	184,452.0	186,296.6	188,159.5
Farm Family Benefits Before Financing	172,723.5	183,070.6	184,908.4	186,750.1	188,617.1	190,504.0	192,409.0	194,333.1	196,276.4	198,239.2
Net Financing	-	-3,517.5	-3,552.7	-3,588.2	-3,624.1	-3,660.3	-3,696.9	-3,733.9	-3,771.2	-
Cash Flow After Financing	163,507.2	170,244.7	171,947.1	173,666.6	175,403.2	177,157.3	178,928.8	180,718.1	182,525.3	188,159.5
Change in Net Worth										
Contribution from own savings	-	-	-	-	-	-	-	-	-	-
Residual value of										
Transfer to Next Period	-	-	-	-	-	-	-	-	-	380,894.9
Sub-Total Change in Net Worth	-	-	-	-	-	-	-	-	-	380,894.9
Farm Family Benefits After Financing	172,723.5	179,553.1	181,348.6	183,162.1	184,993.7	186,843.6	188,712.1	190,599.2	192,505.2	579,134.1
Returns per Family-Day of Labor	785.1	816.2	824.3	832.6	840.9	849.3	857.8	866.4	875.0	2,632.4

IRR = 30.9%, NPV = 10,085.20

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Kenya
On-Farm Maize Storage Ana..ysis
Large Scale Mixed Farm Crop Model
FINANCIAL BUDGET (AGGREGATED)
(In KSh)

November

With Project

1	2	3	4	5	6	7	8	9	10
523,529.5	528,764.8	534,052.4	539,392.9	544,786.9	550,234.7	555,737.1	561,294.4	566,907.4	572,576.5
4,343.0	4,386.4	4,430.3	4,474.6	4,519.3	4,564.5	4,610.2	4,656.3	4,702.8	4,749.9
527,872.5	533,151.2	538,482.7	543,867.5	549,306.2	554,799.3	560,347.3	565,950.7	571,610.2	577,326.3
9,216.3	9,308.4	9,401.5	9,495.5	9,590.5	9,686.4	9,783.2	9,881.1	9,979.9	10,079.7
518,656.2	523,842.8	529,081.2	534,372.0	539,715.7	545,112.9	550,564.0	556,069.7	561,630.4	567,246.7
10,302.0	10,405.0	10,509.1	10,614.2	10,720.3	10,827.5	10,935.8	11,045.1	11,155.6	11,267.1
528,958.2	534,247.8	539,590.3	544,986.2	550,436.0	555,940.4	561,499.8	567,114.8	572,785.9	578,513.8
20,831.3	21,039.6	21,250.0	21,462.5	21,677.1	21,893.9	22,112.8	22,333.9	22,557.3	22,782.8
6,635.7	6,702.1	6,769.1	6,836.8	6,905.1	6,974.2	7,043.9	7,114.4	7,185.5	7,257.4
4,545.0	4,590.5	4,636.4	4,682.7	4,729.5	4,776.8	4,824.6	4,872.9	4,921.6	4,970.8
7,272.0	7,344.7	7,418.2	7,492.3	7,567.3	7,642.9	7,719.4	7,796.6	7,874.5	7,953.3
1,515.0	1,530.2	1,545.5	1,560.9	1,576.5	1,592.3	1,608.2	1,624.3	1,640.5	1,656.9
25,250.0	-	-	-	-	-	-	-	-	-
66,049.0	41,206.9	41,619.0	42,035.2	42,455.6	42,880.1	43,308.9	43,742.0	44,179.4	44,621.2
57,898.3	57,839.7	58,418.1	59,002.2	59,592.3	60,188.2	60,790.1	61,398.0	62,012.0	62,632.1
123,947.2	99,046.6	100,037.1	101,037.4	102,047.8	103,068.3	104,099.0	105,140.0	106,191.4	107,253.3
236,926.6	239,295.9	241,688.8	244,105.7	246,546.8	249,012.2	251,502.4	254,017.4	256,557.6	259,123.1
12,483.6	12,608.4	12,734.5	12,861.9	12,990.5	13,120.4	13,251.6	13,384.1	13,517.9	13,653.1
249,410.2	251,904.3	254,423.4	256,967.6	259,537.3	262,132.6	264,754.0	267,401.5	270,075.5	272,776.3
373,357.4	350,950.9	354,460.4	358,005.0	361,585.1	365,200.9	368,852.9	372,541.5	376,266.9	380,029.6
373,357.4	350,950.9	354,460.4	358,005.0	361,585.1	365,200.9	368,852.9	372,541.5	376,266.9	380,029.6
155,600.8	183,296.9	185,129.8	186,981.1	188,850.9	190,739.5	192,646.9	194,573.3	196,519.1	198,484.2
164,817.0	192,605.3	194,531.3	196,476.6	198,441.4	200,425.8	202,430.1	204,454.4	206,498.9	208,563.9
799.1	-3,509.5	-3,544.6	-3,580.1	-3,615.9	-4,652.0	-3,688.5	-3,725.4	-3,762.7	-
156,399.9	179,787.4	181,585.2	183,401.1	185,235.1	187,087.4	188,958.3	190,847.9	192,756.4	198,484.2
21,607.4	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	380,029.6
-21,607.4	-	-	-	-	-	-	-	-	380,029.6
144,008.7	189,095.8	190,986.7	192,896.6	194,825.6	196,773.8	198,741.6	200,729.0	202,736.3	588,593.5
654.6	859.5	868.1	876.8	885.6	894.4	903.4	912.4	921.5	2,675.4

Kenya
On-Farm Maize Storage Analysis
Large Scale Mixed Farm Crop Model
FINANCIAL BUDGET (AGGREGATED)
(In KSh)

	Without Project									January- 10
	1	2	3	4	5	6	7	8	9	
Main Production										
Outputs	586,345.9	592,209.4	598,131.5	604,112.8	610,153.9	616,255.4	622,418.0	628,642.2	634,928.6	641,277.9
By Products										
Crop Residues	4,343.0	4,386.4	4,430.3	4,474.6	4,519.3	4,564.5	4,610.2	4,656.3	4,702.8	4,749.9
Gross Value Of Production	590,688.9	596,595.8	602,561.8	608,587.4	614,673.2	620,820.0	627,028.2	633,298.5	639,631.4	646,027.8
On-Farm Consumption										
Outputs	9,216.3	9,308.4	9,401.5	9,495.5	9,590.5	9,686.4	9,783.2	9,881.1	9,979.9	10,079.7
Net Value Of Production	581,472.7	587,287.4	593,160.3	599,091.9	605,082.8	611,133.6	617,244.9	623,417.4	629,651.6	635,948.1
Off Farm Employment										
Labour Input	10,302.0	10,405.0	10,509.1	10,614.2	10,720.3	10,827.5	10,935.8	11,045.1	11,155.6	11,267.1
INFLOWS	591,774.7	597,692.4	603,669.3	609,706.0	615,803.1	621,961.1	628,180.7	634,462.5	640,807.2	647,215.2
Production Cost										
Investment										
Purchased Inputs										
Livestock	20,831.3	21,039.6	21,250.0	21,462.5	21,677.1	21,893.9	22,112.8	22,333.9	22,557.3	22,782.8
Fencing	6,635.7	6,702.1	6,769.1	6,836.8	6,905.1	6,974.2	7,043.9	7,114.4	7,185.5	7,257.4
Milking sheds	4,545.0	4,590.5	4,636.4	4,682.7	4,729.5	4,776.8	4,824.6	4,872.9	4,921.6	4,970.8
Milk cans	7,272.0	7,344.7	7,418.2	7,492.3	7,567.3	7,642.9	7,719.4	7,796.6	7,874.5	7,953.3
Feeding Buckets	1,515.0	1,530.2	1,545.5	1,560.9	1,576.5	1,592.3	1,608.2	1,624.3	1,640.5	1,656.9
Store Construction Cost	-	-	-	-	-	-	-	-	-	-
Sub-Total Purchased Inputs	40,799.0	41,206.9	41,619.0	42,035.2	42,455.6	42,880.1	43,308.9	43,742.0	44,179.4	44,621.2
Hired Labor										
Labour Input	57,267.0	57,839.7	58,418.1	59,002.2	59,592.3	60,188.2	60,790.1	61,398.0	62,012.0	62,632.1
Sub-total Investment Costs	98,066.0	99,046.6	100,037.1	101,037.4	102,047.8	103,068.3	104,099.0	105,140.0	106,191.4	107,253.3
Operating										
Purchased Inputs										
Variable Inputs	237,458.8	239,833.3	242,231.7	244,654.0	247,100.5	249,571.5	252,067.3	254,587.9	257,133.8	259,705.1
Hired Labor										
Labour Input	12,120.0	12,241.2	12,363.6	12,487.2	12,612.1	12,738.2	12,865.6	12,994.3	13,124.2	13,255.5
Sub-total Operating Costs	249,578.8	252,074.5	254,595.3	257,141.2	259,712.7	262,309.8	264,933.9	267,582.2	270,259.0	272,960.6
Sub-Total Production Cost	347,644.7	351,121.2	354,632.4	358,178.7	361,760.5	365,378.1	369,031.9	372,722.2	376,449.4	380,213.9
OUTFLOWS	347,644.7	351,121.2	354,632.4	358,178.7	361,760.5	365,378.1	369,031.9	372,722.2	376,449.4	380,213.9
Cash Flow Before Financing	244,129.9	246,571.2	249,037.0	251,527.3	254,042.6	256,583.0	259,148.9	261,740.3	264,357.8	267,001.3
Farm Family Benefits Before Financing	253,346.2	255,879.7	258,438.5	261,022.8	263,633.1	266,269.4	268,932.1	271,621.4	274,337.6	277,081.0
Net Financing	-	-3,511.2	-3,546.3	-3,581.8	-3,617.6	-3,653.8	-3,690.3	-3,727.2	-3,764.5	-
Cash Flow After Financing	244,129.9	243,060.0	245,490.6	247,945.5	250,425.0	252,929.2	255,458.5	258,013.1	260,593.3	267,001.3
Change in Net Worth										
Contribution from own savings	-	-	-	-	-	-	-	-	-	-
Residual value of										
Transfer to Next Period	-	-	-	-	-	-	-	-	-	380,213.9
Sub-Total Change in Net Worth	-	-	-	-	-	-	-	-	-	380,213.9
Farm Family Benefits After Financing	253,346.2	252,368.4	254,892.1	257,441.1	260,015.5	262,615.6	265,241.8	267,894.2	270,573.1	657,294.9
Returns per Family-Day of Labor	1,151.6	1,147.1	1,158.6	1,170.2	1,181.9	1,193.7	1,205.6	1,217.7	1,229.9	2,987.7

IRR = 20.2%, NPV = 1,323.82

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Kenya
On-Farm Maize Storage Analysis
Large Scale Mixed Farm Crop Model
FINANCIAL BUDGET (AGGREGATED)
(In KSh)

November

With Project

1	2	3	4	5	6	7	8	9	10
595,476.8	601,431.6	607,445.9	613,520.4	619,655.6	625,852.1	632,110.6	638,431.7	644,816.1	651,264.2
4,343.0	4,386.4	4,430.3	4,474.6	4,519.3	4,564.5	4,610.2	4,656.3	4,702.8	4,749.9
599,819.8	605,818.0	611,876.2	617,995.0	624,174.9	630,416.6	636,720.8	643,088.0	649,518.9	656,014.1
9,216.3	9,308.4	9,401.5	9,495.5	9,590.5	9,686.4	9,783.2	9,881.1	9,979.9	10,079.7
590,603.6	596,509.6	602,474.7	608,499.4	614,584.4	620,730.3	626,937.6	633,207.0	639,539.0	645,934.4
10,302.0	10,405.0	10,509.1	10,614.2	10,720.3	10,827.5	10,935.8	11,045.1	11,155.6	11,267.1
600,905.6	606,914.6	612,983.8	619,113.6	625,304.7	631,557.8	637,873.4	644,252.1	650,694.6	657,201.6
20,831.3	21,039.6	21,250.0	21,462.5	21,677.1	21,893.9	22,112.8	22,333.9	22,557.3	22,782.8
6,635.7	6,702.1	6,769.1	6,836.8	6,905.1	6,974.2	7,043.9	7,114.4	7,185.5	7,257.4
4,545.0	4,590.5	4,636.4	4,682.7	4,729.5	4,776.8	4,824.6	4,872.9	4,921.6	4,970.8
7,272.0	7,344.7	7,418.2	7,492.3	7,567.3	7,642.9	7,719.4	7,796.6	7,874.5	7,953.3
1,515.0	1,530.2	1,545.5	1,560.9	1,576.5	1,592.3	1,608.2	1,624.3	1,640.5	1,656.9
25,250.0	-	-	-	-	-	-	-	-	-
66,049.0	41,206.9	41,619.0	42,035.2	42,455.6	42,880.1	43,308.9	43,742.0	44,179.4	44,621.2
57,898.3	57,839.7	58,418.1	59,002.2	59,592.3	60,188.2	60,790.1	61,398.0	62,012.0	62,632.1
123,947.2	99,046.6	100,037.1	101,037.4	102,047.8	103,068.3	104,099.0	105,140.0	106,191.4	107,253.3
236,926.6	239,295.9	241,688.8	244,105.7	246,546.8	249,012.2	251,502.4	254,017.4	256,557.6	259,123.1
12,483.6	12,608.4	12,734.5	12,861.9	12,990.5	13,120.4	13,251.6	13,384.1	13,517.9	13,653.1
249,410.2	251,904.3	254,423.4	256,967.6	259,537.3	262,132.6	264,754.0	267,401.5	270,075.5	272,776.3
373,357.4	350,950.9	354,460.4	358,005.0	361,585.1	365,200.9	368,852.9	372,541.5	376,266.9	380,029.6
373,357.4	350,950.9	354,460.4	358,005.0	361,585.1	365,200.9	368,852.9	372,541.5	376,266.9	380,029.6
227,548.1	230,023.7	232,523.3	235,108.6	237,719.6	240,356.8	243,020.4	245,710.6	248,427.7	251,172.0
236,764.4	265,272.1	267,924.8	270,604.1	273,310.1	276,043.2	278,803.6	281,591.7	284,407.6	287,251.7
170.2	-3,509.5	-3,544.6	-3,580.1	-3,615.9	-3,652.0	-3,688.5	-3,725.4	-3,762.7	-
227,718.4	252,454.2	254,978.7	257,528.5	260,103.8	262,704.8	265,331.9	267,985.2	270,665.1	277,172.0
22,236.3	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	380,029.6
-22,236.3	-	-	-	-	-	-	-	-	380,029.6
214,698.4	261,762.6	264,380.2	267,024.0	269,694.3	272,391.2	275,115.1	277,866.1	280,644.9	667,281.2
975.9	1,189.8	1,201.7	1,213.7	1,225.9	1,238.1	1,250.5	1,263.0	1,275.7	3,033.1

Kenya
On-Farm Maize Storage Analysis
Large Scale Mixed Farm Crop Model
FINANCIAL BUDGET (AGGREGATED)
(In KSh)

	Without Project									January-10
	1	2	3	4	5	6	7	8	9	10
Main Production										
Outputs	586,345.9	592,209.4	598,131.5	604,112.8	610,153.9	616,255.4	622,418.0	628,642.2	634,928.6	641,277.9
By Products										
Crop Residues	4,343.0	4,386.4	4,430.3	4,474.6	4,519.3	4,564.5	4,610.2	4,656.3	4,702.8	4,749.9
Gross Value Of Production	590,688.9	596,595.8	602,561.8	608,587.4	614,673.2	620,820.0	627,028.2	633,298.5	639,631.4	646,027.8
On-Farm Consumption										
Outputs	9,216.3	9,308.4	9,401.5	9,495.5	9,590.5	9,686.4	9,783.2	9,881.1	9,979.9	10,079.7
Net Value Of Production	581,472.7	587,287.4	593,160.3	599,091.9	605,082.8	611,133.6	617,244.9	623,417.4	629,651.6	635,948.1
Off Farm Employment										
Labour Input	10,302.0	10,405.0	10,509.1	10,614.2	10,720.3	10,827.5	10,935.8	11,045.1	11,155.6	11,267.1
INFLOWS	591,774.7	597,692.4	603,669.3	609,706.0	615,803.1	621,961.1	628,180.7	634,462.5	640,807.2	647,215.2
Production Cost										
Investment										
Purchased Inputs										
Livestock	20,831.3	21,039.6	21,250.0	21,462.5	21,677.1	21,893.9	22,112.8	22,333.9	22,557.3	22,782.8
Fencing	6,635.7	6,702.1	6,769.1	6,836.8	6,905.1	6,974.2	7,043.9	7,114.4	7,185.5	7,257.4
Milking sheds	4,545.0	4,590.5	4,636.4	4,682.7	4,729.5	4,776.8	4,824.6	4,872.9	4,921.6	4,970.8
Milk cans	7,272.0	7,344.7	7,418.2	7,492.3	7,567.3	7,642.9	7,719.4	7,796.6	7,874.5	7,953.3
Feeding Buckets	1,515.0	1,530.2	1,545.5	1,560.9	1,576.5	1,592.3	1,608.2	1,624.3	1,640.5	1,656.9
Store Construction Cost	-	-	-	-	-	-	-	-	-	-
Sub-Total Purchased Inputs	40,799.0	41,206.9	41,619.0	42,035.2	42,455.6	42,880.1	43,308.9	43,742.0	44,179.4	44,621.2
Hired Labor										
Labour Input	57,267.0	57,839.7	58,418.1	59,002.2	59,592.3	60,188.2	60,790.1	61,398.0	62,012.0	62,632.1
Sub-total Investment Costs	98,066.0	99,046.6	100,037.1	101,037.4	102,047.8	103,068.3	104,099.0	105,140.0	106,191.4	107,253.3
Operating										
Purchased Inputs										
Variable Inputs	237,458.8	239,833.3	242,231.7	244,654.0	247,100.5	249,571.5	252,067.3	254,587.9	257,133.8	259,705.1
Hired Labor										
Labour Input	12,120.0	12,241.2	12,363.6	12,487.2	12,612.1	12,738.2	12,865.6	12,994.3	13,124.2	13,255.5
Sub-total Operating Costs	249,578.8	252,074.5	254,595.3	257,141.2	259,712.7	262,309.8	264,932.9	267,582.2	270,258.0	272,960.6
Sub-Total Production Cost	347,644.7	351,121.2	354,632.4	358,178.7	361,760.5	365,378.1	369,031.9	372,722.2	376,449.4	380,213.9
OUTFLOWS	347,644.7	351,121.2	354,632.4	358,178.7	361,760.5	365,378.1	369,031.9	372,722.2	376,449.4	380,213.9
Cash Flow Before Financing	244,129.9	246,571.2	249,037.0	251,527.3	254,042.6	256,583.0	259,148.9	261,740.3	264,357.8	267,001.3
Farm Family Benefits Before Financing	253,346.2	255,879.7	258,438.5	261,022.8	263,633.1	266,269.4	268,932.1	271,621.4	274,337.5	277,081.0
Net Financing	-	-3,511.2	-3,546.3	-3,581.8	-3,617.6	-3,653.8	-3,690.3	-3,727.2	-3,764.5	-
Cash Flow After Financing	244,129.9	243,060.0	245,490.6	247,945.5	250,425.0	252,929.2	255,458.5	258,013.1	260,593.3	267,001.3
Change in Net Worth										
Contribution from own savings	-	-	-	-	-	-	-	-	-	-
Residual value of										
Transfer to Next Period	-	-	-	-	-	-	-	-	-	380,213.9
Sub-Total Change in Net Worth	-	-	-	-	-	-	-	-	-	380,213.9
Farm Family Benefits After Financing	253,346.2	252,368.4	254,892.1	257,441.1	260,015.5	262,615.6	265,241.8	267,894.2	270,573.1	657,294.9
Returns per Family-Day of Labor	1,151.6	1,147.1	1,158.6	1,170.2	1,181.9	1,193.7	1,205.6	1,217.7	1,229.9	2,987.7

IRR = 9.9%, NPV = -3,900.23

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Kenya
On-Farm Maize Storage Analysis
Large Scale Mixed Farm Crop Model
FINANCIAL BUDGET (AGGREGATED)
(In KSh)

November

With Project									
1	2	3	4	5	6	7	8	9	10
590,895.5	596,804.4	602,772.4	608,800.2	614,888.2	621,037.1	627,247.4	633,519.9	639,855.1	646,253.7
4,343.0	4,386.4	4,430.3	4,474.6	4,519.3	4,564.5	4,610.2	4,656.3	4,702.8	4,749.9
595,238.5	601,190.8	607,202.7	613,274.8	619,407.5	625,601.6	631,857.6	638,176.2	644,557.9	651,003.5
9,216.3	9,308.4	9,401.5	9,495.5	9,590.5	9,686.4	9,783.2	9,881.1	9,979.9	10,079.7
586,022.2	591,882.4	597,801.2	603,779.3	609,817.1	615,915.2	622,074.4	628,295.1	634,578.1	640,923.8
10,302.0	10,405.0	10,509.1	10,614.2	10,720.3	10,827.5	10,935.8	11,045.1	11,155.6	11,267.1
596,324.2	602,287.4	608,310.3	614,393.4	620,537.4	626,742.7	633,010.2	639,340.3	645,733.7	652,191.0
20,831.3	21,039.6	21,250.0	21,462.5	21,677.1	21,893.9	22,112.8	22,333.9	22,557.3	22,782.8
6,635.7	6,702.1	6,769.1	6,836.8	6,905.1	6,974.2	7,043.9	7,114.4	7,185.5	7,257.4
4,545.0	4,590.5	4,636.4	4,682.7	4,729.5	4,776.8	4,824.6	4,873.9	4,921.6	4,970.8
7,272.0	7,344.7	7,418.2	7,492.3	7,567.3	7,642.9	7,719.4	7,796.6	7,874.5	7,953.3
1,515.0	1,530.2	1,545.5	1,560.9	1,576.5	1,592.3	1,608.2	1,624.3	1,640.5	1,656.9
8,332.5	-	-	-	-	-	-	-	-	-
49,131.5	41,206.9	41,619.0	42,035.2	42,455.6	42,880.1	43,308.9	43,742.0	44,179.4	44,621.2
57,469.0	57,839.7	58,418.1	59,002.2	59,592.3	60,188.2	60,790.1	61,398.0	62,012.0	62,632.1
106,600.5	99,046.6	100,037.1	101,037.4	102,047.8	103,068.3	104,099.0	105,140.0	106,191.4	107,253.3
239,475.9	241,870.7	244,289.4	246,732.3	249,199.6	251,691.6	254,208.5	256,750.6	259,318.1	261,911.3
12,241.2	12,363.6	12,487.2	12,612.1	12,738.2	12,865.6	12,994.3	13,124.2	13,255.5	13,388.0
251,717.1	254,234.3	256,776.7	259,344.4	261,937.9	264,557.2	267,202.8	269,874.8	272,573.6	275,299.3
358,317.6	353,280.9	356,813.7	360,381.9	363,985.7	367,625.5	371,301.8	375,014.8	378,765.0	382,552.6
358,317.6	353,280.9	356,813.7	360,381.9	363,985.7	367,625.5	371,301.8	375,014.8	378,765.0	382,552.6
238,006.6	249,006.5	251,496.6	254,011.5	256,551.7	259,117.2	261,708.4	264,325.4	266,968.7	269,638.4
247,222.9	258,314.9	260,898.1	263,507.1	266,142.1	268,803.6	271,491.6	274,206.5	276,948.6	279,710.1
-2,159.8	-3,532.8	-3,568.1	-3,603.8	-3,639.9	-3,676.3	-3,713.0	-3,750.1	-3,787.6	-
235,846.8	245,473.7	247,928.4	250,407.7	252,911.8	255,440.9	257,995.3	260,575.3	263,181.0	269,638.4
7,196.4	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	382,552.6
-7,196.4	-	-	-	-	-	-	-	-	382,552.6
237,866.6	254,782.1	257,329.9	259,903.2	262,503.3	265,127.3	267,778.6	270,456.4	273,160.9	665,776.7
1,081.2	1,158.1	1,169.7	1,181.4	1,193.2	1,205.1	1,217.1	1,229.3	1,241.6	3,010.3

Kenya
On-Farm Maize Storage Analysis
Large Scale Mixed Farm Crop Model
FINANCIAL BUDGET (AGGREGATED)
(In KSh)

	Without Project									January- 10
	1	2	3	4	5	6	7	8	9	
Main Production										
Outputs	521,525.1	526,740.4	532,007.8	537,327.9	542,701.1	548,128.1	553,609.4	559,145.5	564,737.0	570,384.3
By Products										
Crop Residues	4,343.0	4,386.4	4,430.3	4,474.6	4,519.3	4,564.5	4,610.2	4,656.3	4,702.8	4,749.9
Gross Value Of Production	525,868.1	531,126.8	536,438.1	541,802.4	547,220.5	552,692.7	558,219.6	563,801.8	569,439.8	575,134.2
On-Farm Consumption										
Outputs	9,216.3	9,308.4	9,401.5	9,495.5	9,590.5	9,686.4	9,783.2	9,881.1	9,979.9	10,079.7
Net Value Of Production	516,651.9	521,818.4	527,036.6	532,306.9	537,630.0	543,006.3	548,436.4	553,920.7	559,459.9	565,054.5
Off Farm Employment										
Labour Input	11,362.5	11,476.1	11,590.9	11,706.8	11,823.9	11,942.1	12,061.5	12,182.1	12,304.0	12,427.0
INFLOWS	528,014.4	533,294.5	538,627.5	544,013.7	549,453.9	554,948.4	560,497.9	566,102.9	571,763.9	577,481.5
Production Cost										
Investment										
Purchased Inputs										
Livestock	20,831.3	21,039.6	21,250.0	21,462.5	21,677.1	21,893.9	22,112.8	22,333.9	22,557.3	22,782.8
Fencing	6,635.7	6,702.1	6,769.1	6,836.8	6,905.1	6,974.2	7,043.9	7,114.4	7,185.5	7,257.4
Milking sheds	4,545.0	4,590.5	4,636.4	4,682.7	4,729.5	4,776.8	4,824.6	4,872.9	4,921.6	4,970.8
Milk cans	7,272.0	7,344.7	7,418.2	7,492.3	7,567.3	7,642.9	7,719.4	7,796.6	7,874.5	7,953.3
Feeding Buckets	1,515.0	1,530.2	1,545.5	1,560.9	1,576.5	1,592.3	1,608.2	1,624.3	1,640.5	1,656.9
Store Construction Cost	8,332.5	-	-	-	-	-	-	-	-	-
Sub-Total Purchased Inputs	49,131.5	41,206.9	41,619.0	42,035.2	42,455.6	42,880.1	43,308.9	43,742.0	44,179.4	44,621.2
Hired Labor										
Labour Input	14,746.0	14,688.4	14,836.3	14,984.7	15,134.5	15,285.9	15,438.7	15,593.1	15,749.1	15,906.6
Sub-total Investment Costs	63,877.5	55,896.4	56,455.3	57,019.9	57,590.1	58,166.0	58,747.7	59,335.1	59,928.5	60,527.8
Operating										
Purchased Inputs										
Variable Inputs	166,684.5	168,351.3	170,034.8	171,735.2	173,452.5	175,187.1	176,938.9	178,708.3	180,495.4	182,300.4
Hired Labor										
Labour Input	12,241.2	12,363.6	12,487.2	12,612.1	12,738.2	12,865.6	12,994.3	13,124.2	13,255.5	13,388.0
Sub-total Operating Costs	178,925.7	180,714.9	182,522.1	184,347.3	186,190.8	188,052.7	189,933.2	191,832.6	193,750.9	195,688.4
Sub-Total Production Cost	242,803.1	236,611.3	238,977.4	241,367.2	243,780.9	246,218.7	248,680.9	251,167.7	253,679.4	256,216.2
OUTFLOWS	242,803.1	236,611.3	238,977.4	241,367.2	243,780.9	246,218.7	248,680.9	251,167.7	253,679.4	256,216.2
Cash Flow Before Financing	285,211.2	296,683.2	299,650.0	302,646.5	305,673.0	308,729.7	311,817.0	314,935.2	318,084.5	321,265.4
Farm Family Benefits Before Financing	294,427.5	305,991.6	309,051.5	312,142.0	315,263.4	318,416.1	321,600.2	324,816.2	328,064.4	331,345.1
Net Financing	-	-2,366.1	-2,389.8	-2,413.7	-2,437.8	-2,462.2	-2,486.8	-2,511.7	-2,536.9	-
Cash Flow After Financing	285,211.2	294,317.1	297,260.2	300,232.8	303,235.2	306,267.5	309,330.2	312,423.5	315,547.7	321,265.4
Change in Net Worth										
Contribution from own savings	-	-	-	-	-	-	-	-	-	-
Residual value of										
Transfer to Next Period	-	-	-	-	-	-	-	-	-	256,216.2
Sub-Total Change in Net Worth	-	-	-	-	-	-	-	-	-	256,216.2
Farm Family Benefits After Financing	294,427.5	303,625.5	306,661.7	309,728.4	312,825.6	315,953.9	319,113.4	322,304.6	325,527.6	587,561.2
Returns per Family-Day of Labor	1,338.3	1,380.1	1,393.9	1,407.9	1,421.9	1,436.2	1,450.5	1,465.0	1,479.7	2,670.7

IRR = 29.5%, NPV = 9,127.23

Sat Dec 31 23:50:13 1994

Kenya
On-Farm Maize Storage Analysis
Large Scale Mixed Farm Crop Model
FINANCIAL BUDGET (AGGREGATED)
(In KSh)

November

With Project

1	2	3	4	5	6	7	8	9	10
530,174.3	535,476.0	540,830.8	546,239.1	551,701.5	557,218.5	562,790.6	568,418.6	574,102.7	579,843.8
4,343.0	4,386.4	4,430.3	4,474.6	4,519.3	4,564.5	4,610.2	4,656.3	4,702.8	4,749.9
534,517.3	539,862.4	545,261.0	550,713.7	556,220.8	561,783.0	567,400.8	573,074.8	578,805.6	584,593.6
9,216.3	9,308.4	9,401.5	9,495.5	9,590.5	9,686.4	9,783.2	9,881.1	9,979.9	10,079.7
525,301.0	530,554.0	535,859.6	541,218.1	546,630.3	552,096.6	557,617.6	563,193.8	568,825.7	574,514.0
11,362.5	11,476.1	11,590.9	11,706.8	11,823.9	11,942.1	12,061.5	12,182.1	12,304.0	12,427.0
536,663.5	542,030.1	547,450.4	552,924.9	558,454.2	564,038.7	569,679.1	575,375.9	581,129.7	586,941.0
20,831.3	21,039.6	21,250.0	21,462.5	21,677.1	21,893.9	22,112.8	22,333.9	22,557.3	22,782.8
6,635.7	6,702.1	6,769.1	6,836.8	6,905.1	6,974.2	7,043.9	7,114.4	7,185.5	7,257.4
4,545.0	4,590.5	4,636.4	4,682.7	4,729.5	4,776.8	4,824.6	4,872.9	4,921.6	4,970.8
7,272.0	7,344.7	7,418.2	7,492.3	7,567.3	7,642.9	7,719.4	7,796.6	7,874.5	7,953.3
1,515.0	1,530.2	1,545.5	1,560.9	1,576.5	1,592.3	1,608.2	1,624.3	1,640.5	1,656.9
25,250.0	-	-	-	-	-	-	-	-	-
66,049.0	41,206.9	41,619.0	42,035.2	42,455.6	42,880.1	43,308.9	43,742.0	44,179.4	44,621.2
15,175.3	14,680.4	14,836.3	14,984.7	15,134.5	15,285.9	15,438.7	15,593.1	15,749.1	15,906.6
81,224.2	55,896.4	56,455.3	57,019.9	57,590.1	58,166.0	58,747.7	59,335.1	59,928.5	60,527.8
165,650.9	167,307.4	168,980.5	170,670.3	172,377.0	174,100.8	175,841.8	177,600.2	179,376.2	181,170.0
12,483.6	12,608.4	12,734.5	12,861.9	12,990.5	13,120.4	13,251.6	13,384.1	13,517.9	13,653.1
178,134.5	179,915.8	181,715.0	183,532.2	185,367.5	187,221.2	189,093.4	190,984.3	192,894.1	194,823.1
250,358.7	235,812.2	238,170.4	240,552.1	242,957.6	245,387.2	247,841.0	250,319.4	252,822.6	255,350.9
250,358.7	235,812.2	238,170.4	240,552.1	242,957.6	245,387.2	247,841.0	250,319.4	252,822.6	255,350.9
277,304.8	306,217.9	309,280.1	312,372.9	315,496.6	318,651.6	321,838.1	325,056.5	328,307.0	331,590.1
286,52..0	315,52..3	318,681.6	321,868.4	325,087.1	328,337.9	331,621.3	334,937.5	338,286.9	341,669.8
799.1	-2,359.1	-2,381.7	-2,405.5	-2,429.6	-2,453.9	-2,478.4	-2,503.2	-2,528.2	-
278,103.9	303,859.8	306,898.4	309,967.4	313,067.0	316,197.7	319,359.7	322,553.3	325,778.8	331,590.1
22,747.4	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	255,350.9
-..,747.4	-	-	-	-	-	-	-	-	255,350.9
264,572.7	313,168.2	316,299.9	319,462.9	322,657.5	325,884.1	329,..42.9	332,434.3	335,758.7	597,020.6
1,202.6	1,423.5	1,437.7	1,452.1	1,466.6	1,481.3	1,496.1	1,511.1	1,526.2	2,713.7

Kenya
On-Farm Maize Storage Analysis
Large Scale Mixed Farm Crop Model
FINANCIAL BUDGET (AGGREGATED)
(In KSh)

	January-									
	Without Project									
	1	2	3	4	5	6	7	8	9	10
Main Production										
Outputs	518,149.7	523,331.2	528,564.5	533,850.1	539,188.7	544,580.5	550,026.3	555,526.6	561,081.9	566,692.7
By Products										
Crop Residues	4,343.0	4,386.4	4,430.3	4,474.6	4,519.3	4,564.5	4,610.2	4,656.3	4,702.8	4,749.9
Gross Value Of Production	522,492.7	527,717.6	532,994.8	538,324.7	543,708.0	549,145.1	554,636.5	560,182.9	565,784.7	571,442.6
On-Farm Consumption										
Outputs	9,216.3	9,308.4	9,401.5	9,495.5	9,590.5	9,686.4	9,783.2	9,881.1	9,979.9	10,079.7
Net Value Of Production	513,276.4	518,409.2	523,593.3	528,829.2	534,117.5	539,458.7	544,853.3	550,301.8	555,804.8	561,362.9
Off Farm Employment										
Labour Input	11,362.5	11,476.1	11,590.9	11,706.8	11,823.9	11,942.1	12,061.5	12,182.1	12,304.0	12,427.0
INFLOWS	524,638.9	529,885.3	535,184.2	540,536.0	545,941.4	551,400.8	556,914.8	562,484.0	568,108.8	573,789.9
Production Cost										
Investment										
Purchased Inputs										
Livestock	20,831.3	21,039.6	21,250.0	21,462.5	21,677.1	21,893.9	22,112.8	22,333.9	22,557.3	22,782.8
Fencing	6,635.7	6,702.1	6,769.1	6,836.8	6,905.1	6,974.2	7,043.9	7,114.4	7,185.5	7,257.4
Milking sheds	4,545.0	4,590.5	4,636.4	4,682.7	4,729.5	4,776.8	4,824.6	4,872.9	4,921.6	4,970.8
Milk cans	7,272.0	7,344.7	7,418.2	7,492.3	7,567.3	7,642.9	7,719.4	7,796.6	7,874.5	7,953.3
Feeding Buckets	1,515.0	1,530.2	1,545.5	1,560.9	1,576.5	1,592.3	1,608.2	1,624.3	1,640.5	1,656.9
Store Construction Cost	-	-	-	-	-	-	-	-	-	-
Sub-Total Purchased Inputs	40,799.0	41,206.9	41,619.0	42,035.2	42,455.6	42,880.1	43,308.9	43,742.0	44,179.4	44,621.2
Hired Labor										
Labour Input	14,544.0	14,689.4	14,836.3	14,984.7	15,134.5	15,285.9	15,438.7	15,593.1	15,749.1	15,906.6
Sub-total Investment Costs	55,343.0	55,896.4	56,455.3	57,019.9	57,590.1	58,166.0	58,747.7	59,335.1	59,928.5	60,527.8
Operating										
Purchased Inputs										
Variable Inputs	166,183.1	167,844.9	169,523.3	171,218.6	172,930.8	174,660.1	176,406.7	178,170.7	179,952.4	181,752.0
Hired Labor										
Labour Input	12,120.0	12,241.2	12,363.6	12,487.2	12,612.1	12,738.2	12,865.6	12,994.3	13,124.2	13,255.5
Sub-total Operating Costs	178,303.1	180,086.1	181,886.9	183,705.8	185,542.9	187,398.3	189,272.3	191,165.0	193,076.7	195,007.4
Sub-Total Production Cost	233,646.0	235,982.5	238,342.3	240,725.7	243,133.0	245,564.3	248,019.9	250,500.1	253,005.1	255,535.2
OUTFLOWS	233,646.0	235,982.5	238,342.3	240,725.7	243,133.0	245,564.3	248,019.9	250,500.1	253,005.1	255,535.2
Cash Flow Before Financing	290,992.9	293,902.9	296,841.9	299,810.3	302,808.4	305,836.5	308,894.8	311,983.8	315,103.7	318,254.7
Farm Family Benefits Before Financing	300,709.2	303,211.3	306,243.4	309,305.8	312,398.9	315,522.9	318,678.1	321,864.9	325,083.5	328,334.4
Net Financing	-	-2,359.8	-2,383.4	-2,407.3	-2,431.3	-2,455.6	-2,480.2	-2,505.0	-2,530.1	-
Cash Flow After Financing	290,992.9	291,543.0	294,458.5	297,403.1	300,377.1	303,380.9	306,414.7	309,478.8	312,573.6	318,254.7
Change in Net Worth										
Contribution from own savings	-	-	-	-	-	-	-	-	-	-
Residual value of Transfer to Next Period	-	-	-	-	-	-	-	-	-	255,535.2
Sub-Total Change in Net Worth	-	-	-	-	-	-	-	-	-	255,535.2
Farm Family Benefits After Financing	300,709.2	300,851.5	303,860.0	306,898.6	309,967.6	313,067.2	316,197.9	319,359.9	322,553.5	583,869.6
Returns per Family-Day of Labor	1,364.6	1,367.5	1,381.2	1,395.0	1,408.9	1,423.0	1,437.3	1,451.6	1,466.2	2,654.0

IRR = 19.3%, NPV = 365.84

Sun Jan 01 00:10:11 1995

Kenya
On-Farm Maize Storage Analysis
Large Scale Mixed Farm Crops Model
FINANCIAL BUDGET (AGGREGATED)
(In KSh)

November

With Project

1	2	3	4	5	6	7	8	9	10
527,280.6	532,553.4	537,878.9	543,257.7	548,690.3	554,177.2	559,719.0	565,316.2	570,969.3	576,679.0
4,343.0	4,386.4	4,430.3	4,474.6	4,519.3	4,564.5	4,610.2	4,656.3	4,702.8	4,749.9
531,623.6	536,939.8	542,309.2	547,732.3	553,209.6	558,741.7	564,329.2	569,972.5	575,672.2	581,428.9
9,216.3	9,308.4	9,401.5	9,495.5	9,590.5	9,686.4	9,783.2	9,881.1	9,979.9	10,079.7
522,407.4	527,631.4	532,907.7	538,236.8	543,619.2	549,055.4	554,545.9	560,091.4	565,692.3	571,349.2
11,362.5	11,476.1	11,590.9	11,706.8	11,823.9	11,942.1	12,061.5	12,182.1	12,304.0	12,427.0
533,769.9	539,107.5	544,498.6	549,943.6	555,443.0	560,997.5	566,607.5	572,273.5	577,996.3	583,776.2
20,831.3	21,039.6	21,250.0	21,462.5	21,677.1	21,893.9	22,112.8	22,333.9	22,557.3	22,782.8
6,635.7	6,702.1	6,769.1	6,836.8	6,905.1	6,974.2	7,043.9	7,114.4	7,185.5	7,257.4
4,545.0	4,590.5	4,636.4	4,682.7	4,729.5	4,776.8	4,824.6	4,872.9	4,921.6	4,970.8
7,272.0	7,344.7	7,418.2	7,492.3	7,567.3	7,642.9	7,719.4	7,796.6	7,874.5	7,953.3
1,515.0	1,530.2	1,545.5	1,560.9	1,576.5	1,592.3	1,608.2	1,624.3	1,640.5	1,656.9
25,250.0	-	-	-	-	-	-	-	-	-
66,049.0	41,206.9	41,619.0	42,035.2	42,455.6	42,880.1	43,308.9	43,742.0	44,179.4	44,621.2
15,175.3	14,689.4	14,836.3	14,984.7	15,134.5	15,285.9	15,438.7	15,593.1	15,749.1	15,906.6
81,224.2	55,896.4	56,455.3	57,019.9	57,590.1	58,166.0	58,747.7	59,335.1	59,928.5	60,527.8
165,650.9	167,307.4	168,980.5	170,670.3	172,377.0	174,100.8	175,841.8	177,600.2	179,376.2	181,170.0
12,483.6	12,608.4	12,734.5	12,861.9	12,990.5	13,120.4	13,251.6	13,384.1	13,517.9	13,653.1
178,134.5	179,915.9	181,715.0	183,532.2	185,367.5	187,221.2	189,093.4	190,984.3	192,894.1	194,823.1
235,158.7	235,812.2	238,170.4	240,552.1	242,957.6	245,387.2	247,841.0	250,319.4	252,822.6	255,350.9
235,158.7	235,812.2	238,170.4	240,552.1	242,957.6	245,387.2	247,841.0	250,319.4	252,822.6	255,350.9
274,411.1	303,295.3	306,328.3	309,391.5	312,485.5	315,610.3	318,766.4	321,954.1	325,173.6	328,425.4
283,627.4	312,603.7	315,729.8	318,887.1	322,075.9	325,296.7	328,549.7	331,835.2	335,153.5	338,505.0
170.2	-2,358.1	-2,381.7	-2,405.5	-2,429.6	-2,453.9	-2,478.4	-2,503.2	-2,528.2	-
274,581.4	300,937.2	303,946.6	306,986.0	310,055.9	313,156.4	316,288.0	319,450.9	322,645.4	328,425.4
23,376.2	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	255,350.9
-23,376.2	-	-	-	-	-	-	-	-	255,350.9
260,424.4	310,245.6	313,348.1	316,481.5	319,646.4	322,842.8	326,071.2	329,332.0	332,625.3	593,855.9
1,103.7	1,113.2	1,124.3	1,135.6	1,452.9	1,467.5	1,482.1	1,497.0	1,511.9	2,699.3

Kenya
On-Farm Maize Storage Analysis
Large Scale Mixed Farm Case Model
FINANCIAL BUDGET (AGGREGATED)
(In KSh)

	Without Project									January- 10
	1	2	3	4	5	6	7	8	9	
Main Production										
Outputs	542,950.2	548,379.7	553,863.5	559,402.2	564,996.2	570,646.2	576,352.6	582,116.2	587,937.3	593,816.7
By Products										
Crop Residues	4,343.0	4,386.4	4,430.3	4,474.6	4,519.3	4,564.5	4,610.2	4,656.3	4,702.8	4,749.9
Gross Value Of Production	547,293.2	552,766.2	558,293.8	563,876.8	569,515.5	575,210.7	580,962.8	586,772.4	592,640.2	598,566.6
On-Farm Consumption										
Outputs	9,216.3	9,308.4	9,401.5	9,495.5	9,590.5	9,686.4	9,783.2	9,881.1	9,979.9	10,079.7
Net Value Of Production	538,077.0	543,457.8	548,892.3	554,381.3	559,925.1	565,524.3	571,179.6	576,891.4	582,660.3	588,486.9
Off Farm Employment										
Labour Input	11,362.5	11,476.1	11,590.9	11,706.8	11,823.9	11,942.1	12,061.5	12,182.1	12,304.0	12,427.0
INFLOWS	549,439.5	554,933.9	560,483.2	566,088.1	571,748.9	577,466.4	583,241.1	589,073.5	594,964.2	600,913.9
Production Cost										
Investment										
Purchased Inputs										
Livestock	20,831.3	21,039.6	21,250.0	21,462.5	21,677.1	21,893.9	22,112.8	22,333.9	22,557.3	22,782.8
Fencing	6,635.7	6,702.1	6,769.1	6,836.8	6,905.1	6,974.2	7,043.9	7,114.4	7,185.5	7,257.4
Milking sheds	4,545.0	4,590.5	4,636.4	4,682.7	4,729.5	4,776.8	4,824.6	4,872.9	4,921.6	4,970.8
Milk cans	7,272.0	7,344.7	7,418.2	7,492.3	7,567.3	7,642.9	7,719.4	7,796.6	7,874.5	7,953.3
Feeding Buckets	1,515.0	1,530.2	1,545.5	1,560.9	1,576.5	1,592.3	1,608.2	1,624.3	1,640.5	1,656.9
Store Construction Cost	-	-	-	-	-	-	-	-	-	-
Sub-Total Purchased Inputs	40,799.0	41,206.9	41,619.0	42,035.2	42,455.6	42,880.1	43,308.9	43,742.0	44,179.4	44,621.2
Hired Labor										
Labour Input	14,544.0	14,689.4	14,836.3	14,984.7	15,134.5	15,285.9	15,438.7	15,593.1	15,749.1	15,906.6
Sub-total Investment Costs	55,343.0	55,896.4	56,455.3	57,019.9	57,590.1	58,166.0	58,747.7	59,335.1	59,928.5	60,527.8
Operating										
Purchased Inputs										
Variable Inputs	165,678.1	167,334.8	169,008.2	170,698.3	172,405.3	174,129.3	175,870.6	177,629.3	179,405.6	181,199.7
Hired Labor										
Labour Input	12,120.0	12,241.2	12,363.6	12,487.2	12,612.1	12,738.2	12,865.6	12,994.3	13,124.2	13,255.5
Sub-total Operating Costs	177,798.1	179,576.0	181,371.8	183,185.5	185,017.4	186,867.5	188,736.2	190,623.6	192,529.8	194,455.1
Sub-Total Production Cost	233,141.0	235,472.4	237,827.1	240,205.4	242,607.5	245,033.5	247,483.9	249,958.7	252,458.3	254,982.9
OUTFLOWS	233,141.0	235,472.4	237,827.1	240,205.4	242,607.5	245,033.5	247,483.9	249,958.7	252,458.3	254,982.9
Cash Flow Before Financing	316,298.5	319,461.5	322,656.1	325,882.6	329,141.5	332,432.9	335,757.2	339,114.8	342,505.9	345,931.0
Farm Family Benefits Before Financing	325,514.7	328,769.9	332,057.6	335,378.2	338,731.9	342,119.3	345,540.5	348,995.9	352,485.8	356,010.7
Net Financing	-	-2,354.7	-2,378.3	-2,402.1	-2,426.1	-2,450.3	-2,474.8	-2,499.6	-2,524.6	-
Cash Flow After Financing	316,298.5	317,106.7	320,277.8	323,480.6	326,715.4	329,982.6	333,282.4	336,615.2	339,981.4	345,931.0
Change in Net Worth										
Contribution from own savings	-	-	-	-	-	-	-	-	-	-
Residual value of										
Transfer to Next Period	-	-	-	-	-	-	-	-	-	254,982.9
Sub-Total Change in Net Worth	-	-	-	-	-	-	-	-	-	254,982.9
Farm Family Benefits After Financing	325,514.7	326,415.2	329,679.3	332,976.1	336,305.9	339,668.9	343,065.6	346,496.3	349,961.2	610,993.6
Returns per Family-Day of Labor	1,479.6	1,483.7	1,498.5	1,513.5	1,528.7	1,543.9	1,559.4	1,575.0	1,590.7	2,777.2

IRR = 8.2%, NPV = -4,962.45

Sun Jan 01 00:52:20 1995

Kenya
On-Farm Maize Storage Analysis
Large Scale Mixed Farm Crop Model
FINANCIAL BUDGET (AGGREGATED)
(In KSh)

November	With Project									
1	2	3	4	5	6	7	8	9	10
547,499.8	552,974.8	558,504.5	564,089.6	569,730.5	575,427.8	581,182.1	586,993.9	592,863.8	598,792.5
4,343.0	4,386.4	4,430.3	4,474.6	4,519.3	4,564.5	4,610.2	4,656.3	4,702.8	4,749.9
551,842.8	557,361.2	562,934.8	568,564.2	574,249.8	579,992.3	585,792.2	591,650.2	597,566.7	603,542.3
9,216.3	9,308.4	9,401.5	9,495.5	9,590.5	9,686.4	9,783.2	9,881.1	9,979.9	10,079.7
542,626.5	548,052.8	553,533.3	559,068.7	564,659.4	570,305.9	576,009.0	581,769.1	587,586.8	593,462.7
11,362.5	11,476.1	11,590.9	11,706.8	11,823.9	11,942.1	12,061.5	12,182.1	12,304.0	12,427.0
553,989.0	559,528.9	565,124.2	570,775.5	576,483.2	582,248.0	588,070.5	593,951.2	599,890.7	605,889.7
20,831.3	21,039.6	21,250.0	21,462.5	21,677.1	21,893.9	22,112.8	22,333.9	22,557.3	22,782.8
6,635.7	6,702.1	6,769.1	6,836.8	6,905.1	6,974.2	7,043.9	7,114.4	7,185.5	7,257.4
4,545.0	4,590.5	4,636.4	4,682.7	4,729.5	4,776.8	4,824.6	4,872.9	4,921.6	4,970.8
7,272.0	7,344.7	7,418.2	7,492.3	7,567.3	7,642.9	7,719.4	7,796.6	7,874.5	7,953.3
1,515.0	1,530.2	1,545.5	1,560.9	1,576.5	1,592.3	1,608.2	1,624.3	1,640.5	1,656.9
8,332.5	-	-	-	-	-	-	-	-	-
49,131.5	41,206.9	41,619.0	42,035.2	42,455.6	42,880.1	43,308.9	43,742.0	44,179.4	44,621.2
14,746.0	14,889.4	14,836.3	14,984.7	15,134.5	15,285.9	15,438.7	15,593.1	15,749.1	15,906.6
63,877.5	55,896.4	56,455.3	57,019.9	57,590.1	58,166.0	58,747.7	59,335.1	59,928.5	60,527.8
167,695.2	169,372.2	171,065.9	172,776.6	174,504.3	176,249.4	178,011.9	179,792.0	181,589.9	183,405.8
12,241.2	12,363.6	12,487.2	12,612.1	12,738.2	12,865.6	12,994.3	13,124.2	13,255.5	13,388.0
179,936.4	181,735.8	183,553.2	185,388.7	187,242.6	189,115.0	191,006.2	192,916.2	194,845.4	196,793.8
243,813.9	237,632.2	240,008.5	242,408.6	244,832.7	247,281.0	249,753.8	252,251.4	254,773.9	257,321.6
243,813.9	237,632.2	240,008.5	242,408.6	244,832.7	247,281.0	249,753.8	252,251.4	254,773.9	257,321.6
310,175.1	321,896.7	325,115.7	328,366.9	331,650.5	334,967.0	338,316.7	341,699.9	345,116.9	348,568.0
319,391.4	331,205.2	334,517.2	337,862.4	341,241.0	344,653.4	348,099.9	351,580.9	355,096.8	358,647.7
-2,159.8	-2,376.3	-2,400.1	-2,424.1	-2,448.3	-2,472.8	-2,497.5	-2,522.5	-2,547.7	-
308,015.4	319,520.4	322,715.6	325,942.8	329,202.2	332,494.2	335,819.2	339,177.4	342,569.1	348,568.0
8,341.5	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	257,321.6
-8,341.5	-	-	-	-	-	-	-	-	257,321.6
308,890.1	328,828.8	332,117.1	335,438.3	338,792.7	342,180.6	345,602.4	349,058.4	352,549.0	615,969.3
1,404.0	1,494.7	1,509.6	1,524.7	1,540.0	1,555.4	1,570.9	1,586.6	1,602.5	2,799.9

Kenya
Small Scale On-Farm Maize Storage Analysis
Maize Small Farm Mixed Farm
CREDIT ANALYSIS
(In Kenya Shillings)

	Without Project										January-November	
	1	2	3	4	5	6	7	8	9	10	1	2
Cash Carry Forward												
Production Costs	81,006.4	76,690.5	77,457.4	78,232.0	79,014.3	79,804.4	80,602.5	81,408.5	82,222.6	83,044.8	91,494.9	76,904.3
Contribution from own savings	-	-	-	-	-	-	-	-	-	-	- 14,804.4	
Financing required from own sources	81,006.4	76,690.5	77,457.4	78,232.0	79,014.3	79,804.4	80,602.5	81,408.5	82,222.6	83,044.8	76,690.5	76,904.3
Carry Forward %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Transfer from Previous Period	76,690.5	76,690.5	77,457.4	78,232.0	79,014.3	79,804.4	80,602.5	81,408.5	82,222.6	83,044.8	76,690.5	76,904.3
Transfer to Next Period	76,690.5	77,457.4	78,232.0	79,014.3	79,804.4	80,602.5	81,408.5	82,222.6	83,044.8	83,044.8	76,904.3	77,673.3

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Kenya
Small Scale On-Farm Maize Storage Analysis
Maize Small Farm Mixed Farm
CREDIT ANALYSIS
(In Kenya Shillings)

	With Project							
	3	4	5	6	7	8	9	10
Cash Carry Forward								
Production Costs	77,673.3	78,450.1	79,234.6	80,026.9	80,827.2	81,635.5	82,451.8	83,276.3
Contribution from own savings	-	-	-	-	-	-	-	-
Financing required from own sources	77,673.3	78,450.1	79,234.6	80,026.9	80,827.2	81,635.5	82,451.8	83,276.3
Carry Forward %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Transfer from Previous Period	77,673.3	78,450.1	79,234.6	80,026.9	80,827.2	81,635.5	82,451.8	83,276.3
Transfer to Next Period	78,450.1	79,234.6	80,026.9	80,827.2	81,635.5	82,451.8	83,276.3	83,276.3

Kenya
Small Scale On-Farm Maize Storage Analysis
[illegible] Small Farm Mixed Farm
FINANCIAL BUDGET (AGGREGATED)
(In Kenya Shillings)

	Without Project									January- 10
	1	2	3	4	5	6	7	8	9	
Main Production										
Outputs	144,904.4	146,353.5	147,817.0	149,295.2	150,788.1	152,296.0	153,819.0	155,357.2	156,910.8	158,479.9
By Products										
Crop Residues	1,969.5	1,989.2	2,009.1	2,029.2	2,049.5	2,070.0	2,090.7	2,111.6	2,132.7	2,154.0
Gross Value Of Production	146,873.9	148,342.7	149,826.1	151,324.4	152,837.6	154,366.0	155,909.7	157,468.8	159,043.4	160,633.9
On-Farm Consumption										
Outputs	9,579.9	9,675.6	9,772.4	9,870.1	9,968.8	10,068.5	10,169.2	10,270.9	10,373.6	10,477.3
Net Value Of Production	137,294.1	138,667.0	140,053.7	141,454.2	142,868.8	144,297.5	145,740.5	147,197.9	148,669.8	150,156.5
Production Cost										
Investment										
Purchased Inputs										
Fixed Inputs	18,889.5	14,028.9	14,169.2	14,310.9	14,454.0	14,598.6	14,744.5	14,892.0	15,040.9	15,191.3
Hired Labor										
Labour Input	21,386.8	21,524.1	21,739.4	21,956.7	22,176.3	22,398.1	22,622.1	22,848.3	23,076.8	23,307.5
Sub-total Investment Costs	40,276.3	35,553.0	35,908.6	36,267.7	36,630.3	36,996.6	37,366.6	37,740.3	38,117.7	38,498.8
Operating										
Purchased Inputs										
Fixed Inputs	2,727.0	2,754.3	2,781.8	2,809.6	2,837.7	2,866.1	2,894.8	2,923.7	2,953.0	2,982.5
Variable Inputs	54,400.5	54,944.5	55,494.0	56,048.9	56,609.4	57,175.5	57,747.2	58,324.7	58,908.0	59,497.0
Sub-Total Purchased Inputs	57,127.5	57,698.8	58,275.8	58,858.5	59,447.1	60,041.6	60,642.0	61,248.4	61,860.9	62,479.5
Hired Labor										
Labour Input	2,363.4	2,387.0	2,410.9	2,435.0	2,459.4	2,484.0	2,508.8	2,533.9	2,559.2	2,584.8
Sub-total Operating Costs	59,490.9	60,085.8	60,686.7	61,293.5	61,906.5	[illegible]	63,150.8	63,782.3	[illegible]	65,064.3
Sub-Total Production Cost	99,767.2	95,638.9	96,595.2	[illegible]	98,536.8	[illegible]	100,517.4	101,522.6	102,537.8	103,563..
OUTFLOWS	99,767.2	[illegible]	96,595.2	97,561..	[illegible]	99,522.2	100,517.4	101,522.6	102,537.8	103,563..
Cash Flow Before Financing	[illegible]	43,028.2	43,458.5	43,893.0	44,332.0	44,775.3	45,223.0	45,675.3	46,132.0	46,593.4
Farm Family Benefits Before Financing	47,106.8	[illegible]	53,..30.9	[illegible]	[illegible]	54,843.8	55,392.3	55,946.2	56,505.6	57,070.7
Net Financing	-	-956.4	-966.0	-975.6	-985.4	[illegible]	-1,005.2	-1,015.2	-1,025.4	-
Cash Flow After Financing	37,526.9	42,071.8	42,492.5	42,917.4	43,346.6	43,780.1	44,217.9	44,660.1	45,106.7	46,593.4
Change in Net Worth										
Contribution from own savings	-	-	-	-	-	-	-	-	-	-
Residual value of										
Transfer to Next Period	-	-	-	-	-	-	-	-	-	103,563..
Sub-Total Change in Net Worth	-	-	-	-	-	-	-	-	-	103,563..
Farm Family Benefits After Financing	47,106.8	[illegible]	52,964.9	52,787.6	53,315.4	[illegible]	54,387.1	54,931.0	55,480.3	160,633.9
Returns per Family-Day of Labor	147.4	162.0	163.8	[illegible]	166.9	168.5	170.2	171.9	173.6	502.8

IRR = 27.9%. NPV = 5,034.45

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Kenya
Small Scale On-Farm Maize Storage Analysis
Maize Small Farm Mixed Farm
FINANCIAL BUDGET (AGGREGATED)
(In Kenya Shillings)

November — With Project

1	2	3	4	5	6	7	8	9	10
150,944.8	152,454.2	153,978.7	155,518.5	157,073.7	158,644.5	160,230.9	161,833.2	163,451.5	165,086.1
1,969.5	1,989.2	2,009.1	2,029.2	2,049.5	2,070.0	2,090.7	2,111.6	2,132.7	2,154.0
152,914.3	154,443.4	155,987.8	157,547.7	159,123.2	160,714.4	162,321.6	163,944.8	165,584.2	167,240.1
9,579.9	9,675.6	9,772.4	9,870.1	9,968.8	10,068.5	10,169.2	10,270.9	10,373.6	10,477.3
143,334.4	144,767.7	146,215.4	147,677.6	149,154.4	150,645.9	152,152.4	153,673.9	155,210.6	156,762.7
29,040.0	14,028.9	14,169.2	14,310.9	14,454.0	14,598.6	14,744.5	14,892.0	15,040.9	15,191.3
21,513.0	21,524.1	21,739.4	21,956.7	22,176.3	22,398.1	22,622.1	22,848.3	23,076.8	23,307.5
50,553.0	35,553.0	35,908.6	36,267.7	36,630.3	36,996.6	37,366.6	37,740.3	38,117.7	38,498.8
2,727.0	2,754.3	2,781.8	2,809.6	2,837.7	2,866.1	2,894.8	2,923.7	2,953.0	2,982.5
54,536.5	55,081.8	55,632.6	56,189.0	56,750.9	57,318.4	57,891.5	58,470.5	59,055.2	59,645.7
57,263.5	57,836.1	58,414.4	58,998.6	59,588.6	60,184.5	60,786.3	61,394.2	62,008.1	62,628.2
2,439.2	2,463.5	2,488.2	2,513.1	2,538.2	2,563.6	2,589.2	2,615.1	2,641.2	2,667.7
59,702.6	60,299.6	60,902.6	61,511.7	62,126.8	62,748.0	63,375.5	64,009.3	64,649.4	65,295.9
110,255.6	95,853.7	96,811.2	97,779.3	98,757.1	99,744.7	100,742.1	101,749.5	102,767.0	103,794.7
110,255.6	95,853.7	96,811.2	97,779.3	98,757.1	99,744.7	100,742.1	101,749.5	102,767.0	103,794.7
33,078.8	48,915.1	49,404.2	49,898.3	50,397.3	50,901.2	51,410.2	51,924.3	52,443.6	52,968.0
42,658.6	58,590.7	59,176.6	59,768.4	60,366.1	60,969.8	61,579.4	62,195.2	62,817.1	63,445.4
-213.8	-958.5	-968.1	-977.8	-987.6	-997.4	-1,007.4	-1,017.5	-1,027.7	-
32,865.0	47,956.6	48,436.1	48,920.5	49,409.7	49,903.8	50,402.8	50,906.9	51,415.9	52,968.0
14,616.8	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	103,794.7
-14,616.8	-	-	-	-	-	-	-	-	103,794.7
27,878.1	57,410.2	58,208.5	58,790.6	59,378.5	59,972.3	60,572.0	61,177.7	61,789.5	167,240.1
97.1	100.4	102.2	104.0	105.8	107.7	109.6	111.5	113.4	523.1

Kenya
Small Scale On-Farm Maize Storage Analysis
Maize Small Farm Mixed Farm
FINANCIAL BUDGET (AGGREGATED)
(In Kenya Shillings)

	January-									
	Without Project									
	1	2	3	4	5	6	7	8	9	10
Main Production										
Outputs	143,604.6	145,040.6	146,491.0	147,955.9	149,435.5	150,929.9	152,439.2	153,963.5	155,503.2	157,058.2
By Products										
Crop Residues	1,969.5	1,989.2	2,009.1	2,029.2	2,049.5	2,070.0	2,090.7	2,111.6	2,132.7	2,154.0
Gross Value Of Production	145,574.1	147,029.8	148,500.1	149,985.1	151,485.0	152,999.8	154,529.8	156,075.1	157,635.9	159,212.2
On-Farm Consumption										
Outputs	9,579.9	9,675.6	9,772.4	9,870.1	9,968.8	10,068.5	10,169.2	10,270.9	10,373.6	10,477.3
Net Value Of Production	135,994.2	137,354.2	138,727.7	140,115.0	141,516.1	142,931.3	144,360.6	145,804.2	147,262.3	148,734.9
Production Cost										
Investment										
Purchased Inputs										
Fixed Inputs	13,890.0	14,028.9	14,169.2	14,310.9	14,454.0	14,598.6	14,744.5	14,892.0	15,040.9	15,191.3
Hired Labor										
Labour Input	21,311.0	21,524.1	21,739.4	21,956.7	22,176.3	22,398.1	22,622.1	22,848.3	23,076.8	23,307.5
Sub-total Investment Costs	35,201.0	35,553.0	35,908.6	36,267.7	36,630.3	36,996.6	37,366.6	37,740.3	38,117.7	38,498.8
Operating										
Purchased Inputs										
Fixed Inputs	2,727.0	2,754.3	2,781.8	2,809.6	2,837.7	2,866.1	2,894.8	2,923.7	2,953.0	2,982.5
Variable Inputs	55,474.5	56,029.2	56,589.5	57,155.4	57,726.9	58,304.2	58,887.2	59,476.1	60,070.9	60,671.6
Sub-Total Purchased Inputs	58,201.5	58,783.5	59,371.3	59,965.0	60,564.7	61,170.3	61,782.0	62,399.8	63,023.8	63,654.1
Hired Labor										
Labour Input	2,312.9	2,336.0	2,359.4	2,383.0	2,406.8	2,430.9	2,455.2	2,479.7	2,504.5	2,529.6
Sub-total Operating Costs	60,514.4	61,119.5	61,730.7	62,348.0	62,971.5	63,601.2	64,237.2	64,879.6	65,528.4	66,183.7
Sub-Total Production Cost	95,715.4	96,672.5	97,639.3	98,615.6	99,601.8	100,597.8	101,603.8	102,619.8	103,646.0	104,682.5
OUTFLOWS	95,715.4	96,672.5	97,639.3	98,615.6	99,601.8	100,597.8	101,603.8	102,619.8	103,646.0	104,682.5
Cash Flow Before Financing	40,278.9	40,681.6	41,088.5	41,499.3	41,914.3	42,333.5	42,756.8	43,184.4	43,616.2	44,052.4
Farm Family Benefits Before Financing	49,850.7	50,357.2	50,860.9	51,369.5	51,883.2	52,402.0	52,926.0	53,455.3	53,989.8	54,529.7
Net Financing	-	-966.7	-976.4	-986.1	-996.0	-1,006.0	-1,016.0	-1,026.2	-1,036.5	-
Cash Flow After Financing	40,278.9	39,714.9	40,112.1	40,513.2	40,918.3	41,327.5	41,740.8	42,158.2	42,579.8	44,052.4
Change in Net Worth										
Contribution from own savings	-	-	-	-	-	-	-	-	-	-
Residual value of										
Transfer to Next Period	-	-	-	-	-	-	-	-	-	104,682.5
Sub-Total Change in Net Worth	-	-	-	-	-	-	-	-	-	104,682.5
Farm Family Benefits After Financing	49,850.7	49,390.6	49,884.5	50,383.3	50,887.1	51,396.0	51,910.0	52,429.1	52,953.4	159,212.2
Returns per Family-Day of Labor	156.1	154.6	156.1	157.7	159.3	160.9	162.5	164.1	165.7	498.3

IRR = 33.7%, NPV = 9,086.11

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Kenya
Small Scale On-Farm Maize Storage Analysis
Maize Smal. Farm Mixed Farm
FINANCIAL BUDGET (AGGREGATED)
(In Kenya Shillings)

November

With Project

1	2	3	4	5	6	7	8	9	10
150,126.7	151,627.9	153,144.2	154,675.6	156,222.4	157,784.6	159,362.5	160,956.1	162,565.7	164,191.3
1,969.5	1,989.2	2,009.1	2,029.2	2,049.5	2,070.0	2,090.7	2,111.6	2,132.7	2,154.0
152,096.2	153,617.1	155,153.3	156,704.8	158,271.9	159,854.6	161,453.1	163,067.7	164,698.3	166,345.3
9,579.9	9,675.6	9,772.4	9,870.1	9,968.8	10,068.5	10,169.2	10,270.9	10,373.6	10,477.3
142,516.3	143,941.5	145,380.9	146,834.7	148,303.0	149,786.1	151,283.9	152,796.8	154,324.7	155,868.0
29,040.0	14,028.9	14,169.2	14,310.9	14,454.0	14,598.6	14,744.5	14,892.0	15,040.9	15,191.3
21,513.0	21,524.1	21,739.4	21,956.7	22,176.3	22,398.1	22,622.1	22,848.3	23,076.8	23,307.5
50,553.0	35,553.0	35,908.6	36,267.7	36,630.3	36,996.6	37,366.6	37,740.3	38,117.7	38,498.8
2,727.0	2,754.3	2,781.8	2,809.6	2,837.7	2,866.1	2,894.8	2,923.7	2,953.0	2,982.5
54,536.5	55,081.8	55,632.6	56,189.0	56,750.9	57,318.4	57,891.5	58,470.5	59,055.2	59,645.7
57,263.5	57,836.1	58,414.4	58,998.6	59,588.6	60,184.5	60,786.3	61,394.2	62,008.1	62,628.2
2,439.2	2,463.5	2,488.2	2,513.1	2,538.2	2,563.6	2,589.2	2,615.1	2,641.2	2,667.7
59,702.6	60,299.6	60,902.6	61,511.7	62,126.8	62,748.0	63,375.5	64,009.3	64,649.4	65,295.9
110,255.6	95,852.7	96,811.2	97,779.3	98,757.1	99,744.7	100,742.1	101,749.5	102,767.0	103,794.7
110,255.6	95,852.7	96,811.2	97,779.3	98,757.1	99,744.7	100,742.1	101,749.5	102,767.0	103,794.7
32,260.7	48,088.8	48,569.7	49,055.4	49,545.9	50,041.1	50,541.8	51,047.3	51,557.7	52,073.3
41,840.5	57,764.5	58,342.1	58,925.5	59,514.8	60,109.9	60,711.0	61,318.1	61,931.3	62,550.6
819.9	-958.5	-968.1	-977.8	-987.6	-997.4	-1,007.4	-1,017.5	-1,027.7	-
33,080.5	47,130.3	47,601.6	48,077.6	48,558.4	49,044.0	49,534.4	50,029.7	50,530.0	52,073.3
13,583.1	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	103,794.7
-13,583.1	-	-	-	-	-	-	-	-	103,794.7
29,077.3	56,805.9	57,374.0	57,947.7	58,527.2	59,112.5	59,703.6	60,300.6	60,903.6	166,345.3
91.0	177.8	179.6	181.4	183.2	185.0	186.9	188.7	190.6	520.6

Kenya
Small Scale On-Farm Maize Storage Analysis
Maize Small Farm Mixed Farm
FINANCIAL BUDGET (AGGREGATED)
(In Kenya Shillings)

January--

	Without Project									
	1	2	3	4	5	6	7	8	9	10
Main Production										
Outputs	99,856.0	100,854.6	101,863.1	102,881.8	103,910.6	104,949.7	105,999.2	107,059.2	108,129.8	109,211.1
By Products										
Crop Residues	1,969.5	1,989.2	2,009.1	2,029.2	2,049.5	2,070.0	2,090.7	2,111.6	2,132.7	2,154.0
Gross Value Of Production	101,825.5	102,843.8	103,872..	104,910.9	105,960.0	107,019.6	108,089.8	109,170.7	110,262.5	111,365.1
On-Farm Consumption										
Outputs	9,579.9	9,675.6	9,772.4	9,870.1	9,968.8	10,068.5	10,169.2	10,270.9	10,373.6	10,477.3
Net Value Of Production	92,245.7	93,168.1	94,099.8	95,040.8	95,991.2	96,951.1	97,920.6	98,899.8	99,888.8	100,887.7
Production Cost										
Investment										
Purchased Inputs										
Fixed Inputs	13,890.0	14,028.9	14,169.2	14,310.9	14,454.0	14,598.6	14,744.5	14,892.0	15,040.9	15,191.3
Hired Labor										
Labour Input	3,131.0	3,162.3	3,193.9	3,225.9	3,258.1	3,290.7	3,323.6	3,356.9	3,390.4	3,424.3
Sub-total Investment Costs	17,021.0	17,191.2	17,363.1	17,536.8	17,712.1	17,889.3	18,068.2	18,248.8	18,431.3	18,615.6
Operating										
Purchased Inputs										
Fixed Inputs	2,727.0	2,754.3	2,781.8	2,809.6	2,837.7	2,866.1	2,894.8	2,923.7	2,953.0	2,982.5
Variable Inputs	44,925.0	45,374.3	45,828.0	46,286.3	46,749.1	47,216.6	47,688.8	48,165.7	48,647.3	49,133.8
Sub-Total Purchased Inputs	47,652.0	48,128.5	48,609.8	49,095.9	49,586.9	50,082.7	50,583.6	51,089.4	51,600.3	52,116.3
Hired Labor										
Labour Input	12,008.9	12,129.0	12,250.3	12,372.8	12,496.5	12,621.5	12,747.7	12,875.2	13,003.9	13,134.0
Sub-total Operating Costs	59,660.9	60,257.5	60,860.1	61,468.7	62,083.4	62,704.2	63,331.2	63,964.6	64,604.2	65,250.2
Sub-Total Production Cost	76,681.9	77,448.7	78,223.2	79,005.5	79,795.5	80,593.5	81,399.4	82,213.4	83,035.5	83,865.9
OUTFLOWS	76,681.9	77,448.7	78,223.2	79,005.5	79,795.5	80,593.5	81,399.4	82,213.4	83,035.5	83,865.9
Cash Flow Before Financing	15,563.7	15,719.4	15,876.6	16,035.3	16,195.7	16,357.7	16,521.2	16,686.4	16,853.3	17,021.8
Farm Family Benefits Before Financing	25,143.6	25,393.0	25,649.0	25,905.5	26,164.5	26,426.2	26,690.4	26,957.3	27,226.9	27,499.1
Net Financing	-	-774.5	-782.2	-790.1	-798.0	-805.9	-814.0	-822.1	-830.4	-
Cash Flow After Financing	15,563.7	14,944.9	15,094.3	15,245.3	15,397.7	15,551.7	15,707.2	15,864.3	16,023.0	17,021.8
Change in Net Worth										
Contribution from own savings	-	-	-	-	-	-	-	-	-	-
Residual value of										
Transfer to Next Period	-	-	-	-	-	-	-	-	-	83,865.9
Sub-Total Change in Net Worth	-	-	-	-	-	-	-	-	-	83,865.9
Farm Family Benefits After Financing	25,143.6	24,620.5	24,866.8	25,115.4	25,366.6	25,620.3	25,876.4	26,135.2	26,396.6	111,365.1
Returns per Family-Day of Labor	52.2	51.1	51.6	52.2	52.7	53.2	53.7	54.3	54.8	231.3

IRR = 58.7%, NPV = 7,351.31

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Kenya
Small Scale On-Farm Maize Storage Analysis
Maize Small Farm Mixed Farm
FINANCIAL BUDGET (AGGREGATED)
(In Kenya Shillings)

November — MAIZE PRICE

1	2	3	4	5	6	7	8	9	10
103,105.7	104,136.8	105,178.1	106,229.9	107,292.2	108,365.1	109,448.8	110,543.3	111,648.7	112,765.2
1,969.5	1,989.2	2,009.1	2,029.2	2,049.5	2,070.0	2,090.7	2,111.6	2,132.7	2,154.0
105,075.2	106,126.0	107,187.2	108,259.1	109,341.7	110,435.1	111,539.4	112,654.8	113,781.4	114,919.2
9,579.9	9,675.6	9,772.4	9,870.1	9,968.8	10,068.5	10,169.2	10,270.9	10,373.6	10,477.3
95,495.3	96,450.3	97,414.8	98,389.0	99,372.8	100,366.6	101,370.2	102,383.9	103,407.8	104,441.9
18,889.5	14,028.9	14,169.2	14,310.9	14,454.0	14,598.6	14,744.5	14,892.0	15,040.9	15,191.3
3,206.8	3,182.3	3,193.9	3,225.9	3,258.1	3,290.7	3,323.6	3,356.9	3,390.4	3,424.3
22,096.3	17,191.2	17,363.1	17,536.8	17,712.1	17,889.3	18,068.2	18,248.8	18,431.3	18,615.6
2,727.0	2,754.3	2,781.8	2,809.6	2,837.7	2,866.1	2,894.8	2,923.7	2,953.0	2,982.5
44,760.5	45,208.1	45,660.2	46,116.8	46,578.0	47,043.8	47,514.2	47,989.3	48,469.2	48,953.9
47,487.5	47,962.4	48,442.0	48,926.4	49,415.7	49,909.9	50,409.0	50,913.0	51,422.2	51,936.4
12,059.4	12,180.0	12,301.8	12,424.8	12,549.1	12,674.6	12,801.3	12,929.3	13,058.6	13,189.2
59,546.9	60,142.4	60,743.8	61,351.2	61,964.8	62,584.1	63,210.3	63,842.4	64,480.8	65,125.6
81,643.2	77,333.6	78,107.0	78,888.0	79,676.9	80,473.7	81,278.4	82,091.2	82,912.1	83,741.2
81,643.2	77,333.6	78,107.0	78,888.0	79,676.9	80,473.7	81,278.4	82,091.2	82,912.1	83,741.2
13,852.2	19,116.7	19,307.8	19,500.9	19,695.9	19,892.8	20,091.8	20,292.7	20,495.7	20,700.6
23,432.0	28,792.3	29,080.3	29,371.1	29,664.8	29,961.4	30,261.0	30,563.6	30,869.3	31,178.0
115.1	-773.3	-781.1	-788.9	-796.8	-804.7	-812.8	-820.9	-829.1	-
13,967.3	18,343.3	18,526.8	18,712.0	18,899.2	19,088.2	19,279.0	19,471.8	19,666.5	20,700.6
4,194.4	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	83,741.2
-4,194.4	-	-	-	-	-	-	-	-	-83,741.2
19,352.7	28,019.0	28,299.2	28,582.2	28,868.0	29,156.7	29,448.2	29,742.7	30,040.1	114,919.2
40.2	58.2	58.8	59.4	60.0	60.6	61.2	61.8	62.4	238.7

Kenya
Small Scale On-Farm Maize Storage Analysis
Maize Small Farm Mixed Farm
FINANCIAL BUDGET (AGGREGATED)
(In Kenya Shillings)

	January									
	Without Project									
	1	2	3	4	5	6	7	8	9	10
Main Production										
Outputs	101,155.9	102,167.5	103,189.1	104,221.0	105,263.2	106,315.9	107,379.0	108,452.8	109,537.3	110,632.7
By Products										
Crop Residues	1,969.5	1,989.2	2,009.1	2,029.2	2,049.5	2,070.0	2,090.7	2,111.6	2,132.7	2,154.0
Gross Value Of Production	103,125.4	104,156.6	105,198.2	106,250.2	107,312.7	108,385.8	109,469.7	110,564.4	111,670.0	112,786.7
On-Farm Consumption										
Outputs	9,579.9	9,675.6	9,772.4	9,870.1	9,968.8	10,068.5	10,169.2	10,270.9	10,373.6	10,477.3
Net Value Of Production	93,545.5	94,481.0	95,425.8	96,380.1	97,343.9	98,317.3	99,300.5	100,293.5	101,296.4	102,309.4
Production Cost										
Investment										
Purchased Inputs										
Fixed Inputs	21,616.5	16,783.2	16,951.0	17,120.5	17,291.7	17,464.7	17,639.3	17,815.7	17,993.9	18,173.8
Hired Labor										
Labour Input	3,206.8	3,162.3	3,193.9	3,225.9	3,258.1	3,290.7	3,323.6	3,356.9	3,390.4	3,424.3
Sub-total Investment Costs	24,823.3	19,945.5	20,145.0	20,346.4	20,549.9	20,755.4	20,962.9	21,172.6	21,384.3	21,598.1
Operating										
Purchased Inputs										
Variable Inputs	44,123.8	44,565.0	45,010.7	45,460.8	45,915.4	46,374.5	46,838.3	47,306.6	47,779.7	48,257.5
Hired Labor										
Labour Input	12,059.4	12,180.0	12,301.8	12,424.8	12,549.1	12,674.6	12,801.3	12,929.3	13,058.6	13,189.2
Sub-total Operating Costs	56,183.2	56,745.0	57,312.4	57,885.6	58,464.4	59,049.1	59,639.6	60,236.0	60,838.3	61,446.7
Sub-Total Production Cost	81,006.4	76,690.5	77,457.4	78,232.0	79,014.3	79,804.4	80,602.5	81,408.5	82,222.6	83,044.8
OUTFLOWS	81,006.4	76,690.5	77,457.4	78,232.0	79,014.3	79,804.4	80,602.5	81,408.5	82,222.6	83,044.8
Cash Flow Before Financing	12,539.1	17,790.5	17,968.4	18,148.1	18,329.6	18,512.9	18,698.0	18,885.0	19,073.8	19,264.6
Farm Family Benefits Before Financing	28,119.0	27,466.1	27,740.8	28,018.2	28,298.4	28,581.4	28,867.2	29,155.9	29,447.4	29,741.8
Net Financing	-	-766.9	-774.6	-782.3	-790.1	-798.0	-806.0	-814.1	-822.2	-
Cash Flow After Financing	12,539.1	17,023.6	17,193.8	17,365.8	17,539.4	17,714.6	17,892.0	18,070.9	18,251.6	19,264.6
Change in Net Worth										
Contribution from own savings	-	-	-	-	-	-	-	-	-	-
Residual value of										
Transfer to Next Period	-	-	-	-	-	-	-	-	-	83,044.8
Sub-Total Change in Net Worth	-	-	-	-	-	-	-	-	-	83,044.8
Farm Family Benefits After Financing	22,119.0	26,699.2	26,966.2	27,235.9	27,508.3	27,783.3	28,061.2	28,341.8	28,625.2	112,786.7
Returns per Family-Day of Labor	45.9	55.5	56.0	56.6	57.1	57.7	58.3	58.9	59.5	234.2

IRR = 27.6%, NPV = 4,877.20

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Kenya
Small Scale On-Farm Maize Storage Analysis
Maize Small Farm Mixed Farm
FINANCIAL BUDGET (AGGREGATED)
(In Kenya Shillings)

	November	With Project								
	1	2	3	4	5	6	7	8	9	10
Main Production										
Outputs	107,196.2	108,268.2	109,350.8	110,444.4	111,548.8	112,664.3	113,790.9	114,928.8	116,078.1	117,238.9
By Products										
Crop Residues	1,969.5	1,989.2	2,009.1	2,029.2	2,049.5	2,070.0	2,090.7	2,111.6	2,132.7	2,154.0
Gross Value Of Production	109,165.7	110,257.4	111,359.9	112,473.5	113,598.3	114,734.2	115,881.6	117,040.4	118,210.8	119,392.9
On-Farm Consumption										
Outputs	9,579.9	9,675.6	9,772.4	9,870.1	9,968.8	10,068.5	10,169.2	10,270.9	10,373.6	10,477.3
Net Value Of Production	99,585.8	100,581.7	101,587.5	102,603.4	103,629.4	104,665.7	105,712.4	106,769.5	107,837.2	108,915.6
Production Cost										
Investment										
Purchased Inputs										
Fixed Inputs	31,767.0	16,783.2	16,951.0	17,120.5	17,291.7	17,464.7	17,639.3	17,815.7	17,993.9	18,173.8
Hired Labor										
Labour Input	3,333.0	3,162.3	3,193.9	3,225.9	3,258.1	3,290.7	3,323.6	3,356.9	3,390.4	3,424.3
Sub-total Investment Costs	35,100.0	19,945.5	20,145.0	20,346.4	20,549.9	20,755.4	20,962.9	21,172.6	21,384.3	21,598.1
Operating										
Purchased Inputs										
Variable Inputs	44,259.7	44,702.3	45,149.3	45,600.8	46,056.8	46,517.4	46,982.6	47,452.4	47,926.9	48,406.2
Hired Labor										
Labour Input	12,135.2	12,256.5	12,379.1	12,502.9	12,627.9	12,754.2	12,881.7	13,010.5	13,140.6	13,272.0
Sub-total Operating Costs	56,394.9	56,958.9	57,528.4	58,103.7	58,684.7	59,271.6	59,864.3	60,462.9	61,067.5	61,678.2
Sub-Total Production Cost	91,494.9	76,904.3	77,673.3	78,450.1	79,234.6	80,026.9	80,827.2	81,635.5	82,451.8	83,276.3
OUTFLOWS	91,494.9	76,904.3	77,673.3	78,450.1	79,234.6	80,026.9	80,827.2	81,635.5	82,451.8	83,276.3
Cash Flow Before Financing	8,091.0	23,677.4	23,914.2	24,153.3	24,394.8	24,638.8	25,085.2	25,134.0	25,385.4	25,639.2
Farm Family Benefits Before Financing	17,670.8	33,353.0	33,686.6	34,023.4	34,363.7	34,707.3	35,054.4	35,404.9	35,759.0	36,116.6
Net Financing	-213.8	-769.0	-776.7	-784.5	-792.3	-800.3	-808.3	-816.4	-824.5	-
Cash Flow After Financing	7,877.2	22,908.4	23,137.4	23,368.8	23,602.5	23,838.5	24,076.9	24,317.7	24,560.9	25,639.2
Change in Net Worth										
Contribution from own savings	14,804.4	-	-	-	-	-	-	-	-	-
Residual value of										
Transfer to Next Period	-	-	-	-	-	-	-	-	-	83,276.3
Sub-Total Change in Net Worth	-14,804.4	-	-	-	-	-	-	-	-	83,276.3
Farm Family Benefits After Financing	2,652.6	32,584.0	32,909.8	33,238.9	33,571.3	33,907.0	34,246.1	34,588.6	34,934.5	119,392.9
Returns per Family-Day of Labor	5.5	67.7	68.3	69.0	69.7	70.4	71.1	71.8	72.6	248.0

Kenya
Small Scale On-Farm Maize Storage Analysis
Maize Small Farm Mixed Farm
CREDIT ANALYSIS
(In Kenya Shillings)

	January-November											
	Without Project											
	1	2	3	4	5	6	7	8	9	10	1	1
Cash Carry Forward												
Production Costs	76,954.6	77,724.2	78,501.4	79,286.4	80,079.3	80,880.1	81,688.9	82,505.8	83,330.8	84,164.1	91,494.9	76,904.3
Contribution from own savings	-	-	-	-	-	-	-	-	-	-	- 13,770.7	-
Financing required from own sources	76,954.6	77,724.2	78,501.4	79,286.4	80,079.3	80,880.1	81,688.9	82,505.8	83,330.8	84,164.1	77,724.2	76,904.3
Carry Forward %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Transfer from Previous Period	77,724.2	77,724.2	78,501.4	79,286.4	80,079.3	80,880.1	81,688.9	82,505.8	83,330.8	84,164.1	77,724.2	76,904.3
Transfer to Next Period	77,724.2	78,501.4	79,286.4	80,079.3	80,880.1	81,688.9	82,505.8	83,330.8	84,164.1	84,164.1	76,904.3	77,673.3

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Kenya
Small Scale On-Farm Maize Storage Analysis
Maize Small Farm Mixed Farm
CREDIT ANALYSIS
(In Kenya Shillings)

With Project							
3	4	5	6	7	8	9	10
77,673.3	78,450.1	79,234.6	80,026.9	80,827.2	81,635.5	82,451.8	83,276.3
-	-	-	-	-	-	-	-
77,673.3	78,450.1	79,234.6	80,026.9	80,827.2	81,635.5	82,451.8	83,276.3
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
77,673.3	78,450.1	79,234.6	80,026.9	80,827.2	81,635.5	82,451.8	83,276.3
78,450.1	79,234.6	80,026.9	80,827.2	81,635.5	82,451.8	83,276.3	83,276.3

Kenya
Small Scale On-Farm Maize Storage Analysis
Maize Small Farm Mixed Farm
FINANCIAL BUDGET (AGGREGATED)
(In Kenya Shillings)

	Without Project									January- 10
	1	2	3	4	5	6	7	8	9	
Main Production										
Outputs	99,856.0	100,854.6	101,863.1	102,881.8	103,910.6	104,949.7	105,999.2	107,059.2	108,129.8	109,211.1
By Products										
Crop Residues	1,969.5	1,989.2	2,009.1	2,029.2	2,049.5	2,070.0	2,090.7	2,111.6	2,132.7	2,154.0
Gross Value Of Production	101,825.5	102,843.8	103,872.2	104,910.9	105,960.0	107,019.6	108,089.8	109,170.7	110,262.5	111,365.1
On-Farm Consumption										
Outputs	9,579.9	9,675.6	9,772.4	9,870.1	9,968.8	10,068.5	10,169.2	10,270.9	10,373.6	10,477.3
Net Value Of Production	92,245.7	93,168.1	94,099.8	95,040.8	95,991.2	96,951.1	97,920.6	98,899.8	99,888.8	100,887.7
Production Cost										
Investment										
Purchased Inputs										
Fixed Inputs	13,890.0	14,028.9	14,169.2	14,310.9	14,454.0	14,598.6	14,744.5	14,892.0	15,040.9	15,191.3
Hired Labor										
Labour Input	3,131.0	3,162.3	3,193.9	3,225.9	3,258.1	3,290.7	3,323.6	3,356.9	3,390.4	3,424.3
Sub-total Investment Costs	17,021.0	17,191.2	17,363.1	17,536.8	17,712.1	17,889.3	18,068.2	18,248.8	18,431.3	18,615.6
Operating										
Purchased Inputs										
Fixed Inputs	2,727.0	2,754.3	2,781.8	2,809.6	2,837.7	2,866.1	2,894.8	2,923.7	2,953.0	2,982.5
Variable Inputs	45,197.7	45,649.7	46,106.2	46,567.2	47,032.9	47,503.2	47,978.3	48,458.1	48,942.6	49,432.1
Sub-Total Purchased Inputs	47,924.7	48,403.9	48,888.0	49,376.9	49,870.6	50,369.3	50,873.0	51,381.8	51,895.6	52,414.5
Hired Labor										
Labour Input	12,008.9	12,129.0	12,250.3	12,372.8	12,496.5	12,621.5	12,747.7	12,875.2	13,003.9	13,134.0
Sub-total Operating Costs	59,933.6	60,532.9	61,138.3	61,749.7	62,367.1	62,990.8	63,620.7	64,256.9	64,899.5	65,548.5
Sub-Total Production Cost	76,954.6	77,724.2	78,501.4	79,286.4	80,079.3	80,880.1	81,688.9	82,505.8	83,330.8	84,164.1
OUTFLOWS	76,954.6	77,724.2	78,501.4	79,286.4	80,079.3	80,880.1	81,688.9	82,505.8	83,330.8	84,164.1
Cash Flow Before Financing	15,291.0	15,444.0	15,598.4	15,754.4	15,911.9	16,071.0	16,231.8	16,394.1	16,558.0	16,723.6
Farm Family Benefits Before Financing	24,870.9	25,119.6	25,370.8	25,624.5	25,880.8	26,139.6	26,401.0	26,665.0	26,931.6	27,200.9
Net Financing	-	-777.2	-785.0	-792.9	-800.8	-808.8	-816.9	-825.1	-833.3	-
Cash Flow After Financing	15,291.0	14,666.7	14,813.4	14,961.5	15,111.1	15,262.2	15,414.9	15,569.0	15,724.7	16,723.6
Change in Net Worth										
Contribution from own savings	-	-	-	-	-	-	-	-	-	-
Residual value of										
Transfer to Next Period	-	-	-	-	-	-	-	-	-	84,164.1
Sub-Total Change in Net Worth	-	-	-	-	-	-	-	-	-	84,164.1
Farm Family Benefits After Financing	24,870.9	24,342.4	24,585.8	24,831.6	25,080.0	25,330.8	25,584.1	25,839.9	26,098.3	111,365.1
Returns per Family-Day of Labor	51.7	50.6	51.1	51.6	52.1	52.6	53.1	53.7	54.2	231.3

IRR = 33.4%, NPV = 8,928.46

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Kenya
Small Scale On-Farm Maize Storage Analysis
Maize Small Farm Mixed Farm
FINANCIAL BUDGET (AGGREGATED)
(In Kenya Shillings)

Increases	With Project									
1	2	3	4	5	6	7	8	9	10
106,378.1	107,441.9	108,516.3	109,601.5	110,697.5	111,804.5	112,922.5	114,051.7	115,192.2	116,344.2
1,969.5	1,989.2	2,009.1	2,029.2	2,049.5	2,070.0	2,090.7	2,111.6	2,132.7	2,154.0
108,347.6	109,431.1	110,525.4	111,630.6	112,746.9	113,874.4	115,013.2	116,163.3	117,324.9	118,498.2
9,579.9	9,675.6	9,772.4	9,870.1	9,968.8	10,068.5	10,169.2	10,270.9	10,373.6	10,477.3
98,767.7	99,755.4	100,753.0	101,760.5	102,778.1	103,805.9	104,844.0	105,892.4	106,951.3	108,020.8
29,040.0	14,028.9	14,169.2	14,310.9	14,454.0	14,598.6	14,744.5	14,892.0	15,040.9	15,191.3
3,333.0	3,162.3	3,193.9	3,225.9	3,258.1	3,290.7	3,323.6	3,356.9	3,390.4	3,424.3
32,373.0	17,191.2	17,363.1	17,536.8	17,712.1	17,889.3	18,068.2	18,248.8	18,431.3	18,615.6
2,727.0	2,754.3	2,781.8	2,809.6	2,837.7	2,866.1	2,894.8	2,923.7	2,953.0	2,982.5
44,259.7	44,702.3	45,149.3	45,600.8	46,056.8	46,517.4	46,982.6	47,452.4	47,926.9	48,406.2
46,986.7	47,456.6	47,931.1	48,410.4	48,894.6	49,383.5	49,877.3	50,376.1	50,879.9	51,388.7
12,135.2	12,256.5	12,379..	12,502.9	12,627.9	12,754.2	12,881.7	13,010.5	13,140.6	13,272.0
59,121.9	59,713.1	60,310.2	60,913.3	61,522.4	62,137.7	62,759.0	63,386.6	64,020.5	64,660.7
91,494.9	76,904.3	77,673.3	78,450.1	79,234.6	80,026.9	80,827.2	81,635.5	82,451.8	83,276.3
91,494.9	76,904.3	77,673.3	78,450.1	79,234.6	80,026.9	80,827.2	81,635.5	82,451.8	83,276.3
7,272.9	22,851.1	23,079.6	23,310.4	23,543.5	23,779.0	24,016.8	24,256.9	24,499.5	24,744.5
16,852.7	32,526.0	32,852.0	33,180.6	33,512.4	33,847.5	34,186.0	34,527.8	34,873.1	35,221.8
819.9	-769.0	-776.7	-784.5	-792.3	-800.3	-808.3	-816.4	-824.5	-
8,092.7	22,082.1	22,302.9	22,525.9	22,751.2	22,978.7	23,208.5	23,440.6	23,675.0	24,744.5
13,770.7	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	83,276.3
-13,770.7	-	-	-	-	-	-	-	-	83,276.3
3,901.9	31,757.7	32,075.3	32,396.1	32,720.0	33,047.2	33,377.7	33,711.5	34,048.6	118,498.2
8.1	66.0	66.6	67.3	68.0	68.6	69.3	70.0	70.7	246.1

Kenya
Small Scale On-Farm Maize Storage Analysis
Maize Small Farm Mixed Farm
FINANCIAL BUDGET (AGGREGATED)
(In Kenya Shillings)

	Without Project									January-10
	1	2	3	4	5	6	7	8	9	
Main Production										
Outputs	143,604.6	145,040.6	146,491.0	147,955.9	149,435.5	150,929.9	152,439.2	153,963.5	155,503.2	157,058.2
By Products										
Crop Residues	1,969.5	1,989.2	2,009.1	2,029.2	2,049.5	2,070.0	2,090.7	2,111.6	2,132.7	2,154.0
Gross Value Of Production	145,574.1	147,029.8	148,500.1	149,985.1	151,485.0	152,999.8	154,529.8	156,075.1	157,635.9	159,212.2
On-Farm Consumption										
Outputs	9,579.9	9,675.6	9,772.4	9,870.1	9,968.8	10,068.5	10,169.2	10,270.9	10,373.6	10,477.3
Net Value Of Production	135,994.2	137,354.2	138,727.7	140,115.0	141,516.1	142,931.3	144,360.6	145,804.2	147,262.3	148,734.9
Production Cost										
Investment										
Purchased Inputs										
Fixed Inputs	13,890.0	14,028.9	14,169.2	14,310.9	14,454.0	14,598.6	14,744.5	14,892.0	15,040.9	15,191.3
Hired Labor										
Labour Input	21,311.0	21,524.1	21,739.4	21,956.7	22,176.3	22,398.1	22,622.1	22,848.3	23,076.8	23,307.5
Sub-total Investment Costs	35,201.0	35,553.0	35,908.6	36,267.7	36,630.3	36,996.6	37,366.6	37,740.3	38,117.7	38,498.8
Operating										
Purchased Inputs										
Fixed Inputs	2,727.0	2,754.3	2,781.8	2,809.6	2,837.7	2,866.1	2,894.8	2,923.7	2,953.0	2,982.5
Variable Inputs	55,474.5	56,029.2	56,589.5	57,155.4	57,726.9	58,304.2	58,887.2	59,476.1	60,070.9	60,671.6
Sub-Total Purchased Inputs	58,201.5	58,783.5	59,371.3	59,965.0	60,564.7	61,170.3	61,782.0	62,399.8	63,023.8	63,654.1
Hired Labor										
Labour Input	2,312.9	2,336.0	2,359.4	2,383.0	2,406.8	2,430.9	2,455.2	2,479.7	2,504.5	2,529.6
Sub-total Operating Costs	60,514.4	61,119.5	61,730.7	62,348.0	62,971.5	63,601.2	64,237.2	64,879.6	65,528.4	66,183.7
Sub-Total Production Cost	95,715.4	96,672.5	97,639.3	98,615.6	99,601.8	100,597.8	101,603.8	102,619.8	103,646.0	104,682.5
OUTFLOWS	95,715.4	96,672.5	97,639.3	98,615.6	99,601.8	100,597.8	101,603.8	102,619.8	103,646.0	104,682.5
Cash Flow Before Financing	40,278.9	40,681.6	41,088.5	41,499.3	41,914.3	42,333.5	42,756.8	43,184.4	43,616.2	44,052.4
Farm Family Benefits Before Financing	49,858.7	50,357.3	50,860.9	51,369.5	51,883.2	52,402.0	52,926.0	53,455.3	53,989.8	54,529.7
Net Financing	-	-966.7	-976.4	-986.2	-996.0	-1,006.0	-1,016.0	-1,026.2	-1,036.5	-
Cash Flow After Financing	40,278.9	39,714.9	40,112.1	40,513.2	40,918.3	41,327.5	41,740.8	42,158.2	42,579.8	44,052.4
Change in Net Worth										
Contribution from own savings	-	-	-	-	-	-	-	-	-	-
Residual value of										
Transfer to Next Period	-	-	-	-	-	-	-	-	-	104,682.5
Sub-Total Change in Net Worth	-	-	-	-	-	-	-	-	-	104,682.5
Farm Family Benefits After Financing	49,858.7	49,390.6	49,884.5	50,383.3	50,887.1	51,396.0	51,910.0	52,429.1	52,953.4	159,212.2
Returns per Family-Day of Labor	156.1	154.6	156.1	157.7	159.3	160.9	162.5	164.1	165.7	498.3

IRR = 53.6%, NPV = 6,767.48

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Kenya
Small Scale On-Farm Maize Storage Analysis
Maize Small Farm Mixed Farm
FINANCIAL BUDGET (AGGREGATED)
(In Kenya Shillings)

November

With Project

1	2	3	4	5	6	7	8	9	10
146,854.3	148,322.8	149,806.0	151,304.1	152,817.1	154,345.3	155,888.7	157,447.6	159,022.1	160,612.3
1,969.5	1,989.2	2,009.1	2,029.2	2,049.5	2,070.0	2,090.7	2,111.6	2,132.7	2,154.0
148,823.8	150,312.0	151,815.1	153,333.3	154,866.6	156,415.3	157,979.4	159,559.2	161,154.8	162,766.3
9,579.9	9,675.6	9,772.4	9,870.1	9,968.8	10,068.5	10,169.2	10,270.9	10,373.6	10,477.3
139,243.9	140,636.3	142,042.7	143,463.1	144,897.8	146,346.7	147,810.2	149,288.3	150,781.2	152,289.0
18,935.0	14,028.9	14,169.2	14,310.9	14,454.0	14,598.6	14,744.5	14,892.0	15,040.9	15,191.3
21,513.0	21,524.1	21,739.4	21,956.7	22,176.3	22,398.1	22,622.1	22,848.3	23,076.8	23,307.5
40,448.0	35,553.0	35,908.6	36,267.7	36,630.3	36,996.6	37,366.6	37,740.3	38,117.7	38,498.8
2,727.0	2,754.3	2,781.8	2,809.6	2,837.7	2,866.1	2,894.8	2,923.7	2,953.0	2,982.5
55,310.0	55,863.1	56,421.7	56,985.9	57,555.8	58,131.3	58,712.6	59,299.8	59,892.8	60,491.7
58,037.0	58,617.3	59,203.5	59,795.5	60,393.5	60,997.4	61,607.4	62,223.5	62,845.7	63,474.2
2,439.2	2,463.5	2,488.2	2,513.1	2,538.2	2,563.6	2,589.2	2,615.1	2,641.2	2,667.7
60,476.1	61,080.9	61,691.7	62,308.6	62,931.7	63,561.0	64,196.6	64,838.6	65,487.0	66,141.8
100,9.4.1	96,633.9	97,600.3	98,576.3	99,562.0	100,557.6	101,563.2	102,578.8	103,604.6	104,640.7
100,9.4.1	96,633.9	97,600.3	98,576.3	99,562.0	100,557.6	101,563.2	102,578.8	103,604.6	104,640.7
38,319.8	44,000.4	44,442.5	44,886.9	45,335.7	45,789.1	46,247.0	46,709.5	47,176.6	47,648.3
47,899.7	53,670.1	54,214.9	54,757.0	55,304.6	55,857.6	56,416.2	56,980.4	57,550.2	58,125.7
38.6	-966.3	-976.0	-985.8	-995.6	-1,005.6	-1,015.6	-1,025.8	-1,036.0	-
38,358.4	43,036.1	43,466.4	43,901.1	44,340.1	44,783.5	45,231.4	45,683.7	46,140.5	47,648.3
4,251.6	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	104,640.7
-4,291.6	-	-	-	-	-	-	-	-	104,640.7
43,686.7	52,711.7	53,230.9	53,771.2	54,309.0	54,852.0	55,400.6	55,954.6	56,514.1	162,766.3
136.7	165.0	166.6	168.3	170.0	171.7	173.4	175.1	176.9	509.4

Kenya
Small Scale On-Farm Maize Storage Analysis
Maize Small Farm Mixed Farm
SUMMARY FINANCIAL EFFICIENCY MEASURES
(In Kenya Shillings)

	Appraisal Value	Switching Value	Percent Change
Switching values before financing at 18%			
Incremental inflows	27,048.0	9,583.8	-64.6
Incremental outflows			
Investment costs	8,635.9	26,100.1	202.2
Operating costs	947.9	18,412.1	1,842.4
Total outflows	9,583.8	27,048.0	182.2
Net Present Value = 17,464.16			
Internal rate of return = 133.27%			
Benefits cost ratio = 2.82			
Switching values after financing			
Incremental inflows			
Revenues	27,048.0	9,770.8	-63.9
Financing inflows	770.0	-16,507.2	-2,243.7
Total inflows	27,818.0	10,540.8	-62.1
Incremental outflows			
Investment costs	8,635.9	25,913.1	200.1
Operating costs	947.9	18,225.1	1,822.6
Financing outflows	957.0	18,234.2	1,805.4
Total outflows	10,540.8	27,818.0	163.9
Net Present Value = 17,277.20			
Internal rate of return = 127.16%			
Benefits cost ratio = 2.64			

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Kenya
Small Scale On-Farm Maize Storage Analysis
Maize Small Farm Mixed Farm
SUMMARY FINANCIAL EFFICIENCY MEASURES
(In Kenya Shillings)

	Appraisal Value	Switching Value	Percent Change
Switching values before financing at 18%			
Incremental inflows	29,205.3	9,265.9	-68.3
Incremental outflows			
Investment costs	12,900.8	32,840.3	154.6
Operating costs	-3,635.0	16,304.5	1,842.4
Total outflows	9,265.9	29,205.3	215.2
Net Present Value = 18,939.44			
Internal rate of return = 93.11%			
Benefits cost ratio = 3.15			
Switching values after financing			
Incremental inflows			
Revenues	29,205.3	8,549.0	-70.7
Financing inflows	-2,952.8	-23,609.2	-2,243.7
Total inflows	26,252.5	5,596.1	-78.7
Incremental outflows			
Investment costs	12,900.8	33,557.2	160.1
Operating costs	-3,635.0	17,021.4	1,822.6
Financing outflows	-3,669.7	16,986.6	1,805.4
Total outflows	5,596.1	26,252.5	369.1
Net Present Value = 20,656.38			
Internal rate of return = 103.83%			
Benefits cost ratio = 4.69			

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Kenya
Small Scale On-Farm Maize Storage Analysis
Maize Small Farm Mixed Farm
SUMMARY FINANCIAL EFFICIENCY MEASURES
(In Kenya Shillings)

	Appraisal Value	Switching Value	Percent Change
Switching values before financing at 19%			
Incremental inflows	14,551.8	3,754.5	-74.2
Incremental outflows			
Investment costs	4,264.9	15,062.2	253.2
Operating costs	-510.4	10,286.9	1,842.4
Total outflows	3,754.5	14,551.8	287.6
Net Present Value = 10,797.28			
Internal rate of return = 199.48%			
Benefits cost ratio = 3.88			
Switching values after financing			
Incremental inflows			
Revenues	14,551.8	3,653.8	-74.9
Financing inflows	-414.6	-11,312.6	-2,243.7
Total inflows	14,137.2	3,239.2	-77.1
Incremental outflows			
Investment costs	4,264.9	15,162.9	255.5
Operating costs	-510.4	10,387.5	1,822.6
Financing outflows	-515.3	10,362.7	1,805.4
Total outflows	3,239.2	14,137.2	336.4
Net Present Value = 10,897.95			
Internal rate of return = 213.86%			
Benefits cost ratio = 4.36			

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Kenya
On-Farm Maize Storage Analysis
Large Scale Mixed Farm Crop Model
SUMMARY FINANCIAL EFFICIENCY MEASURES
(In KSh)

	Appraisal Value	Switching Value	Percent Change
Switching values before financing at 19%			
Incremental inflows	38,730.1	11,034.3	-71.5
Incremental outflows			
Investment costs	14,577.1	42,273.0	190.0
Operating costs	-3,542.8	24,153.0	-
Total outflows	11,034.3	38,730.1	251.0
Net Present Value = 27,695.86			
Internal rate of return = 121.49%			
Benefits cost ratio = 3.51			
Switching values after financing			
Incremental inflows			
Revenues	38,730.1	10,335.5	-73.3
Financing inflows	-2,878.0	-31,272.6	-
Total inflows	35,852.2	7,457.5	-79.2
Incremental outflows			
Investment costs	14,577.1	42,971.7	194.8
Operating costs	-3,542.8	24,851.8	-
Financing outflows	-3,576.7	24,817.9	-
Total outflows	7,457.5	35,852.2	380.8
Net Present Value = 28,384.63			
Internal rate of return = 135.20%			
Benefits cost ratio = 4.81			

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Kenya
On-Farm Maize Storage Analysis
Large Scale Mixed Farm Crop Model
SUMMARY FINANCIAL EFFICIENCY MEASURES
(In KSh)

	Appraisal Value	Switching Value	Percent Change
Switching values before financing at 19%			
Incremental inflows	40,887.5	20,994.2	-48.7
Incremental outflows			
Investment costs	21,748.9	41,642.2	91.5
Operating costs	-754.7	19,138.5	-
Total outflows	20,994.2	40,887.5	94.8
Net Present Value = 19,893.26			
Internal rate of return = 56.55%			
Benefits cost ratio = 1.95			
Switching values after financing			
Incremental inflows			
Revenues	40,887.5	20,845.4	-49.0
Financing inflows	-613.1	-20,655.2	-
Total inflows	40,274.4	20,232.3	-49.8
Incremental outflows			
Investment costs	21,748.9	41,791.1	92.2
Operating costs	-754.7	19,287.4	-
Financing outflows	-762.0	19,280.2	-
Total outflows	20,232.3	40,274.4	99.1
Net Present Value = 20,042.12			
Internal rate of return = 57.17%			
Benefits cost ratio = 1.99			

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Kenya
On-Farm Maize Storage Analysis
Large Scale Mixed Farm Crop Model
SUMMARY FINANCIAL EFFICIENCY MEASURES
(In KSh)

	Appraisal Value	Switching Value	Percent Change
Switching values before financing at 18%			
Incremental inflows	20,372.5	16,747.4	-17.8
Incremental outflows			
Investment costs	7,171.8	10,797.0	50.5
Operating costs	9,575.5	13,.00.7	37.9
Total outflows	16,747.4	20,372.5	21.6
Net Present Value = 3,625.12			
Internal rate of return = 38.44%			
Benefits cost ratio = 1.22			
Switching values after financing			
Incremental inflows			
Revenues	20,372.5	18,636.0	-8.5
Financing inflows	7,778.6	6,042.1	-22.3
Total inflows	28,151.1	26,414.6	-6.2
Incremental outflows			
Investment costs	7,171.8	8,908.4	24.2
Operating costs	9,575.5	11,312.0	18.1
Financing outflows	9,667.2	11,403.7	18.0
Total outflows	26,414.6	28,151.1	6.6
Net Present Value = 1,736.51			
Internal rate of return = 26.23%			
Benefits cost ratio = 1.07			

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Kenya
On-Farm Maize Storage Analysis
Large Scale Mixed Farm Crop Model
SUMMARY FINANCIAL EFFICIENCY MEASURES
(In KSh)

	Appraisal Value	Switching Value	Percent Change
Switching values before financing at 198			
Incremental inflows	-	-	-17.8
Incremental outflows			
Investment costs	-	10,797.0	50.5
Operating costs	-	-	37.9
Total outflows	-	-	21.6
Net Present Value = 0.00			
Internal rate of return = None			
Benefits cost ratio = 0.00			
Switching values after financing			
Incremental inflows			
Revenues	-	-	-8.5
Financing inflows	-	-	-22.3
Total inflows	-	-	-6.2
Incremental outflows			
Investment costs	-	8,908.4	24.2
Operating costs	-	-	18.1
Financing outflows	-	-	18.0
Total outflows	-	-	6.6
Net Present Value = 0.00			
Internal rate of return = None			
Benefits cost ratio = 0.00			

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IRR,NPV and Payback
capital Investment Calculator
Project A Project B

Cash Flow	Sum	Year	Cash Flow	Sum	Year
-5000	-5000	0	-10150	-10150	0
215.1	-1784.9	1	5802.2	-4347.8	1
215.1	1430.2	2	5802.2	1454.4	2
215.1	4645.3	3	5802.2	7256.6	3
215.1	7860.4	4	5802.2	13058.8	4
215.1	11075.5	5	5802.2	18861	5
215.1	14290.6	6	5802.2	24663.2	6
215.1	17505.7	7	5802.2	30465.4	7
215.1	20720.8	8	5802.2	36267.6	8
215.1	23935.9	9	5802.2	42069.8	9
215.1	27151	10	5802.2	47872	10
count Rate		19.00%			19.00%
	IRR	63.84%			56.52%
	NPV	8950.109			15025.37
back Periods		1			1
efit/Cost		2.79			2.48

ject A: Traditional Store (no store)
ject B: Improved Storage (with store)

IRR,NPV and Payback
capital Investment Calculator
Project A Project B

Cash Flow	Sum	Year	Cash Flow		Year
5000	-5000	0	-15150	-15150	0
15.1	-1784.9	1	7059.1	-8090.9	1
15.1	1430.2	2	7059.1	-1031.8	2
15.1	4645.3	3	7059.1	6027.3	3
15.1	7860.4	4	7059.1	13086.4	4
15.1	11075.5	5	7059.1	20145.5	5
15.1	14290.6	6	7059.1	27204.6	6
15.1	17505.7	7	7059.1	34263.7	7
15.1	20720.8	8	7059.1	41322.8	8
15.1	23935.9	9	7059.1	48381.9	9
15.1	27151	10	7059.1	55441	10
ount Rate		19.00%			19.00%
		IRR			
		63.84%			45.50%
		NPV			
		8950.109			15478.98
ack Periods		1			1
fit/Cost		2.79			2.02

ect A: Traditional Store (no store)
ect B: Improved Storage (no store)

IRR,NPV and Payback
capital Investment Calculator
Project A Project B

Cash Flow	Sum	Year	Cash Flow		Year
32.5	-8332.5	0	-16917.5	-16917.5	0
77.6	-5054.9	1	6943.9	-9973.6	1
77.6	-1777.3	2	6943.9	-3029.7	2
77.6	1500.3	3	6943.9	3914.2	3
77.6	4777.9	4	6943.9	10858.1	4
77.6	8055.5	5	6943.9	17802	5
77.6	11333.1	6	6943.9	24745.9	6
77.6	14610.7	7	6943.9	31689.8	7
77.6	17888.3	8	6943.9	38633.7	8
77.6	21165.9	9	6943.9	45577.6	9
77.6	24443.5	10	6943.9	52521.5	10
count Rate		19.00%			19.00%
		IRR			
		37.73%			39.58%
		NPV			
		5888.793			13211.63
back Periods		1			1
efit/Cost		1.71			1.78

ject A: Traditional Store (without store)
ject B: Improved Storage (with store)

IRR,NPV and Payback
capital Investment Calculator
Project A Project B

Cash Flow Sum	Year	Project A Cash Flow	Project B Cash Flow	Year
32.5 -8332.5	0	-25250	-25250	0
77.6 -5054.9	1	9437.9	-15812.1	1
77.6 -1777.3	2	9437.9	-6374.2	2
77.6 1500.3	3	9437.9	3063.7	3
77.6 4777.9	4	9437.9	12501.6	4
77.6 8055.5	5	9437.9	21939.5	5
77.6 11333.1	6	9437.9	31377.4	6
77.6 14610.7	7	9437.9	40815.3	7
77.6 17888.3	8	9437.9	50253.2	8
77.6 21165.9	9	9437.9	59691.1	9
77.6 24443.5	10	9437.9	69129	10
ount Rate	19.00%			19.00%
	IRR 37.73%			35.60%
	NPV 5888.793			15700.43
back Periods	1			1
efit/Cost	1.71			1.62

ject A: Traditional Store (no store)
ject B: Improved Storage (no store)