IMPACT OF MECHANIZATION ON MAIZE OUTPUT IN KENYA

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DECLARATION

This research project is my original work and has not been presented for the award of degree in any other university or tertiary institution of higher learning.

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APPROVAL

This research proposal has been submitted for examination with my approval as the university supervisor.

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DEDICATION

I dedicate this work to my family members for their efforts and support throughout the entire course and during research on this paper. A special dedication goes to the Almighty God.

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My sincere gratitude to the Almighty God for granting me courage, knowledge, and wisdom during the time spent on this project.

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ABSTRACT

The main aim of this research project was to determine the impact of mechanization on maize output in Kenya as well as providing policy recommendations on the use of machinery as a modern way of improving maize productivity. The study adopted Egerton University Tegemeo Institute of Agricultural Policy and Development 2010 (being the most recent at the time of the study) Household Survey. The raw data from the institute was collected from targeted rural smallholder farmers all over Kenya. Cross-sectional household data was analyzed for the year 2010 in Kenya using the Cobb-Douglas function. Two-Stage Least Squares Estimation was used as credit facility use was applied as an instrument to mechanization. The study sample consisted of 1,634 farmers who planted maize with 352 out of the 1634 farmers in the sample purchased fertilizers and 133 used pesticides. All farmers in the sample used some form of machineries such as tractors, farm implements, harvesters, planters, ridgers, shellers among other farm machinery and implements. On average, farmers spent only Ksh. 995 on machinery. Many farmers are small-scale farmers with an average of 0.78 acres used for maize production. The results of the empirical analysis found that machinery use has a weak positive impact on maize production with its usage among small-scale farmers, having no major effects on maize output due to the challenges of economies of scale. Fertilizer use is the most critical input and government should continue to subsidize it, in improving maize production as it boosts soil health. The study recommends that both the county and national government establish and embolden mechanization units through public-private partnerships to serve rural farmers. Legislations should also be passed to curb the issue of land mutation in arable areas to encourage the use of farm machinery in agriculture.

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DEFINITION OF TERMS

i. Agricultural implements – refers to attachable devices that can execute agricultural related tasks by tractors, animals, or humans when being pushed or pulled from behind.

ii. Agricultural intensification – refers to the increment of farming inputs and labor usage in farm production per allocated unit of land thus reducing idleness in land use.

iii. Agricultural machinery – refers to combines, implements, and tractors that are superior to hand-held tools that are mechanically powered or can be pulled by animal in farming activities.

iv. Agricultural mechanization – refers to the use of any mechanically powered device used by a farmer to accomplish agricultural operations during production.

v. Food Security – refers to the availability and accessibility of nutritious food depending on peoples' social, economic, and physical status to attain healthy and active life by meeting their dietary requirements (FAO, 2012).

vi. Innovation – refers not just to factor substitution with existing technology but to the development and application of new technology.

vii. Large scale farming - Refers to farmers with maize farms of more than 5 acres.

viii. Post-harvest losses – refers to the measurable qualitative and quantitative loss in a given crop that occurs along its various stages.

ix. Post-harvest handling – refers to the management of harvested farm produce right from the farm to when it is purchased by consumers. The process refers to storage, handling, or primary processing.

x. Productivity – refers to the amount of real output per unit of inputs.

xi. Small-scale farmers – refers to farmers with small parcels below 5 acres for farming.

xii. Technology adoption – refers to the decision to acquire and use a new or improved invention or innovation.

xiii. Tractorization – is the intensive use tractors of varying sizes in agricultural production. The variation can be interms of horse power ratings, double or single axle.

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LIST OF ABBREVIATIONS AND ACRONYMS

AGCO	Allis-Gleaner Company (AGCO Corporation Company)
ASAL	Arid and Semi-Arid Land
ASDS	Agricultural Sector Development Strategy 2010-2020
AUC	African Union Commission
CIMMYT	International Maize and Wheat Improvement Centre
ERA	Economic Review of Agriculture
FAO	United Nations Food and Agriculture Organization
GDP	Gross Domestic Product
GoK	Government of Kenya
KNBS	Kenya National Bureau of Statistics
MTP III	Medium-Term Plan III
RTS	Returns-to-Scale
SDG	Sustainable Development Goals
TAPRA	Tegemeo Agricultural Policy Research Analysis
WB	World Bank

CHAPTER ONE: INTRODUCTION

1.1: Background

Major production areas for maize in the world lie in the temperate regions of the western hemisphere and China. Generally, maize is cultivated globally over one hundred and forty million hectares with yields of up to 637 million tons (FAOSTAT, 2014), with the United States accounting for 42% of world output.

Industrialized countries produce the highest yield since they are highly mechanized and have a well-developed crop cultivar, seed selection, adequate inputs with the added advantage of favorable climates supported with irrigation and arable soils (Nafziger, 2009).

Most maize produced in Africa comes from small-scale rural farmers who depend on human labor and animal power with 70% of farms being less than 2 hectares (Pingali, 2007). This has led to poor performance in maize production with yields of this staple cereal being at about one ton per hectare thus averaging to the third yield for Asia and Latin America (FAOSTAT, 2010). According to African Union (2003) in Maputo Declaration, African leaders agreed that ten percent of their nation's budget shall be spent on agriculture to achieve a 6% annual growth in the sector.

Kenya's Vision 2030 is meant to change Kenya into an internationally recognized country with a thriving economy for her people to achieve higher living standards. For the vision to be realized, innovations in the agricultural sector, specifically through mechanization are inevitable. The agricultural sector is vital to Kenya's economic growth and employment creation. It accounts for 26% of direct GDP growth with 25% indirect contribution through linkage with other sectors, which depend on agricultural products as raw materials. (Kenya Economic Update Edition 19, 2019). Additionally, over nine million Kenyans, translating to over 56% of total employment in the country in 2017 were employed in the agriculture sector (Kenya Economic Update Edition 19, 2019). Equally, in 2017 the sector accounted for over 65% of export merchandise. The Big 4 Agenda on Food Security, on the other hand, aspires to reduce to 50 percent the number of food insecure Kenyans, reduce expenditure on food by 47 percent and realize 100 percent security in food and nutrition. If this is to be achieved, then rethinking the modes of agricultural

production, specifically through establishing the effect of mechanization on maize production is necessary.

1.1.1: Role of Maize in Agricultural Production

Globally, maize is among three cereal crops that ensure food availability with rice and wheat dominating household diets and providing more than thirty percent of calories uptake to over forty five billion citizens of ninety four developing countries. By consumption, maize contributes more than twenty percent of calorie intake among consumers in twenty one countries with low-income and more than thirty percent in twelve developing countries, with a population of more than 310 million (Ignaciuk, 2014; Shiferaw et al., 2011). Among 22 countries worldwide where maize consumption forms the biggest calorie intake, 16 are in Africa (Nuss & Tanumihardjo, 2011) and Kenya is among them.

The maize sub-sector in Kenya is dominated by small-scale farmers who produce maize as the main food crop accounting for more than ninety eight percent of the three million and five hundred thousand smallholder farmers, who together produce more than 70 percent of the total production (Economic Survey 2015; Guantai et. al., 2010; Kirimi et. al., 2011; FAO 2014, GoK; 2007) and its production patterns account for 28% of agricultural gross output (Mathenge & Tschirley, 2009).

On average, a Kenyan individual consumes over 90kg per year of maize, with its dominance in Western and Nyanza counties, making Kenya the highest in Africa as it is supported by national policies that equate maize security with food security (Brooks, Thompson & Odame, 2009).

The significance of maize as a staple crop in Kenya dates back over 100 years since the arrival of British settlers who produced maize crops for two reasons. First, maize farming required little capital and technical know-how, unlike commercial crops. Secondly, maize gave greater returns to land than

traditional cereals such as sorghum and millet under similar favorable conditions (Brooks, Thompson & Odame, 2009).

Large-scale maize-producing counties in Kenya are Uasin Gishu, Trans Nzoia, Nakuru, Kericho, and Laikipia with about 700 hectares with 25% of these farms averaging between 20-25 hectares. Small-scale production areas include Bungoma, Nyeri, Kisii, and Siaya with an average of between 02-12 hectares of farmland (FAO, 2009) with maize being intercropped with other subsistence crops like beans, groundnuts, bananas among other short maturing crops.

The relative importance of the maize crop among Kenyans is because it can be consumed as human food, used to formulate animal feed, and seed for propagation (Alene et al. 2007). The grain is used in industrial extraction of oil and starch for biofuels (FAO, 2014), and for other industrial uses (CGIAR, 2016).

1.1.2: Food Security, Maize, and Other Crops

Maize production and availability in Kenya are equated to food security. Its consumption provides the majority of urban and rural consumers with a large intake of calories (Nyoro, 1992), which is estimated to be a third among Kenyans (Kirimi et. al., 2011). Among other main crops meant for food like wheat, beans, rice, bananas, and potatoes, maize stands out as the principal crop in Kenya as its farming is done in more than 90% of all arable farms in Kenya and any poor yields or shortage in its production and supply results to famine (FAO, 2009). Maize farming earns income to framers as it offers 25 percent of employment in the agricultural sector (FAO, 2009). Banana is equally important in addressing food insecurity and as a source of income as well as common beans which come second to maize as a source of food (FAO, 2009).

In the 1980s, efforts were directed on the increased distribution of millet and sorghum in ASAL areas with government policies focusing on their production as a panacea to food insecurity with the

accumulation of various crops for food reserves from smallholder farm surpluses to cater for seasons of production inadequacies (the Republic of Kenya, 1981). Until in the recent past, the government has been pursuing the same policies (Republic of Kenya 1986; 2004).

Increased maize research, production, and commercialization show how important and valuable maize crop is, as cash and main food crop. This has led to lower production of sorghum and millet, which traditionally were considered major in addressing food availability issues in various households (FAO, 2014).

Besides, the efforts of improving maize production to address food insecurity could be futile if storage issues and proper post-harvest operations are not addressed as it leads to loss of earnings from surplus sales (Republic of Kenya, 2004; Compton,1992). It is estimated that post-harvest losses for all crops in Sub-Saharan Africa are at 37% with 8% for cereal grains (World Bank, 2014) while in Kenya maize post-harvest loss ranges between 12%-20% of national output.

1.1.3: Role of other inputs in Maize Production

In general, factors that influence the productivity in terms of quality and quantity of a crop depend on capital, land, seeds, labor and fertilizer, farmer characteristics, and prevailing government policies (Wiebe et al., 2001). Maize crop yield performance majorly depends on certified hybrid seeds, inorganic fertilizer application, and the use of pest control chemicals. In Kenya, maize is grown majorly under rain-fed systems. The farming systems include and are not limited to maize mono-crop production, maize mixed cropping with other crops like beans and groundnuts being intercropped with maize in most cases. Agro-pastoral, cereal-root crop mixed and highland mixed are some more common maize farming systems in other parts of Kenya.

Maize certified seeds variety provide farmers with improved crop genetics that ensures high output, resistance to diseases, and ability to withstand unfavorable climatic conditions. Seed quality depends on agronomic management, quality assurance standards, and field production methods.

Fertilizer use has been responsible for sustained crop productivity globally (Sanchez et al., 1997) as it helps to overcome nutrient deficiencies (Crawford et al., 2008). In Kenya, the application of fertilizer was among the first agricultural technologies adopted and that led to increased crop yields.

Maize production depends on the efficacy in control of pests and weed by use of pesticides. Weeds tend to suffocate maize crops by competing for nutrients, water, and a host to pest that lead to lower productivity as well as making it difficult to harvest (Ohene, 1998). Herbicide application on maize promotes productivity by reducing on the costs of inputs such as labor.

To sum up, the development of agricultural machinery technology, use of certified hybrid seeds, inorganic fertilizer or fertile soils, pesticides, and availability of water through government support or well-distributed rainfall contribute immensely to maize output as well as access to extension services (Chumo, 2014; Karanja, et al., 1998).

1.1.4: Overview of Agricultural Mechanization

Agricultural mechanization involves the application of technical and scientific knowledge into the field of agriculture to improve yields and drive commercial agriculture. This involves improvement and taking charge of machines for farming activities, proper water usage, and post-harvest operations (Omwombo et al., 2012; Rahman & Lawal, 2003). It also includes the use of agricultural tools and implements that are powered by machines to achieve agricultural production using motorized power machines, animal power, and manual energy from land preparation, management, and processing of crops (Clarke & Simalenga, 1997; Brordet et al., 1988). Automation is considered as the main input in agriculture as it covers the use of mechanized technology and increased power to agricultural

operations by enhancing the productive potential of land and human efforts (the Republic of Kenya, 2015; Havard et al., 1988).

Adoption and expansion of mechanization in agricultural production can lead to sustainable growth in farming, as it offers employment opportunities that can address poverty, and food insecurity. It can also lead to the development of other sectors such as agribusiness, tourism, and trade (Mounirou, 2018). According to Boserup (1965), the take-up of land-saving techniques like the use of inorganic fertilizer in agricultural intensification requires added labor input thus creating demand for farm machinery. The use of farm mechanization should be directed to cereals production as it is relatively inexpensive compared to investments in other crops (Mounirou, 2018).

The global population is rising to lead to a proliferation of urban development for the settlement of people. At this rate, there is a need to modernize agriculture and food production along various value chains through agricultural mechanization (Takeshima & Salan, 2010; ASDS, 2010). This paints a picture that future maize production will depend on efficient use of inputs for increased output with limited land expansion for its production (Kibaara & Kavoi, 2012).

In the past, efforts to promote agricultural mechanization in Africa were done by state interventions and due to bureaucracy and inefficiencies, the program failed due to limited demand for agricultural mechanization in crop production (Pingali et. al., 1987).

Renewed efforts are currently being recognized to revive mechanization due to its central importance in economic transformation and development in Africa. According to FAO and AUC, mechanizing agriculture is unavoidable for the attainment of Zero Hunger by 2025 as per the Malabo Declaration of 2014, the second Goal of SDGs, and attainment of Agenda 2063 - Prosperous Africa We Want (FAO & AUC, 2018). In areas with growing demand, private investors are at the forefront to import types of machinery needed, guaranteeing farmers' availability of spare parts, services, and repairs. The

government imports brands through concessional loans, and in most cases does not meet farmers' demands. Mechanization fosters agricultural productivity (Agarwal, 1980), as it involves shifting to an alternative combination of land, capital, and labor to improve farm income through increased output, reduced costs with the benefit of reduction in drudgery (Karim et al., 2013). The use of advanced machinery technology in America and Europe was responsible for increased maize yield (Karlen and Kasperbauer, 1989), which has been maintained since its adoption to date in agricultural farmlands.

In Ghana mechanization of maize production is linked to greater return-to-scale, as a result of ownership of tractors (Takeshima et al., 2018). Tractor density in Zimbabwe stands at 35.6% for every 100 square km. This makes it the most tractorized country in Africa, with 75 percent of tractors concentrated in commercial zones and with inadequate access to small-scale farmers (Kienzle et al., 2013). In Zambia, 60 percent of tractors are found in Southern and Central parts of the nation while in Kenya, it is concentrated around maize leading production areas of Rift Valley and parts of flat Western lands (World Bank 2013; 2012).

Current efforts to pursue tractor use in Africa are seen through the partnership of AGCO Corporation to manufacture Massey Ferguson tractors together with Algeria Tractors Company for exports and local use in Africa (AGCO, 2012). In Sub-Saharan Africa, farmers owning combine harvesters are very few while small-scale farmers might only possess threshing machines but at times hire the services of combine harvesters (Silver, Takeshima, & Silver, 2016).

In East Africa, farming machinery is owned by commercial and individual farmers who own combines and several specialized tractors. They hardly hire neighboring potential commercial farmers making it hard for small-scale farmers to embrace mechanization. Examples of commercial estates are owned by foreigners and are prevalent in Zimbabwe, Kenya, Zambia, and Tanzania with an emerging trend in Ghana, Nigeria, and Ethiopia (Jayne et al 2014).

Most African governments, including Kenya, have demonstrated their support for mechanization through investing in mechanization research, providing technical support and training as well as creating policies to encourage private sector business persons to offer mechanization services (Silver et al., 2016).

1.2: Statement of the Problem

The prominence of Agriculture in Kenya cannot be underrated. The sector constitutes a significant share of GDP and as a source of livelihood to rural natives as well as employment with maize production taking the lead as a foreign income earner from exports.

In recent years, Kenya has experienced the drastic impact of climate change with the effects of famine in most parts of the country. This has resulted in food scarcity as the country relies mostly on rain for food crop production with limited adoption of modern maize crop production methods. Kenya being among countries experiencing rapid growth in population (World Bank, 2007; Gitu, 2006; Pingali, 2001), it is critical for her and the rest of Sub-Saharan countries to increase production of maize crop for food security. Maize is a major staple crop in most communities in Kenya and its production has been seen to decline and, in some situations, stagnant with consumption demand exceeding domestic supply.

Furthermore, various government policies have been formulated to increase its production for the nation to achieve self-sufficiency and food security. Its increased production needs advanced technology to improve its yield and support the achievement of the Government of Kenya Big 4 Agenda, a priority agenda for 2017 to 2022, the United Nations SDG goal of no hunger to be achieved by 2030, and food security in Kenya as well as the Vision 2030 a development blueprint for the period 2008 to 2030. Despite these policy interventions and commitment to boosting food security to address such challenges as, reducing hunger and malnutrition, the country has still produced inadequate maize

output forcing the government to import to take care of the deficit. In some scenarios, most of what has been produced gets wasted during harvesting with some getting lost during post-harvest handling hence the need to adopt improved if not sophisticated storage facilities to minimize such losses.

With all these spirited efforts to improve maize productivity, the decline in maize output over the recent years is worrying due to high costs of production, declining soil fertility, inadequate supply of quality inputs, decreasing land sizes, constraints in accessing affordable capital as well as low use and acceptance of current farming techniques like the use of agricultural machinery in maize production (Ministry of Agriculture, 2009).

Besides, most studies relating to maize production have in most cases related to technical efficiencies, supply response, use of specific technologies such as the use of inorganic fertilizers, use of hybrid seeds, and use of tractors which is only one facet of agricultural mechanization. The study investigated the impact of mechanization on maize output, with the study focusing on the use of machinery, pest control, application of fertilizer, farm size, cost of labor, and use of certified seeds.

1.3: Research Questions

i. What is the impact of agricultural mechanization on maize production output in Kenya?
ii. What is some policy intervention to support the adoption of agricultural mechanization in maize production in Kenya?

1.4: Objective of Study

i. To empirically examine the impact of agricultural mechanization on maize output in Kenya.
ii. To conclude and propose suitable policies for the adoption of agricultural mechanization for Kenya.

1.5: Significance of Study

Farming activities in Kenya mostly rely on human power and family labor to operate hand-held tools which limit the energy requirement and operational output potential in agricultural production. The rate at which population growth and urbanization are taking place in Kenya requires that food production systems adopt advanced technologies to increase food supply since consumption has also increased. Additionally, manual maize production leads to delays in operations, poor work quality, and poor grain quality, and quantity. From research studies, modern economies in the world achieved significant growth by modernizing the agricultural sector as it creates jobs for rural communities as well as satisfying their nutritional needs providing a lease to better livelihoods. In Kenya, maize sufficiency is equated to food security and has received various supports from policies. The maize sub-sector and the importance of agriculture have been highlighted through Kenya Vision 2030, the MTP III 2018-2022, and the Big 4 Agenda with an emphasis on food and nutrition security in Kenya.

Most studies and research done on the adoption of farm technologies have been done on specific aspects like the adoption of certified maize hybrid seeds, use of inorganic fertilizer, application of weed and pest control, and use of tractors. In Kenya, there is limited literature on the influence of agricultural machinery usage on maize production relating to output. Therefore, this research aims at bridging this gap on agricultural mechanization by investigating its impact on maize output. The study will also add to the limited study on agricultural mechanization, enrich the literature on agricultural modernization, recommend policy measures that will revitalize maize production for food security, and provide room for debate and more research.

1.6: Scope of Study

This paper investigated the impact of mechanization on maize output in Kenya. Mainly, it focused on the effect of agricultural machinery variables that influence maize productivity among rural smallholder farmers in Kenya. The cross-sectional household data was collected from Egerton

University Tegemeo Institute of Agricultural Policy and Development for the year 2010 being the most current study in their database.

1.7: Organization of Study

This study starts with the introduction in Chapter one and an overview of mechanization and maize production globally and in Kenya. Chapter two delved into the literature review, discussing theories of mechanization, empirical discussions by various authors on the topic and lastly ending with the topic literature overview. Chapter three identified and discussed the theoretical framework, empirical model, data sources and diagnostic tests for empirical data analysis. Chapter four gives the results, discussion, and a report of the findings discussed as per the study objectives. Chapter five gives the findings, summary, conclusions, and policy recommendations.

CHAPTER TWO: LITERATURE REVIEW

2.0: Introduction

This chapter reviewed both theoretical and empirical literature on the impact of agricultural mechanization on crop production and output from other authors and researchers.

2.1: Theoretical Literature

2.1.1: The Theory of Induced Innovation

The theory proposes that advancement in technology is accelerated by the costs and availability of land and labor as main elements of production (Hayami and Ruttan 1987; Binswanger and Ruttan 1978). Trends and speed of adoption of existing machines designs are influenced by economy-wide factor scarcities and various variables in the macroeconomic environment. The responsiveness of innovation to the wider economy and other factors is what is known as the process of induced innovation (Hayami & Ruttan, 1973; Binswanger & Ruttan, 1978).

The theory further stipulates that as farm wages rise, labor-saving inventions lead to changes in factor prices thus inducing innovations in production techniques to save more costly factors. In some cases, changes in market demand are seen as elements inducing technical change. In their study of the Green Revolution in India, Binswanger and Ruttan (1978), noted uneven patterns of adoption of new techniques of agricultural operations in India and other Asian countries.

2.1.2: Farming Systems Evolution or Boserup's Influence on Induced Theory

This theory was formulated by Boserup (1965) and Ruthenberg (1980) to construe technological changes in agricultural practices as endogenic factors to an economic body. Such factors are dependent on agro-ecological conditions and induced by changing features of the socioeconomic issues among farmers (Binswanger 1986).

Ester Boserup, in her book, "The Conditions of Agricultural Growth" (1965), emphasized that with available land resources, which are fixed in nature, population growth will lead to the squeezing of more output from each parcel of land. She further clarified that fallow periods are then reduced, and less capable land may be used, hence more labor will be needed for agricultural operations. This, therefore, drives innovation in agricultural practices, by the development and adoption of new tools and machinery.

According to this theory, the major factors driving the evolution of farming systems are market access and a high population density which lead to land intensification. Boserup (1965) links population growth to agricultural intensification including labor and fertilizer use as well as incorporating growth of the non-agricultural sector. Limited food imports are also characterized by the intensification of agricultural production. More demand for crop output motivates farmers to adopt sophisticated technology leading to intensive cultivation of crops.

2.1.3: Theories of Technology Demand

In a study by Geography, Jan, & Goldman, (2019), they assessed the works of Binswanger and his collaborators at the World Bank in which they analyzed Boserup's concepts with that of induced innovation on agricultural growth and innovation in Sub-Saharan Africa. From induced innovation,

Binswanger and his collaborators focused on reduction in factor costs as a critical determinant of rate and direction of technical change in agricultural systems.

According to Binswanger, he categorized innovation as yield increasing, labor-saving, and quantity improving. Their argument focused on the probable levels of demand for technology innovations in different regions of varying character concerning land availability and labor costs.

In a densely populated area, according to their study, there is high demand for yield-increasing technologies since their economic value is directly proportional to the land scarcity value. In regions with low population density, the demand for stress-avoiding, labor-saving, and quality-enhancing technologies is high. With a greater preexisting degree of machinery capital input use, the value and demand for yield increasing technology also increase. Lastly, demand for labor-saving technology is positively related to wage rates with minimal dependence on the value of land and pre-existing technology levels.

2.1.4: Hagerstrand's Theory on the Diffusion of Innovation

The concept suggests that the adoption of innovation is a result of an outcome of a learning process in which diffusion theory considers only elements corresponding to efficient information flow. The factors include personal characteristics in controlling communication patterns and the influence of the message delivered to recipients, the consistency as well as the intensity of the relationships among farmers. Such exposures lead to the adoption of appropriate technologies with little resistance. (Hagerstrand, 1965).

In his research, Hagerstrand views that interpersonal communication is more influential in the adoption of new techniques of farm operations than mass media, thus proposing an interpersonal association as a sure way of spreading information from high adopters of mechanization for low adopters to embrace it.

In yet another proposition, Hegerstrand uses the Monto Carlo Simulation to create an operational model of diffusion. Hagerstrand established several rules, in which one of which was the mechanism by which information is passed from one person to another. Among farmers, he assumed that this would be done via face-to-face contact and that the likelihood and frequency of such interaction are determined by the distance between the persons concerned.

2.3: Empirical Literature

Yunhua & Xiaobing (2005) studied the development of technology and agricultural progress in China in the 1990s. They used the Cobb-Douglas Production function in their empirical analysis. Data for the periods 1991-1999 from 28 provinces were used. The results showed an increment of 5.14% in agricultural yield for every unit of cultivated land with the adoption of mechanization in farm operations. Farms with mechanized operations showed a positive impact on yield at a declining trend proving diminishing returns in machinery input.

Zangeneh & Banaeian, (2014), investigated agricultural mechanization status for corn production in Iran. The study used data from Agricultural Ministry Jihad, Iran from 2001 to 2008. Data collection was done in Iran provinces. The study estimated Cobb-Douglas Production function. The result showed an improvement in corn output from farmers who owned planting and harvesting machinery in corn production with significant levels of 95% in maize planting and 99% in harvesting operations.

Takeshima (2017) researched whether tractor hiring services can raise returns to scale among smallholder farmers in Nepal Terai in 2010. A total of 2,856 randomly selected primary samples were used with 1,965 farm households reporting to have cultivated some plots. Translog and Cobb-Douglas Production function was used in econometric data analysis. The results study found out that custom-hiring services of tractors had positive effects of increased RTS in crop production.

Ayodele (2015) adopted the Logistic regression model in a study on the economic effects of mechanization in Nigeria. The study used a sample of 200 maize farmers in Ondo State and applied a multi-stage sampling technique with the information from respondents captured in structured questionnaires. The results showed that better access by farmers to machinery at minimum cost improved their productivity of maize.

Kirui (2019) examined the impact of mechanization in eleven African countries focusing on the drivers and state of mechanization development. The study used data from a household agricultural survey of 9,597 from Northern, Western, Eastern, and South African countries. Multinomial treatment effects models were used for empirical analysis of the dataset collected in 2004. The results showed that light hand-held tools and equipment remain dominant in most countries with significant improvement in rice and maize productivities. The countries in the study included Senegal, Ghana, Niger, Cameroon, Egypt, Kenya, Ethiopia, Zimbabwe, and Zambia.

Mounirou (2018) used secondary data from FAO for the period starting from 1961 to 2016 for Benin. The study adopted the Vector Error Correction model to analyze the effects of mechanization on crops such as maize, cassava, cotton, yams, rice, and millet production. The study found out that mechanization for cassava, maize, and cotton was still inadequate in improving yields but rather

suggested that investment in mechanization should be geared towards the production of cereal crops as it is inexpensive compared to the production of cotton.

Din & Khattak (2018), in assessing the influence of farm mechanization on the productivity of wheat and maize crops in Peshawar valley, used a simple random selection of 175 farmers with 117 mechanized farmers and 58 non-mechanized farmers in 2015. The results of Cobb-Douglas production function analysis revealed that for every acreage maize productivity increased by 25.32 mounts from mechanized farms at 23.22 mounds for non-mechanized farmers.

Panin (1995), in his study on the effects of mechanization in Botswana among small-scale farming systems, used survey data for the period 1991-1992 where 127 farmers were selected randomly in seven rural villages. Cobb-Douglas production function analysis results showed that draught animal technology had a very minimal benefit to farmers and with tractor usage having no effects on crop yields.

Houssou & Chapoto (2015), used household data collected from a three-year panel survey of 936 farmers in Savelugu-Nanton, Tamale municipality, Northern Ghana, and West Mamprusi. The study was carried out by IPA (Innovations for Poverty Action) between 2010 and 2012 in the three districts to analyze the impacts of mechanization on farming system intensification and cropland expansion. The result estimated from the Correlated Random Effects (CRE) model showed positive correlation of agricultural mechanization on farm and cropland expansion contributing to increased agricultural production.

Willis Oluoch-Kosura (1983), in his economic study of small-scale farm mechanization in Western Kenya, used data from the Integrated Agricultural Development Program (IADP), panel survey records

for 1977 and 1981 with an additional non-IADP sample of 40 farmers in 1981. The IADP records were collected by the monitoring and evaluation unit of the Ministry of Agriculture. The results of the Cobb-Douglas production function and covariance analyses showed that those owning oxen and hiring tractors achieved higher yields of maize than those using hoe with a one-acre increase in land expansion leading to 1 bag and 1.5 bags respectively.

Leonel (2016) carried out a study to examine the perception of rural farmers on agricultural mechanization. A descriptive survey was used in 23 rural farming areas of Rivers State, Nigeria in 2016 where 102 farmers from six rural government localities were selected from a respondent sample size of 612. Using Mean and Standard Deviation with a value of ≥3.00 as acceptance, the study revealed an increase in maize crop productivity.

2.4: Overview of Literature

Most studies reviewed adopted Cobb-Douglas production function (Yunshua & Xiaobing, 2005; Zangenah & Banaeia, 2014; Takeshima, 2016; Din & Khattak, 2018; Panin, 1995; Oluoch-Kosura, 1983) in determining the influence of mechanization on crop yields which is in line with this study on maize output. Panin (1995) presented a different view on tractor usage having negligible effects on crop productivity while Din & Khattak (2018), found out that there was little effect on productivity among mechanized and non-mechanized farmers. In general, agricultural mechanization has various benefits such as increase in yields, reduction in time of operation (Leonel, 2016; Kirui, 2016; Ayodele 2015), increase in income (Leonel, 2016; Panin, 1995) as well as increased expansion of cropland (Leonel, 2016). From most studies, mechanization of agriculture has led to more use of inputs with greater cropping intensity on large farmlands and the increased productive potential of labor (Verma, 2001). There are limited studies on agricultural mechanization in Kenya, with some studies only done

for workshops and conference discussions (Mbuya et al., 2010), with most studies delving only on tractor usage as main farm machinery.

From all the reviewed literature, only one or two aspects focused on maize output were discussed. The lack of other contributory factors affecting maize output limits the strength of such studies. This study focused on revealing the impact of mechanization on maize output by incorporating the effects of the farm machinery usage (farm implements, harvesters, planters, ridgers, shellers) and pest control on maize production unlike use of tractor as seen in most studies dealing with maize production and supply response. The inclusion of vital components of farm machinery creates a strong background from which policymakers can draw ideas when coming up with policy decisions on agricultural mechanization. This type of study is novel and offers promising precedence for more research to be carried out by scholars.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1: Introduction

This chapter described the theoretical and empirical framework of the study. It included a description of the variables, the data used, measurement method, and model specification. Moreover, this chapter outlined the diagnostic tests applied to improve model robustness.

3.2: Theoretical Framework

The study employed Cobb-Douglas (CD) production function as it has been used by various authors in the literature reviewed. Since most farmers in the country practice smallholding agriculture, this study adds to the existing literature on the need and impact of modernization or mechanization of agriculture to improve maize productivity. Particularly, the study examined the use of modern farm implements such as combine harvesters, threshers, sprayers for pest control, tractors among other farming implements) in maize production. Charles Cobb and Paul Douglas pioneered the Cobb-Douglas production function by empirically testing for statistical evidence from 1927 to 1947. This production function is commonly used as it is simple to estimate using OLS regression. Moreover, the CD equation has been widely employed to analyze inputs-outputs relationships in economic production. Furthermore, the model was chosen since it is applied to estimate the returns to labor and capital as well as the technology level of production. Lastly, the Cobb-Douglas function can also be used to obtain the return to scale: increasing, decreasing, and constant return to scale.

$Y=AK^{\alpha}L^{\beta}$

Representation of variable symbols:

Y = Total output

L = Labor input

K = Capital input (value premises, machines, and equipment)

A = Total factor productivity

α and β are output elasticities of capital and labor

3.3: Model Specification

The research will estimate a production function in Cobb-Douglas general form, where maize output will relate to X_1, X_2, X_3, X_4, X_5, and X_6 by the function:

$Y = A\ X_1^{\alpha 1}\ X_2^{\alpha 2}\ X_3^{\alpha 3}\ X_4^{\alpha 4}\ X_5^{\alpha 5}\ X_6^{\alpha 6}\ \mu$ ----------1

Where:

α_1, α_2, α_3, α_4, α_5, α_6 - the output elasticities,

Y - Maize output in the number of 90 kilograms bags.

A - Total factor productivity,

X_1 - Quantity of certified seeds used,

X_2 - Expenditure on machinery use (hiring of tractors, combine harvesters, farm implements for pest control).

X_3 - Cost of labor for hired workers.

X_4 - Expenditure on pest control,

X_5 - Expenditure on fertilizer in of Kenyan shillings,

X_6 - Size of the farm under maize production,

μ - Stochastic error term.

The equation was transformed by taking the logarithms of both sides.

The function was written as

$\ln Q = \ln A + \alpha_1 \ln X_1 + \alpha_2 \ln X_2 + \alpha_3 \ln X_3 + \alpha_4 \ln X_4 + \alpha_5 \ln X_5 + \alpha_6 \ln X_6 + u$ ……2

Where parameters to be estimated are A, α_l, α_2, α_3, α_4, α_5, α_6 and u being the the error term stochastically defined.

The model will be expressed as:

Maize Output = f (quantities of certified maize seed used, machinery use (farm implements, harvesters, planters, ridgers, shellers), labor, pest control, expenditures on fertilizer, maize farm sizes).

3.4: Description of Variables and Measurements

The dependent variable, maize output, will be measured in 90 kg bags of maize harvested per hectare of land. Mechanization aspect will be measured using the expenditure on farm machinery components used as relates to hiring of tractors, farm implements, harvesters, planters, ridgers, shellers among other farm machinery and implements. Control variables such as expenditure on fertilizer, the quantity of certified seed used and farm sizes under maize cultivation, and expenditure on pest control were used.

Table 3.4: Description of Variables and Measurements

Name	Description	Measurement
Y	Maize output (Dependent)	Measured in numbers of 90 kilograms bags.
X_1	Certified Seed (Independent)	Expenditure on seed quantities used.
X_2	Machinery use (Independent)	Expenditure in Kenyan shillings spent on hiring tractors, combine harvesters, threshers, and farm implements.
X_3	Labor (Independent)	Expenditure in Kenya shillings on hiring workers.
X_4	Pest control (Independent)	Expenditure in Kenya shillings on pest control.
X_5	Fertilizer (Independent)	Expenditure in Kenya shillings for quantities used.
X_6	Farm Size (Independent)	Measured in acres for area harvested under maize.

3.5: Data Type and Source

The study used primary data from Egerton University Tegemeo Institute of Agricultural Policy and Development - TAPRA (Cross-Sectional) data in carrying out the empirical estimation for this study.

In summary, the sampling method was administered uniformly across all households and was randomly done with all the sites of study despite some few cases of household relationships. The Universal KAMPAP sampling approach for selecting households for interviews was used.

The survey constituted Tampa's survey sample of 1372 in which 1309 households were interviewed and 30 of them were not interviewed in 2007 and as such was not included in the survey. Garissa and Turkana were left out of the survey. Garissa was considered productive as the area employed irrigation and it was hard to gather panel data from Turkana as most households are nomadic to fit the model of the study.

3.6: Diagnostic Tests

The following diagnostic tests were conducted to improve the robustness of the estimated model.

3.6.1: Heteroskedasticity

The Breusch-Pagan test was applied to check for heteroskedasticity to check presence of constant covariance.

3.6.2: Endogeneity

Endogeneity refers to the occurrence of one or more explanatory variables that correlate to the error term in a model. Some of the causes of endogeneity include omission variable bias, simultaneity, and self-selection. Simultaneity occurs when there is reverse causality, that is, Y causes X, and X also causes Y. To correct the problem of endogeneity, appropriate instrumental variables are used in place of the endogenous variables.

3.6.3: Normality Test (Skewness/Kurtosis)

While OLS does not require the residuals to be normal to obtain unbiased estimates, this assumption is critical to perform reliable statistical hypothesis testing including confidence intervals. A normal probability plot of the residuals was drawn to check for normality.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.0. Introduction

The study empirical results, diagnostic tests findings, and discussions on the topic were presented by aligning them to the research objectives. The cross-section data was obtained from Tegemeo Institute, for the year 2010 (being the most recent survey data for the institution) among rural Kenya smallholder farmers. The objective of the study was to empirically examine the impact of agricultural mechanization on maize output in Kenya, draw conclusions and propose suitable policies for the adoption of agricultural mechanization in Kenya.

4.1. Descriptive Statistics

The study sample consisted of 1,634 farmers who planted maize. The average maize harvest was approximately 132 90-kg bags. On average farmers spent Ksh. 2450 on seeds and Ksh. 577 on labor. Only 352 out of the 1634 farmers in the sample purchased fertilizers, while only 133 used pesticides. Amongw farmers who used fertilizers, the average fertilizer cost was Ksh. 6543. Similarly, farmers who used pesticides spent on average Ksh. 5787 to control pests. All farmers in the sample used some form of machinery such as tractors, farm implements, harvesters, planters, ridgers, shellers among other farm machinery. Averagely, farmers spent only Ksh. 995 on machinery. Many farmers are small-scale farmers with an average of 0.78 acres used for maize production.

Table 4.1: Variables Statistical Summaries

Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
Maize harvests (90 kg bags)	1,634	131.714	1393.934	0	42000

Cost of seed purchased	1,634	2449.68	4575.023	110	55000
Labor costs	1,634	576.885	2397.566	0	52500
Fertilizer used costs	352	6542.31	11945.76	35	136800
Pesticide used costs	133	5786.05	33637.88	30	270000
Cost of machinery use	1,634	994.994	3261.831	0	57000
Farm size in acres	1,634	0.78019	1.595209	0.002	30

Source: Author's Computation

4.2: Diagnostic Test Results

4.2.1: Breusch-Pagan test for Heteroskedasticity Test

Table 4.2.1: Heteroskedasticity Test

chi2(1)	0.99
Prob>chi2	0.3205
Prob>chi2	0.3205

Source: Author's Computation

The null hypothesis (Ho) Constant variance was tested against the alternative hypothesis (Ha) to determine the presence of heteroskedasticity. Since the probability of Chi-Square was not significant, we failed to reject the null hypothesis to conclude the presence of a constant variance of the residuals (homoskedasticity).

4.2.2: Endogeneity Test

Endogeneity test was conducted for two independent variables log (labor) and log (mechanization). The log of labor was found to be exogenous, while the log of mechanization was found to be endogenous.

As a result, Two-Stage Least Squares estimation was performed whereby the use of a credit facility was applied as an instrument to mechanization. The simultaneous equation was specified as follows;

Log (maize harvest) = β_0 + $\beta_1$log (Seed purchased) + $\beta_2$log (mechanization) + $\beta_3$log (labor) + $\beta_4$log (fertilizer use) + $\beta_5$acres + ε ----------1

The reduced form equation was given by;

Log (mechanization) = β_6 + β_7Use of Credit Facility + $\beta_8$acres + α ----------2

The identification requirement is that β_7 is not equal to zero. Since the estimated β_7 is not equal to zero, the structural equation is identified, and the use of a credit facility is applied as an instrumental variable for machinery use.

4.2.3: Kurtosis/Skewness Test

This test was employed to determine the normality of the residual since the error term in a regression model are required to have a normal distribution for a model to have unbiased estimates.

Table 4.2.3: OLS and Instrumental Variable Estimation
Dependent Variable: Log (Maize Harvests)

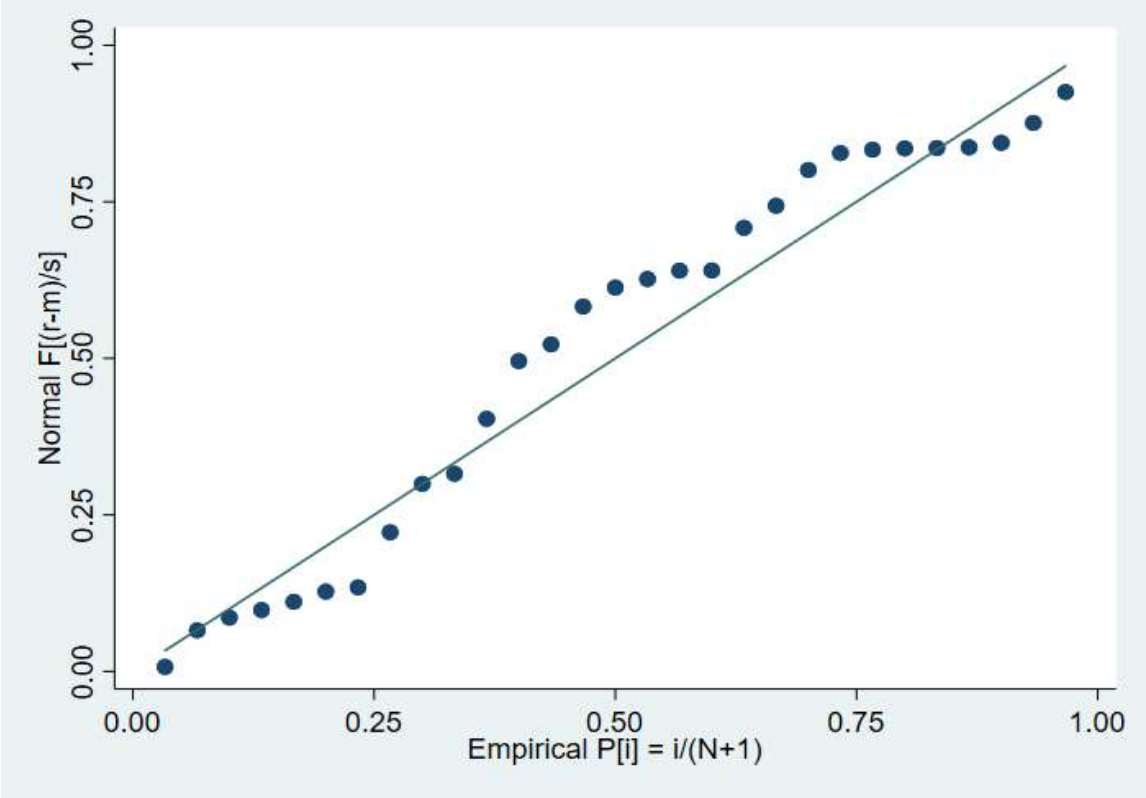
Independent Variable (IV)	OLS Model I	OLS Model 2	Instrumental Variable Model
log of Seed purchased	-0.5281		0.3958
	(0.6165)		(2.8577)
Log of total machinery used	0.7991*		6.1426
	(0.4101)		(13.776)
Log of total labor used	-0.0207		0.9123
	(0.2027)		(2.4545)
Log of fertilizer used	2.0041**		1.9735
	(0.5955)		(1.5374)
Log of seed purchased squared		-0.264	
		(0.3082)	
Log of total machinery used squared		0.3995*	
		(0.2051)	
Log of total labor used squared		-0.0103	
		(0.1013)	
Log of fertilizer used square		1.002**	
		(0.2978)	
acres	-0.4041**	-0.3935*	-1.8397
	(0.1476)	(0.1483)	(3.7369)
Number of observations	1634	1634	1634
R squared	0.5761	0.551	

Source: Author's Computation Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

OLS regression was used to estimate the relationship between the inputs and maize production. The results show that only machinery used, fertilizer and the number of acres have a statistically significant relationship with the number of maize bags produced/maize output. Machinery use is weakly significant at ten percent. A one percent increase in machinery use caused an 80 percent increase in maize production holding other factors constant. Fertilizer use had a significant positive relationship with maize production with a unit increase in fertilizer use causing a 200 percent in maize production holding other factors constant. The number of acres under maize production has a significant but negative relationship with maize production, with the number of acres under maize production associated with a 40 percent decrease in the number of 90 kg bags of maize produced.

In the second model, the square of machinery use and the number of acres is only significant at the 10 percent level. The square of fertilizer use was still statistically significant at a 5 percent significance level. The other variables, like in the first model, are not statistically significant. However, when using an instrumental variable for mechanization, all the variables are not statistically significant.

Figure 4.1: Normal Plot of Residuals



Source: Author's Computation

The plot shows slight deviations of the residuals from the normal distribution. The plot shows that the residuals are slightly normally distributed.

CHAPTER FIVE: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1: Discussions of Study Findings

The study objective was to analyze the impact of mechanization on maize output in Kenya. The cross-section data was from Egerton University Tegemeo Institute of Agricultural Policy and Development survey for the year 2010 for smallholder farmers in rural Kenya with a focus on maize production. The study found that machinery and fertilizer use had a significant positive relationship with maize produced. However, machinery use is only significant at ten percent. The weak effect of mechanization on maize output can be attributed to smallholder farmers where most farmers in the sample had small farms of less than one acre on average. The square of machinery used is also significant at a 10 percent level indicating that farmers in rural Kenya are yet to reach diminishing marginal returns in machinery use. Both fertilizer use and its square are significant at five percent. This indicates that the use of fertilizer is the most critical input in increasing maize output. The number of acres under maize production had a negative but significant relationship on maize output. This can be attributed to the poor soil fertility where increasing areas under maize production without using inputs like fertilizers do not lead to an increase in maize output.

5.2: Conclusions and Recommendations

5.2.1: Conclusions

The study found that machinery use has a weak positive impact on maize production. Among small-scale farmers, machinery use may not have major effects on improving maize production due to the challenges of economies of scale when using machinery on smallholder farms. Fertilizer use is the most critical input in improving maize production. Additionally, most farms have low productivity due to poor soil quality.

5.2.2: Recommendations

The study recommends that the government steps up the provision of fertilizer subsidies to farmers to improve maize production for food security in the country. Employment and deployment of extension officers to rural areas should be prioritized to educate farmers on the most suitable fertilizer depending on their soil types and soil health will help improve maize production. Government programs should be initiated to educate smallholder farmers on how to use technology-based farming instead of using large farm machinery to increase maize production. Since most farmlands are too small for mechanization practices to be carried out in rural areas, both national and county governments should pass legislation to protect agricultural zones from land mutations and curb the issue of land subdivision and sale of smaller parcels in arable areas. Both county and national governments should encourage private sector players to take lead in agricultural mechanization in offering suitable mechanization technologies appropriate to smallholder farmers.

5.3: Limitation of Study

This study focused on maize as a single commodity in which the findings cannot relate to other crops and other variables under similar climatic and policy conditions. The study only adopted the six variables that are, maize seed quantities, labor costs, cost of the machinery (tractors, planter, Sheller, combines, storage, and implements), and acreage of land under maize, pesticide control, and expenditure on fertilizer. The study also relied on past data which might not give a true reflection, trend, and prediction of the future.

5.4. Areas for Further Research

This study recommends that more studies should be done for large-scale maize producers in Kenya to understand the effects of mechanization and its spillover to rural small-scale farmers neighboring such mechanized farms. Moreover, this study should be conducted again with more current or latest data for a true depiction of the current state of affairs with mechanization among smallholder farmers in Kenya.

Studies of mechanization with other major crops such as rice, legumes, potatoes, and various cash crops among this segment of farmers should be carried. Other variable factors such as irrigation, access to credit facilities, training, foreign direct investments among other major variables of production that contribute to maize productivity should be studied.

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APPENDICES

APPENDIX 1: Regression Estimates among Farmers with more than One Acre

Dependent Variable: Log (Maize Harvest)

Independent Variable (IV)	OLS Model I	OLS Model 2	Instrumental Variable Model
log of Seed purchased	-0.5281		0.3958
	(0.6165)		(2.8577)
Log of total machinery used	0.7991*		6.1426
	(0.4101)		(13.776)
Log of total labor used	-0.0207		0.9123
	(0.2027)		(2.4545)
Log of fertilizer used	2.0041**		1.9735
	(0.5955)		(1.5374)
Log of seed purchased squared		-0.264	
		(0.3082)	
Log of total machinery used squared		0.3995*	
		(0.2051)	
Log of total labor used squared		-0.0103	
		(0.1013)	
Log of fertilizer used square		1.002**	
		(0.2978)	
acres	-0.4041**	-0.3935*	-1.8397
	(0.1476)	(0.1483)	(3.7369)
Number of observations	1634	1634	1634
R squared	0.5761	0.551	

Source: Author's Computation

Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

APPENDIX 2: 2010 SURVEY DOCUMENT

EGERTON UNIVERSITY
TEGEMEO INSTITUTE OF AGRICULTURAL POLICY AND DEVELOPMENT
&
MICHIGAN STATE UNIVERSITY
TEGEMEO AGRICULTURAL POLICY RESEARCH ANALYSIS (TAPRA) PROJECT
HOUSEHOLD SURVEY 2010 DATA DOCUMENTATION

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2010

SAMPLING METHOD

This TAPRA sample is only composed of TAPRA households that were interviewed in 2007. The

sampling method used was similar across all the sites and is described below:

1. Within the designated area of study (considering AEZs and other criteria), all the villages/sub-areas were listed with the help of the administration or chief.

AEZ, population, and whether the district belonged to the "original" KAMPAP districts (districts where Tegemeo had conducted much research before and had some supplementary data and information on) were some of the key factors in this exercise.

The first step was to identify the spatial distribution of AEZ in the district. The idea was to capture as much of the diverse conditions as possible in our sampling. From this step we were able to classify certain areas within AEZ with the help of the Ministry of Agriculture officers. Each district was in turn divided into divisions, locations and sub-locations and then villages/wards. From the district level we were able to pick representative divisions with the help of the district officers. I believe that we also took into account the populations and AEZ conditions within these areas to help us select these divisions. Because not all divisions could possibly be visited we picked a random sample of these divisions for further follow-up. These were selected with the idea of incorporating the diversities that were inherent in each district that we visited (a representative sample).

At the division level, a similar exercise was carried out with the help of the Ministry officials. Then the locations were selected randomly. This was followed by sub-locations and then finally the villages/clusters below.

2. From this list (and considering the sample size required from the area) a number of villages were randomly selected by picking from the list above.

3. For the selected villages, and with the help of the administration and key informants, we listed all household units within the village by head of household.

4. In most cases the list above exceeded the sample size requirements for the area. Accordingly we used the 'universal' KAMPAP sampling technique to select households for interview.

Universal KAMPAP sampling technique description: Most village elders/chiefs have a pretty comprehensive list of householders' names. Suppose we had a total list of 76 households for a village or cluster from the chief (numbered from 1 to 76). Assume too that all we needed was to interview 12 households from this village. The objective was to randomly select every sixth household to get the 12 we needed (approx. 76/12=6). The question is, on a numerical list of 1 to 76 where do you start the selection (is it 1, 2, 3, 4, 5 or 6)? We wrote the numbers 1 to 6 on different pieces of paper of similar size, folded and mixed them up. Then we asked a villager or the chief

to pick one of these papers and reveal the number. Suppose the number picked is 3; then we proceeded to pick the households starting from the third on the list, i.e. 3, 9, 15, 21, 27 etc.

5. It happened that in some areas some of the selected households within a village had household heads that were related by marriage or some other kinship relationship (though the samples had been selected randomly in the first place). In such instances one could find cousins, brothers, uncles, etc who had bought farms in the same area and over the years subdivided their farms to their children, etc but all these were clearly separate households with different management styles and approached their household decisions separately. Relationships among households do not necessarily imply joint decision-making.
6. In conclusion the samples were as random as was possible and the data should be able to express this random nature despite some pockets here and there of 'relationships', if one may.

SUMMARY OF HOUSEHOLDS SURVEYED

Out of the 2010 Tampa survey sample of 1372 households, there were 1309 households that were interviewed. There were 30 households that were not interviewed in 2007 for various reasons (but were not dissolved or moved away). Those households were not included in the sample for the 2010.

Turkana and Garissa were not interviewed. The argument was that the original sample was not typical of the area. Garissa for example, had households who were engaged in irrigation which gave an indication that the area was highly productive. Turkana district did not give the typical scenario of a nomadic pastoralist household. Moreover, in Turkana, it was difficult to generate panel data due to the nomadic nature of the household.

It is important to note that there was no replacement of households in the TAPRA sample for this survey.

intview Why HH is not able to participate in interview

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 Completed	1309	95.4	97.5	97.5
	1 Head & spouse dead	5	.4	.4	97.9
	2 Head & spouse separated 3 Refused	1	.1	.1	98.0
	4 HH mems cannot be found	3	.2	.2	98.2
	5 Family commitments (burial, wedding...) 6 HH moved from area	3	.2	.2	98.4
	7 HH mems working outside area	1	.1	.1	98.5
	8 Displaced by post-election violence 10 HH dissolved	12	.9	.9	99.4
		1	.1	.1	99.5
		5	.4	.4	99.9
		2	.1	.1	100.0
		1342	97.8	100.0	
Total Missing	-7 Not interviewed	30	2.2		
Total		1372	100.0		

The data for page one of the survey instruments are contained in two files: allhhid10.sav and hhidfinal10.sav. The first file (allhhid10.sav) contains all the original selected households to be interviewed. The second file (hhidfinal10.sav) contains only those households that completed the interview for this 2010 survey (1309 hhids) of the TAPRA sample. This file should be used to merge the identifying characteristics to the other files as needed.

DATA FILES

Directory: C:\...\Kenya\Kenyahh2010\augdata

Type of data	File name	Key variables	Number of cases	Computed variables	Comments
Household identification	hhidfinal10.sav	hhid	1,309		All households that **completed** the interview – **use this file to merge in location variables**
Household level questions	+hh10.sav	hhid	1,309		General household level questions.
Notes on hh10 file: GPS coordinates were collected in decimal degrees for this survey. In 2007 the data were collected degrees, minutes and seconds. There are several cases where the hh does not know how far the nearest NCPB depot is. The enumerator did not then ask if they sold to the NCPB and if not, why not.					
Household	allhhid10.sav	hhid	1,342		All households that were – **use only if want to kn households were not in**
Inventory of crops	incrop10.sav	hhid, crop	15,406		Crop inventory- field cro vegetables (tc = tissue cu
Field level information	field10.sav	hhid, harvest, field	8,735		Field level data - acreage preparation types and co
Cropping patterns	croplev10.sav	hhid, harvest, field, crop	20,791	kgseed = kgs of seed planted; kgharv = kgs harvested; kgsold = kgs sold; kgsspol = kgs spoiled	Crop level data - crops grown, seed information, harvest, sales & buyers, amount spoiled for fruits and vegetables
Fertilizer used	fert10.sav	hhid, harvest, field, ferttype	8,433	Fertotal – amount used was standardized to kgs Fertcost – cost of fertilizer	Types and amounts of fertilizer used in each field Price of fertilizer is calculated using PriceFert.sps, File is at fertilizer type, fertilizer unit level (fertqty*pfert). Manure and compost are not valued.

Type of data	File name	Key variables	Number of cases	Computed variables	Comments
Type of maize seed used	maizeseed10.sav	hhid, harvest, field, crop, sdvar, sdobtain, units	2,739	kgseed = kgs of seed obtained; totval = total value of seed obtained	Seed type – sdvar = 22 (DH2) is a different seed from sdvar = 56 (DH 02)
Non-agricultural credit	nagcred10.sav	Hhid, crduse, ctype, crdsor	503		
crop inputs purchased with own cash or credit	input10.sav	hhid, inputype, mcrop, numpur, punit, inputpr, inpsorce	4,852		Fertilizer and other inputs purchased/hired. Transport costs for manure were not collected
Fertilizer subsidies received over the last 3 years	fertsubsidy10.sav	hhid, sfert, subsidyr, sbunit	259	sbkg – kgs of fertilizer received as a subsidy	A respondent would say the fertilizer was given by government simply because it was handed out by the chief or assistant chief (government). It's not always possible for the farmer to know the actual source. There could be an issue of confusing the year the subsidy was given.
Availability of fertilizer in last 3 years	Fertaval10.sav	hhid, fyear	134		
Labour inputs	labour10.sav	hhid, activity	9,387		Labour inputs for largest monocropped maize field. Some monocropped fields will have vegetables and fruits listed in the field.
Notes on labor: Where harvest is missing the household generally harvested green maize as they weeded. An assumption was made during cleaning with respect to hired labor – the household could either hire labor or they could hire as a contract, but not both. This issue should be clarified in future panel surveys. Some low costs or hours were justified by notes indicating the person was supervising the activity. New categories were created for a combination of tasks where the respondent could not break down the hours to individual tasks.					
Who makes the decisions on production, marketing, and income use	decision10.sav	hhid, enterp	7,854	partentr – added during data cleaning as a yes/no question to permit 6 cases per	If the HH did not have the enterprise in the reference period, they could have practiced the same earlier hence all HH were to respond to the six enterprises. However if a HH has never engaged in that enterprise it

Type of data	File name	File to be used with	Key	Number of cases	Comments
Crop quantity conversion to Kgs	Cropconv.sav	Croplev10.sav	Crop, unit	806	File used to convert harvested/sold crop units to kgs
Fertilizer quantity conversion to Kgs	Fertconv.sav	Fert10.sav	Ferttype, fertunit	155	File used to convert fertilizer units in to kgs
Crop prices	pricecrop.sav	croplev10.sav	crop, dist	955	Created with PriceCrop.sps. Developed using the following approach: district median if >=10 observations, otherwise zonal median if >=10 observations, otherwise provincial median, then national median.
Fertilizer prices	pricefert.sav	fert10.sav	ferttype, fertunit, dist	268	Created with PriceFert.sps. Followed standard approach as in PriceCrop.sps. Note that we also used a fertilizer price lookup file in the 2000 data set. Computation of Pfert is as with pricecrop.sps where we consider the district, zone, provincial and national prices in that order.
Prices of seed	priceseed.sav	croplev10.sav	crop, sdtype, sunit, dist	1,910	Convert prices of seed into district prices Price of seed computed as in the other price lookup files. This file assigns a value to the seed used. Not all seeds were purchased.

File name	Contents
2010_Original_Questionnaire.pdf	Questionnaire used in the field
2010_Synthetic_Questionnaire.pdf	Field questionnaire restructured to reflect the data file structure
2010_SurveyDocumentation.pdf	Documentation of data files, sampling methods, specific issues with the data set
2010_Enumerator_Manual.pdf	Instructions to enumerators

HHID_____

APPENDIX 3: 2010 SYNTHETIC QUESTIONAIRE
Egerton University - Tegemeo Institute/MSU

Tegemeo Agricultural Policy Research Analysis (TAPRA)

Rural Household Indicator Survey 2010 – Synthetic Survey Instruction 2010

Location of data files: ….\Kenya\Kenyahh2010\augdata

Files created for this questionnaire:

File name	Level of data	Page	Table description
allhhid10.sav (.dta)	Household	1	Contains all households that were to be interviewed
hhidfinal10.sav (.dta)	Household	1	Contains only households that **completed** the survey
hh10.sav (.dta)	Household	multiple	General household level questions
incrop10.sav (.dta)	Household, crop	2	Crop inventory-field crops, fruit trees & vegetables
field10.sav (.dta)	Household, harvest, field	3	Acreage, tenure, land preparation types and costs
croplev10.sav (.dta)	Household, harvest, field, crop	4	Details on crops grown, seeds used, quantities harvested and sold (and spoiled for fruits and vegetables only), buy types for main and short seasons
fert10.sav (.dta)	Household, harvest, field	5	Types and quantity of fertilizer used per field
maizeseed10.sav (.dta)	Household, season, field, seed variety	5	Types of maize seed varieties used and their sources
nagcred10.sav (.dta)	Household, main use of credit	6	Sources, uses and value of credit for non-agricultural purposes
input10.sav (.dta)	Household, input type	7	Inputs bought in cash or on credit
fertsubsidy10.sav (.dta)	Household, fertilizer type, year of subsidy	8	Fertilizer subsidies received over the last 3 years
fertaval10.sav (.dta)	Household, fertilizer year	8	Availability of fertilizer in last 3 years
labour10.sav (.dta)	Household, activity	10	Labour inputs for largest maize field
decision10.sav (.dta)	Household, enterprise	11	Who makes the decisions on production, marketing, and income use
landmkt10.sav (.dta)	Household, transaction	13	Land transactions for last 10 years
livestock10.sav (.dta)	Household, livestock type	14	Livestock, inventory, purchases and sales
cowmilk10.sav (.dta)	Household, cow milk	15	Quantities of cow milk produced and sold fresh or in sour form
liveprod10.sav (.dta)	Household, livestock product	15	Livestock products produced and sold apart from cow milk
livescost10.sav (.dta)	Household, animal species	16	Costs incurred with regard to livestock
livestinput10.sav (.dta)	Household, livestock input	16	Livestock and livestock inputs acquired on credit
extension10.sav (.dta)	Household, extension service	17	Gauges the amounts respondents are willing to pay for various extension services
demog10.sav (.dta)	Household, member number	18	Details about adult household members listed in 2004
demogA10.sav (.dta)	Household, member number	19	Details about additional adult household members not listed in 2004
mortality10.sav (.dta)	Household, member number	20	Details about deaths in the household since 2004
business10.sav (.dta)	Household, member number, activity	21	Business and informal labour activities
salwg10.sav (.dta)	Household, member number, activity	22	Salaried wage /permanent employment activities-includes pension and remittances

savings10.sav (.dta)	Household, member number	23	Details on savings accounts held by household members
purch10.sav (.dta)	Household, item purchased	24	Quantities of selected dry food items bought, includes maize grain obtained as gift or relief
climate10.sav (.dta)	Household, weather type	25	Weather patterns
pev10.sav (.dta)	Household, effect	26	Post-election violence effects
cellphone10.sav (.dta)	Household, phone use	27	Mobile phone usage

File name	Level of data	Page	Table description
asset10.sav	Household, asset	28	Household agricultural assets
store10.sav	Household, type of storage for grains	30	Storage of grains

Identifying Location Variables:

***Filenam*es: allsurid10.sav and hhidfinal10. sav** *Key variables: hhid*

Variable **code**

Province: 1= Coast, 3= Eastern, 4= Nyanza, 5= Western, 6= Central, 7= Rift Valley **prov** _____

District: **dist** _____

11 Kilifi	33 Makueni	43 Siaya	62 Nyeri	75 Uasin Gishu
12 Kwale	34 Meru	51 Bungoma	71 Bomet	81 Laikipia
13 Taita Taveta	35 Mwingi	52 Kakamega	72 Nakuru	
31 Kitui	41 Kisii	53 Vihiga	73 Narok	
32 Machakos	42 Kisumu	61 Muranga	74 Trans Nzoia	

Division **div** _____

111 Kalolenii	351 Migwani	512 Kimilili	613 Kiharu	741 Cherangani
121 Kinango	411 Marani	513 Tongaren	622 Mukurweini	742 Saboti
122 Msambweni	421 Kadibo	521 Kabras	623 Othaya	751 Ainabkoi
131 Mwatate	422 Nyando	522 Mumias	711 Kimulot	752 Moiben
311 Chuluni	423 Winam	523 Lugari/Likuyani	721 Mbogoine	811 Lamuria
321 Mwala	431 Bondo	531 Sabatia	722 Molo	
331 Kilome	432 Uranga	611 Kandara	723 Njoro	
341 W. Abothogucii	511 Kanduyi	612 Kangema	731 Ololunga	

HHID_____

HHID: _____

Location

location _____

subloc _____

111 Buni
- 112 Rabai
- 121 Vigurugani
- 122 Pongwe/ Kidimwi
- 131 Mwakitau
- 311 Mbitini
- 321 Mwala,
- 331 Itaani
- 332 Kithangathini
- 333 Kilungu
- 334 Kilome/ Kilungu
- 341 Githongo
- 342 Katheri
- 351 Migwani
- 411 Mwamunari
- 412 Kegogi,
- 421 Kobura
- 422 Awasi
- 423 C. Kolwa
- 431 Usonga
- 432 N. Sakwa
- 511 Bukembe

512 Kamukunywa
- 521 Etenje
- 522 Shiruku
- 523 Likuyani
- 531 North Maragoli
- 601 Ithiru
- 611 Mbiri
- 613 Muguru
- 621 Muhito
- 622 Chinga
- 711 Kimulot
- 721 Sachangwan
- 722 Ngata
- 723 Weseges
- 731 Melelo
- 741 Kinyoro
- 742 Kaplamai
- 751 Sergoit
- 752 Olare
- 811 Thigiti
- 821 Katuli

Sub-location:
- 1111 Kisimani
- 1121 K/Mwale
- 1122 Kizuritini
- 1211 Vigurugani
- 1221 Wasini/ Mukwiro
- 1311 Godoma
- 3111 Mbitini
- 3112 Katwala
- 3211 Myanyani
- 3212 Mathunthine
- 3311 Kalongo
- 3321 kalongo
- 3331 Kithangathini
- 3341 Kalongo 3341.000000
- 3411 Kabaranyiki
- 3421 Kirimagiathi
- 3422 Kathita
- 3511 Kyambo
- 4111 Rioma
- 4112 Nyakeiri

4121 Ngokoro
- 4211 lela
- 4221 Border1
- 4222 Ayucha
- 4231 Nyalunya
- 4311 Sumba
- 4321 Abom
- 4322 Bar-Chando
- 5111 Namirembe
- 5112 N.Sangalo
- 5121 Nabikoto
- 5211 Bungasi
- 5212 Musanda
- 5221 Mugai
- 5222 Malekha
- 5231 Soi
- 5311 Kivagala
- 5312 Mulundu
- 6011 Gakarara
- 6111 Gikandu
- 6131 Kiairathe
- 6211 Gaturia

6212 Gatura
- 6221 Mumbuni
- 6222 Kathera
- 7111 Kapsinendet
- 7112 Kapset
- 7211 Sachangwan
- 7221 Ngecha
- 7222 Kirobon
- 7231 Nyamamithi
- 7311 Melelo
- 7411 Kinyoro
- 7421 Kimison
- 7422 Motosiet
- 7511 Chepkoilel
- 7512 Kelji
- 7521 Kapkeno
- 8111 Lamuria
- 8112 Kariguini

Zone

zone _____

2 = Coastal Lowands, 3 = Eastern Lowalnds, 4 = Western Lowlands,
5 = Western Transitional,
6 = High Potential Maize Zone, 7 = Western Highlands,
8 = Central Highlands,
9 = Marginal Rain Shadow.

HHID_____

Egerton University - Tegemeo Institute/MSU Tegemeo Agricultural Policy Research Analysis (TAPRA)

Rural Household Indicator Survey 2010

"We are part of a team at Egerton University, who are studying aspects to do with agricultural development in the country. Your participation in answering these questions is very much appreciated. Your responses will be **COMPLETELY CONFIDENTIAL**. Your responses will be added to those of 1,400 other households and analysed together. If you indicate your voluntary consent by participating in this interview, may we begin? If you have any questions or comments about this survey, you may contact the Director, Tegemeo Institute, Egerton University, P.O. Box 20498 (00200), Nairobi; **Tel: 0720 895454**; email: egerton@tegemeo.org"

Household No **HHID** _____

Date: (ddmmyy) **SURDATE** _____

HH Name _____ Respondent(s) _____

MEM _____

(**Enumerator Instruction**: Record the member number of the Respondent from the Demography table on pages 19 through 21 after the survey is completed.)

Identifying Variables:

Supervisor:	_____	**SNUM**	_____
Enumerator:	_____	**ENUM**	_____
Province:	_____	**PROV**	_____
District:	_____	**DIST**	_____
Division:	_____	**DIV**	_____
Location:	_____	**LOC**	_____
Sub-Location:	_____	**SUBLOC**	_____
Village:	_____	**VIL**	_____

GPS coordinates: (1=North 2=South) **NS**_____ **HH1 :**_____._____**dd**)

East_ **HH2** :_____._____**dd**)

HH3 : Altitude **m.a.s.l** (_____)

IF THE HOUSEHOLD IS <u>NOT ABLE TO PARTICIPATE</u> IN THE SURVEY, WHY NOT? **INTVIEW** _____

(1 = head and spouse died 2=head and spouse separated 3 = refused 4 = household members cannot be found
5 =family commitments (burial, wedding, etc) 6= moved from the area 7 =working outside the area 8=Displace by PEV 9= other, specify_____

HHID_____

CROP INVENTORY AND CROP CODES: Did you plant this crop either in the main or short harvest? (leave blank if did not plant)

Filename: incrop10.sav *(Key variables: hhid, crop)* (Season: 1=main season 2=short season 3=both seasons)

Code	Crop	Season	Code	Crop	Season	Code	Crop	Season	Code	Crop	Season
119	apple		71	eggplant		80	nappier /elephant grass		8	sorghum	
44	arrowroots		20	flowers		165	nathi (goose berry)		39	sorghum (drought	
201	artemesia		25	french beans		147	njahi (dolichos)		160	soyabeans	
97	avocado					37	njugu mawe(bambara		66	spinach	
50	avocado (grafted)		138	garlic onion					124	squash	
18	babycorn		62	gourds		32	oats		190	stefali	
10	bananas		179	grapes		77	okra		206	stinging nettle	
202	bananas, tc		34	green grams		96	onions		177	strawberries	
60	barley		167	green peas		61	orange (grafted)		187	sugar beets	
7	beans		33	groundnuts		75	oranges		15	sugarcane	
221	beetroot		72	guava		22	other fodder leaves		170	sugarcane, chewing	
129	brinjals /biriganya					184	other leaves (bean,njahi)		64	sukuma wiki	
169	bulrush millet		139	indigenous grains					30	sunflower	
			140	indig veg/amaranthus		59	passion (grafted)		68	sweet melon	
93	cabbage		27	Irish potatoes		137	passion fruit		43	sweet potatoes	
200	camomile		51	irish potatoes, tc		46	passion fruits, tc		49	sweet potatoes, tc	
67	capsicum /sweet		210	karela		85	pasture (not				
94	carrots		38	Jack fruit		58	pawpaw(grafted)		3	tamarind	
24	cashew nuts		302	Jatropha		70	pawpaws		189	tangawizi	
28	cassava		84	lemon (grafted)		166	peaches		136	tangerine	
48	cassava, tc		207	lemon grass		134	pears		12	tea	
146	castor oil		74	lemons		65	pepper, bell		29	tobacco	
175	cauliflower		173	lettuce		141	pigeon peas		63	tomatoes	
26	chickpeas		83	lucerne		133	pineapples		162	tree tomato	
131	chillie peppers		118	lugard		121	plums		53	trees (multi purpose),	
42	citrus, tc					178	pomegranate		161	Turnips	
23	coconuts		203	macadamia nuts		35	poyo		5	trees, commercial	
194	coconuts, copra		135	macadamia nuts		76	pumpkin				
193	coconuts, green		47	macadamia, tc		172	pumpkin leaves		205	vanilla	
6	coffee, cherries		1	**maize, dry**		17	pyrethrum		300	Venessi	
176	coffee, churned		2	**maize, green**							
11	coffee, mbuni		4	**maize (fodder)**		211	ravaya		69	watermelon	
168	corn flower		73	mangoes		31	rice		13	wheat	
14	cotton		204	mangoes (grafted)		86	rosemary		41	wheat (drought	
21	cowpeas		45	mangoes, tc		171	runner beans		163	white suppoise	
19	cowpeas leaves		120	matomoko					149	wild berries	
125	cucumber		9	millet		36	saina				
			148	miraa		40	simsim (drought		95	yellow passion	
192	dates		197	mkunga		78	simsim		81	yams	
183	dhania		196	mkuyu		16	sisal				
182	dhania grains		122	mulberry		301	Snap peas		174	zambarao	
164	dry peas		222	medicinal plants		90	snow peas				

HHID_____

LAND USE

Q1a. How many **acres** in **total land holding** does the household **own**? **TACRES** _____
Q1b. How many acres of land are **currently under non fruit trees**? **ATREE** _____
Q1.1a. How many acres of land **were leased out** in the last **main season 2009/2010?** **LEASE** _____
Q1.1b. How many acres of land **were rented-in** in the last **main season 2009/2010?** **RENT** _____
Q1.1c. How many acres of land were kept **fallow and/or abandoned** in the **main season 2009/2010?** **FALLOW**_____

Q1.1d. Did this household have any cropping activity during **MAIN CROP Season 2009/2010?** (1= Yes No=2) **MAINCROP**_____

Q1.3 Did this household have any cropping activity during **SHORT CROP Season 2009/2010?** (1=Yes 2=No**)** **SHOTCROP**_____

MAIN CROP Season 2009/2010 (Eastern Kenya refers to Jan-March 2010 harvest, Western, Coast Central July/October 2009; R.Valley Nov/Dec 2009)
SHORT CROP 2009/2010 (Eastern Kenya refers to Jul-Sept 2009 harvest, Western, Coast, Central Nov 2009-Jan 2010, Rift Valley; planted in October rains)
The main and short crops are combined into one table.

NOTE: Three files were created from the table on crop activities: field10.sav, croplev10.sav and fert10.sav

Filename: field10.sav ***(****Key variables: hhid, harvest, field)*

Harvest season 1=Main 2=Short	Field number	Acres	Is this field 1=owned with title deed 2=owned without title deed 3=rented 4=owned by parent / relative 5=government/communal/co-operative	System of watering using 1=rainfed 2=irrigated (piped) 3=irrigated (gravity) 5=can/bucket irrigation	Main land preparation type 0=none 1=manual 2=oxen 3=tractor	Hired land preparation cost (Ksh)
harvest	**field**	**acres**	**tenure**	**system**	**landprep**	**lpcost**

HHID_____

Q1.2 If **Q1.1d =Yes, go to table below (Probe for fruits trees, vegetables, and medicinal or aromatic plants). Otherwise, move to the short season crop.**

Filename: croplev10.sav (*Key variables: hhid, harvest, field, crop)*

Harvest Season 1=Main 2=Short	Field No.	Crop code	Planting/ Seed Type	Quantity of seed used and cost, if purchased this season			Number of product-ive fruit trees	Harvest -777 = not yet harvested		Sales		For the largest Sale				Quantity harvested that spoiled Use harvest unit codes *(for fruits and veg only)*	Seed kg conversion	Kgs of seed quantity used	Harvest kg conver-sion	Kgs harvested	Sale kg conver-sion	Kgs sold	Quantity of fruit and vegetable that got spoiled after harvest
				Qty	Unit	Cost per unit		Qty	Unit	Qty	unit	Month 1=Jan …… 12=Dec	Price received per unit	Buyer type	Km to point of sale								
harvest	**field**	**crop**	**sdtype**	**sqt**	**sunit**	**scost**	**ptrees**	**hvt**	**hunit**	**sold**	**slunit**	**mon**	**price**	**buyer**	**km**	**spoil**	**sdconv**	**seedkg**	**hvtconv**	**kgharv**	**slconver**	**kgsold**	**kgspoil**

Harvest Season 1=Main 2=Short	Field No.	Crop code	Quantity retained	Value of production	Value of sales	Value retained	Conversion for seed units	Conversion for harvest units	Conversion for sales unit	Median price per kg	The price that pkg represents
harvest	**field**	**crop**	**kgret**	**vprod**	**vsold**	**vret**	**sdconver**	**hvtconv**	**slconv**	**pkg**	**pkgreg**

Seed Type:

1=purchased new hybrid
2=retained hybrid
3=OPV
4=local variety
5=local seedling / cuttings/ splits
6=improved seedling / cuttings / splits
7=hybrid & local variety
8=purchased hybrid and retained
9=IR maize
10=volunteer / ratoon seed

Unit codes:

1=90 kg bag
11=50 kg bag
2=kgs
3=litre
4=crates
5=numbers
6=bunches
7=handfuls
9=gorogoro
10=tonnes
12=debe
13=grams
14=wheelbarrow
15=cart
16=canter
17=pickup
18=2 kg packet (seed)
19=bale

Buyer type codes:

1=small trader
2=large trader
3=KTDA
4=coffee coop
5=NCPB
6=miller
7=other coop
8=NGO
9 =consumer
10=exporter
11=processor
12=supermarket
13=cereal bank
14=Pyrethrum board
15=bicycle trader
16=National Irrigation Board
17=Kenya Seed

Fertilizer Use

Filename: fert10.sav ***(****Key variables: hhid, harvest, field, ferttype)*

Harvest season 1=Main 2=Short	Field no.	Fertilizer typ used	Quantity of fertilizer type	Unit of fertilizer type	Kg conversion value	Kgs of fertilizer	District media price	Total fertilize cost	District	The price that pfert represents
harvest	**field**	**ferttype**	**fertqty**	**fertunit**	**kgconver**	**fertotal**	**pfert**	**fertcost**	**dist**	**pfertrep**

Unit codes:			**Fertilizer codes**:				
1=90 kg bag	9=gorogoro	16=canter	1=DAP	8=CAN(26:0:0)	15=NPK(23:23:23)	21=NPK(23:23:0)	31=mavuno-top dressing
11=50 kg bag	10=tonnes	17=pickup	2=MAP	9=ASN(26:0:0)	16=NPK(20:10:10)	22=NPK(17:17:17)	58=NPK+CAN
2=kgs	12=debe	18=2 kg packet	3=TSP	10=UREA(46:0:0)	17=DAP + CAN	23=NPK(18:14:12)	59=NPK(22:6:12) + TE
3=litre	13=grams		4=SSP	11=SA(21:0:0)	18=compost	24=NPK(15:15:15)25=Mavuno-	60=NPK(26:5:5)
7=25 kg bag	14=wheelbarrow		5=NPK (20:20:0)	12=Other (specify)	19=magmax lime	basal	61=NPK(22:11:11)
8 = 10 kg bag	15=cart		6=NPK (17:17:0)	13=manure	20=DSP	26=Kero green	62=mavuno top dressing + urea
			7=NPK(25:5:+5S)	14=Foliar feeds			

USE OF MAIZE SEED

Q2. Indicate the types of maize seed planted in the main and short seasons:

(Enumerator Instructions: Refer back to the crop table and copy the field and seasons, where maize was planted, to this table. Then ask the questions.)

Filename: Maizeseed10.sav *(Key variables: hhid, harvest, field, crop, sdvar, sdobtain, units)*

Field No.	Season 1=Main 2=Short	Crop 1=Maize-dry 2=Maize-green 4=Maize - fodder	. **Seed Type** 1=Purchased /New Hybrid 2=Retained Hybrid 3=OPV 4=Local variety 9=IR maize	Seed **varieties** planted Use code below	How did you **obtain this seed**? 1=Cash purchase 2=Credit 3=Exchange 4=Free	5=Retained seed 6=Voucher 7=other, specify	Source of seed (see codes below)	**Quantity used on this particular field** **Unit code:** 1=90 kg bag 2=kgs 7=25 kg bag 8=10 kg bag	9=gorogoro 11=50 kg bag 12=debe 18=2 kg packet	**Cash/Credit/Exchange** (*Give total value if **cannot** get price per unit*) **Price per unit**	**Total value**	**Total value of seed**
field	**harvest**	**crop**	**sdtype**	**sdvar**	**sdobtain**		**source**	**qty**	**units**	**kgseed**	**price**	**value**	**totval**

Maize Seed Codes:									**Source codes:**	
2=KS 611	**55**=KS 515	**100**=KS 1920	**22**=DH2	**43**=Pan 67	**28**=Coast Composite	**48**=Rwanda	**45**=WS 501		1=Small trader	8=Farmer /Neighbour
1=KS 614	**91**=KS 516	**64**=KS 6210	**56**=DH 02	**18**=Pan 99	**87**=Freshco	**69**=Sadvil A	**54**=WS 502		2= Stockist/agent	9=General market
3=KS 622	**99**=KS 520	**85**=KS 6212	**23**=DH3	**68**=Pan 612	**29**=Indigenous/Local type	**70**=Sadvil B	**77**=WS 503		3=Large company	10=GoK
4=KS 623	**42**=KS 612	**59**=KS 6213	**24**=DH4	**49**=Pan 691	**65**=IR	**71**=Sadvil Composite	**78**=WS 504		4=NGO /CBO	11=Farmer group
5=KS 625	**33**=KS 613	**60**=KS 9201	**83**=DK 3081	**15**=Pan 5195	**66**=Kakamega Synthetic	**72**=Simba	**75**=WS 505		5=KFA	12= Other, specify_____
6=KS 627	**62**=KS 615	**36**=KS 9401	**97**=DK 8031	**16**=Pan 5355	**37**=Kinyanya	**84**=WS 105	**40**=WS 699		6=Cooperative	13=Church
7=KS 628	**63**=KS 616	**12**=CG 4141	**86**=DK 8053	**17**=Pan 5243	**25**=Katumani **38**=Makueni	**81**=WS 205	**41**=WS 904		7=Own seed	14=Employer
8=KS 511	**53**=KS 621	**13**=CG 5051	**51**=DK 8071	**26**=PH1	**19**=Maseno DC	**74**=WS 402	**79**=WS 905			
9=KS 512	**98**=KS 624	**14**=CG 5252	**46**=Faida Seed 650	**27**=PH2	**44**=Monsanto	**76**=WS 403	**80**=WS 909			
10=KS 513	**34**=KS 626		**58**=KH500-21A	**39**=PH4	**11**=Pioneer	**61**=WS 404	**31**=Don't know			
32=KS 514	**52**=KS 629	**20**=DLC	**67**=KSTP 94	**50**=PH 1033		**82**=WS 500	**30=other specify** _			
	35=KS 636	**21**=DH1	**57**=SCDUMA43							

HHID_____

CROP INPUTS

Q4. What **CROP INPUTS** did you purchase/hire on **CREDIT OR IN CASH in 2009/10 cropping year**? **(Excluding seeds)**

Filename: input10.sav (*Key variables: hhid, inputype, mcrop, numpur, punit, inputpr, inpsor)*

Inputype codes: 1 = DAP 17=DAP + CAN 20=DSP 2 = MAP 3 = TSP 4 = SSP 37=AT equip 28=NPK 14:14:20 24=NPK (15:15:15) 6=NPK (17:17:0) 22=NPK (17:17:17) 23=NPK (18:14:12) 16=NPK (20:10:10) 5 =NPK (20:20:0) 43=NPK (22:6:12) 21=NPK (23:23:0) 15=NPK (23:23:23) 58=NPK(25:5:0) 7=NPK (25:5:5S) 8=CAN (26:0:0) 9=ASN (26:0:0) 10=UREA (46:0:0) 30=UREA+CAN 11=SA (21:0:0) 56=farm machinery 13=Manure 14=Foliar feeds 26=Kero green 19=Magmax Lime 25=Mavuno-basal 31=Mavuno-top dressing 29=Mijingu 1100 27=Rock phosphate	32=pesticide 33=insecticide 34=herbicide 40=fungicide 35=plough 36=sprayer 39=technical support 41=water 46=planter cost 47=harvester cost 49=sheller cost 52=ridger cost 48=transport 50=fuel 51=gunny bags 53=land rent 54=land preparation cost(on credit only) 55=farm implements 57=irrigation equipment 12=other, specify_____	**Input type** (Select fertilizer codes from column on the left)	Quantity bought/hired	**Unit** 1 = 90 kg bag 2 = kg 3 = litre 13=gram 20=5 kg bag 8=10 kg bag 7= 25 kg bag 9 =gorogoro 10=tonnes 11=50 kg bag 14=w/barrow 15=cart 16=canter 21=days 17=numbers 30=acres	**Mode of Purchase** 1=own cash 2=borrowed cash 3=in kind credit 4=own and borrowed cash 5=voucher	**Source of Fertilizer and other inputs** **Source type codes:** 1=Small trader/ 2=Stockist 3=Large company 4=CBO 5=KFA 6=Coffee coop 7=Farmer / neighbour 8=KTDA 9=Other coop 11=Farmer group 12=Relative or friend 13=Other, specify___ 14=Research institute 15=Fuel station 16=NCPB 17=NIB 18=Kenya Wildlife Serv 19=FTC-Feed the Child.	**Price per unit specified**	**Kms** from point of purchase to farm	**Transport Cost per Unit** of the fertilizer (Ksh) **(Instruction : fill for only fertilizers)**	**Main Crop** for which input was used	**How is/was the credit repaid?** 1=crop revenue 2=livestock revenue 3=off farm income 4=both livestock and crop revenue 5=other, specify_____
		inputype	**numpur**	**punit**	**mdpurch**	**inpsorce**	**inputpr**	**kms**	**trancost**	**mcrop**	**inppaid**

HHID_____

Fertilizer Subsidy and Availability

Q5a. Did you receive any fertilizer subsidy over the last three years? (1=Yes 2=No -> skip to **Q5c**) **SUBSIDY**_____ **Q5b**. Please fill the table if the household received any fertilizer subsidy

(Enumerator Instruction: payment for partial subsidy and the market price should be recorded for the same unit as specified in Sbunit)

Filename: fertsubsidy10.sav ***(****Key variables: hhid, sfert, subsidyr, sbunit****)***

Fertilizer type received *(use fertilizer codes)*	Year you received	Source of the subsidised fertilizer 1=Government NAAIAP 2=Government Other 3=NGO 4=Other (specify) _____	Quantity received	Unit 2 =kg 3 =litre 13=gram 8 =10 kg bag 7 =25 kg bag 9 =gorogoro 11=50 kg bag	Kgs of fertilizer received	What form of subsidy was it 1=Partial 2=Full	If partial (sform =1), how much did you pay per unit	What was the market price per unit during that period?
sfert	**subsidyr**	**fsorc**	**sqnty**	**sbunit**	**sbkg**	**sform**	**sprice**	**mktprice**

Q5c. Have there been any periods during the **last 3 years** that you have tried to get fertilizer and have not been able to at the normal location?

(1=Yes 2= No -> **go to Q5e**) **FERTGET**_____

Q5d. Fill the table below:

Filename: fertaval10.sav ***(****Key variables: hhid, fyear****)***

Year	Month (1=Jan…. 12=Dec)	**Main reason** you were unable to get the fertilizer at the **normal source** 1=high prices 2=out of stock 3=national shortage 4=other (specify) _____ 5=hoarding	Did you travel to another location to get fertilizers? 1=Yes 2=No	Distance **travelled to another location** to get fertilizer during this period? (km)	Did you get **the quantity** you wanted to buy **at this new location?** 1=Yes 2=No	If you did not get the quantity you wanted (***fqnty*** =2), **give main reason** why not? 1=high prices 2=rationing of the commodity 3=high transport cost 4=lack of appropriate transport 5=other (specify) _____ 6=stocks ran out
fyear	**fmnth**	**freason**	**travel**	**fkm**	**fqnty**	**whyno**

(**Enumerator Instruction**: check to see if household used fertilizer on maize from crop table. ***(If did use then skip to Q6a)***

Q5e. If you **didn't use chemical fertilizer on maize**, why not? **NFERMZ** _____

(0=did not plant maize 1=not profitable 2=low response rate 3=couldn't obtain credit 4=not enough cash 5=too expensive 6=maize price too low 7=no cash when needed
8= fertilizer not available 9= no need to use 10=other, specify_____11=lack of advice 12=low rains in the area 13=practising organic farming 14=spoils the soil)

(**Enumerator Instruction**: check to see if household used fertilizer from crop table.)

Q5f. Why **didn't** the household use fertilizer **(if did not use chemical fertilizer in the cropping year)** **NOFERT** _____

(1=no money 2=fertilizer not available 3=practicing organic farming 4=uses organic manure 5=lack of advice
6=no need to use 7=campaign against the use of chemical fertilizers 8 = other, specify_____)

LABOUR COSTS

Q6a. In total, how much did you spend on salaried farm worker(s) for cropping activities in the main and short harvests, 2009/10? (Ksh)

(Enumerator Instruction: *Remember to consider only the proportion of time spent on cropping activities on apportioning salary)* **SALFWRK** _____

Enumerator Instruction: Ask about labour activities related to **Maize Only (Exclude fodder maize)**

Q6b. Identify the **largest monocrop maize** field *otherwise* consider the **largest intercrop maize** field in the **main season** **FIELD** _____

Q6c. What is the **slope** of this field*:* (1=flat 2=steep 3=steep terrace 4=moderate 5=moderate terrace) **SLOPE** _____

Q6d. When did you plant maize in the **main** season *(relative to the usual planting time)*? (1=early 2=on time 3=late) **TPLANT** _____

Q6e. Did any of your salaried workers work on **the largest maize field** for the 2009/10 main season**?** (1=yes) (2=no) **SALLBR** _____

HHID_____

Ask about the largest monocrop maize field. If no maize monocrop field ask for the largest intercrop maize field in the **main** season.

Q6f. What **labor inputs** did you use for **the largest maize field** for the 2009/10 **main** season**?**

Filename: labour10.sav *(Key variables: hhid, activity)*

Activity name	Code	Hired Labour				Family Labour (adults)					Family Labour (children)			Salaried Labour (ONLY if unpaid)		
		No hired	No of days	Kshs per person per day	Total Kshs by contract	No of males	Total No of hours each	Total Hours for all days worked	No of females	Total No of hours each	No of children	Total No of hours each	Total Hours for all days worked	No of workers	No of days worked each	No of hours per day each (on average)
ACTIVITY		**LB01**	**LB02**	**LB03**	**LB04**	**LB05**		**LB06**	**LB07**		**LB08**	**LB09**		**LB10**	**LB11**	**LB12**	**LB13**
1st Ploughing	**1**															
2nd Ploughing	**2**															
Harrowing	**3**															
Planting	**4**															
1st Weeding	**5**															
Top-dressing	**6**															
2nd Weeding	**7**															
Field Dusting	**8**															
Stooking	**9**															
Harvesting	**10**															
Transport	**11**															
Drying	**12**															
Shelling	**13**															
Dusting(post harvest)	**14**															
Bagging	**15**															
Storage	**16**															
Other, specify	**17**															
Security	**18**															
Irrigation	**19**															
Slashing	**20**															
Harvesting & transport	**21**															
Shell, bag, store	**22**															
Shell, dust, bag, store	**23**															
Harvest, dust, bag, store	**24**															
Shell, dust, bag	**25**															
Dry, shell, bag, store	**26**															
Dry, shell, dust, bag, store	**27**															
Dry, shell, dust, bag	**28**															
Stook, harvest, transport	**29**															

WAGE RATES. *(Ref: June09 – May10).*

Q6g. What is the **daily wage rate** for **general farm labor** in this area? (Ksh per day): **MALEWAGE** _____ **MALEHOUR**_____

FEMWAGE_____ **FEMHOUR**_____

MAIZE MARKET ACCESS

Q7.1 Now, as **compared to 6-7 years ago**, is it more convenient or less convenient a) to sell your maize **EZYSELL** _____

(1 = more convenient now 2 = more convenient 6-7 years ago 3 = the same 4 = not sure) b) to buy maize **EZBUY** _____

Q7.2a Has there been a change in the **number of private maize buyers/brokers** in this area to choose from, *compared to 6-7 years ago?* **BUYERS** _____

(1 = more private traders now 2 = fewer private traders now 3 = the same 4 = not sure)

Q7.2b In the **last main season** how many traders came into this village within the first 4-5 months after harvest to buy maize? *(-9=Don't Know)* **TRADENUM** _____

TIME ALLOCATION AND DECISION MAKING

Enumerator Instructions: Introduce this section as follows: "As a farmer you may be involved in several activities such as farming, livestock, business activities and salaried activities." Show the respondent the lines and let him/her mark for you the points.

Q8.1 What Proportion of **time** did the **Household Head** allocate to **farming activities (crop/livestock)** in the last one year? **TIMEHD** _____

0 25% 50% 75% 100%

Q8.2 What Proportion of **time** did the **spouse** allocate to **farming activities (crop/livestock)** in the last one year? **TIMESP** _____

(no spouse use code -9)

0 25% 50% 75% 100%

Q8.3 Indicate in the table below who in the household is the main decision maker on production marketing and income of the following enterprises in this Household

Filename: decision10.sav *(Key variables: hhid, enterp)*

Enterprise		Participate in enterprise 1=yes 2=no	Who is the main decision maker on…			**Prodec, makdec, useinc codes:**
			Production	Marketing	Use of income generated	1=head 2=spouse 3=male children 4=female children 5=head and spouse 6=head, spouse & children 7=household non-members 8=other (specify) _____ 9=brother 10=daughter-in-law
	enterp	**partentr**	**prodec**	**makdec**	**useinc**	
Maize	1					
Cash crops	2					
Fruits and Vegetables	3					
Other crops	4					
Large Livestock	5					
Small livestock	6					

HHID_____

Q8.4 In which year did this household **first use improved** maize seed (hybrid/OPV)? (Enter 0 if household never used hybrid seed) **YEARHMZ** _____

Q8.5 In which year did this HH **first use inorganic/chemical fertilizer on crops**? (Enter 0 if houseold never used inorganic fertilizer) **YEARFERT** _____

SOIL, WATER AND ENVIRONMENTAL CONSERVATION

Q9a. What Soil, Water and Environmental conservation methods are you **practising?** **SWEPRA1** ____ **SWEPRA2** _____ **SWEPRA3** ____

(0=none 1=terracing 2=mulching/cover crops 3=minimum tillage 4=wind breaks 5=contour farming 6=crop rotation 7=water pans 8=grass strips 9=afforestation 10=re-afforestation 11=agro forestry 12=gabions 13=cut-off drains 14=fallow 15=other, specify_____16=dam 17=zero tillage)

Q9b. Are you practising **zero-tillage**? (1=Yes) (2=No) **ZEROTIL** _____

Q9c. Are you **composting manure**? (1=Yes) (2=No **go to Q9e.**) **COMPOST** _____

Q9d. If **Yes**, which year did you start **composting manure?** **YRCOMP** _____

Q9e. How do you dispose of the **maize stover** after harvest? **MZSTOVER** _____

(1= preserve as fodder 2= feed to cattle immediately 3= burn 4= sell 5= exchange for oxen service 6= make compost 7=leave to rot in the field 8=other, specify_____ 9=used as firewood)

PRICES

We would like to know the prices of the following commodities in this area **during the 2009/2010 main season**?

(**Enumerator Instructions**: Ask the price of the item and record the price and unit of measure for the price. If the unit of measure for the fertilizer questions is a **50 kg bag**, you do not need to ask section b of questions 9.1 through 9.4. If the respondent does not know the price of a "50 kg bag", record -9, do not know. These questions refer to a "**50 kg bag**" and NOT the "quantity" of 50 kgs. If the respondent does not know of price of an item in any unit, record -9.)

Price **Unit**

Q 9.1a. What is the price of **DAP** in this area? (record the price and unit of measure) (Ksh): **DAP** _____ **UDAP** _____

(**Instruction**: Do not ask this question if the unit given for DAP is a 50 kg bag.)
Q9.1b. What is the price of a **50 kg bag** of **DAP** in this area**?** (-9 = Do not know) (Ksh): **PDAP** _____

Q 9.2a. What is the price of **urea** in this area? (record the price and unit of measure) (Ksh): **UREA** _____ **UUREA** _____

(**Instruction**: Do not ask this question if the unit given for urea is a 50 kg bag.)
Q9.2b. What is the price of a **50 kg bag** of **urea** in this area**?** (-9 = Do not know) (Ksh): **PUREA** _____

Q 9.3a. What is the price of **NPK** in this area? (record the price and unit of measure) (Ksh): **NPK** _____ **UNPK** _____

(Instruction*:* Do not ask this question if the unit given for NPK is a 50 kg bag.)
Q 9.3b. What is the price of a 50 kg bag of NPK in this area? (-9 = Do not know) **(Ksh): PNPK** _____

HHID_____

Q 9.4a. What is the price of CAN in this area? (record the price and unit of measure) **(Ksh): CAN** _____

(**Instruction**: Do not ask this question if the unit given for CAN is a 50 kg bag.)

Q 9.4b. What is the price of a 50 kg bag of CAN in this area? (-9 = Do not know) **(Ksh): PCAN** _____

UCAN _____

Q 9.5a. What is the price of **sifted maize flour** in this area? (record the price and unit of measure) (Ksh): **SIFTED**_____ **USIFTED** _____

(**Instruction**: Do not ask this question if the unit given for sifted maize flour is 2 kg packet.)

Q 9.5b. What is **the price of a** 2 kg **packet of** sifted maize **flour in this area?** (-9 = Do not know) (Ksh): **PSIFTED**_____

Q9.6 What is Posho mill charge for 1 gorogoro (2.25 kg) of maize into **straight run posho meal**? (Ksh per 2 kg tin): **POSHOR** _____

Unit Codes:

2=kgs	11= 50 kg bag	7 = 25 kg bag	20 = 5 kg bag
9=gorogoro	18 = 2 kg packet	8 = 10 kg bag	19 = 1 kg packet

y goat placement 8=Buying household items) **SERV3** _____

HHID_____

Q15. DEMOGRAPHIC CHARACTERISTICS OF HOUSEHOLD MEMBERS (OLD MEMBERS ONLY- Adults and Children listed in 2007)

Filename: demog10.sav *(Key variables: hhid mem)* **Reference Period: June 2009 to May 2010**

ID	Name	In which **year** was this person born?	Age (2010-da01)	What is the **sex** of .... ? 1=male 2=female	**Relation -ship** to **current** head ***See codes below***	Marital Status ***See codes below***	Is..... **currently** attending school? 1 = Yes 2 = No -99=don't know	What is the **highest** level of education completed? ***See codes below***	Is this person **currently** considered a **member** of this household? 1=Yes –> DA09 2=No	If this person is **not a member** of this household anymore, **why**? ***See codes below***	Not a member in 2007 1=returned to hh, but reason not asked 2=not a member in 2007 or 2010, deceased	**How many months** in the period June 2009 to May 2010 has this person been living at home?	Did this person receive cash from **informal /business activity?** Include **farm kibarua, dividends** Between June 2009 & May 2010? 1=Yes 2=No	Did this person receive cash or payment in kind from **salaried employment, wage activities, remittances, or pensions** between June 2009 & May 2010? 1=Yes 2=No	Has this person been **chronically ill** for a **3 consecutive month period** in the last 12 months and unable to perform hh duties? 1= Yes 2= No
mem	**name**	**da01**	**age**	**da02**	**da03**	**da04**	**da05**	**da06**	**da07**	**da08**	**notmem07**	**da09**	**da10**	**da11**	**da12**

Relation to head(DA03)

1= head	10=other relative
2= spouse	11=unrelated
3= own child	12=brother /sister-in-law
4= step child	13=parent-in-law
5= parent	14=worker
6= brother /sister	15=Other specify
7= nephew /niece	16=adopted child
8= son/daughter-in-law	17=co-wife
9= grandchild	18=step-mother

Marital Status(DA04)

1 = single
2 = monogamously married
3 = polygamously married
4 = divorced
5 = widowed
6 = separated
7 = other, specify_____
-99=don't know

Education levels(DAO6)

-99=don't know	6=std 6	13=form 5	20=univ 2
-9=None	7=std 7	14=form 6	21=univ 3
0=pre school	8=std 8	15= college 1	22=univ 4
1=std 1	9= form1	16= college 2	23=univ 5 & above
2=std 2	10 = form 2	17= college 3	
3=std 3	11=form 3	18= college 4	
4=std 4	12=form 4	19=univ 1	
5=std 5			

Reason for absence(DAO8)

1=left to find a job	8=went back home
2=left to attend school	9=another household
3=married away	10=went missing
4=deceased	7= Other, specify
5=divorced /separated	
6=living with other relatives	

HHID_____

Q16. ADDITIONAL ADULTS AND CHILDREN NOW RESIDENT BUT NOT LISTED IN 2007

Filename: demogA10.sav *(Key variables: hhid, mem)* **Reference Period: June 2009 to May 2010**

ID	Name	In which **year** was this person born?	Age (2010-ad01)	What is the **sex** of ....? 1=male 2=female	**Relation-ship** to **current** head ***See codes below***	Marital status ***See codes below***	Is..... currently **attending** school? 1 = Yes 2 = No	What is the **highest** level of educat-ion. com-pleted? ***See codes below***	What year did …. come to reside here?	**How many months** in the period June 2009 to May 2010 has this person been **living at home**?	Was ..... a **member** of this hh in **2007?** 1 = Yes–> AD14 2 = No	How did this **new memb-er** join the household? ***See codes below***	Before coming to reside in this hh, was … engaged in **1 = yes, 2 = no, -9=don't know**			After coming to reside in this household		Has this person been **chronically ill** for any **3 consecutive month period** in the last 12 months and unable to perform hh duties? 1= Yes 2= No
													Formal or informal business activity	Formal sector salary employ-ment	Farming some-where else	Did this person receive cash from a **formal or informal business activity** between June 2009 & May 2010? 1=Yes 2=No	Did this person receive cash or payment in kind from **salaried employment, wage activities, remittances, or pensions** between June 2009 & May 2010? 1=Yes 2=No	
mem	**name**	**ad01**	age	**ad02**	**ad03**	**ad04**	**ad05**	**ad06**	**ad07**	**ad08**	**ad09**	**ad10**	**ad11**	**ad12**	**ad13**	**ad14**	**ad15**	**ad16**
91																		
92																		

Relationship to head (ad03)

1= head	8= son/daughter-in-
2= spouse	9= grandchild
3= own child	10=other relative
4= step child	11=unrelated
5= parent	12=brother/sister-in-
6= brother/sister	13=parent-in-law
7= nephew/niece	14=worker
15=Other specify	

Marital Status (ad04)

1 = single
2 = monogamously
3 = polygamously married
4 = divorced
5 = widowed
6 = separated
7 = other, specify_____

Education levels (ad06)

-99=don't	6=std 6	13=form 5	19=univ 1
-9=None	7=std 7	14=form 6	20=univ 2
0=nursery	8=std 8	15= college	21=univ 3
1=std 1	9= form1	16= college	22=univ 4
2=std 2	10 = form	17= college	23=univ 5 & above
3=std 3	11=form 3	18= college	
4=std 4	12=form 4		
5=std 5			

New HH member (ad10)

1=married into the family	10=separated/divorced
2=returned to hh to help with hh activities	11=death of spouse
3=returned to the hh because he/she is sick	12=ran away from home
4=hh member missed during 2007 survey	13=lost job
5=lost parents (orphaned)	14=inherited household
6=fostered	15=live with relatives
8=worker	16=born
9=attend school	17=displayed by PEV (post election violence)
7=specify, other_____	

HHID_____

MORTALITY: Reference Period is since 2007

For some years, we have been following the progress of a number of households across the country including yourselves. Since we would like to monitor changes in welfare in different parts of the country, we would like to understand all the changes that happened in every household in our sample since the last time we interviewed you in 2007. We appreciate your responses.

Q17.0 Since 2007, has there been any household member who has died? (1=Yes) (2=No **go to Q18**) **MEMDIED** _____

Q17.1 If **17.0 =Yes**, could you tell us about them starting from the most recent.

Filename: mortality10.sav *(Key variables: hhid, pdmem)* **Reference Period: Since July 2007**

Person ID	If this person is listed in the DEMOG table, indicate his or her id number (mem). -889=no member number	Write the Name	Sex 1=Male 2=Female	Relationship to the current head *See codes below*	In which **year** was this person born?	In which **year** did this person die?	What was the cause of death?	What was the **highest** level of education ..... completed?
pdmem	**mem**	**name**	**pd01**	**pd02**	**pd03**	**pd04**	**pd05**	**pd06**
1								
2								
3								
4								
5								
6								

Cause of death (pd05)

1 = Pneumonia
2 = Malaria
3 = TB
4 = Chronic diarrhoea
5 = Meningitis
6 = Anaemia
7 = Fits(e.g. epilepsy)
8 = Mental illness
9 = Heart disease
10 = Chest pains
11 = Stomach disease
12 = Stroke
13 = HIV/AIDS
14 = Accident
15 = Suicide
16 = Murdered
17 = Snake bites
18 = Old age
19 = Other sudden death within 4 days
20 = Don't know
22=Cancer
23=Asthma
24=Diabetes
25=Yellow fever/measles
26=Birth complications
27=Kwashiorkor
28=Miscellaneous illness
29=Alcohol
30=Typhoid
31=Cholera
32=brucellosis
33=liver cirrhosis
34=tetanus
35=malnutrition
36=goitre
37=jiggers
38=food poisoning
39=arthritis
40=hepatitis
41=ulcers
21 = Other, specify_____

Relationship to head (pd02)

2 = spouse
3 = own child
4 = step child
5 = parent
6 = brother/sister
7 = nephew/niece
8 = son/daughter-in-law
9 = grandchild
10 = other relative
11 = unrelated
12=brother/sister-in-law
13 =parent-in-law
14 =worker

Education levels (pd06)

-9=None
0=pre school
1=std 1
2=std 2
3=std 3
4=std 4
5=std 5
6=std 6
7=std 7
8=std 8
9= form1
10 = form 2
11=form 3
12=form 4
13=form 5
14=form 6
15= college 1
16= college 2
17= college 3
18= college 4
19=univ 1
20=univ 2
21=univ 3
22=univ 4
23=univ 5 & above

-99=don't know

HHID_____

Q18. BUSINESS AND INFORMAL LABOUR ACTIVITIES

We would like to know about all the off-farm income earning activities, including share dividends, your household was involved in, **except** *salaried employment pensions and remittances*. Please list the names of all persons from the demography table who indicated they had engaged in a business or informal labour activity, then enter their corresponding person code From the list below, please list all the informal income earning activities for which this person had primary responsibility at any time during the past 12 months (June 2009-May 2010) (include jua kali and farm kibaruas). **(Probe for charcoal burning, fishing and own tree selling)**

Filename: business10.sav (*Key variables: hhid, mem, activity)*

Person name	Person code	Activity Code	Please classify each month's net earnings as: 0=none 1=low 2=average 3=high												Low earnings month			Average earnings month			High earnings month			Total business income
			6/09	7/09	8/09	9/09	10/09	11/09	12/09	1/10	2/10	3/10	4/10	5/10	# mon			# mon			# mon			
name	**mem**	**activity**	**jun**	**jul**	**aug**	**sep**	**oct**	**nov**	**dec**	**jan**	**feb**	**mar**	**apr**	**may**	**low**	**lgross**	**lcost**	**med**	**agross**	**acost**	**high**	**hgross**	**hcost**	**totbus**

Activity Codes:

58 Accounting clerk
1 Agricultural trading
76 Athlete
46 Bar operator
64 Battery charging
2 Bicycle (repair/transporter)
60 Boat making
77 Book seller
3 Brick making
4 Brokerage
62 Building
5 Butcher
6 Carpentry
75 Casual worker
8 Charcoal burning
78 Choir master
9 Clothes/shoes business
51 Cobbler
10 Curio trader
11 Dealing ropes/sisal/firewood
12 Driver
13 Earning dividends
14 Electrician
72 Income from another farm
7 Farm kibarua
15 Fish trading
44 Hair dresser / barber
80 Hardware
16 Harrowing
70 Harvesting
17 Hawker
57 Hiring out a bull
73 Hotel
81 Hunter
18 Jaggery
82 Jua kali
49 Laundry business
19 Livestock trader
20 Local brewing
42 Lumbering/wood cutting
21 Making pots
22 Masonry
23 Matatu business
24 Mining
41 Medical health business
74 Non-agricultural business
54 Nurse
68 Pet breeder
84 Phone charger/charging
25 Photography
63 Pit latrine digger
26 Planting
27 Ploughing
47 Plumber
85 Pool table business
28 Posho miller
29 Rental of properties
30 Retail
86 Road construction
53 Sand harvesting
43 School business
31 Selling mandasi
32 Selling water
69 Sheep shearer
89 Sitting allowance
33 Spraying
50 Surveyor
34 Tailor
65 Teacher, part time
61 Thatching grass
35 Timber trading
59 Tour guide
36 Tout/turnboys
37 Traditional doctor
38 Transporter (goods)
55 Tree seller, commercial
52 Vehicle mechanic
45 Veterinary doctor
67 Video business
56 Village elder
39 Weaving
40 Welding/painting/blacksmith
66 Wine tapper
71 Other, specify_____

HHID_____

Q19. SALARIED WAGE EMPLOYMENT/PERMANENT EMPLOYMENT ACTIVITIES

We would now like to talk about all ***salaried employment*** that anyone in this household engaged in during the past 12 months from **June 2009 to May 2010** including **pensions and remittances**. **For remittances remember to separate into local and from abroad, depending on source.** Include only income remitted back to household.

Filename: salwg10.sav *(Key variables: hhid, mem, activity)*

Person name Please list the names of all persons from the demography table who indicated they had engaged in ***salaried employment activities***, then enter their corresponding person code	Person code	From the list below, please list all the ***salaried employment activities*** in which this person was engaged at any time during the past 12 months	What is this person's current monthly wage? Kshs	Did this person earn this same monthly wage during all of the past 12 months? 1=Yes (go to next activity) 2=No	If the person did ***not*** earn the same wage during all 12 months, please indicate the wage earned for each month individually (Kshs) ***Skip this section if person received the same monthly wage during the whole year***												Total salary for the year
					6/09	7/09	8/09	9/09	10/09	11/09	12/09	1/10	2/10	3/10	4/10	5/10	
Name	**mem**	**activity**	**mnwage**	**samewage**	**jun**	**jul**	**aug**	**sep**	**oct**	**nov**	**dec**	**jan**	**feb**	**mar**	**apr**	**may**	**totsal**

Employment Codes:

38 Accountant	20 Civil leader	5 Doctor	7 House help	28 Messenger	59 Postmaster	57 Soldier	26 Veterinary doctor
50 Administrator	23 Cleaner	40 Electrician	8 Industrial worker	60 Miller	69 Public health officer	62 Sports/coach	16 Waiter/cook
18 Banker/receptionist	3 Clerk	36 Engineer	33 Lab attendant	9 Nurse	**12 Remittance (local)**	70 Stock broker	17 Watchman
67 Bursary	35 Committee member	56 Equipment operator	58 Lawyer	27 Pastor/religious services	**65 Remittance (abroad)**	29 Subordinate civil services	43 Welding
44 Butcher	25 Conductor	46 Extension agent	21 Lecturer/tutor	10 Pension	63 Research	32 Surveyor	
1 Cane cutter	51 Construction	52 Fishing	30 Lumber	64 Petrol seller	22 Road constructor	41 Tailor	
55 Caretaker/groundsman	49 Cook/caterer	61 Forester	19 Manager	68 Pharmacist	13 Sales person	14 Tea picker	42 Other (specify)
34 Carpenter/mason	45 Craftsman/artisan	6 General farm	66 Matron	53 Plumber/battery	31 Secretary	15 Teacher	_____
2 Chief	4 Driver	47 Hair dresser/salon	39 Mechanic	11 Policeman/woman	24 Shop keeper/attendant	54 Technician	

19a. What were the **two main** sources of the **remittances**? **REMIT1_____REMIT2_____**

(1=Son/Daughter 2=Other relative 3=friend 4=Well wisher 5=Other, specify_____)

19b. If the household received **remittance**, what was the **main mode** of delivery? **MREMIT_____**

(1= Hand delivery 2=Bus 3=Western union 4=Posta pay 5=Money gram 6=M-pesa 7=Zap 8=Telegraphic money Order 9= Postal Order 10=Courier 11= yuCash 12=Other, specify_____)

HHID_____

OBSERVE AND ASK ABOUT THE FOLLOWING:

Q29a. What is the **roofing** material of the **main house**? **ROOF** _____

(1=grass /makuti 2=iron sheet 3=tiles 4=other, specify_____5=tent-canvas)

Q29b. What is the **wall** material of the **main house**? **WALL** _____

(1=mud 2=bricks/stones 3=iron sheet 4=wood 5=plaster 6=other, specify_____5=tent-canvas)

Q29c. What is the **floor** material of the **main house**? **FLOOR** _____

(1= earth 2=cement 3=wood 4=tiles 5=other, specify_____)

Q29d. What is the mode of ownership of the **main house?** **HSEOWN** _____

(1= owned 2= rented 3= owned by relative 4=other, specify_____)

Q29e. What type of **toilet** do you use? **TOILET** _____

(1= pit latrine 2= bush 3= flush toilet 4= other, specify_____)

Q29f. What is the **main** source of water for domestic use during the **wet-season**? **MAINWET** _____

(1=pond 2=dam /sanddam 3=lake 4=stream/river 5=unprotected spring 6=protected spring 7=well 8=borehole
9=piped into compound 10=piped outside compound 11=water tankers 12=roof catchments 13=waterhawkers-cart /bodaboda 14= other, specify_____)

Q29g. What is the **main** source of water for domestic use during the **dry-season**? **MAINDRY** _____

(1=Pond 2=dam /sanddam 3=lake 4=stream/river 5=unprotected spring 6=protected spring 7=well 8=borehole
9=piped into compound 10=piped outside compound 11=water tankers 12=roof catchments 13=waterhawkers-cart /bodaboda 14= other, specify)

Q29h. What is your **main cooking fuel**? **COOKFUEL**

(1=electricity 2=paraffin 3=firewood 4=gas 5=charcoal 6=solar power 7=other, specify_____)

Q29i. What is your **main type of lighting**? **LITFUEL** _____

(1=electricity 2=pressure lamp 3=tin lamp 4=fuel wood 5=lantern 6=solar power 7=other, specify_____)

Q30 Is your family **better off, worse off, or about the same** as most households in this area? **COMPARE** _____

(1=better off 2=worse off 3=about the same)

Thank You