

POTATO PRICING AND MARKETING POLICIES

A CASE STUDY OF KURESOI SUB-COUNTY IN NAKURU COUNTY

BY

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DECLARATION

I declare that this research proposal is my original work and has not been presented for examination in any other university or institution.

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SUPERVISOR'S APPROVAL

This Research Proposal has been submitted for examination with my approval as the university supervisor

Signed.....Date.....

DR. GEORGE RUIGU

DEDICATION

I sincerely dedicate this work to my lovely and caring wife Jackline Chepkemoi, my daughters Sherril Chepkirui and Sharlyn Chemutai whose unwavering support enabled me pursue this course. I will not forget my parents, brothers, sisters and friends who supported me morally and financially to ensure that I cleared my studies at the university of Nairobi.

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All errors, omissions, views and interpretations remain my personal responsibility and should not be attributed to the above acknowledged persons.

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ABSTRACT

The overall economic and social development in Kenya depends on Agricultural growth and development. Kenya is a major producer of agricultural commodities such as tea and coffee for export while cultivation of food crops such as maize and Irish potatoes are mainly for consumption purposes. This study investigates potato pricing and marketing policies in Kuresoi Sub-County of Nakuru County for the period 1977-2010. Price stability for any crop in the market encourages more production and hence income stability for the farmers. The fluctuations and unpredictable increase in farm input prices, inadequate market competition due to poor infrastructural facilities leads to lower productivity for Irish potatoes and consequent unstable incomes for the farmers. The Ordinary Least Square (OLS) was used as an estimation technique upon verifying of the various assumptions which include linearity, normality and constant variance across observations, no serial correlation and stationarity. The study utilized both descriptive statistics and estimation technique in presentation of the findings. The study variables include the current number of hectares under cultivation, the input cost per hectare, the previous year's average price of potatoes, the previous year's last quarter average price of potatoes, the previous year's yield per hectare and the previous year's price of competing crop (maize). The regression results show that previous year's average price of potatoes and the previous year's last quarter average price of potatoes were statistically significant at 5%. However, the previous year's average price of potatoes was negatively related to the current number of hectares under cultivation while the previous year's last quarter average price of potatoes was positively related to the current number of hectares under cultivation. Based on the study findings, it is suggested that stability in prices may be achieved if the government through the relevant sectors improve infrastructures which link farmers to the markets thus increasing income for potato farmers as the cost of production will reduce. Utilization of proper storage facilities such as the cold stores to store Irish potatoes will lead to improved prices in the market. Finally, it is recommended that pricing policies be reviewed in order to ensure sustainability of price stability.

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ACRONYMS

ADC	-Agricultural Development Corporation
AERC	-African Economic Research Consortium.
AFC	-Agricultural Finance Corporation
FAO	-Food and Agricultural Organization of the United Nations
GOK	-Government of Kenya
KARI	-Kenya Agricultural Research Institute
KENOFA	- Kenya National Potato Farmers Association
KFA	-Kenya Farmers Association
KG	-Kilogramme
KIHBS	- Kenya Integrated Household Budget Survey
KNBS	-Kenya National Bureau of Statistics
MOPND	-Ministry of Planning and National Development
MT/H	-Metric Metrictonnes per Hectare
NAL	-National Agricultural Laboratories
PDP	-Potato Development Programme
SACCOs	-Saving and Credit Cooperative Organizations.

CHAPTER ONE: INTRODUCTION

1.1 General Introduction

The Agricultural sector in Kenya is the backbone of the national economy, directly contributing approximately 24% of GDP and 60% of export earnings. Moreover, through links with manufacturing, distribution and service-related sectors, agriculture indirectly contributes to a further 27% of the country's GDP. According to the Kenya Integrated Household Budget Survey 2005/2006, 57% of the total Kenyan population and 60% of the rural population live below the poverty line. Agricultural growth and development, therefore, is crucial for Kenya's overall economic and social development. In Kenya, cultivation of agricultural commodities such as tea and coffee are for export while food crops such as maize and Irish potatoes are mainly grown for consumption purposes (Republic of Kenya, 2007).

The Irish potato originated in the high plains of the Andes Cordillera where the Incas people cultivated the plant largely for food. It was imported from Europe to Africa by missionaries and thereafter by colonial administrators in the 19th Century. The European settler farmers introduced the crop in Kenya initially in Kiambu, Muranga and Nyeri districts in the late 19th century primarily for domestic consumption and later for export. Indigenous Kenyan farmers started potato cultivation in 1920 and entered the export market in 1923. New potato varieties and seed potato production were introduced at the National Agricultural Laboratories, Kabete in 1903 and at the Plant Breeding Station, Njoro in 1927. (Republic of Kenya, 2011)

In 1963, the Government of Kenya undertook to promote potato production in the country by introducing new varieties from Germany and with the establishment of a potato development Programme in 1967 which streamlined production of certified seeds and disease resistant

varieties. In 1979, the Government through the Agricultural Development Corporation (ADC) and in collaboration with the Kenya Farmers Association (KFA) established a commercial oriented Seed Potato Production Programme to produce and market seed potatoes. The increased seed production in 1980's led to the setting up of a cold storage complex in Molo with a capacity of 2,250 Metric tonnes in 1985. The Agricultural Development Corporation (ADC) and the Kenya Agricultural Research Institute (KARI) played a key and central role in the production of seed potatoes. However, after the 1990's, the production of seed potato became a challenge mainly due to reallocation and subdivision of ADC and KARI farms which were previously used for research and production (Republic of Kenya, 2012).

A study carried out by the Kenya Agricultural Research Institute (KARI) in 2007 showed that Kenya used to be a net exporter of potatoes to India, Middle East and Europe three decades ago when its production was at the peak. However, potato production in Kenya has stagnated between 1999-2007 due to factors associated with poor crop husbandry, climate change and low policy priority. The potato value chain is hobbled by a myriad challenges that includes poor marketing and storage that reduces farmer's income and morale. This decline in potato production has further been attributed to rain failure, potato blight and bacteria wilt diseases. Other bottlenecks that have dwarfed sustainable potato farming in Kenya include poor quality seeds and post-harvest losses due to poor road network and lack of cold storage facilities. According to the Economic survey (Republic of Kenya, 2011), potato production increased from 2.6million Metric tonnes in 2009 to 3.1million Metric tonnes in 2010. This was attributed to provision of disease free planting materials by the Kenya Agricultural Research institute (KARI) and Private Sector Development Authority (PSDA) project.

According to the Ministry of Agriculture, potato farming is a multimillion industry that employs 2.5 million people at all levels of the value chain. The annual potato crop value is estimated to be KSh5 billion at the farm gate level and KSh10 billion at the consumer level. Potato consumption is expanding rapidly in the country owing to changing dietary habits occasioned by urbanization. Irish Potatoes are commonly consumed in the fresh cooked forms but changes in eating habits especially in the urban centers has led to increased consumption of processed products. It is estimated that there are over 40 local processors of crisps and chips who prefer Irish potato varieties with high dry matter content for processing. It is estimated that Nairobi alone has over 800 restaurants selling chips. Industrial level processing of Irish potatoes is mainly in the production of starch and snack foods such as crisps, frozen potato chips and dried potato cubes.

1.2 Background Information

Since the introduction of Irish potatoes into the country by the British settlers in the 1920s, there has never been any organized marketing of ware potatoes within the Kenya market. There have been two major channels through which farmers could market Irish potatoes by either selling directly to consumers or through market traders. The major handicaps in marketing include lack of market infrastructure such as cold storage facilities, poor handling of the crop at the farms and poor state of roads leading to high transportation costs. The existence of middlemen with excessive marketing margins leading to lower farm gate prices and absence of strong producer organizations have been other challenges facing Irish potato farmers.

The Kenya government, immediately after independence tried to put in measures to control potato price instability by ensuring that the crop was marketed through the watchful eyes of the Kenya Farmers Association (KFA) but this did not succeed because the farmers were directly

linked with the middle men in the sale of the produce. Another challenge that was faced by the government was the grading and packaging of the crop. Potato farmers have witnessed big losses due to the packaging which in most cases exceed the 110kg bag that is recommended by the government in the Legal Notice No. 44 of May 2005. Enforcement however, has been weak despite the provision of the legal notice No.113 empowering the Local government (market superintendents) to enforce Legal Notice No 44 of May 2005. Consequently in most areas, Ware Irish potatoes are still packaged in extended bags weighing between 130-280Kgs containing ungraded poor quality produce.

The government's attempt in regulating the pricing and marketing of potatoes was aimed at stabilizing the producer and consumer prices. The government is serious in ensuring stable food security in the country since potatoes are a major food crop after maize in Kenya. Attempts to promote and improve pricing has also been made through the formation of farmers' cooperative societies such as the Kenya National Potato Farmers Association (KENOFA) to assist in marketing the produce and championing the rights of farmers especially in relation to the type of packaging used. Despite all these efforts being made, the government has not been able to provide farmers with guaranteed farm gate prices and this has not only led to reduction in production of the crop but also unstable income for the farmers within the country including Kuresoi Sub County. Since liberalization of the agricultural sector in 1986, government intervention in the marketing of most agricultural products including Irish potatoes has been minimal. The liberalization of the sector has left the market forces of demand and supply to determine the price every season. In general, potato farmers in Kuresoi sub-county experience problems in the marketing of their produce in the liberalized market. Price instability of the

output, high and unstable input prices, lack of proper extension services, poor quality seeds, insufficient credit facilities and poor infrastructure has acted as a deterrent to potato production.

1.3 The area of Study

Kuresoi Sub County is one of the administrative units that lie within the County of Nakuru. It covers an area of 1210 square kilometres with a population of 239,485 and a population growth rate of 2.4% per annum according to the 2009 census results. The Sub County is located on the west Mau Escarpment and borders Narok County to the south, Bomet County to the south west and Kericho County to the west. It exhibits a temperate type of climate which favours crop production, especially horticultural crops and temperate fruits, cabbages, kales, peas, plums, pears and apples. It has an average altitude of 2500m above the sea level. The settlement patterns in the area are largely guided by natural resources availability, rainfall patterns and economic opportunities in the urban centres. The main economic activities in the sub county are crop production, dairy, lumbering and quarry mining. A total of 90% of the sub county is arable while 10% is under forest, quarries, water mass and infrastructure making it one of the most productive region within the county.

Table.1.1 Agro-climatic zones of Kuresoi Sub-County

Altitude(Metres)	Average rainfall (mm)	Temperature(⁰ C)	Areas covered by the climatic zone
2400-2700	1500-1800	8 ⁰ C to 18 ⁰ C	Forest, Tinet location, Kiptororo, Bararget, Kaplamboi location
2100-2400	1300-1500	10 ⁰ C to 28 ⁰ C	Lower Keringet, Kamara, Kuresoi and parts of Olenguruone.

Source: Kuresoi District Agricultural Reports

Irish Potatoes are a major food as well as commercial crop within the sub county and has witnessed varied and fluctuating prices thus forming the interest of this research.

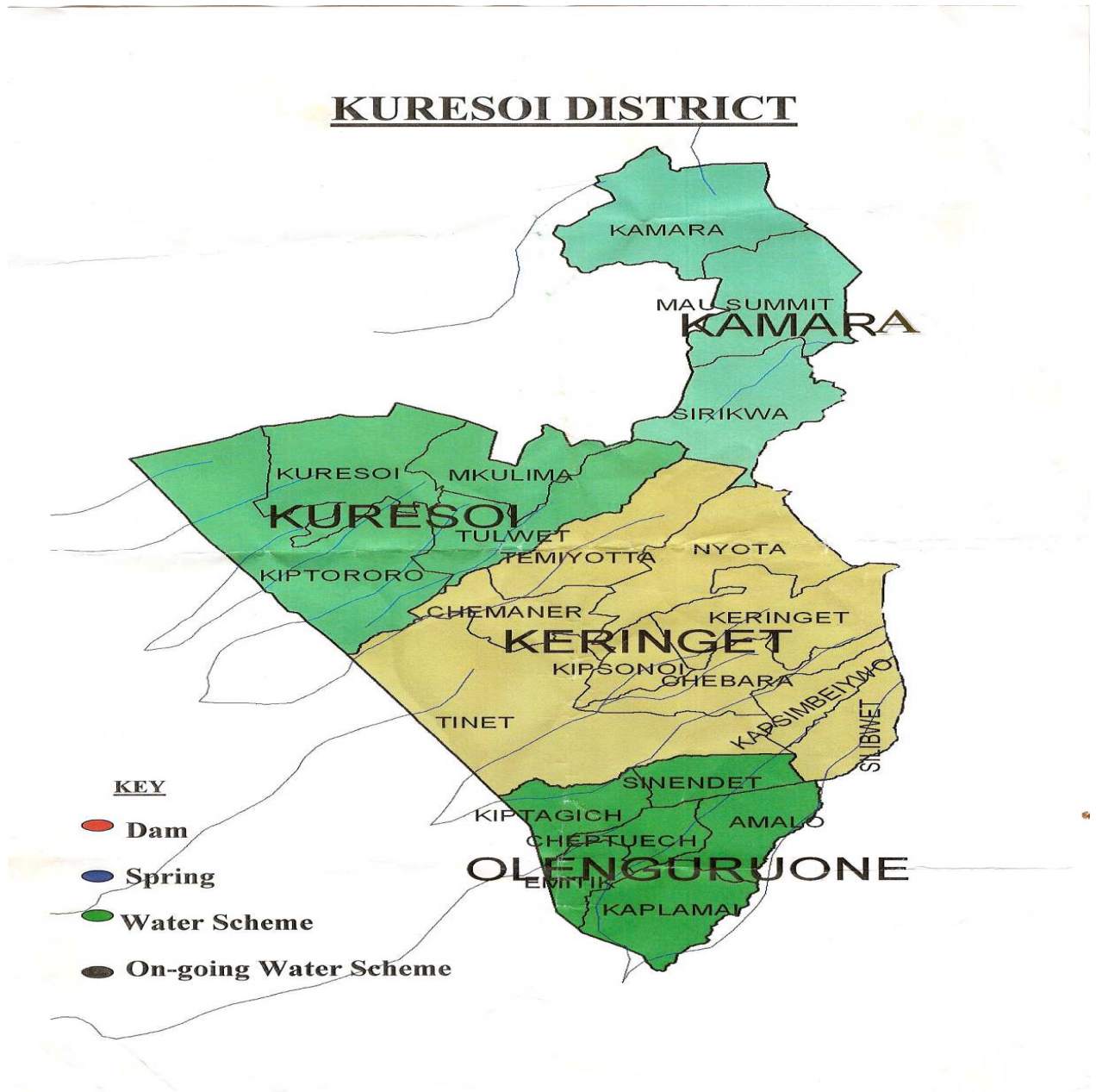


Figure1: Map showing the area of study (Kuresoi Sub-County)

1.4 Statement of the Problem

Price stability for the crop in the market encourages more production and hence income stability for the farmers. The problem of unstable prices for Irish potatoes and unstable incomes to the farmers is further compounded by the fluctuating and increasing farm input prices, inadequate market competition due to poor infrastructural facilities and lower productivity due to cases of poor quality inputs such as seeds (Republic of Kenya, 2007).

While average potato yields in North America and Western Europe often reach 40 Metric tonnes per hectare, yields in developing countries are usually below 20 Metric tonnes per hectare. The national average potato yields for Kenya has been reported at 7.7 Metric tonnes per hectare, but this figure has fluctuated considerably over recent years, from over 9.5 Metric tonnes per hectare to around 7.5 Metric tonnes per hectare (FAO, 1998). The low yields have been attributed to poor agronomic practices, low use of inputs especially fertilizers, poor and deteriorating prices, and lack of markets. The price fluctuations of potatoes always give a wrong signal and disincentives to the farmers leading to unstable and unpredictable farm incomes hence poor planning before planting, land preparation and acquisition of farm inputs such as fertilizers will not be acquired on time.

Assessing credit facilities from financial institutions such as the banks and Agricultural Finance Corporation (AFC) have not been made easy for the farmers. This could be due to unavailable or insufficient securities to guarantee the loans leading to decline in the production of the crop.

1.5 Study Objectives

1. To analyse potato price stability in Kuresoi Sub County with the view of evaluating the effectiveness of price marketing policies over time;

2. To analyse factors that cause farm income instability of potato farmers in the sub county;
3. To evaluate various ways through which the government can intervene to improve potato market prices in order to improve competitiveness of potato production.

1.6 Hypotheses

There are three hypotheses that are postulated in this study and that include:

1. The instability in the potato farm gate prices has led to unpredictable and unstable farm incomes in the sub-county;
2. The increasing and unstable farm input prices have led to unstable potato farm income in the area of study;
3. The instability in the potato farm gate prices and variability in the yield per hectare over the period of study has led to the reduction in the rate of increase in area under potato farming in the area of study.

1.7 Justification

Market price fluctuation of potatoes indicates that farmers are not able to gauge the expected selling price of their produce and this translates to unstable farm incomes. The government has all along been trying to control the uncertainty and fluctuation through the Ministry of Agriculture but it has not been successful at all thus prompting our research in this area. The unstable and upward trend in the prices of farm inputs especially fertilizers has impacted negatively on the productivity of the crop and on potato farm gate prices and income stability to the farmers.

This research will try to determine possible ways of improving potato prices in order to encourage its production. The study results will help to explain the underlying interrelationship of potato production within Kuresoi Sub-County so as to determine the farmer's problems to realizing profits in potato farming. The major determining variables available for the policy makers are the potatoes farm gate prices and the government intervention on the grading, packaging and marketing of the produce. The price of the competing crop (Maize) will be considered on how it impacts on the pricing of the potatoes.

CHAPTER TWO: LITERATURE REVIEW

2.1 Theoretical Literature

Accelerating agricultural growth remains one of the most important objectives policy makers face in less developed countries where agricultural productivity is low, population growth rates are high and the ability to import food are severely constrained. In Kenya, the development policy of the medium term (2000 - 2030) continues to recognize agriculture as an important sector for the Kenyan economy, with priority centered on food security initiatives and provision of employment opportunities. For the agricultural sector to play this central role in the economy rapid growth in output and productivity are critical and the role of Irish potato in the subsector is important as well. Past policies have been supply driven and has been designed without the participation of stakeholders especially the farmers and even if such policies were good for the farmers, they may not have had the desired effect, as there was no ownership by the intended beneficiaries (Idachaba, 2000).

The rationale behind high producer prices is based on the conjecture that for both microeconomic and macroeconomic reasons. No country has managed to sustain rapid economic growth without first obtaining food self-sufficiency, at least in the main staple (Timmer, 1998a). At micro economic-level, inadequate and irregular access to food limits labour productivity and reduces investment in human capital (Bliss and Stern, 1978; Strauss, 1986; Fogel, 1994).

The macroeconomic impact of periodic food crises is to undermine both economic and political stability, hence reducing the levels and efficiency of investment (Timmer, 1996; Dawe, 1996).

The importance of food price levels on the welfare of producers and consumers has over the years led governments to consider 'getting the prices right' especially on key food commodities.

The 'food price dilemma', articulated in Timmer (1986) embodies conflicting interests between producers and consumers of food commodities. Timmer's seminal contribution has been followed by an array of empirical work mostly in the context of developing countries. Theoretical studies on the subject include; Barret and Dorosh (1996) on changing rice prices and farmers welfare in Madagascar and Budd (1993) on changing food prices and rural welfare in Cote d'Ivoire.

Arun Pandit *et al.* (2003) studied on potato marketing in India by way of surveying potato producers in India. The study revealed that the Indian marketing system suffers from high marketing cost, high middleman's margin, low producers share and inadequate marketing infrastructure. Their solutions were that grading should be followed rigorously and the marketing cost could be reduced by establishing cold stores in producing areas. Regulation of potato market could be done by establishment of more processing units.

Weak research and extension linkages have adversely affected agricultural production and productivity. Although Kenya's agricultural research system is relatively strong as compared to other developing countries, progress in increasing total factor productivity in agriculture suggests that it has inherent weakness that forces it to operate below its potential. This has been related to weaknesses in research priority setting, financing, management and poor inter-agency linkages, underfunding of operational costs, lack of managerial autonomy and accountability (Omamo, 2003). A major limiting factor to agricultural research has been the fact that local research institutes mainly rely on donor funds which may not be sufficient or reliable. The weaknesses in research and extension linkage have limited the generation of new technologies for use in the farms.

Recent analysis shows a declining trend in efficiency and effectiveness of the Ministry of Agriculture extension services and research, (Kosura, 2001). This has been as a result of declining budgetary allocations to the sector, lack of clear objectives, failure to identify the role of beneficiaries and poor organizational and institutional structures among others. Although new technologies are available on the shelf for use, the farming community has not benefited much from them since research findings do not flow to the farming community as a result of inefficiency of the agricultural extension service.

The Policies affecting agricultural growth consist of government decisions that influence the level and stability of input(mainly fertilizers and fungicides) and output prices, public investment, costs and revenues, and allocation of research and development funds to improve farming and agricultural related processing technologies (Nyagito, 1997).

Subsidized food import enters Kenyan market at low prices thus forcing domestic prices to decline and hence threatening domestic production of food commodities such as maize and potatoes. Cheap food imports reduce the market for domestic agricultural products and leave many farmers and workers in agricultural related industries without a source of income unless they are able to switch to production that is more profitable .This implies that even if low-cost food supplies are plentiful, many people will be unable to purchase them due to their low incomes. This is particularly so when the imports dampen domestic producers prices thereby reducing incentives to produce (Nyagito, 1997).

The subsidized food imports represent unfair competition to domestic producers in the market since they increase supply and lower prices. Consequently, food aid may have some rather serious disincentives on domestic agricultural production especially when such food aid is used

primarily as a means of dumping excess produce abroad. At times in Kenya, imported food commodities such as maize, rice and sugar have been far much cheaper than the locally produced ones and in such cases domestic producers have been unable to offload their produce to the local market since the prices offered do not cover their costs of production.

Counterpart funds generated by the local sale of the commodities become a potentially important source of budget support for the local governments. A country's dependence on counterpart funds for budget support may cause it to fail purposely to develop its agricultural sector in order to continue to receive this cheap form of budget support. Such practices are common in low-income countries that devote little resources to their agricultural research and production but are known to always beg for assistance from donors to feed their rural populace. Kenya is one of such countries, which has continued to depend on food aid. For example, drought and floods always recur in many areas of the country and yet not much effort is directed towards irrigation or flood control that would boost agricultural productivity in such cases.

Resource-poor farmers prefer growing potatoes because the crop has a short maturity period and can be grown throughout the year. Conditions for potato farming in most divisions are favorable with cultivation being possible all year round (Kabira, 2002). Irish Potatoes are predominantly rain fed and output is therefore heavily influenced by the amount, distribution and variability of rainfall, which causes considerable risks and uncertainty in production. Increased potato production can enormously contribute to the national objective of diversification and food security.

Walingo et al (1998) studied and analyzed the requirements of potato processing in terms of their preferred varieties, their availability and price of farm inputs such as raw materials, pre-processing storage facilities and challenges facing the potato industry by use of a two- stage sampling procedure for potato chips preparation survey. Their findings were that potato processing will always be an alternative to fresh consumption since the perishability and bulkiness of potato increases the cost of marketing and consumer prices. They also found declining trends in potato exports due to increase in local consumption due to change in population dietary habits. Further, they advocated for intensification of potato production through irrigation and use of appropriate post storage facilities.

2.2 Empirical Literature

Ogola et al., (2002) did research aimed at establishing the current levels of technical efficiency of smallholder Irish potato producers and the factors that influence levels of farm production and technical efficiency using data from a major potato growing area, Nyandarua District in the central Kenya highlands. The objective was primarily to provide insights into constraints that hamper improved potato production; he sought to identify avenues for policy intervention towards improved Irish potato production in Kenya. The results show that the land area allocated to Irish potatoes was small averaging 0.34 hectares. The average age of the sample farmers was 47 years while the mean household head's farming experience was 14 years and 9 years of formal education. The farm size in the sample was between 0.51 - 24.49 ha with a mean of 2.46 ha and a standard deviation of 3.06. On average, the sampled farms reported a mean yield of 97.55 bags/ha while the yields varied between a low of 62.05 and a high 185 bags/ha suggesting considerable room for improving Irish potato yields. On average, 154 man-days/ha of labor, 1592.10 kg/ha of seed and 238.12 kg/ha of fertilizer were used by the farmers. Only 35% of the

sample of farmers had access to credit while 42% belonged to a farmers' association. The households received an average of one extension visit per year.

Further, the study also showed that farmers with more years of formal schooling were more efficient than their counterparts who had less education. Similar results have been reported in studies which have focused on the association between formal education and technical efficiency (Bozoglu and Ceyhan, 2007; Bravo-Ureta and Pinheiro, 1997). In general, more educated farmers are able to perceive, interpret and respond to new information and adopt improved technologies such as use of fertilizers, pesticides and planting materials much faster than their counterparts, thus leading to higher income.

Muthoni and Nyamongo (2009), in their study on "A review of constraints to Ware Irish potatoes in Kenya" found out that low soil fertility, lack of quality seeds and attacks by pests and diseases were the main factors that limit Irish potato production in Kenya. The study also revealed that access to certified seed is limited by lack of appropriate supply channels and high per unit cost leading to self-supply and neighbour supply being the main sources of potato seed in the country. Consequently, high costs of inputs such as fertilizers and fungicides led to their minimal application in the farms leading to low production. They also noted that Production of potatoes was largely rain-fed resulting to seasonal fluctuations in its supply. This, coupled with inadequate on-farm storage facilities, results in low prices during the peak production periods and hence low returns to farmers. Moreover, marketing channels of the produce were controlled by cartels and middlemen leaving farmers with minimal opportunity to negotiate for prices for their produce. Poor road infrastructure and packaging of the produce in extended bags disregarding recommended standards such as weight per bag and quality produce worsen the situation. They recommended the urgent need for the government to enforce the existing

regulatory measures such as weight standards to save the farmers from exploitation by the market cartels, improvement of the road infrastructure, the government should assist farmers to organize themselves into cooperatives that will assist in selling their produce protecting farmers from exploitation by middlemen and building the capacity of farmers in order to produce certified potato seed. Singh and Mathur (1994) assessed instability in potato production in India by using coefficient of variation and found out that the area and production were unstable because of the response of potato production to prices of competing crops and the adoption of modern technology.

Abdulai and Eberlin (2001) established that an increase in human capital will augment the productivity of farmers since they will be better able to allocate family-supplied and purchased inputs, select and utilize the appropriate quantities of purchased inputs while applying available and acceptable techniques to achieve the portfolio of household pursuits such as income. The study also showed that regular visits by extension workers led to improved technical efficiency. Access to extension services had a positive significant coefficient in relation to technical efficiency, implying that technical efficiency increases with the number of visits made to the farm household by extension workers. Similar results were reported by Bozoglu and Ceyhan (2007) for vegetable farmers in Turkey. The result is also consistent with findings by Seyoum et al. (1998) who found a 14% difference in technical efficiency between farmers who had access to extension services and those who did not in a study on farmers within and outside the Sasakawa- Global 2000 project. Extension workers play a central role in informing, motivating and educating farmers about available technology.

Further, results show increasing credit use would enhance technical efficiency of sample farms. This is consistent with the findings by Abdulai and Eberlin (2001) for farmers in Nicaragua and Alene et al. (2003) for farmers in Ethiopia. Dolisca and Jolly (2008) found farm households who used credit in Haiti to be more technically efficient than their counterparts. Availability of credit is an important factor for attaining higher levels of efficiency. Access to credit permits farmers to enhance efficiency by overcoming liquidity constraints which may affect their ability to purchase and apply inputs and implement farm management decisions on time hence increasing efficiency. It is therefore important that credit constrained smallholder farmers be facilitated to access loans at reasonable costs in order to purchase farm inputs such as inorganic fertilizers and pesticides. There was a positive and significant difference between membership in a farmers' association and technical efficiency, suggesting that farmers who belong to an organization are likely to benefit from better access to inputs and to information on improved farming practices. Being a member in farmer's association may lead to sharing of information on farming technologies which tends to influence the production practices of members through peer learning and social interaction. This could be explained by the fact that farmer's associations have the potential to shorten the marketing chain by directly connecting small producers to markets, better coordinate production and marketing activities and facilitate farmer access to production inputs at fair prices. Studies have found that participation in local groups has inefficiency reducing effect and also provide avenues for information and technology transfer by extension agents for group members to make appropriate farming decisions thus enhancing productivity and efficiency. Similar results for farmers in Canada and Cameroon are reported Binam et al. (2005). Binam et al., (2003) found a negative and statistically significant relationship between membership in a farmers' association and technical efficiency for coffee farmers in Cote

d'Ivoire. This finding is consistent with local practice where farmers prefer to allocate family and collective labour to cocoa farms first and hence they cannot execute improved agronomic practices on coffee production on time thereby negatively influencing productivity and technical efficiency. With respect to age, gender and household head's experience, however, this study found no statistically significant relationship. This is possibly because these variables do not directly influence efficiency but rather indirectly through decisions on variable input use levels. The farm-gate prices of ware potatoes were very low compared to market prices and these differences could not be explained by the normal marketing costs. In support of this, the producer's share (the ratio of the producer price to consumer price) of the ware potato price in the three divisions of Nakuru district were 32%, 25% and 30% for Molo, Mau Narok and Bahati, respectively, while the overall producer share was 29% . The low producer share may suggest that there exist large marketing margins that, however, accrue to the middlemen. Indeed, Ogola et al. (2002) reported that middlemen in the marketing chain of ware potato exploited potato growers by paying very low farm-gate prices. This may lead to low producer prices, high consumer prices and price instability because of inefficient and/or exploitative marketing practices. In general, potato prices are highly affected by price instability and uncertainty (associated with supply and demand), and the perishability of the crop. Moreover, the output is extremely vulnerable to changing weather conditions. The inelastic demand in some cases, and the narrowness of the market in others, often create conditions of high price volatility (FAO, 1998).

Ogola et al., (2002) in their study found that results from regression of seed, fertilizer and potato output prices against fertilizer demand showed that the demand for fertilizer was negatively related (but not significantly) to seed price and fertilizer price, but positively related to output

price .For example, a 10% increase in farm-gate price of ware potato was found to lead to a similar increase in fertilizer demand.. When other variables were included, output price, farmer's experience (proxied by number of years in potato farming) and potato acreage were found to be significantly related to fertilizer demand. This implies that although fertilizer use may be affected by input (seed and fertilizer) prices, the most significant factor determining use was the expected output prices. This study has clearly shown that the producer price of potato was the major determinant of fertilizer use in potato in Nakuru district, Kenya and that the performance of the potato sub-sector was inefficient. Therefore the government should improve the working of a free market through the development of appropriate legal and institutional frameworks and provision of physical infrastructure before leaving the market to perform allocative functions. Also, selective interventions to provide an enabling environment are necessary if market based reforms are to be effective.

Understanding the input market must be necessary for proper targeting of production and marketing, which may in turn lead to increased fertilizer consumption. Several attempts have been made to encourage fertilizer use in Kenya. For example, between 1964 and 1990, the government controlled fertilizer prices with the objective of making fertilizers affordable to small-scale farmers. However, the controls had unforeseen bottlenecks such as delays in fixing and announcing input prices and late deliveries of fertilizer to farmers. Moreover, the fixed fertilizer prices could neither compensate for the marketing costs nor provide reasonable profit incentive to promote the distribution of the input by private traders (Mulagoli and Karuri, 2001). Consequently, key changes in the fertilizer sub-sector were instituted between 1983 and 1990. These included, amongst others, fertilizer market reform programs to liberalize fertilizer imports and set realistic margins, with the aim of increasing private sector involvement in fertilizer trade

(Mulagoli and Karuri, 2001). The high fertilizer prices could be due to oligopolistic tendencies and/or built-in costs in the marketing system within the fertilizer industry. Higher fertilizer prices in rural centers compared with major urban centers have also been reported by Agwings-Kodhek (1996). Thus, the government should undertake reforms to ease restrictions on business entry and operations while putting in place appropriate safeguards against anti-competitive behaviour. This can be achieved by rationalization, and reduction in the number of local fees and licenses required. Research showed that there are few number of fertilizer traders due to some restrictive practices. This is because the effect of market concentration is manifested in its ability to highlight barriers to entry that might exist in the trade. The barriers to entry probably included the high capital requirement (compounded by inaccessibility to credit) and the seasonal nature of demand for the commodity. Indeed Ogola et al. (2002b) reported that none of the farmers in the study region used credit to finance the purchase of farm input, mainly due to unfavorable repayment terms. In contrast, Jones (1972) concluded that African marketing systems were reasonably efficient and competitive in the face of numerous obstacles such as lack of market intelligence and poor transport system.

2.3 Overview of Literature

Most studies on Irish potato farming and production in Kenya have not been exhausted. It is evidenced from the literature review that the level of farm input application such as fertilizers, fungicides, use of certified seeds and farmer's training influence agricultural productivity and profitability. Most studies attempted to either include price variability or address issues of infrastructure utilization such as roads, utilization of cooling plants for storage purposes which affects market competitiveness thus affecting potato farm gate price variability.

Most studies revealed that production costs of potatoes in Kenya could be reduced by selection of graded large tubers from healthy plants as planting material, proper seed treatment, effective, improved and control of pests and diseases. Muthoni and Nyamongo (2009) found out that production was hampered by low soil fertility, lack of quality seeds and attacks by pests and diseases. Daniel et al (2010) concluded that farmer's education and access to extension services had an upper hand in potato production. The authors further revealed that farmers training was needed to enhance their capacity to efficiently use the available resources. Most studies in the empirical review used cointegration and time series hence this study will also use the same in our analysis. The studies reviewed were not comprehensive enough since they omitted important factors like input prices and effects of other crops (competing crops) that greatly affect the level of productivity. Therefore, our study attempts to incorporate these important factors and looking at both prices and non-price factors that influence the level of potato production in Kenya.

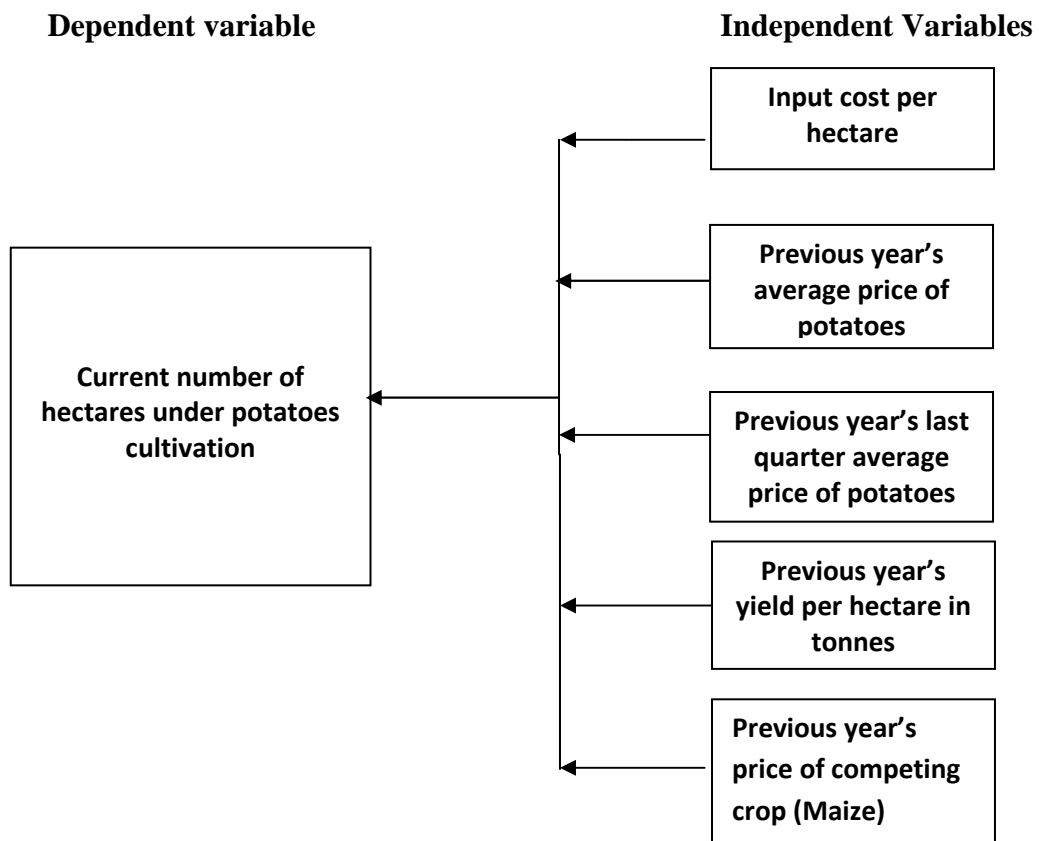
CHAPTER THREE: METHODOLOGY

3.1 Conceptual Framework

Smyth (2004) define conceptual framework as a group of concepts that are broadly defined and systematically organized to provide a focus, a rationale, and a tool for the integration and interpretation of information. Kothari (2004) defines an independent variable also known as the explanatory variable as the presumed cause of the changes of the dependent variable, while a dependent variable refers to the variable which the researcher wishes to explain. From our conceptual framework, the current number of hectares under potato cultivation is determined by the input costs per hectare, previous year's average price of potatoes, previous year's last quarter average price of potatoes, previous year's yield per hectare in tonnes and previous year's price of competing crop (Maize). Ogola et al., (2002) suggested that middlemen in the marketing chain of ware potato are likely to exploit potato growers by paying very low farm-gate prices which they argue could lead to low producer prices, high consumer prices and price instability because of inefficient and exploitative marketing practices. This implies that, as a result, there may be a consequent decline in productivity of potatoes. Consequently, high costs of inputs such as fertilizers and fungicides led to their minimal application in the farms leading to low production (Muthoni and Nyamongo, 2009).

Figure 2 below is a representation of the variables explored by this study.

Figure 2: Conceptual framework



Source: Author

3.2 Specification of the Model

The study will use the Ordinary Least Square (OLS) to estimate the relationship among the variables hypothesized to determine the farmer's response to changes in price among other factors. The model will measure the level of farmer's motivation by the number of hectares under potatoes cultivation per annum.

The General Multiple Regression Model will be;

$$Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t-1} + \beta_3 X_{3t-1} + \beta_4 X_{4t-1} + \beta_5 X_{5t-1} + u_t \dots \dots \dots 1$$

Where Y_t is the current number of hectares under cultivation

X_{1t} is the input cost per hectare

$X_{2,t-1}$ is the previous year's average price of potatoes per 130kg bag

$X_{3,t-1}$ is the previous year's last quarter average price of potatoes per 130kg bag

$X_{4,t-1}$ is the previous year's yield of potatoes per hectare in tonnes

$X_{5,t-1}$ is the previous year's price of competing crop (maize) per 90kg bag

β 's are the coefficients to be estimated

U_t is the error term or the disturbance term

3.3 Empirical Framework

This study has a number of measurable variables that correspond to the concepts used. Potato pricing will be measured by taking farm gate prices for different months and years under the study. The market information can be obtained from information channels available in Kuresoi Sub County which include the newspapers, articles, journals, radio and television programs covering information pertaining to potato market and the number of reliable market informants to the farmers. Income is measured by the gross margin determination and analysis per hectare. The production cost is measured by prices and volume of various inputs used by farmers in production. The output level will be measured by the number of 130 Kg bags of potatoes produced by farmers per hectare at a given season.

3.4 Assumption of OLS

The OLS technique used to provide empirical estimates makes the following assumptions: there is a linear relationship between the explanatory variables and the dependent variable through the coefficients, the conditional expectation of the random error terms is zero, the random error

terms have constant variance and are uncorrelated across all observations, there is no exact linear relationship among the independent variables and the random error terms are approximately normally distributed. These assumptions were tested in the next chapter.

3.5 Expectation

Table 3.1: Variable definition, measurement and Expected sign

Variables	Measurement	Expected sign
Dependent variable		
Y_t	Number of hectares under potato cultivation	
Independent variables		
$X1_t$	Input cost per hectare in Kenya shillings	Negative
$X2_{t-1}$	The previous year's average price of potatoes per 130kg bag in Kenya shillings	Positive
$X3_{t-1}$	The previous year's last quarter average price of potatoes per 130kg bag in Kenya shillings	Positive
$X4_{t-1}$	The previous year's yield per hectare in tonnes	Positive
$X5_{t-1}$	The previous year's price of competing crop (maize) per 90kg bag in Kenya shillings	Negative

Table 3.1 indicates that an inverse (negative) relationship exists between Y and X1 implying that when the cost of input per hectare increases, there is likelihood that the resources to invest will be scarce and thus the production of potatoes anticipated will be less. This will result in less land being allocated to potato production. Also, there will be a direct (positive) relationship between

Y on one hand and X2, X3, and X4 on the other hand. An increase in the expected price of output and expected yield per hectare holding other factors constant would lead to an increase on the number of hectares under potatoes cultivation. Further, there is an inverse relationship between Y and X5 because high prices of maize, holding other factors constant would deter farmers from cultivating potatoes.

3.6 Data Source

This study used time series secondary data from the period 1977 to 2010 which was obtained from Ministry of Agriculture (MOA). The presentations were done with the use of tables and graphs for illustration purposes.

CHAPTER FOUR: DATA ANALYSIS, INTERPRETATIONS AND DISCUSSION OF THE RESULTS

4.1 Introduction

This study investigates potato pricing and marketing policies in Kuresoi sub-county in Nakuru County. This chapter has made use of descriptive and regression statistics in its presentation of results. Time series data containing variables of the number of hectares under potatoes, input cost per hectare, average previous years farm gate price, average previous year's last quarter farm gate price, the previous year's yield per hectare and the price of the competing crop (maize) for the period 1978-2010 has been used.

4.2 Descriptive Statistics

This study has considered the mean, standard deviation, minimum and maximum values.

Table 4.1a: Descriptive statistics

VARIABLE	OBS	MEAN	STD. DEV.	MIN	MAX
Y	33	13620.89	4301.376	7845	23808
X1	33	69640.91	7665.328	57500	79900
X2	33	1568.182	418.856	1050	2400
X3	33	1738.364	474.8373	852	2420
X4	33	8.445455	1.772373	5.6	12.1
X5	33	1178.18	122.99	788	1370

Source: Author's computation

The mean values show the averages for all variables under consideration while the standard deviation is a measure of dispersion that indicates variability in the measures. The average number of hectares is 13621; the average input cost per hectare is 69641 Kenya shillings, the

average previous year's farm gate price is 1738 Kenya shillings, the average previous year's yield per hectare is 8.4 tonnes and the average price of maize is 1178 Kenya shillings. The hectares under potato cultivation varied for the duration of analysis because its standard deviation measure of 4301 is considerably large. On the other hand, the previous year's yield per hectare exhibited low variation with a standard deviation of 1.8. It was observed that the maximum number of hectares under potato cultivation during the period of study is 23808. The average previous year's last quarter's price also varied for the period of analysis with the highest price of 2420 Kenya shillings and the lowest price of 852 Kenya shillings.

Table 4.1b: Skewness and Kurtosis

VARIABLE	OBS	SKEWNESS	KURTOSIS
Y	33	1.076	3.657
X1	33	-0.308	1.830
X2	33	0.773	2.406
X3	33	-0.119	2.145
X4	33	0.513	2.823
X5	33	-0.956	4.793

Source: Author's computation

Further descriptive statistics are presented in Table 4.1b above; the kurtosis statistic shows that all the variables are flatter. This means that their distributions are flatter than a normal distribution, with a wider peak and the probability for extreme values is less than for a normal distribution with the values having a wider spread around the mean. As a measure of asymmetry of the distribution of the series around its mean, the statistic for skewness shows that all the variables are positively skewed, implying that their distributions have long right tails.

4.3 Correlation Analysis

4.3.1 Correlation matrix

The correlation coefficients are used to describe the relationship between various pairs of variables. Correlation coefficients greater than zero indicate a positive relationship while coefficients less than zero indicate an inverse relationship. The Input cost per hectare, previous year's yield per hectare and the price of the competing crop are positively correlated to the number of hectares under potato cultivation. The two price variables: average previous year's farm gate price and average previous year's last quarter price are also positively correlated with the number of hectares under potato cultivation. There is a high correlation between average previous year's last quarter's price and input cost per hectare with a correlation coefficient of 0.8340 implying existence of a strong relationship since it is close to one. There is a negative correlation between previous years yield per hectare and price of maize with a correlation coefficient of -0.2069 implying a weak relationship its absolute value is close to zero. The correlation coefficients for other pairwise comparisons are presented in Table 4.2a below.

Table 4.2a: Correlation matrix

VARIABLE	Y	X1	X2	X3	X4	X5
Y	1.0000					
X1	0.6426	1.0000				
X2	0.7684	0.6863	1.0000			
X3	0.7732	0.8340	0.8786	1.0000		
X4	0.4307	0.4955	0.2085	0.3956	1.0000	
X5	0.0751	0.1191	0.0813	0.0399	-0.2069	1.0000

Source: Author's computation

4.3.2 Addressing Multicollinearity

Multicollinearity arises when a given pair of independent variables exhibits high correlation. If not accounted for, this bias could lead to wrong signs of the coefficients and even spurious standard errors. The Variance Inflation Factors (VIF) are used to check if the correlation between variables is high enough as to yield misleading results. For values of VIF greater than 10 and values of $1/VIF$ less than 0.10 imply Multicollinearity. Table 4.2b below presents the Variance Inflation Factors;

Table 4.2b: Variance Inflation Factors

VARIABLE	VARIANCE INFLATION FACTORS	1/VIF
X3	8.28	0.1208
X2	4.92	0.2033
X1	3.97	0.2509
X4	1.57	0.6354
X5	1.14	0.8763

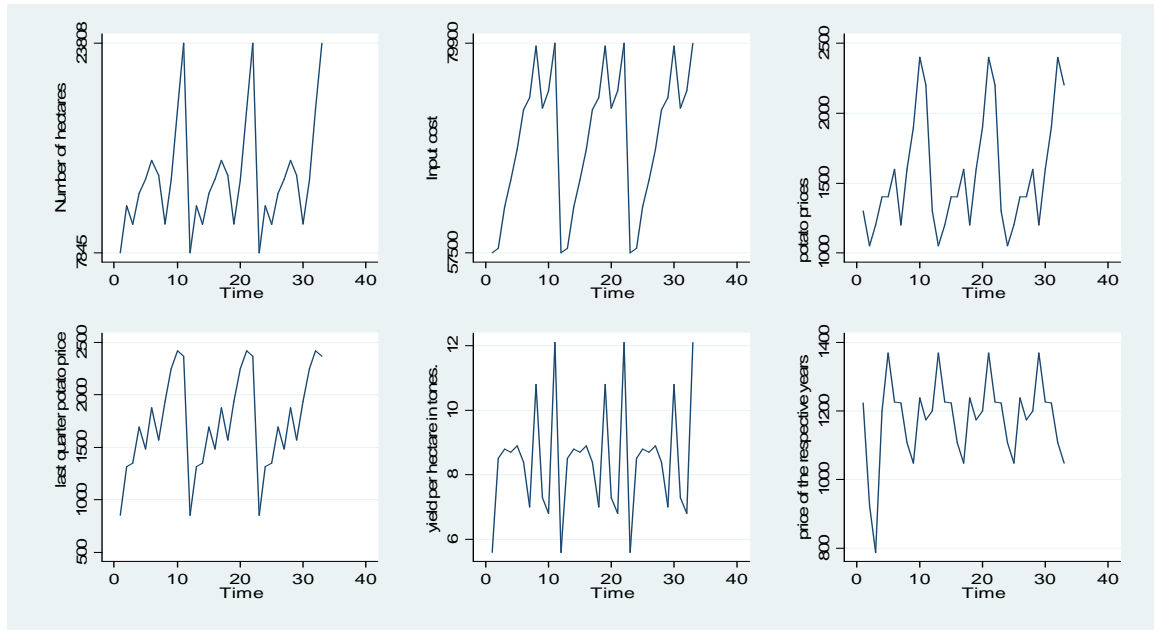
Source: Author's computation

Table 4.2b above show that all VIFs which are less than 10 and the tolerance of more than 0.1 implying absence of Multicollinearity.

4.4 Graphical Analysis

Various graphs showing the trends of our variables of interest are presented. These graphs show that over the years, there is fluctuation in the number of hectares under potato cultivation, input costs per hectare, average year's farm gate prices, average previous years last quarter's price, previous year's yield per hectare and the average price of maize. This is as illustrated in the Figure2 below.

Figure 3: Graphical analysis



4.5 Checking Normality of Residuals

Since Ordinary Least squares estimation requires a normal distribution for the random error term.

We carry out the Shapiro Wilk Test to check if the random error term is normally distributed.

The test is also performed on all the variables to ascertain normality (See Table 4.4).

Table 4.3: Shapiro Wilk Test for Normality

VARIABLE	OBSERVATION	P-VALUE
Y	33	0.00374
X1	33	0.04658
X2	33	0.01957
X3	33	0.35333
X4	33	0.07610
X5	33	0.00081
Random Error Term	33	0.07030

Source: Author's computation

From Table 4.3 above, all variables except average previous year's last quarter's price and previous year's yield per hectare are not normally distributed since their p-values are below 0.05. This leads to the rejection of the null hypothesis of normality. However, the p-value of the random error term is greater than 0.05 implying that although most variables are not normally distributed, the random error terms follow a normal distribution.

4.6 Homoscedasticity

Heteroscedasticity refers to variation of the error terms across all the observations under study. The residual plot method is used to test for it however it is too subjective as it relies on observation. We employed the Cook-Weisberg test for heteroscedasticity. Table 4.4 show that 12.98% is greater than 5% significance level which implies that heteroscedasticity is absent.

Table 4.4: Breusch-Pagan test for heteroscedasticity

Variables: fitted values of number of hectares under cultivation
chi2(1) = 2.30
Prob> chi2 = 0.1298

Ho: Constant variance

4.7 Autocorrelation

Presence of Autocorrelation implies the correlation between random error terms of the subsequent time periods, if present; the bias leads to spurious estimates. We applied Breusch-Godfrey LM test for autocorrelation. The use of robust standard errors also serves as a remedy for autocorrelation. As can be observed from Table 4.5, the p-value of 39.55% was greater than 5% which means that we fail to reject the null hypothesis of no serial correlation.

Table 4.5: Breusch-Godfrey LM test for Autocorrelation

lags(p)	chi2	df	Prob> chi2
1	0.722	1	0.3955

H₀: No serial correlation

4.8 Checking assumption of stationarity of variables

The Ordinary Least Squares (OLS) requires time series variables to be stationary. The properties of stationary time series variables are constant over the analysis time and have very low tendency to change. If regression proceeds in the presence of non-stationary variables, the results may end up being spurious. The Augmented Dickey Unit Root Tests is used to determine if variables are non-stationary. The test results shown in Table 4.6 below;

Table 4.6: Unit root test

VARIABLE	P VALUE	P VALUE AFTER FIRST DIFFERENCE	P VALUE AFTER SECOND DIFFERENCE
Y	0.0823	0.0039	-
X1	0.0057	-	-
X2	0.1041	0.1375	0.0011
X3	0.0854	0.0448	-
X4	0.000	-	-
X5	0.0784	0.0123	-

Source: Author's computation

From Table 4.6 above, it was revealed that input cost per hectare, previous years yield per hectare were stationary without differencing while number of hectares under cultivation, previous years last quarter average price and price of the competing crop (maize) were stationary after first differencing. On the other hand, average previous year's farm gate price was stationary after the second difference which led to the following model;

$$DY_t = \beta_0 + \beta_1 X1_t + \beta_2 D2X2_{t-1} + \beta_3 DX3_{t-1} + \beta_4 X4_{t-1} + \beta_5 DX5_{t-1} + u_t \dots \dots \dots 2$$

Where DY_t is the first difference of the current number of hectares under cultivation

$X1_t$ is the input cost per hectare

$D2X2_{t-1}$ is the second difference of the previous year's average price of potatoes

$DX3_{t-1}$ is the first difference of the previous year's last quarter average price of potatoes

$X4_{t-1}$ is the previous year's yield per hectare

$DX5_{t-1}$ is the first difference of the previous year's price of competing crop (maize)

β 's are the coefficients to be estimated

The above model is now stationary implying it can be estimated after identifying the order of cointegration of the variables. However, it should be noted that if two or more variables are integrated of the same order and their differences have no clear tendency to increase or decrease then this will suggest that their differences are stationary. Table 4.6 above shows that these variables are not integrated of the same order which implies that cointegration test is invalid.

4.9 Model specification

Considering model specification, we applied Ramsey Reset test using powers of the fitted values of the first difference of the current number of hectares under cultivation in estimating the omitted variables and established that the p-value of 0.0144 is less than the chosen significance level of 0.05 leading to rejection of the null hypothesis (see Table 4.7) below which implies that there are other omitted variables which influence production of potatoes in our area of study.

Table 4.7: Ramsey RESET test for variable omission

RESET test using powers of the fitted values of DY
Prob> F = 0.0144
H ₀ : The model has no omitted variables

Source: Author's calculations.

This effectively confirmed the evidence of omitted variable(s) which is true since there are several other factors that motivate farmers to increase the area under potato cultivation. They may be either endogenous or exogenous for example climate change, social interactions and political environment.

4.10 Model Estimation

To realize the core objective of the study, that is explore potato pricing in Kuresoi Sub-County with the view of evaluating the effectiveness of price marketing policies over time, we estimated our final model represented as;

$$DY_t = 3806.52 - 0.0435X1_t - 7.27D2X2_{t-1} + 13.28DX3_{t-1} - 92.43X4_{t-1} + 0.089DX5_{t-1} + u_t \dots \dots \dots 3$$

Where DY_t is the first difference of the current number of hectares under cultivation

$X1_t$ is the input cost per hectare

$D2X2_{t-1}$ is the second difference of the previous year's average price of potatoes

$DX3_{t-1}$ is the first difference of the previous year's last quarter average price of potatoes

$X4_{t-1}$ is the previous year's yield per hectare

$DX5_{t-1}$ is the first difference of the previous year's price of competing crop (maize)

Table 4.8: General Linear Regression Model

DY	Coefficients	Robust Std. Err.	t	P>t
X1	-0.0434872	0.0911089	-0.48	0.637
D2X2	-7.268855	1.416328	-5.13**	0.000
DX3	13.28132	1.370029	9.69**	0.000
X4	-92.43089	372.2161	-0.25	0.806
DX5	0.0885165	4.190019	0.02	0.983
Constant	3806.516	5122.482	0.74	0.464

Number of Observation = 31

F(5, 25) = 38.11

Prob> F = 0.0000

R-squared = 0.8079

Root MSE = 2486.2

Source: Author's computation

Table 4.8 shows that 80.79% of variations in the model have been explained by the independent variables while 19.21% of the proportion was captured by factors not included in the model. As can be seen from Ramsey Reset test, we found that there was an omitted variable which implies that unexplained proportion was as a result of the same. The p-value of 0.000 implies that all variables were fitting the model well.

We further established that if all other factors were kept constant, the first difference of the number of hectares under cultivation would be 3806.52 hectares. As input cost of the per hectare changes by unit, we have a decline in the number of hectares under cultivation by 0.0435 hectares holding other factors constant. This is similar to the previous year's average farm gate price of potatoes whereby the unit change led to a decrease in the number of hectares under cultivation by 7.27 hectares holding other factors constant.

On the other hand, the unit change in the previous year's last quarter average price led to an increase in the number of hectares under cultivation by 13.28 hectares holding other factors constant. This relationship was similar to the positive relationship established between the competing crops (maize). A unit change of the previous year's average price of the competing crop led to an increase in the number of hectares under cultivation by 0.089 hectares under cultivation. Finally, it was revealed that for a unit change in the previous year's yield per hectare led to a fall in the number of hectares under cultivation by 92.43 hectares holding other factors constant.

4.11 Discussion of the results

This study revealed that previous year's average price of potatoes and previous years last quarter average price were significant factors determining the current number of hectares under potato

cultivation. While assessing the pattern of the farm gate prices, (previous year's average price of potatoes, previous year's last quarter average price and previous year's average price of the competing crop) we realized that there was a sporadic fluctuation throughout the entire period of study. The econometric estimation predicted a positive relationship except previous year's average price of potatoes which had a negative relationship with the number of hectares under cultivation. Horton (1987) attributed low producer prices, high consumer prices and price instability to inefficient and/or exploitative marketing practices. On the contribution of prices to output, FAO (1998) explored their volatility and suggested that it was as a result of inelastic demand and the narrowness of the market.

Our study explored the effects of costs of inputs per hectare on production of potatoes and a significant negative relationship was revealed with the number of hectares under cultivation which concurs with our a priori expectation and the economic theory. This concurs with the study carried out by Ogola et al. (2002b) who reported that middlemen in the marketing chain of ware potato exploited potato growers by paying very low farm-gate prices and further suggested that potato productivity are highly affected by price instability, input costs and uncertainty (associated with supply and demand), and the perishability of the crop. Therefore, if there are no effective and proper policies, farmers may end up using lots of finances in potato production and since capital would still be scarce they would produce potatoes mainly for food which implies that the area under cultivation would decline.

Lastly, the output/ yield were also found to have an insignificant negative effect on the number of hectares under cultivation. Our findings contradicts, Shiferaw et al., (2008) who found a significant positive relationship between farmer access to production inputs at fair prices and

technical efficiency. These authors claimed that farmers at times get motivated by the production of the last year's output or yield.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the study findings as per the specified objectives and according to the literature review. Fundamental conclusions based on the investigated relationship between potato pricing and marketing policies within the area of study (Kuresoi Sub County). Thereafter, Policy recommendations are made based on the results of the study. Suggestions for further areas of study are given as a way of filling the gaps identified.

5.2 Summary

This study investigated the potato pricing and marketing policies in order to evaluate the effectiveness of price and marketing policies in Kenya. It specifically sought to explore factors that cause farm income instability to potato farmers in the sub county and evaluate various ways through which the government can intervene to stabilize potato prices in order to improve competitiveness of potato production. The study variables considered in this study were; the current number of hectares under cultivation, the input cost per hectare, the previous year's average price of potatoes, the previous year's last quarter average price of potatoes, the previous year's yield per hectare and the previous year's price of competing crop (maize). The study employed the general linear model in estimation and the following Ordinary least square (OLS) assumptions were tested; Multicollinearity, no serial correlation, normality, linearity, homoscedasticity, unit root and cointegration test.

5.3 Study results

The regression results show that the previous year's average price of potatoes and the previous year's last quarter average price of potatoes were statistically significant at 95% confidence

interval. However, the previous year's average price of potatoes was negatively related to the current number of hectares under cultivation while the previous year's last quarter average price of potatoes was positively related to the current number of hectares under cultivation. On the other hand, the input cost per hectare, the previous year's yield per hectare and the previous year's price of competing crop (maize) were revealed to be statistically insignificant.

5.4 Conclusions

The study extensively explored theoretical literatures and empirical studies which were inconclusive enough since there were some other factors which were excluded although they greatly affect the level of potato productivity. In view of evaluating the effectiveness of price marketing policies over time, our study established that the main factors that influence production of potatoes within our area of study were mainly the previous year's average price of potatoes and the previous year's last quarter average price of potatoes.

5.5 Policy Implications

Based on the trend analysis, it indicates that over the period of study, the farm gate prices of potatoes have been fluctuating significantly implying price instability. Further, previous year's average price of potatoes discourages production. We therefore propose for a need of harmonization of potato prices to enable price stability which may lead to stable production of potatoes in the region. Stability in prices may be enhance through the improvement of the roads which links farmers to the markets which results in increased income to potato farmers since the cost of production will go down. Other factors such as provision of cheap credit to farmers and

accessible market information will boost farmers' production since inputs will easily be availed thus to timely planting of the crop.

The results revealed a positive impact of the previous year's last quarter average farm gate price on production of potatoes. This implies that farmers base their future income on the previous year's last quarter average farm gate price which if increases, leads to an increase in the production of the product. This eventually influences the overall production of potatoes in Kuresoi Sub-County. This factor has great policy consequences which need to be addressed by the policy makers both at the local and the national levels with a view of improving potato production within the district.

5.6 Limitations of the Study

The study recognizes that there are other variables that might not have been considered as influencing potato farming within the Kuresoi Sub-County. These include but not limited to unavailability of land for farming, the soil fertility, and post harvesting problems, methods or techniques of farming, cultural issues and means of transport.

5.7 Further areas of study

The limitations can be brought in through the inaccuracy in the measurements and methods used in data collection. It is possible that measurement errors are obtained in the national account data used in this study. The main limitation is the availability and the accuracy of the data used in the study. The secondary data obtained from the Ministry of Agriculture both at the national,

provincial, district and divisional levels may not be accurate since they are subjective to data collection intrigues.

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APPENDIX 1: DATA USED

Year	Y1	X1	X2	X3	X4	X5
1978	3544	49835	1082	414	2.06025	1059
1979	7154	50335	832	875	4.96025	760
1980	5729	54785	982	913	5.26025	623
1981	8089	57635	1182	1255	5.16025	1036
1982	9152	60935	1182	1045	5.36025	1205
1983	9229	65135	1382	1442	4.86025	1061
1984	9433	66435	982	1129	3.46025	1059
1985	5749	71935	1382	1499	7.26025	942
1986	9087	65335	1682	1815	3.76025	883
1987	14482	67135	2182	1982	3.26025	1073
1988	19507	72235	1982	1935	8.56025	1010
1989	10646	60333	1509	1071	7.37579	1323
1990	14256	60833	1259	1532	10.2758	1492
1991	12831	65283	1409	1570	10.5758	1348
1992	15191	68133	1609	1912	10.4758	1346
1993	16254	71433	1609	1702	10.6758	1229
1994	16331	75633	1809	2099	10.1758	1170
1995	16535	76933	1409	1786	8.77579	1360
1996	12851	82433	1809	2156	12.5758	1297
1997	16189	75833	2109	2472	9.07579	1323
1998	21584	77633	2609	2639	8.57579	1492
1999	26609	82733	2409	2592	13.8758	1348
2000	11829	61925	1777	1230	8.2484	1569
2001	15439	62425	1527	1691	11.1484	1452
2002	14014	66875	1677	1729	11.4484	1393
2003	16374	69725	1877	2071	11.3484	1583
2004	17437	73025	1877	1861	11.5484	1520
2005	17514	77225	2077	2258	11.0484	1546
2006	17718	78525	1677	1945	9.6484	1715
2007	14034	84025	2077	2315	13.4484	1571
2008	17372	77425	2377	2631	9.9484	1569
2009	22767	79225	2877	2798	9.4484	1452
2010	27792	84325	2677	2751	14.7484	1393

Source: Ministry of Agriculture reports