COST-BENEFIT ANALYSIS OF SUBSTITUTING BANANA FOR COFFEE IN MURANGA COUNTY, KENYA

BY

KURIA ISPAN NJENGA

REG: X50/64342/2013

RESEARCH PAPER SUBMITTED TO ECONOMICS DEPARTMENT, UNIVERSITY OF NAIROBI IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR DEGREE OF MASTERS OF ARTS – ECONOMICS

2016

DECLARATION

The research paper is my original work and has not been presented for award of a degree is any other university.

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KURIA ISPAN NJENGA Date

X50/64342/2013

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

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DR. GEORGE RUIGU DATE

ACKNOWLEDGEMENTS

My sincere thanks go to the supervisor Dr. George Ruigu for his professional guidance, tolerance and cooperation. I am greatly indebted for his insights and guidance that made this work more manageable.

Special thanks go to my family for their moral and emotional support that enabled me to complete the work successfully.

LIST OF ABBREVIATIONS

CBA	Cost Benefit Analysis
EGM	Enterprise Gross Margin
GDP	Gross Domestic Product
GI	Gross Income
HCDA	Horticultural Crops Development Authority
KALRO	Kenya Agricultural and Livestock Research
KNBS	Kenya National Bureau of Statistics
MOA	Ministry of Agriculture
NPV	Net Present Value
TEC	Total Enterprise Costs

ABSTRACT

The study examines the cost and benefit of farming bananas and coffee in Muranga County, Kenya. Time series data analysis technique is used for the period 2011-2029. The main objectives of the study are to analyse the welfare of farming bananas Vis a Vis coffee using cost benefit analysis. This study is important since poverty eradication remains a core agenda in improving the welfare of Kenyan citizens.

The base scenario results revealed that banana farming is superior to coffee farmers economically and financially because the incremental benefits are higher than for coffee. This is shown by the results which indicated that there was a net incremental benefit of KShs 85,541 by producing banana and this could even increase if value addition is factored in. Therefore, the conclusion was that the people of Muranga stand to gain in welfare through better income by engaging in banana farming which has nutritional values too.. From the study it is recommended that banana be introduced as an alternative to coffee growing areas.

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CHAPTER 1: THE INTRODUCTION

1.1 Information background

1.1.1 Poverty in Kenya

Poverty reduction is a crucial development issue. On the one hand, material poverty adversely affects the poor, eroding their well-being, security, and development potential, on the other hand, high rates of poverty constrain national development by reducing overall domestic development. This hinders socio-political participation and prevents the realization of human dignity of the population's full potential; therefore policies and efforts to successfully reduce poverty can only be devised if two basic questions are answered:

1. In what areas of the country are the poor in large proportion?
2. Where are the highest numbers of poor people in absolute terms?

Poverty reduction strategies have been adopted by the government of developing countries across the world. The goal of these strategies has been to reduce by a substantial level the percentage of people falling within the set poverty lines among these countries' population. Strategies of development of the 1960's have been widely criticized which were based on large–scale capital intensive integrated rural development, similar with the attempting import substitution industrialization of the 1970's (Balassa 1980). Equally, many African countries still believe in the strategy of agricultural-led growth though they are still disillusioned with the traditional crops which have suffered decline in prices. Production of horticultural crops have provided a platform for growth and development in several African countries being a non-traditional.

The national poverty rate for Kenya in 2009 was 45% (KNBS 2014) despite recent declines in poverty incidences; this means that nearly half of Kenya's 38 million (KNBS 2014) people are still poor. Poverty reduction as clearly indicated must remain at the top of the country's development plan. With the national poverty rate still over 40%, this study targets areas largely inhabited by the poor. Strategies of reducing poverty targeting poor areas will focus on issues and economic conditions and social development affecting these areas.

More than 20 million people in Kenya – about 55% of the total population – live above the poverty line and are thus categorized as non-poor (KNBS 2014). The question that arises, however is, how much above the poverty line they live and how this varies throughout Kenya. For three reasons:

1. It's useful to know the wealth of the majority compared to the population living in poverty.
2. Wealth levels and their distribution are important indicators of economic potential and may reveal where buttressing processes of growth and diffusion can reduce poverty
3. The population living just above the poverty line could easily fall into poverty in the event of economic/ ecological shocks, whereas a larger wealth margin could provide a buffer.

A lot still need to be discovered about poverty and the poor despite many years of efforts towards its eradication. This includes the reasons for continued poverty and the subsequent efforts needed to eliminate it. Such must be pursued with full cognizance of the multidimensionality of poverty (World Bank 2000a). In 2013, more than 20 million Kenyans were estimated to be living below the poverty line; this was as established in a survey conducted nationally under the Welfare Monitoring Survey III (WMS) 2014 and which established the total poverty headcount in Kenya at 45.2% (Government of Kenya, 2014).

More than a half of the Kenyan rural dwellers live under the poverty line. Their concentration is mainly in the high and medium potential agricultural lands making their landholdings smaller and smaller. An increasing number of rural households rely on growing fruits and vegetables for home use, with most farmers selling the surplus during harvest peaks within the domestic market.

The Kenya National Bureau of Statistics (KNBS, 2014) Small Area Estimation 1999 (Individuals) estimates that 52.8% of the Kenyan population falls under the rural poor living below the food poverty line. The principal cause of increasing poverty has been a combination of the failure, until recently, of economic growth to keep pace with population growth with a progressively more unequal distribution of income and wealth. About 10% of the rural

population is landless (KNBS, 2014), with the proportion being particularly high in the Rift Valley, Central and Coast regions. Given the small farm sizes and the fact that most horticultural produce has a relatively high net unit value per hectare compared with alternatives, most farm households grow horticultural crops for the market. Thus, horticulture is necessarily associated with the majority of poorest rural households in Kenya, but also represents one of the few means contributing to their livelihoods.

1.1.2 Horticulture industry in Kenya

Agriculture is the single most important sector in Kenya; it contributes about 24% of the country's GDP and employs around 60% of the population, either directly or indirectly. For that matter, changes in the country's GDP and income growth continue to be affected by that of the sector.

There is duality in the country's agricultural sector. In that the players can be classified into two groups: the small scale farmers working on small pieces of land and the few large scale farmers with big tracks of land including ranches. There are two divisions of the smallholder subsector which are: (i) farmers for subsistence and those of pastoral nature, and (ii) farmers practicing commercial farming in small scale in medium to high rain areas. To continue having a greater impact on the economy and for the country to stand a better chance of reducing poverty through wealth creation, agricultural sector must be transformed. The small scale farming must be moved from its current subsistence nature to the level of its profitable commercialization. Besides a pillar of most developing countries, agriculture is earmarked important globally through various commitments including achievement of sustainable development goal on the reduction of extreme poverty and hunger by 2030. Horticulture is a key sub-sector in agriculture. It is seen tremendous growth over the years ending up employing more and earning more in exchange. In 2014 horticulture contributed Kenya shillings 89,339 million to the economy (KNBS 2014). The horticulture sub-sector has a wide range of potential commodities which are key, to its growth. These include fruits, nuts, vegetables, flowers, and medicinal and aromatic plants. The fruits category continues to contribute the least to the horticulture industry simply because, specific commodities have not been accorded due consideration. The major fruits are bananas, mangoes, avocados, passion fruits, pineapples and melons. Of these, banana contributes about 50% of the

total revenue from all fruits. It has gained prominence in the recent past as a fruit and a staple food crop.

Horticultural production has continued to grow in Sun-Saharan countries even as other commodities' productions remain the same. This is not to mention that it has enabled creation of jobs and earn its producers foreign exchange. In Kenya, the sector currently ranks third in exchange earning (below tourism and tea) and is the fastest growing in agricultural sector. An estimate by the World Bank shows that horticulture export industry creates up to 2 million employment opportunities in Kenya (World Bank 2008 and Dolan, 2011). Subsequently, it can be seen to have helped and still able to help in alleviating poverty by providing better pay for its farmers. Also, because of horticulture, the overall agricultural skills in Kenya are better than before.

Kenya is one of the major producers of horticultural products; its annual output is estimated at 3 million tones. Of this output, most is exported to Europe particularly to the United Kingdom, Germany, France, Switzerland, Belgium, Netherlands and Italy which forms the major market. Significant quantity of the product is also shipped to Saudi Arabia and South Africa.

So far, the marketability of horticulture has been a result of the private sector activities which has proven well organized and much developed. For the government, it actions are limited and can be traced to general to indirect incentives like infrastructural development in areas involved in agricultural production. Implementation of the structural adjustment program with its accompanying macroeconomic reforms including market liberalization have done a good deal to the horticultural subsector.

Production and sale of horticultural products falls in the hands of a few for instant, of the sales made in Kenya, 80% 0f those are produce by a paltry 15% of rural households. However, it is banana and kales among the list which are widely produced (Government of Kenya 2014). Therefore, if one is to have major impact on horticultural production, it would be through the two crops because of their already wide production by many.

Despite this potential, the banana sub-sector has not received adequate attention with regard to policy and institutional support, though there are studies on banana tissue culture. Consequently, the sub-sector has realized little growth despite the huge potential that exists for both domestic and export trade. The sub-sector therefore requires attention both in terms of resources and long term planning for it to play its rightful role in the economy. The banana sub-sector has emerged as one of the most promising enterprises with potential to contribute towards food and income generation, poverty reduction and improved livelihood of Kenyans as stipulated in Kenya Vision 2030.

1.2 Analysis of the Banana Industry

Banana continues to contribute towards household food security and income thus gaining acceptance amongst the majority of Kenyans. In addition, the base for technology development in the country is favorable and the existence of a large number of growers countrywide offers a good starting point in the promotion of the commodity.

Despite efforts to promote banana production in the country, supply of clean planting materials has been a challenge. Low levels of technology adoption are also an impediment to the expansion of the industry (except for the case of tissue culture which is only in selected areas). The declining farm sizes and soil fertility have limited orchard expansion and productivity. This has been worsened by the land tenure system. Inadequate water resources also limit exploitation in potential areas. Banana is a bulky and highly perishable commodity, coupled with poor post-harvest handling of the produce by producers and traders, results in heavy losses and is a disincentive to prospective farmers. Disorganized marketing systems have impacted negatively on incomes of producers. Security of produce at various levels along the value chain is currently weak as expressed through incidences of theft and disputes amongst traders. In addition, uncoordinated activities by stakeholders in the industry results in duplication of efforts and conflicts.

The wide range of favorable climatic conditions experienced in the country provides impetus for increased banana production. The current legal and regulatory framework is facilitating the development of the banana industry (National Banana Development Strategy, to oversee growth

of the industry until 2016). The existence of several microfinance institutions offers opportunities for financing the banana enterprise. A growing number of institutions are interested in the sub-sector and are willing to allocate resources for development.

The growing population and urbanization is triggering a demand for bananas and banana products but the prevalence of pests and diseases in Kenya and the neighboring countries is a major threat. Several enterprises are also competing with banana for the limited farm sizes and market. Competition from imports from the regional markets has the potential of adversely affecting the industry. Also, the industry standards, regional and world trade agreements, act as trade barriers and limit market access. The recently signed East African Custom Union that will promote liberalized trade further threatens the banana industry not to mention the adverse effects of climatic change will also have an influence on the development of the industry.

1.3 Role of the Banana Industry

Banana is among the useful fruits and food crops and source of income for many households in Kenya. Production and consumption in the country has been on a steady increase in the recent past. The fruit has several beneficial nutritional properties such as vitamin C, B6 and A. Bananas are concentrated in carbohydrates and fibers, and pose less health risk due to their low concentration of protein and fats besides being full of vital minerals like potassium. It is highly affordable making it useful as main course food if not for dessert. Banana contributes immensely to the incomes of farmers in the growing regions. Banana offers higher returns on investments compared to other competing crops like maize, coffee, potatoes and pawpaw. The enterprise offers livelihood to over two million people in Kenya. Previous studies on banana has proved that it can be used in the management of illnesses such anemia, hypertension, stress, brain power, constipation, ulcers and low immunity. It also has cultural significance to most communities in the country and is, for example, used in wedding ceremonies.

1.4 Trends in Banana Production

In Kenya, banana is grown in all regions. Currently the main production areas are the western, central and eastern regions of the country. The key growing sub-counties in the eastern regions are Meru and Embu, Murang'a South, Kirinyaga, Nyeri, and Thika sub-counties in the central

region, Taveta and Kilifi in the coast region, and Kisii, Karachuonyo, Vihiga, Kakamega and Bungoma in the western region. Rainfall still determines the sector's production. Practice of irrigation is uncommon and is done in various parts of the Eastern region such as Mbooni and Mitunguu, Garissa in the North Eastern region and in Ngurumani, Kajiado in the Rift Valley region.

Table 1: Area under bananas yields and value, 2007 to 2012.

Year	Area (Ha)	Production (Metric Tonnes millions)	Value in Ksh (billions)
2007	79,000	1.2	17.085
2008	82,766	1.60	23.00
2009	79,126	1.255	18.50
2010	61,345	1.253	18.45
2011	63,269	1.2	22.78
2012	58,175	1.39	23.44

Source: Government of Kenya (2012) – KNBS

1.5 Problem Statement

In Kenya, during the 1970s, coffee was described as the country's "black gold" that was the growing (boom) period, though this is not the case. In the recent past coffee has lost its shine for growers. In Central Kenya, therefore, there is a growing shift to banana production and if grown, the banana has combined traits such as high productivity and fast growth which is making it the better crop should the region think seriously about commercializing its agricultural production.

The government has launched the National Banana Development Strategy due to the popularity of banana farming, the strategy will oversee growth of the industry until 2016. Since farmers are keen on the market dynamics, this study undertook a market research on the cost –benefit-analysis of coffee and banana in order to assess rationalization for farmers to shift from coffee production to banana production in Muranga County. The County has varied agro-ecological zones and can support horticultural and non-horticultural crops.

Muranga County poverty analysis indicates that, it has a poverty gap of 7.7 percent and a poverty incidence of 33.2 percent with a poverty severity index of 2.5 percent.

1.6 Research Questions

While undertaking the research, the following questions were the guiding principle

1. What are the potential gains made by the producers and consumers?

1.7 Objectives of the Study

The broad objective of this study was to investigate whether the growing of bananas can improve the welfare of the population and to compare the cost s and benefits of growing banana as compared to coffee in Muranga County. The specific objectives of the study were to:-

1. To estimate and compare the financial and economic costs and benefits of banana and coffee farming in Muranga county.
2. Offer policy recommendations, especially for research, and improvement of horticultural production and consumption in the county.

1.8 Justification of the Study

There has been a shift of farmers from traditional cash crops to horticultural crops and especially banana growing in Muranga County but banana farming even though banana farming has its own challenges like pests, diseases and inadequate rainfall.

The research was centered on establishing whether by producing bananas over coffee the farmer is better off. Farming banana contributes to incomes, food and nutrition. Poverty reduction efforts would be accelerated by increased production of bananas.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

A discussion of the different cost and benefits associated to farming follows together with their analysis under Cost-Benefit Analysis (CBA) models. The review here is done first with regard to theory, empirical studies and summarizing both under overview.

2.1 Theoretical Literature

2.1.1 Concept of Cost Benefit Analysis

Cost-Benefit Analysis (CBA) is one of the methods for analytically assessing the efficiency effects of policies (Weimer and Vining, 1991). Because it considers all the cost and benefits possibly associated with a project, it has been termed the social cost benefit analysis (Boardman et al, 2006). CBA borrows from the theory of welfare economics. The principle states, if out of an action, the losers could be compensated by the gainers, the action is considered an improvement even if compensation is not actually paid. Consequently, even if there is no compensation, no one is actually worse off provided the possibility of such exist. Improvement could be made if any at least a person could be made better of without harming any. This is the basis of the Pareto-criterion for improvement. Economic analysis require that the present value of benefits (discounted at an appropriate discount rate) exceed the present value of costs and an inter-temporal compensation should be conceivable in the case where benefits and costs occur over a span of time. An advantage of CBA is that it the aspect of time dimension – cost and benefit streams that the comparative static framework ignores is considered (Mburu and Birner, 2002).

In using CBA, the main aim is ussulally to geuge the extent of efficient allocation of resources and uses that information to make an informed decision (Boardman et al, 2006). CBA analysis falls in two classes depending on the stage; these are the ex ante and the ex post CBA. Ex ante CBA is at the initial stage and aims at assessing the situation before a project implementation mainly to assess the needs. Ex post CBA is a confirmatory procedure, it gauges the effectiveness of a project. A projects cost benefit analysis can also be done in the course of its implementation to assess the progress and needs. This is basically a mixture of ex and post ante CBA. They direct the course of the project and so are as useful as ex ante CBA. Similarly, they mimic ex

post CBA because of their usage of observed data as opposed to predicted used in ex ante CBA. Media res analysis also provides information that can be used to predict costs and benefits in future ex ante analysis. A CBA that compares an ex ante CBA with an ex post (or in medias res CBA of the same project) is the most useful to policy makers for learning about the efficacy of CBA as a decision-making and evaluating tool (Boardman et al 2006).

Pareto efficiency is connected to net benefits. In making decision, CBA utilizes a less common rule called the Kaldor- Hicks criterion, which guides the Pareto efficiency rule. The criterion suggests that a policy should be adopted if the policies have a net benefit that is those who benefit reimburse those who don't gain. The absence of this potential is indicated by Negative net benefits (Boardman et al 2006; and Campbell and Brown, 2003). CBA final decision is comparing the total benefits and costs.

2.1.2 Valuing Economic Costs and Benefits

In valuing economic benefits, both the analysis is done in financial and economic realm. The society aims to get the best in contribution out of the production of banana and/or coffee to the national income.

2.1.3 Empirical Literature

Cost benefit analysis has successfully been used in projects and helped in decision making in 2009 Magati carried out a cost benefit analysis for planting bamboo in place of tobacco in South Nyanza. The literature sought was to estimate the financial and economic benefit of farming bamboo and tobacco in South Nyanza. Primary and secondary data was used to assess the benefits of farming either of the crop. (Magati 2009)

The research revealed that bamboo had more return compared to tobacco, the farmers will have a higher income plus preservation of the environment. The research also showed that bamboo took less labor days per season compared tobacco.

A research conducted in Kakamega, Kenya (Guthiga 2003) on the different ways used in managing Kakamega forest using cost benefit analysis revealed that the conservation functions

of Kakamega forest are not being carried out economically efficient. Using Cost Benefit analysis, the research discovered that efficiency can be increased by developing income generating more opportunities from the forest and thus tapping the forest potential. These income generating activities include involve investing on conventional tourism and eco-tourism since. The research also showed the highest component costs of conservation is borne by the people adjacent to the forest. Therefore, a compensation scheme ought to be designed in form of incentives by the state for the forest adjacent communities so that they can continue to support the conservation efforts.

2.2 Overview of Literature

Few studies have been done on banana especially with an aspect of seeking to find whether banana has a direct impact on the improvement of the welfare of population in Kenya, even though it's acknowledged that bananas play a vital role especially on the nutrition. There has also been a rise of many farmers substituting bananas for coffee especially in the central region of Kenya. Having no knowledge of an existing paper of this scope and nature, the study set to find if it benefits the people of Muranga county to switch to banana farming..

This study will clearly show through the cost benefit analysis, the benefits accrued by banana farmers over coffee farmers and it will further illustrate the welfare improvement of the banana producers.

Using Cost Benefit Analysis, EM Kimani did a study on shamba system in Dundori, Nakuru. The study investigated the impact on reforestation. It found an 88% rate of tree survival with an implication of a possible reforestation; it however recognized that this could be limited by Kenya Forest Service which decides tree type to be planted. It also found that landless farmers are allowed food production and this also adds to their per capita income. Further, the economic benefits were found to be higher than financial ones. There were positive marginal benefits, testing for sensitivity, the signs were found to remain the same.

CHAPTER 3: METHODOLOGY

This chapter is an organization of how the study was conducted. It gives the respective frameworks, models, in addition to a description of the study area and population data and its sources.

It is worth mentioning that the models discussed are mostly based on the concept of discounting which is the process of finding the present value/worth of a project. The "discount rate' is the assumed interest rate for discounting. The rate at which we are willing to give up consumption in exchange for additional consumption in future is the discount rate (Campbell and Brown, 2003).

The discounting concept helps in assessing the viability of a project to be implemented over a period by getting the incremental net benefit stream then discounting it by getting the year by year difference between expenditure from the benefits (Gittinger, 1982). Discounting has three possible approaches: the net project worth, the internal rate of return and the net benefit-investment ratio. Net present value will be adopted in this study, since it's a very straightforward discounted cash flow measure (Gittinger, 1982). In addition, it takes into account, the time dimension of cost and benefit streams (Mburu and Birner, 2002). A discount rate has to be selected while calculating the net present worth of a project. The discount rate is usually the marginal cost of money to the farm while calculating the financial analysis. The farm is able to borrow money at this rate.

In this study's economic analysis, prices are our beginning point. These are then adjusted accordingly in view of a society's value of inputs and outputs. In this context, coffee's market price is seen as an opportunity cost (value of forgoing the next best option) to the society. It therefore becomes our new assign value, the 'shadow price'/ 'accounting price' (Gittinger 1982). Doing the above introduces the concept of scarcity absent in financial accounting and so can be termed as the real economic price. Gittinger (1982) argument is that shadow prices better indicates a society's value hence should be used in determining costs and benefits.

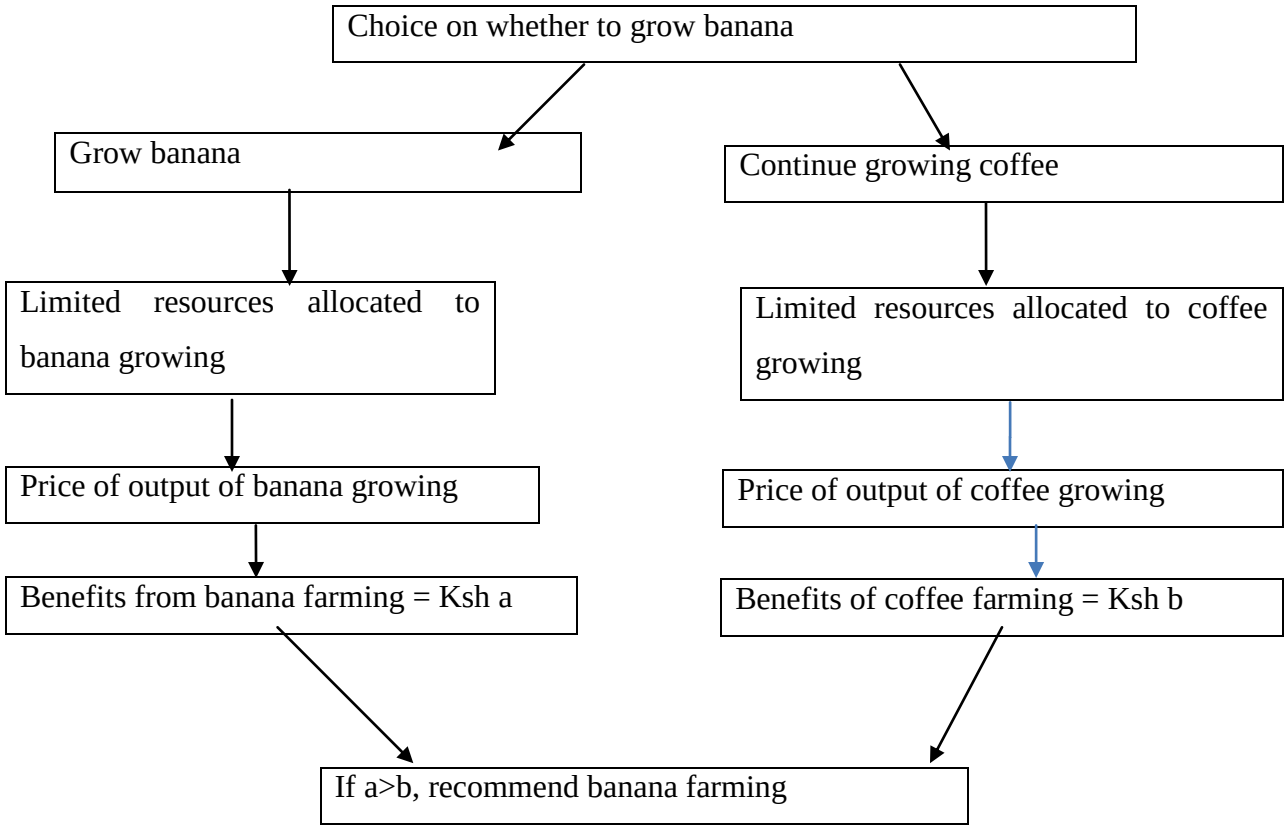
The study analyzed and evaluated whether a shift and focus on horticulture and specifically banana could help in improving the welfare of the population. It also shares policies that will address the constraints that hinder greater productivity of rural incomes in Muranga County.

3.1 Conceptual Framework

CBA's role is evaluating the impact brought about by a project or a policy. Two cases are assumed in this study; the first case is that of growing coffee and the other one is of growing bananas. The farmer, who is the decision maker in this case has an alternative; to grow bananas, since he has been planting coffee. It's illustrated in Figure 1 using a decision tree on the best outcome.

The heart of cost – benefit analysis is formed by the with-and-without approach also considers the opportunity cost concept. Holding all other factors constant, the benefits accrued by the farmer growing banana may not be the same as one growing coffee. To banana farmers, there is an opportunity cost they incur in terms of the benefits lost for not growing coffee. The decision maker will be guided by a comparison ob the cost with respect to benefit and so, if the net benefits (benefits less costs) derived from farming banana are greater than those of coffee, then banana farming should be more encouraged.

Fig 1 Farming decision tree



Source: Adopted from Magati, P (2009)

3.2 Theoretical framework

Cost Benefit analysis forms the basis of this study. Following Kimani (2008) and Magati (2009), the study first established coffee as the base crop. It then compared the net benefits possible from banana farming with what they get from coffee. The argument is that conversion of existing coffee plantations to banana farms results in loss of banana income.

Effective measurement of incremental benefits from any given involvement, in this cases banana farming, must involve a comparison between that intervention's benefits and those associated with another project (here taken as coffee farming). Because banana maturity period ranges from 12-24 months, benefits and cost for this study are tracked over a period of two years. To implement a project, the requirement in Economics is that the benefits (Net Present Value) are greater than the cost. NPV is computed as follows:

NPV = $\sum_{t=0}^{T} \left(\frac{B_t - C_t}{1+r^t}\right)$

This can be summarized as:

NPV = $\sum_{t=0}^{T} \left(\frac{NB_t}{1+r^t}\right)$

As noted above, in the implementation of a project, CBA concept of 'with and without project' comparison is used to establish net incremental benefits. In this case, the 'with project' is the banana farming, where as the 'without project' is the farming of coffee.

Projecting the expected future cash flow and cost is vital in CBA hence, for this study, it becomes important to know the possible future produce of banana relative to coffee keeping the farm acreage constant. In both economic and financial analysis two closely related CBA models are applied.

3.3 Model Specification

This study's CBA model was based on two approaches to project evaluation; financial modeling and economic leaning one. For the purpose of appraisal, no inflation has been assumed. This based on the assumption that costs and benefit are impacted similarly by inflation hence a zero relative effect (Campbell and Brown, 2003). So, the study estimated a model of the below form..

NPV = $\sum_{t=0}^{T} \left(\frac{NB_t}{1+r^t}\right)$

To estimate the model, the following are the variables;

Incomes:

Gross Income (GI) measures revenue. Computing GI is done by multiplying average output by average price at the farm level. GI is computed by adding output produced during the year, and considered as sales, used for household consumption, purchased for farm seed, payments in kind; or kept as closing stock.

Outlays:

Overheads were measured by;

a) Operating costs: They are arrived at by populating refer the input costs, ploughing costs and labor costs. Input costs are expenditures on seedlings, insecticides and herbicides while ploughing costs are foregone costs for using machines for primary land cultivation.

b) Opportunity cost of operating capital: It is estimated at 16% of cash or operational cost, in 2013 a rate of 16% was chosen since it is based on average bank lending rate (Trading Economics Kenya 2014).

c) Opportunity cost of family labor: It's the amount used as family labor, it is priced at market wage rate.

d) Total Enterprise Costs (TEC): It considers the prices of all inputs used in production. What a firm produces in the short term is determined by its varying inputs (Koutsoyiannis1993) because short term evaluation of profits is the norm. Also, because fixed cost are ignored in the short term, net return is therefore defined gross income over the level of activity and given in currency per acre.

Returns:

Return measures included:

a) Enterprise Gross Margin (EGM): given as operating cost minus GI.

b) Return on family land, labor and management: This is calculated by subtracting the opportunity cost of equity from GI and operation costs.

c) Return on family land and management: This is the difference between TEC and GI, which includes the opportunity cost of family labor and equity capital as part of cost. It will help in knowing the reward of the farmers' management and land by the family.

3.3.1 Financial Cost-Benefit Model

NPV = $\sum_{t=0}^{T} \left(\frac{NB_t}{1+r^t} \right)$

Under the financial cost benefit model, the unit of analysis is an individual, for instance, an individual farmer or a single community. Valuing costs and benefits are considered to be the market prices. The model considers costs incurred and benefits obtained by growing banana and coffee which were considered at local market prices. The foregone opportunity cost of the benefits of farming coffee is the other component of cost to be noted. According to Griffiths and Southey (1195), in agricultural analysis, opportunity costs are valued as the net returns from smallholder agriculture (as practiced). The study was guided by this.

3.3.2. Economic Cost-Benefit Model

NPV = $\sum_{t=0}^{T} \left(\frac{NB_t}{1+r^t} \right)$

Where, costs and benefits are valued at their shadow prices. This is what guides the economic CBA (Kimani 2008). Shadow prices are better indicators of the value of goods and services and therefore are used to value the goods and services. The government of Kenya has had incentives toward agriculture; these include fertilizer prices subsidization and free tax for farm implements. In real value, the above connotes benefic needed the adjustment of costs upwards. Our valuation depended on the prevailing market prices in the region of concern; this was done on the assumption of a competitive market for all relevant products except fertilizers.

3.4 Sensitivity Analysis:

This is done to compare different feasible scenarios while discounting at different rates. Since benefits currently enjoyed by rural dwellers is high and combined with the inability to predict the future, rural dweller tend to have high discount rates (Guthiga et al, 2006). To test the CBA model, discount rate are changed in both directions by a value of 50% of the face value (Kimani 2008).

3.5 Future Flows of Costs and Benefits Simulation:

The model is to project the flow of cost and benefits in future. The costs and benefits of this study are for the year 2011-2012 and 2014-2029 which have been estimated using the data on bananas for 2013. The data on coffee for 2011 will be used to approximate the costs and benefits for coffee from 2014-2029. The assumptions made in this study depend on the available information about the future and past scenarios. However, noted is that other factors are in play like environmental resources, population growth rate not directly considered here (Guthiga, 2007).

3.6 Measurement of the welfare improvement

To determine effect of banana production on poverty reduction, the study will examine the incomes of banana and coffee workers and test whether it's true that, holding everything else equal, banana farmers are better off based on the assumption that these farmers do not have both enterprises (bananas and coffee). The study incorporates a survey of banana households in Muranga County.

Poverty incidence is a common variant measure of poverty. It captures the proportion of the population considered poor as determined by their position relative to a poverty line. The line marks the critical point below which one is considered to be leaving below the basic needs hence poor.

How far a person is from a set poverty line gives the poverty gap. The gap for a society is the summation of those for all the people deemed poor assuming the non poor's gap is zero. This

measure captures the mean aggregate expenditure consumption shortfall of the poor across the whole population and is expressed as a percentage of the poverty line in Muranga County.

FGT measure or $P_{(\propto)}$ will be used in deriving poverty estimates.

$$P_{(\propto)} = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{Z-Y_i}{Z}\right)^{\propto} I(Y_i < Z)$$

N is the total population(or sample)

Y_i is the consumption expenditure of the i^{th} household

Z is the poverty line

$I(Y_i < Z)$ is an indicator function that maps a value of 1 when the constraint is satisfied. (i.e. if the given person is poor) or assigns a value of 0 otherwise.

$\propto$ is the poverty sensitivity indicator. Its value is 0, 1 or 2 depending on the poverty index

Calculating incidence of poverty (headcount index), parameter $\propto$ takes the value of 0 and the formula is as follows:

$$P_{\propto=0} = \frac{1}{N}\sum_{i=1}^{N} I(Y_i < Z)$$

Calculating the poverty gap $\propto$ takes the value 1

$$P_{(\propto=1)} = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{Z-Y_i}{Z}\right) I(Y_i < Z)$$

Calculating poverty severity $\propto$ takes the value of 2

$$P_{(\propto=2)} = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{Z-Y_I}{Z}\right)^{2} I(Y_i < Z)$$

3.7 Sources of Data:

The study used secondary data obtained from the Kenya National Bureau of Statistics (KNBS), the Ministry of Agriculture (MOA), the Kenya Agricultural and Livestock Research Organization (KALRO), the Horticultural Crops Development Authority (HCDA) and discussions with the county officers in Muranga County

CHAPTER 4: ANALYSIS OF EMPIRICAL RESULTS

4.0 Introduction

This chapter is the presentation of findings as established from the available data analyzed as previously outlined.

4.1 Results of Cost Benefit Analysis

This study carried out a CBA under the concept of 'with and without project' comparison to gauge net additive benefits associated with banana farming project. Putting this in context, the banana farming made our 'with project' part while the 'without project' aspect was represented in coffee production. The section presents the results as computed using financial and economic models for banana production and possible alternative crops as the control variable.

4.1.1 Financial Cost-Benefit Analysis - Banana

The financial analysis was performed taking the farmers' perspectives, local market prices was the basing of establishing the financial value of costs and benefits. The results are shown in Table 2.

Table 2: Financial cost of a Hectare Coffee production

ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
Plaughing land	Ha	1	5000	5,000
Digging holes	No	2500	70	175,000
Making lay out	Md	250	6	1,500
Lay out sticks	No	2500	1	2,500
Manure	Tonnes	1500	20	30,000
Planting Fertilizer	50 – Kg bags	5	3500	17,500
Planting seedlings	No	2500	20	50,000
Purchase of seedlings	No	30	2500	75,000
Transport cost		1	10000	10,000
Purchase of spray pump	No	1	7500	7,500
Weeding (two times)	Md	40	250	10,000
Fertilizer – NPK	50 kg	15	3500	52,500
Fertilizer – CAN	50 kg	15	2800	42,000
Labor for fertilizer application	Md	10	250	2,500
Manure	Tonnes	20	1500	30,000
Labor for manure application	Md	10	250	2,500
Pruning	Tree	2500	15	37,500
Pest and disease management	Ha	1	10000	10,000
Harvesting	Kg	20000	5	100,000
Transportation of cherries	Bags	240	50	12,000
TOTAL				673,000

Source Ministry of Agriculture – Muranga County

4.1.2 Gains to a Farmer - Coffee

On average the gross income per Ha in a period of four years has been estimated at Ksh 1,000,000 – a kg of cherries being sold at Ksh 50 and a Ha is expected to produce 20,000 kgs after 4 years (Ministry of Agriculture- Muranga County). Total operational cost averaged Ksh 673,000.

4.1.3 Financial Cost Benefit Analysis - Banana

Table 3: Financial cost of Banana production per Ha

ITEM	UNIT	QUANTITY	UNIT COST	TOTAL
Ploughing	Ha	1	5000	5,000
Pegging	Md	10	250	2,500
Digging holes	No	1100	70	77,000
Purchase of manure	Tonnes	20	1500	30,000
Purchase of manure – NPK	50kg	5	3500	17,500
Purchase of nematicide	Kg	44	700	30,800
Planting materials (TC plantlets)	No	1100	120	132,000
Transport materials		1	5000	5,000
Planting labor	No	1100	20	22,000
Pruning	Md	250	20	5,000
Weeding	Md	250	40	10,000
Manure	Tonnes	20	1500	30,000
Fertilizer (NPK)	50kg	5	3500	17.500
Labor (Manure and fertilizer application)	Md	20	250	5,000
Pruning	Md	250	20	5,000
Weeding (twice)	Md	250	40	10,000
Harvesting	Md	30	250	7,500
Transport		1	10,000	10,000
TOTALS				421,800

Source Ministry of Agriculture – Muranga County

4.1.4 Direct Benefits to the Farmer - Banana

Banana harvesting takes place after two years or 24 months. A Ha will yield 35 tonnes at a unit cost of Ksh 14,000 which gives a gross income of Ksh 490,000 while the operational cost is Ksh 421,800. This will give a gross return of Ksh 68,200. From the third to fifth year, each sucker gives additional bunches which gives a margin of Ksh 130,500 per year.

For the purpose of this study another crop is proposed which can be planted in the first two years before the bananas are ready for harvesting.

For the interest of this study, beans have been suggested and have a net income of Ksh 40,000 per Ha.

4.2 Results of Simulation

To calculate incremental net benefits, CBA tracking cost and benefits. In deciding whether a project is worthwhile, future flows of costs and benefits will be discounted.

It is possible for this study, to gather records for year 2011/2012 on coffee and on bananas. It is estimated that farmers will start collecting in the year 2011. This allowed estimates so as to get the data from 2011 to 2029. Regression analysis would be the best method dependent variable being the yield and the independent variables would include among others; the determinants of yield. To forecast numerous expenditures and paybacks for study duration, the coefficients for the year 2011 would have been used. However, due to data limitations of independent variables such as rainfall and temperature this was not possible. Therefore, population growth rate of 3.0% is used for simulation.

When the financial CBA at 14 % (average bank lending rate in 2011) is used the net present value is positive without the national measures of costs and benefits. The interpretation of the above is that it would be beneficial for the people of Muranga to convert their land into banana production. At the end of the project, the Net Present Value (NPV) will be Kshs 1,630,829 for Coffee growers and Kshs 2,169,972 for Banana growers.

Table 4: Financial Net Present Value for Coffee growers

Period	Benefit	Cost	Net Benefit	Disc. Factor (14%)	NPV
2011	63,400	21,600	41,800	1.14	36,667
2012	65,302	22,248	43,054	1.23	35,003
2013	67,261	22,915	44,346	1.48	29,963
2014	1,000,000	673,000	327,000	1.69	193,606
2015	1,030,000	693,190	336,810	1.93	174,966
2016	1,060,900	713,986	346,914	2.2	158,047
2017	1,092,727	735.405	357,322	2.50	162,789
2018	1,125,508	757,467	368,041	2.85	129,001
2019	1,159,274	780,191	379,083	3.25	116,569
2020	1,194,052	803,597	390,455	3.71	105,329
2021	1,229,874	827,705	402,169	4.23	95,165
2022	1,266,770	852,536	414,234	4.82	85,976
2023	1,304,773	878,112	426,661	5.49	77,688
2024	1,343,916	904,456	439,460	6.26	70,190
2025	1,384,233	931,589	452,644	7.14	63,413
2026	1,425,761	959,537	466,224	8.14	57,297
2027	1,384,233	988,323	395,910	9.28	42,663
2028	1,343,916	1,017,973	325,943	10.58	30,807
2029	1,304,773	1,048,512	256,261	12.06	21,249
Totals					1,732,462

Source: Authors survey, Ministry of Agriculture (Muranga County

Table 5: Financial Net Present Value for Banana farmers

Year	Benefit	Cost	Net Benefit	Disc factor (14%)	NPV
2011	63,400	21,600	41,800	1.14	36,667
2012	65,302	22,248	43,054	1.23	35,003
2013	490,000	421,800	68,200	1.48	46,081
2014	639,115	434,454	204,661	1.69	121,101
2015	792,703	447,488	345,215	1.93	178,868
2016	950,899	460,912	489,987	2.19	223,738
2017	979,426	474,740	504,686	2.5	201,874
2018	1,008,809	488,982	519,827	2.85	182,395
2019	1,039,073	503,651	535,422	3.25	164,745
2020	1,070,245	518,760	551,485	3.71	148,648
2021	1,102,352	534,324	568,028	4.23	134,286
2022	1,135,423	550,353	585,070	4.82	121,384
2023	1,169,486	816,964	352,522	5.49	64,212
2024	1,204,571	841,472	363,099	6.26	58,003
2025	1,240,708	866,716	373,992	7.14	52,380
2026	1,277,929	892,718	385,211	8.14	47,323
2027	1,316,266	919,499	396,767	9.28	42,755
2028	1,355,755	947,084	408,671	10.56	38,700
2029	1,396,427	975,500	420,927	12.06	34,903
Totals					1,885,311

Source: Author, Ministry of Agriculture (Muranga County)

Following the investigation, growing bananas is financially profitable because there is a total benefit of net present value of Kshs 1,885,311. However in the 10^{th} year there are re-planting costs.

Table 6: Financial Incremental Net Benefit for Banana

Net Benefit from Banana Production	Net Benefit from Coffee Production	Net Incremental Benefits	Net Incremental at (14%)
41,800	41,800	0	0
43,054	43,054	0	0
68,200	44,346	23,854	12,391
204,661	327,000	-122,339	-63,543
345,215	336,810	8,405	4,366
489,987	346,914	143,073	74,312
504,686	357,322	147,364	76,541
519,827	368,041	151,786	78,838
535,422	379,083	156,339	81,202
551,485	390,455	161,030	83,639
568,028	402,169	165,859	86,147
585,070	414,234	170,836	88,732
352,522	426,661	-74,139	-38,514
363,099	439,460	-76,361	-39,668
373,992	452,644	-78,652	-40,858
385,211	466,224	-83,444	-42,085
396,767	395,910	857	445
408,671	325,943	82,728	42,976
420,927	256,261	164,666	85,541

Source: Authors survey

Its noted there is a net incremental benefit of Ksh 85,541, farming banana is thus found to be financially profitable.

4.4 Results of Sensitivity Analysis

The financial model was done by altering the discount rates in for sensitivity analysis while the time horizon was held at 20 years. The results as shown in Table 12 show adjusted discount rates by increasing and decreasing by 50 % of the base value.

Table 7: Effect of Discount Rate on Net Present Value of Financial Values

Limits	Financial Incremental net Benefit at 14%
NPV at 7%	117,501
NPV at base value (14%)	85,541
NPV at 21%	63,471

Table 7 shows a positive NPV show that banana farming should be promoted.

With a positive NPV, it means that farmers producing bananas will have more disposable income compared to those producing coffee. With a higher disposable income, these farmers will be well off and subsequently reduce the poverty rate.

CHAPTER 5: SUMMARY CONCLUSION AND POLICY IMPLICATIONS

5.0 Main Findings

This study examined the costs and benefits of substituting banana in Muranga County for coffee. This was incited by the aim of the National Banana Development Strategy which is to "to oversee growth of the industry until 2016". The data was analyzed under cost benefit analysis concept. This was based on the hypothesis that switching to banana faring is beneficial for it enhances farmers' income.

The study examined production and yield trends of bananas and coffee in Muranga County and it was evident that both crops were being produced in specific localities of the county. Agricultural officers were focusing on popularizing both crops but many farmers are biased towards producing bananas, though they have been attached to coffee production which experienced a major boom in the 1980s'.

The study also sought to estimate and compare the financial and economic costs and benefits of banana and coffee in Muranga County and through the research it came out clearly that banana production yielded more benefit compared to coffee production. The results of the study revealed that banana farming is financially and economically superior to coffee farmers since the incremental benefits are higher than for coffee. This is shown by the results which indicated that there was a net incremental benefit of KShs 85,541 by producing banana and this could even increase if value addition is factored in.

The research aimed to offer policy recommendations; in regard to research on banana production, further research on tissue culture bananas could be considered because this study did not consider the tissue culture bananas. On improvement of banana consumption, there is still a lot that can be done on value addition which will promote consumption and increase value of bananas.

5.1 Conclusions and Recommendation

From the research findings, people in Muranga County should substitute bananas for coffee because banana production is way better off than coffee production. From the study, bananas are better off than coffee in a ratio of return of 0.6 which is the benefit rate of return. In addition, bananas is food in its raw nature and doesn't require further processing to be consumed in its nature unlike coffee which cannot be consumed in in its nature of beans

5.3 Areas for Further Research

Surely this study had it limitation and scope delimiting what it could cover. Such when strongly looked at present viable areas for future studies, these are in the following lines. Instead of investigating the benefits of switching to banana in terms of better output shown here, future studies can focus on assessing the growth of its market too. Such are a good convincing data for any further policy recommendation. Also, the coverage of similar studies in future could be expanded to include the global arena. This may be the basis of global policy commitments as those under the sustainable development goals. In relation to this is the replication of the study in other coffee growing regions within the country.

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