ANALYSIS OF SMALLHOLDER FARMERS' PREFERENCES FOR BIOFUEL INVESTMENTS FOR LIVELIHOOD DIVERSIFICATION IN KENYA

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Thesis brief prepared for presentation at the African Economic Research Consortium theses dissemination workshop

Egerton Unversity

June, 2014

ACKNOWLEDGEMENT

I am grateful to God for granting me the opportunity to pursue this Master of Science degree at the University of Nairobi and also for giving me continuous strength and guidance throughout this program.

Further, I am grateful to my parents and family for their continuous support, prayers and encouragement.

I acknowledge the Government of Kenya and the African Economic Research Consortium for financial assistance to pursue this masters program. I also appreciate the AFRINT III project for supplemental fieldwork support.

I thank my supervisors Dr. David Jakinda Otieno and Prof. Willis Oluoch-Kosura for their continuous guidance, comments and suggestions that have substantially helped towards the development of my thesis.

I would also like to thank my fellow classmates for their continuous support and constructive criticism that have also positively helped towards the development of my thesis.

Many thanks also go to the farmers in Bungoma and Kakamega for taking their time to complete my questionnaires and also to the enumerators and Mr. Peter Wafula Waboya, the chairman of Mabanga Farmer Field school, who organized meetings with farmer groups and the enumerators who participated in data collection, for the job well done.

ABSTRACT

Poverty continues to be a problem in some parts of the world and is typically severe among small-scale farmers. If this issue is not addressed, farmers will continue to fall into poverty thereby stifling the achievement of Kenya Vision 2030's plan to transform the country to middle income status by 2030. Biofuel investments are emerging as a possible alternative livelihood diversification strategy. However, little is known on farmers' preferences for biofuel investments. Given Kenya's Agricultural Sector Development Strategy (ASDS) 2010-2020, it was important to analyze smallholder farmers' livelihood strategies and preferences for biofuel investments in terms of how they should be designed so as not to stifle ASDS vision of ensuring a food secure and prosperous nation. Specifically, the study focused on characterization of smallholder farmers' livelihood strategies and preferences for biofuel investments. The survey data was generated from a multistage area sample of smallholder farmers in Western Kenya. Descriptive statistics were used in the characterization of smallholder farmers' livelihood strategies. Further, the Choice Experiment (CE) approach and the Random Parameter Logit (RPL) were used to elicit farmers' preferences for biofuel investments.

Pooled results from the preference analysis indicated that farmers had higher preference for short contract length compared to long contract length. In addition to this, farmers had a higher preference for quarter piece of land to be leased out compared to three quarter piece of land to be leased out. Also, they had higher preference for permanent type of employment compared to casual type of employment. Lastly, farmers in both areas had a higher preference for renewable contracts compared to non-renewable contracts. The study also estimated Compensating Surplus (CS) measures, which indicated that farmers in Kakamega are willing to accept higher compensation compared to their counterparts in Bungoma for them to participate in biofuel investments. These findings offer useful insights to policy-makers on the design of biofuel investments to address the livelihood challenges in Western Kenya and other areas with similar conditions.

1.0 INTRODUCTION

1.1 Background Information

Poverty continues to be a problem in some parts of the world despite improvements in the global trade regime and significant enhancements in agricultural productivity through the Green Revolution Technologies. Approximately 1.2 billion people (20% of the global population) live in extreme poverty (earning less than USD$2.5 per day) (United Nations, 2012; FIRA, 2008). The incidence of poverty is greatest in the rural areas and is typically severe among small-scale farmers in developing countries (IFAD, 2011). To achieve the first millennium development goal (MDG) of halving poverty by 2015, these people should be provided with alternative production opportunities that can generate new employment and enhance income. Studies that have been done in various countries such as Zambia, Brazil and India (see for example, Bigsten and Tengstam, 2011; Rahut and Scharf, 2012) indeed confirm that livelihood diversification can assist in generating new sources of income to help poor farmers exit poverty.

Livelihood diversification refers to developing a large number of enterprise mix in favor of high value and more remunerative enterprises. It is the process by which households construct a diverse portfolio of activities and social support capabilities in their struggle for survival and improvement of their standards of living (Ellis, 2000). For rural households, diversification may be in the form of supplementing farm income with non-farm income, increasing the number of crops grown and types of livestock reared and use of resources in different farm enterprises. The main objectives of livelihood diversification include increasing the income of smallholders, generating additional employment, stabilizing farm incomes over time, mitigating risks and conservation of natural resources. The potential benefits of livelihood diversification include improved incomes, reduction of risks such as crop failure and market failure (Ali, 2003).

In developing countries such as Kenya, there are various challenges that necessitate the pursuit of livelihood diversification. These include high population growth, land pressure, low agricultural productivity, failed markets and climate change that reduce profitability. Rapid population growth has led to increased pressure on land and this has resulted to sub division/fragmentation of land into uneconomical sizes that cannot support sustainable agriculture (Lung and Schaab, 2004; Burnsilver et al. 2008). In an attempt to address these challenges, various alternative forms of off-farm diversification activities have emerged. These include shifts from farm labor to non-farm wage employment and rural-urban migration in search of other livelihood activities. However, these livelihood options have shortcomings in that there is a limit on the amount of labor that can be employed at any given time and also there is excessive pressure on limited resources due to rural-urban migration. The World Health Organization (WHO) (2009) and Unwin et al. (2010) state that over 50% of the world's population lives in the urban areas. In Sub Saharan Africa (SSA), it is estimated that 35% of the population live in the urban areas and that by 2050 it will have risen to 61%.

Further, according to the World Bank (2010), 30% of Kenyans currently live in the cities/peri-urban areas. According to the International Labor Organization (ILO) (2009), Kenya's population is facing a general unemployment rate of 40%, reaching about 70% among the youth in some remote and resource-constrained localities. Increased rural-urban migration creates pressure on the limited resources in the urban centers. Unemployment on the other hand leads to increased social evils such as criminal activities among the unemployed communities in their quest for survival. It thus appears reasonable to create alternative livelihood strategies for the unemployed youth within their rural areas.

Due to the reasons discussed above, other forms of livelihood diversification strategies have emerged enabling farmers to diversify their livelihoods without necessarily having to move to urban centers where resources are already limited. For example, the biofuel investments are emerging as a possible alternative livelihood diversification strategy in developing countries (Darkwah et al., 2007). Biofuel refers to renewable energy that is produced from plant matter or agricultural waste referred to as biomass. It could either be in liquid or gaseous form. Biofuel investments refer to livelihood strategies that involve farmers' growing crops that can be used to produce fuel and selling to the biofuel companies. It could also be in the form of farmers selling their land or leasing their land to the biofuel companies. In addition to this, it could involve farmers providing labor to the biofuel companies. Authors such as Banda (2008), Novo et al. (2010), Resnick and Thurlow (2012) and Darkwah et al. (2007) argue that nations with high potential to produce biofuel such as Brazil, South Africa and Mozambique could take advantage of the biofuels industry in that it has the capacity to reverse the decline of agricultural commodity prices and offer an opportunity for agricultural and rural development by offering alternative market for agricultural produce. The authors further suggest that biofuels could help in creation of jobs for poverty alleviation thereby helping in the achievement of the first MDG.

Although Kenya has yet to participate in large scale biofuel investments the government has recently enacted policies and legislations (GoK, 2006) that would possibly support development of biofuels such as ethanol and biodiesel. The Ministry of Energy and Petroleum has developed a biodiesel strategy through its National Biofuel Committee. In addition, a Kenya Biodiesel Association is being formed with support from all sectors of the biofuel industry. Also there are proposals to invest about KSh 12 billion by Western Biofuel Company (WEBCO) funded by investors from Britain, China and Qatar in collaboration with the Bank of Africa and Equity Bank in Kenya. The proposed biofuel complex that is still at a planning stage is aimed at producing fuel ethanol from tropical sugar beet in Bungoma.

In Western Kenya, specifically Bungoma and Kakamega Counties, the main livelihood options are agricultural oriented. These include dependence on maize, sugar cane and previously the Pan Paper industry. However, these diversification options face major challenges such as delayed payments and generally low prices. Further, the maize industry is faced with lack of a milling factory in Bungoma, despite high volumes of maize produced in the area. As a result, farmers have to transport the maize more than one hundred kilometers to Kisumu city for milling; suffice

to mention that most smallholder farmers with limited resources find it difficult to sell to far-away millers due to exorbitant transport costs (Nangendo, 1994; Omiti et al., 2009).

Also, since Bungoma shares borders with Uganda, which also produces maize, the cross border trade generally depresses maize prices in the region (Kimenju and Tschirley, 2008). Therefore, these force farmers to sell their crops at throw away prices. Also the residents of this area traditionally depended on the Webuye Pan Paper industry as a major source of income for over a decade before it was shut down about 3 years ago due to mismanagement and operational inefficiencies. Kakamega County is home to over one million people and like Bungoma, struggles with hardships of severe poverty, facing 73% of its population. This is further compounded by high levels of unemployment and low literacy levels among the youth.

According to the Kenya National Bureau of Statistics (KNBS) (2010), Western Kenya has relatively high poverty index compared to other regions in Kenya. The KNBS estimates that 31.5% of households in Western Kenya are among the hardcore poor as opposed to an average of 19.6% for all rural areas in Kenya. A household is considered poor if it is unable to meet its minimum basic consumption needs. It is defined as hardcore poor if its consumption levels are inadequate to meet basic food needs alone, even if all non-food consumption is foregone. Biofuel investments could be a possible alternative livelihood strategy. Although there are various options in which farmers can participate in biofuel investments, for example, through growing the biofuel crops, lease of land, sale of land or provision of labor, farmers in this region are familiar with traditional small scale non commercial forms of land leases; lease of land arrangements mostly for traditional crops between neighbors. However, farmers in this region are not familiar with leasing out their land for biofuel investments which could come with a lot of restrictions such as land right restrictions, restrictions to foot paths, playing grounds and restriction to water points among others that may disrupt rural livelihood patterns.

1.2 Research problem statement

Reliance on a narrow range of economic activities such maize and sugarcane farming that face major economic challenges such lack of markets, low and delayed payments has led to persistent poverty in Western Kenya. Also, farmers in this region depended on The Webuye Pan Paper industry which recently collapsed and this further magnifies the poverty situation leading to little or no income to sustain their livelihoods (Masayi and Netondo, 2012). UNICEF (1994) further observed that low incomes make households unable to provide education for their children leading to low levels of school enrollment. Biofuel investments could serve as an important livelihood diversification strategy and possibly enable rural households to exit poverty and also contribute in Kenya's Vision 2030 plan to transform the country to middle income status by the year 2030.

However, most of the biofuel investment companies would require farmers to either lease out their land, grow the biofuel crops on their own farms or even sell out their land. Farmers in this region are mostly familiar with lease of land arrangements between neighbors for traditional

crops, which do not come with a lot of restrictions in terms of use of shared resources such as foot paths, water points, land use rights and land access rights. In such traditional arrangements, although farmers would lease out their land, they would still enjoy the benefits of these common resources. However, these farmers are not familiar with leasing out their land for large scale commercial purposes such as biofuel investments that would entail restrictions, which may disrupt the way in which they carry out their livelihood activities. For example, these biofuel investments may squander land or water unsustainably. This would disrupt livelihoods in that it may lead to a situation which there may be limited or no access to water for crop and livestock farming which is the pre dominant livelihood activity in this area. Also, these biofuel investors may require some people to relocate to other areas against their wish. This would contribute to lack of ownership of the development projects to be implemented.

It is worth noting that current tensions among communities and/or conflict with development investors are mostly caused by dispute over access to land and water which are already diminishing resources in most parts of Kenya. In addition to this, given Kenya's ASDS whose vision is to ensure a food secure and prosperous nation, it is important to understand how biofuel investments can effectively be designed without having an adverse negative impact on food security. Moreover, there is lack of empirical insights on whether farmers' preferences towards such investments with respect to how they should be designed in Kenya. The few studies on farmers' preferences for biofuel investments in Africa focus mainly on Southern African countries such as Malawi, South Africa and Swaziland (see for example, Fewell et al., 2011).

Also, lack of stakeholder consultation and their exclusion from investment planning (from negotiation to implementation) often leads to program rejection and conflicts (Amigun et al., 2011). For example, a proposed sugar production investment by Mumias Sugar Company was rejected about three years ago in Tana delta region in Kenya due to inadequate consultation with the farming and pastoralist communities in the area. Further, programs or investment projects that fail to consider local people's needs and aspirations tend to collapse or lead to disruption of rural livelihood patterns, that is, lack of sustainability. Studying farmers' preferences would enable policy makers to understand why communities may object to relatively large bio energy projects. It would also assist the developers of such projects to avoid delays and refusal of planning consent associated with adverse local opinions (Upham and Shackley, 2007; Amigun et al., 2011). Understanding farmers' views and incorporating them in investment program design (for example biofuel) is therefore necessary. This study is therefore important so as to know whether such investments would fit in the context of the enterprise mix desired by farmers in Western Kenya. It also appears reasonable to understand how farmers would want to participate in the biofuel industry and the levels of monetary compensation that they would be willing to accept in order to participate.

1.3 Objectives

The purpose of this study was to analyse smallholder farmers' livelihood strategies and preferences for biofuel investments in Kenya. The specific objectives were

- To characterize farmers' sources of livelihoods.
- To assess monetary compensation levels that farmers would be willing to accept for inclusion of various features in biofuel investment design.

2.0 METHODOLOGY

2.1 Sampling and Data Collection

The data was collected from 342 farmers through face-to- face interviews by trained enumerators through a pre-tested semi structured questionnaire. The multistage sampling approach was used. The two study areas, Bungoma county and Kakamega county, were purposively selected and this will be discussed in detail in the subsequent section. Within each of the two counties, divisions were randomly selected from the list of all the divisions in each of the counties based on the areas where there are proposals to set up biofuel investments and also livelihood activities that face major economic challenges. Thereafter, a sample of locations was randomly selected and from these, sub locations were selected randomly. The sample units were subsequently drawn randomly from the sub-locations. The systematic random sampling approach was used to select the respondents. The ultimate sampling unit was the smallholder farmer household head drawn from a household. The household was defined according to KNBS (2010) as "…a person or groups of persons related or unrelated who live together, are answerable to the same head and who share a common source of food." The household heads were ascertained by asking whether they are the ones who make the critical household decisions that are important to the entire household. If they confirmed that they make decisions on behalf of the entire household then they qualified to be a respondent.

In Bungoma County, four divisions, namely Bungoma East, Bungoma South, Bungoma Central and Bumula were randomly selected. From these divisions, a total of nine locations were randomly selected. Finally, a total of 20 sub locations were randomly selected from which 180 households were randomly drawn and household heads interviewed. In Kakamega, four divisions were purposively selected as discussed earlier. From these divisions, 10 locations were randomly selected. From these 10 locations, a total of 20 sub locations were randomly selected and from these, a total of 162 households were also randomly drawn and household heads interviewed.

The sample size of 342 used in this study provided sufficient statistical degrees of freedom because it was greater than the minimum acceptable sample size of thirty for policy inferences (Battacharya and Johnson, 1977). Similar studies that have analysed preferences normally require a sample of at least 200 respondents. In this study, it was therefore intended to capture 200 respondents in each of the study areas. Therefore the target sample was 400 respondents.

However, due to time, cost and insecurity constraints, only 162 and 180 respondents were interviewed successfully in Bungoma and Kakamega respectively. This sample size was over 80% of the target sample size and was therefore sufficient in eliciting farmers' preferences.

2.2. Study Area

This study was carried out in Western Kenya specifically Bungoma and Kakamega counties. These study sites were chosen to represent areas where livelihood activities face major economic challenges and climatic conditions favor the growth of a variety of biofuel crops. Also these study areas were chosen to represent areas where there are proposals to carry out biofuel investments which could serve as a possible alternative livelihood strategy. According to the KNBS (2010), farmers in these regions depend on a narrow range of agricultural based livelihood activities centered on maize and sugarcane farming. These livelihood options are faced with challenges such as low and delayed payments.

In Bungoma County, there are proposals to set up a biofuel complex to produce ethanol fuel from tropical sugar beet. In Kakamega County, Lugari, Hamisi, Malava and Mumias districts were chosen to represent issues related to poverty effects of straddling in that the households are not quite able to fully exit poverty. Specific problems include issues like market access where as discussed earlier; there is lack of maize milling factory, population pressure and problems related to contract farming respectively which has resulted into high poverty incidence in the area. Also in relation to market access, the various sugar cane factories in that region such as Butali Sugar, West Kenya and Mumias sugar offer competing prices. Sometimes the farmers in Mumias transport their sugar all the way to Butali to fetch better prices. This competition for better pricing has made many households abandon other livelihood activities and focus on sugar cane. This has created a problem in that food crops are no longer grown and some residents resort to stealing from those who still grow some food crops. This situation creates a need for livelihood diversification and now that biofuel investments are emerging in this region, it could serve as a possible alternative livelihood activity. Therefore the study was carried out in this area to find out whether farmers would prefer to participate in emerging alternative livelihood activities such as biofuel investments to assist them exit the poverty trap.

2.3 Model Estimation

The RPL model was applied in the analysis of farmers' preferences Cardel and Dumber (1980). In the RPL, the utility U_{int} derived by person 'n' from alternative 1 in choice set *t* can be given by:

$$U_{int} = \beta_n X_{int} + e_{int} \quad (1)$$

Where: X_{int} is a vector of policy attributes (biofuel investments attributes) and β_n is an individual-specific vector of parameters in the population density function (pdf) f(βn θ), θ are the parameters of the distribution of β_n, e_{int} is the IID random term independent of β_n and X_{int}.

In the estimation of WTA biofuel investments as an alternative livelihood activity, the following equation is used as suggested by Hanemman, (1984).

$$WTA = +1*\frac{\beta k}{\beta p} \quad \ldots\ldots (2)$$

Where β_k is the coefficient for an attribute/attribute level (in this case, contract length, size of land, employment type, and renewability of contract) and βp is the price attribute.

Once the WTA values have been computed, the overall compensating surplus (CS) can be computed using the following equation according to Hanemann (1984).

$$CS = 1\ (V_1 - \underline{V_0}) \quad \ldots\ldots (3)$$
$$B_p$$

3.0 RESULTS AND DISCUSSIONS

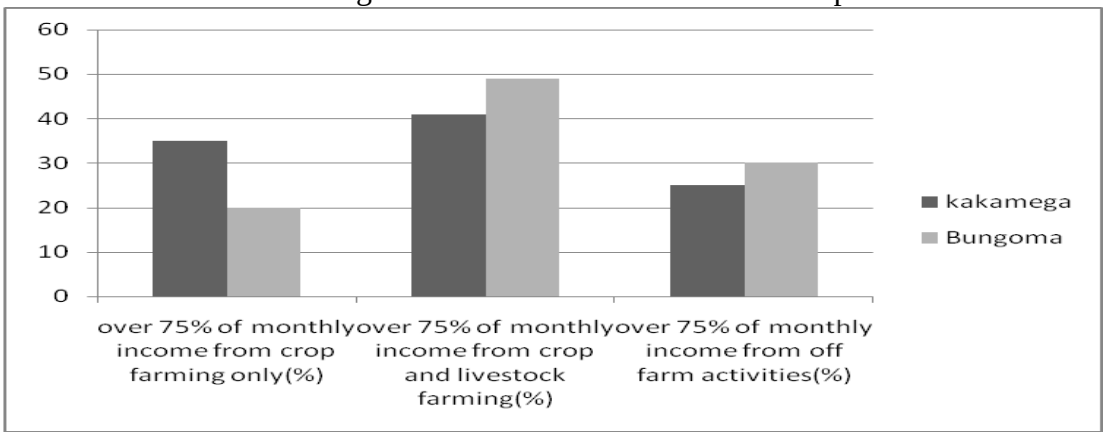
3.1 Characterization of smallholder farmers' livelihood strategies

Farmers' characteristics influence farming decisions and are important in understanding decisions related to livelihood activities. Land is a limited factor of production in Kenya. As shown in Table 1, average farm sizes in the study areas were about 3.1 acres in Bungoma while in Kakamega the average land sizes were about 2.6 acres. The high potential agricultural areas are very densely populated and land sizes are very small. Comparisons between farm size and cultivated area indicated that half of the land was under maize, beans and sugarcane while a quarter of the land in some cases was under other crops such sorghum, cassava and bananas which are not very remunerative. These declining land sizes have a direct effect on investments such as those related to biofuel which are land intensive. It would therefore be interesting to know whether farmers would still prefer to participate in such investments given the declining land sizes.

This study conceptualizes livelihood diversification activities/strategies as defined by Ellis (2000) earlier to be the process by which households construct a diverse portfolio of activities to aid in the improvement of their standards of living. Livelihood activities in the study areas are mainly focused on agricultural activities although some farmers also engage in other off-farm and non-farm activities such as trading, tailoring, welding and teaching among others. As shown in Figure 1, the results revealed that the farmers in the study areas can be grouped in terms of the level of livelihood diversification and the income sources for the different livelihood groups. Therefore, the current enterprise mix in Bungoma and Kakamega was categorized into three groups. Those farmers who derive over 75% of their monthly income from crop farming, those farmers who derive over 75% of their monthly income from crop and livestock farming and those farmers who derive over 75% of their monthly income from off farm and nonfarm

activities. From the results it can be seen that over 60% of the farmers depend on crop and livestock farming and only about 40% of the farmers in the study area engage in some form of off-farm livelihood activity. This indeed confirms reports by the KNBS, (2012), that the livelihood activities in these regions are mostly agricultural based.

Figure 1
Categories of farmers based on their enterprise mix



Source: Author's Survey, 2013

These results indeed confirm that although the farmers grow a variety of crops, they majorly depend on maize and sugarcane farming. These results indeed confirm that maize and sugar cane are rated as the two most important crops in the study areas. As shown in Table 1, majority of the farmers cited challenges related to production, marketing, post harvest and institutional that faces their current livelihood activities. These findings are consistent with those highlighted by KNBS, (2012).

Table 1
Land size and economic challenges facing current livelihood activities

Challenges	Bungoma n= 180	Kakamega n= 162	pooled n= 342
Average farm size (acres)	3.1	2.6	2.7
Production challenges			
Input acquisition (%)	65.0	34.0	50.3
Cost of inputs (%)	76.0	87.7	81.6
Crop & livestock diseases (%)	97.2	84.0	90.9
Damage of crops in farm by pests	95.0	14.2	56.7
Market challenges			
Delayed payments (%)	72.2	49.4	61.4
Low payments (%)	73.3	50.6	62.6
Lack of markets (%)	75.6	12.3	45.6
Flooded markets (%)	76.7	42.0	60.2
Unfavorable prices (%)	99.4	59.3	80.4
Institutional & post harvest challenges			
Access to credit (%)	71.7	32.1	52.9
Lack of storage (%)	55.0	21.6	39.2
Damage of crops by pests, diseases (%)	73.3	52.5	75.1
Loss of cane during transportation (%)	72.2	36.1	55.2

Source: Author's survey, 2013

3.2 Farmer preferences for biofuel investments

3.2.1 Description of variables

The variables used in the model are shown in the Table 2. A likelihood ratio test was done and the utility parameters for all biofuel investments through lease of land option were entered as random parameters assuming a normal distribution, except the price attribute that was specified as fixed. This is because in a normal population, it is expected that some respondents would have

positive preferences or negative preferences. The price is fixed so as to prevent extreme positive or negative values (Revelt and Train, 1998)

Table 2
Description of variables used in the choice analysis

Variable	Description
SHORT	contract length of 2 years (1=yes, 0= otherwise)
LONG	contract length of 10 years (1=yes, 0= otherwise)
QUARTE	size of land to lease out 25% (1=yes, 0= otherwise)
THREEQ	size of land to lease out 75% (1= yes, 0= otherwise)
PERMAN	employment type permanent (1= yes, 0= otherwise)
CASUAL	employment type casual (1=yes, 0= otherwise
YES	renewable contract (1=yes, 0=otherwise)
PRICE	lease price per acre (50%, 75%, 100%)

3.2.2 Empirical estimation

The results for the RPL models for the preferences for biofuel investments are reported in Table 3. The results reveal that compared to medium length contracts of 5 years and contrary to what was expected, farmers in Bungoma and Kakamega have a positive preference for short contract lengths of 2 years and have negative preference for long contract lengths. This may be due to the fact that the biofuel investments are a new venture and due to this, farmers may only want to participate in short contracts for a start as they monitor the progress of their investments before they can decide to venture in such investments over a long period of time. These results are similar to those of Fewell et al. (2011), which also indicated that farmers preferred shorter contracts with biofuel companies as opposed to long contracts. Compared to giving out half of the land that they own, farmers in both Kakamega and Bungoma have higher preference to lease out only a quarter of their land. This result could be attributed to the fact that the biofuel investments are still a new venture and the farmers would want to start by leasing out a small portion of their land first as they monitor the progress of their investments.

Compared to being offered no employment in the biofuel companies and as expected farmers in Bungoma and Kakamega have a higher preference to be offered permanent employment. This result may be due to the fact that people generally prefer permanent employment because one is guaranteed of the stability of income as compared to casual employment where one can be terminated at any time hence risks of unstable income. Also, compared to non renewable contracts, farmers prefer renewable contracts. The parameter estimate for lease price per acre is significant and positive in sign as expected for WTA studies. This therefore allowed computation of tradeoffs between each attribute and money.

These results indicated that in both study areas, farmers have similar preferences for the attributes in the proposed biofuel investment attributes. The estimated RPL models for both study sites and the pooled sample all exhibited good fitness. They all had pseudo R squared values above 18%. Simulations by Dominick and McFadden (1975) show that values of ρ^2 between 0.2-0.4 are equivalent to values between 0.7-0.9 for the R^2 in the case of the ordinary linear regression. In the pooled sample, all attribute coefficients had highly significant standard deviations except three quarter size of land. This showed that there is heterogeneity in the preferences for the biofuel investments. The chi square test indicates that the chi square value is significant at below the 10% level and therefore rejects the null hypothesis that farmers are not willing to accept any significant monetary compensation to have biofuel investment design features.

Table 3
Random parameter estimates for preferences for biofuel investments

	Coefficient (standard error)		
Variable	Bungoma	Kakamega	Pooled sample
SHORT	1.86(0.76) ***	1.68(1.22)	1.47 (0.48) ***
LONG	-3.52 (0.96) ***	-13.45(6.17) **	-3.56(0.76) ***
QUARTER	4.66(1.45) ***	13.17(5.81) **	4.41 (0.97) ***
THREEQUA	2.00(1.23)	4.97(3.05)	1.26 (0.72)*
PERMANEN	3.74 (1.07) ***	10.34 (3.94) ***	3.54 (0.71) ***
CASUAL	2.06 (0.60) ***	8.86 (4.06) **	2.19 (0.47) ***
YES	0.95 (0.37) **	0.47 (0.611)	0.91 (0.26) ***
PRICE	0.036 (0.007) ***	0.06 (0.166)	0.038(0.005) ***
Standard deviations of parameter distributions (standard error)			
sdSHORT	1.49(1.44)	5.03 (2.13)**	2.43 (0.59)***
sd LONG	3.68 (4.25)***	15.19 (6.14)**	4.41(0.95)***
sdQUARTER	1.35 (1.73)*	12.59 (5.01)**	2.99(0.55)***
sdTHREEQUA	2.46 (2.61)***	11.43 (4.59)**	0.27(0.57)
sdPERMANEN	3.08 (3.11)***	6.50 (2.41)***	3.47 (1.03)***
sdCASUAL	1.62 (2.09)**	6.00 (2.40)**	1.77 (0.70) **
sdYES	2.37 (3.54)***	5.11 (2.17)**	1.75 (0.38) ***
Log likelihood	-336.13	-711.90	-1502.0
χ2 (p-value)	909.73(0.000)	849.88 (0.000)	1712.65(0.000)
Adjusted R2	57%	59%	56%
N respondents	180	162	342
N choices	720	648	1368

Note: Statistical significance at 1%, 5% and10% are shown by ***, **, and * respectively.

Table 4 indicates farmers' WTA compensation for various biofuel investments attributes for them to participate through lease of land as alternative livelihood activity. The WTA values also clearly indicate that farmers have heterogeneous preferences for the biofuel investments through lease of land option attributes. In the pooled sample, farmers are willing to accept compensation ranging between KSh 1,443 and KSh 6,295 for the inclusion of short contract length of 2 years in the leases. Even with compensation, farmers would not want long contract lengths of 10 years to be included as a feature in the biofuel investments. This could be attributed to the fact that farmers may be skeptical towards new ventures such as those of biofuel. For this reason, they would prefer shorter contract length at first as they monitor the progress of the investments. Also, farmers would be willing to accept compensation ranging between KSh 6,265 and KSh 16, 853 for the inclusion of leasing out a quarter piece of their land as an attribute in biofuel investments. In addition to this, farmers are willing to accept compensation ranging between KSh 5,761 and KSh 12,767 and a range of KSh 3,369 and KSh 8,131 for the inclusion of permanent employment type and casual employment type respectively as attributes in biofuel investments design. Lastly, farmers are willing to accept compensation ranging between KSh 1,153 and KSh 3,627 for the inclusion of renewable contracts as biofuel investment through lease of land attribute. Based on the WTA values the attributes can be ranked as follows: Quarter piece of land to be leased out, permanent type of employment, casual type of employment, short contract length and lastly renewable contracts.

The results of the study showed that farmers are WTA a higher compensation for leasing out quarter piece of land to be included as an attribute in the biofuel investment program design. Also, results of the study also reveal that they prefer to lease out only a quarter piece of their land as compared to giving out three quarter of their piece of land. This could be attributed to the fact that a great deal of uncertainty surrounds participation in biofuel investments which are just emerging with no well structured markets. The uncertainty is further compounded by the fact that most of the biofuel investment companies may establish contracts with clauses which may state that incase the biofuel crops are damaged by natural climatic causes, then there would be no payment to the farmers for the land they lease out. Such clauses bringing more uncertainty on whether the net returns will continually be forthcoming (See for example, Fewell et al., 2011).

This high compensation amount could be attributed to the fact that farmers in this region mainly engage in livelihood activities that are land intensive (crop and livestock farming or crop farming only) and land is a limiting factor of production. Since the biofuel investments would require them to lease out some portion of their land, however small, this would trigger them to want more compensation to cater for the foregone income they normally get from the use of that land which will be leased out.

When these figures were compared with local context in terms of average wages, it was found that these biofuel investments indeed offer better wages compared to the current sources of livelihood. For instance, a local farmer who is employed as a casual worker is paid about between KSh 150 and KSh 200 per day. This translates to about on average between KSh 3000

and KSh 4000 per day. Therefore, when the proceeds from biofuel investments are added to their current sources of income, then these farmers would have improved incomes which would translate to improved livelihoods.

Table 4
Marginal WTA values for biofuel investments through lease of land option in Kenya shillings (Kshs)

	Marginal WTA (95% confidence interval)		
Variable	Bungoma	Kakamega	Pooled sample
SHORT	50.77	29.06 [d]	38.69
	(14.98 to 86.56) [c]	(-11.83 to 69.95)	(14.43 to 62.95)
LONG	-95.74	-232.72	-93.39
	(-144.19 to 47.29)	(-375.23 to -90.21)	(-127.06 to -59.72)
QUARTE	126.54	227.91	115.59
	(39.48 to 213.60)	(71.42 to 384.40)	(62.65 to 168.53)
THREEQ	54.46 [d]	85.97	32.96 [d]
	(-19.04 to127.96)	(-8.54 to 180.48)	(-7.38 to 73.30)
PERMAN	101.61	178.98	92.64
	(48.53 to 154.69)	(85.33 to 272.63)	(57.61 to 127.67)
CASUAL	56.18	153.29	57.50
	(23.90 to 88.46)	(57.62 to 248.96)	(33.69 to 81.31)
YES	25.87	8.05[d]	23.90
	(6.60 to 45.14)	(-13.53 to 29.63)	(11.53 to 36.27)

Note: Confidence intervals have been calculated from standard errors.
[c] indicates confidence intervals which have been computed using the standard errors
[d] insignificant at 10% level

Farmers are willing to accept a relatively high compensation for permanent employment type and casual employment type to be included as an attribute in the biofuel investments program design. This could be attributed to the fact that farmers have narrow range of livelihood activities which they depend on and would be willing to be offered employment in the biofuel investments company so as to supplement the income they get from the narrow range of livelihood activities that are faced by major economic challenges as highlighted earlier.

The results of the study indicate that farmers would require some moderately low compensation for short contract length to be included as an attribute. This shows that farmers are more

comfortable engaging in short contracts as opposed to long contracts. This can be attributed to the fact that, longer contract lengths are deemed to be undesirable particularly in the early stages of a developing market such as the biofuel investments in Kenya. Also very long contract length of, say 10 years, brings more hesitation due to uncertainty with regard to opportunity costs of not growing traditional crops/food crops. As a result, farmers are reluctant to enter into such long term contractual arrangements explaining why they would be willing to enter into short term contracts of, say 2 years, as shown by their willingness to accept a moderately low compensation for such an attribute to be included in biofuel investment program designs.

The results of the study also show that farmers are willing to accept a relatively low compensation for renewable contracts to be included as an attribute in the biofuel investments program design. This could be attributed to the fact that since biofuel investments are a new and emerging venture, farmers would not be really keen on whether the contract is renewable or not because they may first of all want to try it out first before they would fully decide to continue participating in it or not. Hence whether they would want a renewable contract or not would not be such a major issue since they do not know how the biofuel investment would progress in order for them to decide on whether they would want renewable contracts or not.

3.2.3 Policy scenarios

To better implement biofuel policies in Bungoma and Kakamega counties, it was deemed necessary to characterise farmers based on their enterprise mix. As reported in figure 1, farmers in these regions can be categorized into three distinct groups based on their current livelihood activities. These include those farmers who derive over 75% of their monthly proceeds from crop farming (category 1), those farmers who derive over 75% of their monthly returns from crop and livestock farming (category 2) and those farmers who derive over 75% of their monthly wage from off farm activities such as trading, motorcycle business, tailoring and welding among other activities (category 3).

Results indicated that in Bungoma, about 21%, 49 % and 30% of the farmers belong to category 1, 2 and 3 respectively. In Kakamega, 35%, 40% and 24% of the farmers belong to category 1, 2 and 3 respectively. Based on these categories of farmers three policy scenarios were developed so as to facilitate the implementation of biofuel investments policies that would better target the population in the study areas. Also, this would assist to formulate policy recommendations regarding farmers' WTA biofuel investments through lease of land option.
For the first category of farmers, a policy scenario was developed with suggested attributes such as such as short contract length of 2 years, 50% of owned land to be leased out, casual employment type, and a renewable contract. For the second category of farmers, a policy scenario was developed with suggested attributes such as contract length of 5 years, 25% of owned land to be leased out, no employment provided and a non renewable contract. Also, for the third category of farmers, a policy scenario was developed with suggested attributes such as

contract length of 10 years, 75% of owned land to be leased out, permanent type of employment and a renewable contract.

In the policy scenario targeting the first category of farmers, a 2 year contract length was included so as to target short cropping seasons which farmers are already familiar with. Currently, the farmers grow crops, for example sugar cane, that have a maximum cropping season of approximately 18 months. Therefore, they would expect that when they lease out their land to the biofuel company to grow the biofuel crops, the maximum cropping season would be about two years before they get the returns from the land that they have leased out. Another attribute that was included was 50% of owned land is to be leased out. This is because, since this category of farmers mostly utilize their land for crop farming only, it would be practical for them to lease out about half of their land to the biofuel company without substantially disrupting their livelihood activities. Compared to crop and livestock farming, crop farming only is less land intensive. In addition to this, casual employment type is included because, with casual employment, farmers in this category will also have time to attend to their crop farming activities. Hence this type of employment would be suitable for this category of farmers because it would not lead to a total neglect of their current livelihood activity which is crop farming. A renewable contract type is include as an attribute because it was envisaged that this category of farmers, since they only majorly depend on crop farming, they would want renewable contracts with the biofuel company to as to have an additional source of income.

In the policy scenario targeting the second category of farmers, a 5 year contract length was included to cater for the gestation period of livestock and to also allow for planning purpose on how to use the land. 25% of land to be leased was included because crop and livestock farming is land intensive compared to crop farming only. Therefore, it was seen fit to only require these category of farmers to lease out only a quarter of their land because this would not have an adverse effect on their current livelihood activity. Also, it was realized that since crop and livestock farming is already labor intensive, it would be ideal to offer this category of farmers no employment so that even though they would participate in biofuel investments by leasing out their land, they would still be available to carry out their crop and livestock farming which is an important source of their livelihood. Finally, a non renewable contract was included because, since these farmers already have multiple sources of income therefore, they may not be very keen on whether the contract is renewable or not.

For the third category of farmers, the policy scenario included, a 10 year lease of land contract was included because this category of farmers already derives over 75% of their monthly income from off farm activities. Hence, even though they engage in such long contract length, their livelihood activities would not be destabilized. Also, 75% of owned land to be leased out, was included as an attribute since this category of farmers already derive over 75% of their income from off farm activities which are not land intensive, hence would be comfortable to lease out a three quarters of their land. A permanent employment type was also included because this category of farmers are already accustomed to carrying out off farm activities and therefore

offering them permanent employment would better suit them compared to the other category of farmers. Lastly, a renewable contract type is included for this category of farmers because they already normally derive over 75% of their monthly income from off farm activities hence may want to broaden their range of off farm activities so as to increase their income.

Practically, different biofuel investors would be ready to implement various biofuel investment features and at the same time, various categories of farmers would be comfortable with different biofuel investment packages. Therefore, to harmonize the interests of the investors and that of the farmers, it was deemed important to illustrate how these farmers with different enterprise dynamics/enterprise mix might respond to different combinations of the biofuel investment attributes. This was done through computation of CS. The CS estimates were computed for the three policy scenarios as shown in Table 5. These scenarios include policy scenario for those farmers who derive over 75% of their monthly earnings from crop farming, those farmers who derive over 75% of their monthly earnings from crop and livestock farming and those farmers who derive over 75% of their monthly earnings from off farm activities such as welding, motor bike business, trading, tailoring, and carpentry among others. The CS estimates for all the three scenarios were positive. This suggests that farmers prefer a change from the baseline of no biofuel investments through lease of land option as an alternative livelihood activity.

The CS estimates are however significantly different in that farmers who derive over 75% of their monthly wage from crop and livestock farming had higher CS compared to those who derive over 75% of their monthly wage from crop farming. Those farmers who derive over 75% of their monthly wage from off farm activities had the lowest CS.

Given that farmers who derive over 75% of their monthly revenue from crop and livestock farming have the highest CS, this implies that for them to accept to participate in biofuel investments through lease of land option, they would require higher compensation to cater for the foregone income they normally earn from crop and livestock farming which is land intensive. Those farmers who derive over 75% of their monthly revenue from off farm activities have the lowest CS implying that even though they lease out their land, they would not be greatly destabilized in terms source of income because most of their income comes from off farm activities which are not land intensive. This therefore explains why they would be willing to accept little compensation in order for them to participate in biofuel investments through lease of land option.

It is worth noting that though the CS for farmers who derive over 75% of their monthly is the lowest, the results also show that it is insignificant. This could be explained possibly by the fact that probably most of these farmers who derive over 75% of their monthly returns from off farm activities are not residents of these areas and hence are not the owners of the land they reside on. Also, the results indicate that the CS estimates for Kakamega are higher than those of Bungoma. This implies that farmers in Kakamega are WTA higher compensation than their counterparts in Bungoma. This could be attributed to the fact that land sizes in Kakamega are relatively smaller

compared to those in Bungoma as discussed earlier. This therefore could explain why they would only be willing to participate in biofuel investments through lease of land option if they are offered higher compensation. This is because, also as the results indicate, most their livelihood activities are land based and if they would opt to lease out their land, they would only be left with very little land to carry out their current livelihood activities.

In terms of implementation, scenario 2 would be the most applicable because it is the most preferred as evidenced by the high CS estimate. Also, for implementation purposes, it would be more practical to start with this kind of policy scenario because the results of the study showed that a large percentage of the farmers already fall into this category in terms of their enterprise mix.

Table 5
Attribute levels and compensating surplus for biofuel investment Policy Scenarios

Attributes												Compensating surplus		
	Contract Length			Size of land			Employment			Renewabil-ity				
Scenario	Short	Medium	Long	Quarter	Half	Three quarter	None	Permanent	Casual	Yes	No	Bungoma	Kakamega	Pooled sample
1	√				√				√	√		13,281.7*** (29.39)	19, 040.6*** (57.25)	12, 009.8*** (19.59)
2		√		√			√				√	20,858.9*** (55.11)	38,925.9 *** (117.73)	19, 699.5*** (34.74)
3			√			√		√		√		6,031.9 [a] (43.16)	3,223.0[a] (36.94)	3221.61[a] (26.83)

Note: standard errors are in parentheses

√ indicates that the attribute is present in the policy scenario at the non-zero level

*** indicate the SC estimates are significant at the 1% level
[a] indicates that the CS estimates are significant

4.0 SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

4.1 Summary of results and conclusions

Poverty continues to be a problem among numerous smallholder farmers. In response to this, various ways have emerged to offer famers an alternative source of income, for example, biofuel investments, so that they may exit poverty. This study therefore shed light on smallholder farmer's livelihood strategies and preferences for biofuel investments in Kenya. It sought to characterize farmers' sources of livelihoods through descriptive statistics and assessed their preferences for Biofuel Investments. The study used data from 342 smallholder farmers spread across Bungoma and Kakamega counties.

The study found that farmers continue to solely rely on non remunerative agricultural enterprises such as maize and sugarcane farming. These enterprises were found to suffer various challenges such lack of markets, delayed payments and low payments respectively. For example about two thirds of the respondents cited challenges of delayed payments especially with regards to sugar cane. Findings from the preference analysis indicated that farmers in both study areas had high preference for short contract lengths compared to long contract lengths, leasing out a quarter of their land as opposed to leasing out three quarter of their land, permanent type of employment in comparison to casual type of employment and renewable contracts compared to non renewable contracts. Although farmers in both regions had similar preferences for the biofuel investments attributes, there was a difference in the amount of compensation that they would be willing to accept. Farmers in Kakamega were willing to accept higher compensation compared to their counterparts in Bungoma.

In terms of implementation, scenario 2 would be the most applicable because it is the most preferred as evidenced by the high CS estimate. Also, for implementation purposes, it would be more practical to start with this kind of policy scenario because the results of the study showed that a large percentage of the farmers already fall into this category in terms of their enterprise mix.

4.2 Policy implications and recommendations

This study recommends that since farmers on the whole had higher preference for short contract lengths, leasing out a quarter piece of land, permanent type of employment and renewable contracts, biofuel investments policies should therefore include these features in the design. This would ensure that the needs of the farmers are accounted for therefore creating a sense of ownership by farmers in the biofuel investments. This would therefore facilitate acceptance and sustainability of biofuel investments. Also, given that biofuel investments are land based and could have a potential threat on food security in the study areas where results have shown that land sizes are on the declining trend, it is important to incorporate the priority recommendations of County Development Plans (CDP) and ASDP so as to ensure that such development plans such as biofuel investments receive higher budgetary allocations and political mileage.

4.3 Contribution to knowledge

This study contributed to the literature on farmers' preferences for biofuel investments as an alternative livelihood strategy. Indeed, it is worth noting that biofuels have received considerable interest worldwide. However, much of the information available about biofuels is based on speculations. Little empirical evidence exists in terms of what farmers (who are the major stakeholders) really want in terms of the design of the biofuel investment programs and policies, especially in the Kenyan context. Also, most studies on biofuel focus on farmers in general; this study assessed how biofuel companies could target different categories of farmers based on their enterprise mix and the intensity with which they utilize their land.

4.4 Limitations of the study and suggestions for further research

This study focused on only those farmers who may opt to participate through lease of land. Future research on biofuel investments could assess the other forms of farmer participation in biofuel investments, for example growing biofuel crops or selling land to biofuel companies.

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