AN INVESTIGATION OF THE EFFECT OF LAND SUBDIVISIONS ON SUGARCANE PRODUCTION: A CASE OF LAND HOLDINGS WITHIN SONY SUGAR COMPANY ZONE, KENYA

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A Research Project submitted to the graduate school in partial fulfillment for the requirements of the masters degree in Business Administration of Kisii University College.

EGERTON UNIVERSITY

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DECLARATION AND RECOMMENDATION

DECLARATION

This is my original work and has not been presented for the award of any other degree elsewhere.

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RECOMMENDATION

This research project has been submitted with our approval as the University Supervisors.

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DEDICATION

This work is dedicated to my wife Janet and my children Browline, Arnold, Alfred and Claudius.

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I wish to express my gratitude to my supervisors Dr. Szumbah Mwanaongoro and Mrs. Stella Omari for taking their valuable time to add value to my project and for their guidance throughout the project duration. I salute my colleagues, the entire 2007/08 MBA class for being my source of encouragement by ensuring that we completed all the group assignments.

ABSTRACT

The Kenya Sugar industry has not been able to produce enough sugar to meet the domestic demand. The low production of sugar and low income to the farmer is caused by unsustainable land use practices occasioned by uncontrolled land subdivisions. This research is important as it helped in identifying the priority needs of the farmers and how to address these constraints. The main objective of the study was to investigate the effect of land subdivisions on sugarcane production within SONY Sugar zone. The findings of this research provided vital data to assist researchers, development practitioners, academicians, policy makers, among others to monitor and evaluate existing relations between land subdivision and sugarcane production and to design new strategies and policies for sustainable land use management. The research used a quasi-experimental design that uses pretest – posttest control group design without randomization. The study population was 718 land holders who have continuously used the same parcel of land for sugarcane farming for the last ten years. A sample of 72 land holders was used. Secondary and primary data were collected and analyzed by simple descriptive analysis tested at critical alpha (α) of 0.05 significance level using chi-square test of independence. The findings of this research showed that land subdivision reduces sugarcane production. The farmers are subdividing their land to their sons thus resulting in reduction of mean land holding per individual. The study also revealed that with reduction of the land sizes, per unit cost of production increase; thereby, discouraging farmers from sugarcane production. The study recommends that for sugarcane production to be competitive, sugar milling companies should contract farmers with the land size that allows them to break-even. The study recommends that more farmers be sensitized to consolidate their family land so as to realize economies of scale. The government should also make legislation that prohibits land subdivision below certain minimal level.

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ABBREVIATIONS AND ACRONYMS

AMS	Agriculture Management Systems
ASALS	Arid and Semi-Arid Lands
COMESA	Common Market for Eastern and Southern Africa
EPZ	Export Processing Zones
IEA	Institute of Economic Affairs
IGAD	Inter-Governmental Authority on Development
KFSSG	Kenya Food Security Support Group
KSB	Kenya Sugar Board
KESREF	Kenya Sugar Research Foundation
SONY SUGAR	South Nyanza Sugar Company Limited

CHAPTER ONE
INTRODUCTION

1.1 Background to the problem

The demand for sugar in Kenya has been and continues to be higher than production. By the end of the year 2003, the country consumed approximately 650,000 tons of sugar against a production of slightly less than 450,000 tons. Similar trend of consumption and production has continued such that during the year 2008, production was 448,489 tons against consumption of 663,780 tons (KSB, 2008) leading to a deficit of about 200,000 tons. This annual deficit of over 200,000 tons is imported from other sugar producing countries (EPZ, 2005). Kenya therefore continues to experience deficits despite the fact that the country has eight sugar milling factories with a total installed production capacity of 696,000 tons of sugar annually (KSB, 2009).The under performance of the milling factories has been attributed to several factors for example obsolete machinery, high cost of production, and periodic lack of raw material. The lack of raw material (sugarcane) is caused by among others the low farmers morale and low farm income caused by continuous subdivision of land into uneconomical sizes (KESREF, 2001).

In the sugarcane production zones there is unsustainable land use practices occasioned by uncontrolled land subdivision. This has lead to declines in production and productivity of sugarcane. Land being a vital factor of production in the economy has cultural and traditional value that dictates ownership and use. For instance, large portions of land in Kenya's high potential areas have been sub-divided into uneconomic parcels, while some parts of the land in the medium and low potential areas are rapidly being converted into agricultural use despite their unsuitability (Republic of Kenya, Vision 2030, and 2007:20).

The Vision 2030 pointed out that unsustainable land use persists even in 453 planned settlements schemes that have been established over the past 40 years. The legislative frameworks to handle land related cases are weak and the institutions managing land in Kenya are many and varied. In addition, land issues are governed by many laws and a complex legal process. This has contributed to a backlog of land related disputes in courts.

The subdivision of land into smaller units due to increasing human population is responsible for accelerated land degradation and declining land productivity. This situation has compromised agricultural production and productivity in all agricultural sub-sectors. In urban areas however, proliferation of informal settlements and encroachment into protected land remain key challenges (Republic of Kenya, 2008:35).Under private land tenure system, continuous subdivision of agricultural land together with conflicting land uses like conversion of agricultural land to commercial and industrial use leads to land overuse and pollution in agricultural areas (Republic of Kenya, 2004).

The Institute of Economic Affairs of Kenya suggests that public policy backed by relevant legislation should be initiated to restrict subdivision of agricultural land beyond some limits because productivity stands to suffer if the trend is not stopped. The Institute noted that subdivision of agricultural land in Kenya has advanced to such extents that most of the land presently held are uneconomical units with diminishing returns and overall declining value revealing that there is need to set limits on land subdivision (Institute of Economic Affairs, 2000). Indeed, it is possible that for non-agricultural land, the subdivision may be fuelled by the fact that the value of the land is continuously rising. Therefore this study focused only on agricultural land. Explanations given by the Government of Kenya to justify the declining ability to feed herself includes lack of a comprehensive land policy, uncoordinated sectoral policy formulation and implementation, environmental degradation, poor land use planning and management, continuous land subdivision and high population growth (Republic of Kenya ,2007). These have accelerated downwards the trend in agricultural production and therefore require responsive mechanisms so as to reverse the situation.

The Kenyan government through the ministry of lands has recognized the importance and challenges of land use and management in the country. To streamline land issues, a national land policy has been prepared and approved by the cabinet. The policy seeks to address the critical issues of administration of land, access to land, land use planning, restitution of historical injustices, environmental degradation, conflicts, and information management. This policy categorizes land as public, community or private. It further recognizes and protects customary rights to land, protects private land rights and provides for derivative rights from all categories of

land holding. Through the national land policy the government will ensure that all land is put into productive use on a sustainable basis by facilitating the implementation of key principles on land use, productivity targets and guidelines as well as conservation.

Despite the measures taken by the Government and the industry players to improve the sectors' performance and attain self sufficiency in sugar production, Kenya still experiences sugar deficits. Prevalence of such deficits and market potentials demands concerted efforts from all stakeholders to contribute to narrowing the perennial shortfall and devise targeted strategies of increasing sugarcane production. With the increasing sugar per capita in Kenya, the rapid increase in population and the existing export potential, there exists an ideal investment opportunity in the sector to further increase production capacity.

This research analyzed the effects of land subdivision dynamics in the context of hectares under sugarcane production and land tenure system by empirically determining how these factors influence sugarcane production in Sony Sugar Zone, Kenya. The result of this research could aid and facilitate design of a realistic land use planning and management policy for Sony Sugar zone in particular and Kenya in general with a view to ensuring self sufficiency in sugarcane and sugar production for the country.

1.2 The statement of the problem

In their study of the trends in Kenyan agricultural productivity, Kibaara B., et al, (2009) reported that land unit sizes in the agriculturally productive areas of Kenya are getting smaller due to increased land subdivision. Wawire et al, (1999) in their study of intercropping systems in western Kenya identified land subdivision as a constraint to sugarcane production. Land subdivision is therefore a big concern to the sustainable plantation crop production. Land subdivision in Kenya, and especially in Sony Sugar zone, has advanced to such extents that most of the agricultural land presently held are uneconomical units with diminishing returns. Therefore there was need to establish the effect of land subdivision on sugarcane production with a view to improving sugarcane production and reducing the deficit in sugar production.

1.3 General objective

The general objective of the study was to investigate the effect of land subdivisions on sugarcane production within SONY Sugar zones.

1.3.1 The specific objectives were to;

i. Determine the effect of land subdivision on hectares under sugarcane production.
ii. Establish the relationship between land subdivision and cost of sugarcane production.
iii. Establish the relationship between land subdivision and productivity of sugarcane farms.

1.4 Research questions

The research questions were;

i. How does land subdivision affect hectares under sugarcane production?
ii. What relationship exists between land subdivision and the cost of sugarcane production?
iii. What is the relationship between land subdivision and productivity of sugarcane farms?

1.5 Significance of the study

Currently, the total sugarcane production and productivity in all zones in Kenya is showing a decreasing trend while the annual consumption of sugar is increasing owing to the growing population. The decrease in productivity and production directly affects the out-growers' net income and attitude towards sugarcane farming. Therefore there was an urgent need to look into the constraints facing the out-growers. This research was to help in identifying the priority needs of out- growers and how to address these constraints so as to improve sugarcane production.

The results of the research therefore provided vital data to assist researchers, development practitioners, academicians, policy makers, planners' programmers and policy implementers to monitor and evaluate the existing relations between land subdivision and agricultural production so as to design new strategies and policies for sustainable land use management.

1.6 The scope and limitations

The study was conducted at Sony Sugar zone. Sony Sugar factory is located in Rongo District of Nyanza Province and lies 160 kilometers south of Kisumu town at an altitude of 1,454 meters above sea level, latitude 0^0 – 54' South and longitude 34 ^{0}- 32' East. The zone has 15,000 hectares under sugarcane production within the districts of Homa Bay, Gucha South, Transmara, Kuria, Migori, Uriri and Rongo.

The study intended to receive responses from 72 land holders spread across the various sectors, however only 66 respondents returned the questionnaires. Despite this, the results of study reflected a fair view of the respondents overall view and did not limit analysis. The anticipated time frame for collecting data was exceeded due to the time taken to seek responses from the widely spread respondents. This caused a delay in the data analysis stage.

1.7 Definition of operational terms

The following were the significant terms that were unique in this field of inquiry or that might not be easily understood by the general reader.

Agricultural Land

For the purpose of this research, agricultural land is operationally defined as all land, which is used for purposes of agriculture, that is the growing of crops and/or rearing of livestock for cash income, food production and subsistence, but not being land, which, under any law relating to town and country planning is proposed for use for purposes other than agriculture.

Cane census

This is the exercise of carrying out assessment of the available contracted sugar cane within the zone

Cluster Block

A cluster block is the primary sampling unit under the sampling frame from which the researcher will obtain representative farm household survey samples.

Cluster Sample

Cluster sample refers to the study population that is chosen from the cluster block.

Cost of production

This is the total amount of money used for carrying out the operations and services of land survey, land preparation, seed cane fertilizer, maintenance ,harvesting and transport.

Diminishing returns

Refers to decline in income from a business enterprise.

Ecological zone

This refers to a geographical area with similar patterns of rainfall, temperature and soil type.

Farm Household

A person or a group of people living in a cluster block unit of land holding carrying out the business of farming, answerable to the same household head and sharing common source of food and/or income. Domestic servants and other workers residing with the family members are included as farm household members.

Field

This is a collection of sugarcane plots that are contiguous and accessible from the same direction.

Intercropping

This refers to growing of more than one crop at the same time in a single plot of land.

Land

For this research, land is a unit of earth surface used for agricultural production.

Land Development

Land development includes any measures aimed at establishing or maintaining improvements on land. For the study, land development is any measure of land use aimed at supporting the growing crops and rearing of livestock for increasing agricultural productivity.

Land Holding

Land holding is defined as all the land owned and/or operated by a household (regardless of the ownership status) for commercial farming, growing of food crops and/or rearing of livestock to sustain human life.

Land Subdivision

This refers to the partitioning of land parcels into smaller units as a way of transferring land ownership mainly from parents to sons or through land sales.

Nucleus Estate

The Company's owned sugarcane fields that act as reserve source of sugarcane.

Outgrowers

These are farmers growing sugarcane within the sugar belt for delivery to factory. They are also referred to as contracted farmers.

Respondent

A respondent is a member of the household who provides household information to the interviewer. For this survey, respondent is an individual who will participate in the study process by providing information using an instrument provided by the evaluator.

Sector

This is an administrative unit comprising of a number of sub- locations situated in one geographical area.

Sugar mill

This is refers to the factory that processes sugarcane into sugar.

Zone

Zone in the study is the area designated for growing sugarcane for the purpose of supplying a sugar factory.

CHAPTER TWO
LITERATURE REVIEW

2.1 Land use

The importance of land to economic, social and cultural development in Kenya has been recognized by various government initiatives. Land is crucial to the attainment of economic growth, poverty reduction and gender equity (Government of Kenya: Economic recovery strategy for wealth and employment creation 2003-2007).

In Kenya and other developing countries today, land as a resources affect people's lives since it is a direct requirement for life. To farmers land means a source and key element of living, to elites it is a marketable commodity and to politicians it is a sovereign entity whose boundaries reflect social, cultural and political identity (Mwagore, 2002).

Individuals make choices for use of land by considering the factors of production like the physical nature of land and its location, availability of capital and its distribution and the availability and cost of labor within the social and political climate in which they operate. However, present land use practices often disregarded land potentials, carrying capacities, and limitations of land resources as well as their diversity and distribution (Republic of Kenya, 1999, *Sessional Paper No. 6 of 1999*).

Kenya's population of 38.6 million (Government of Kenya, 2010) has been growing at the average rate of 2.4% per annum. The rapid population increase and the subsequent need for more food and cash crops have exerted immense demand on land in the high and medium potential areas. This growth has led to encroachment of marginal areas thus enhancing desertification.

Land use policies and practices such as introduction and cultivation of new crops and cropping systems, subdivision of land, settlements and related activities, irrigation schemes, and sedentary farming and livestock management have often been promoted with little regard to their impacts on the environment. Their effects are now being seen in form of land use conflicts, unsustainable

use of resources, loss of biodiversity, soil erosion, increased incidences of poverty and widespread land degradation especially in arid and semi-arid lands.

The National land policy in its executive summary page states that Kenya has not had a clearly defined National land policy since independent. This, together with the existence of many land laws, some of which are incompatible, has resulted in complex land management and administration systems. The previous Governments were unable or unwilling to solve the land problem hence the confusion in land related issues (Republic of Kenya, 2009).

Past initiatives made by the government to address the land issues include the presidential commission of inquiry into land law system of Kenya (Njonjo Commission), the constitution of Kenya review commission and the presidential commission of inquiry into the irregular/illegal allocation of public land (Ndungu Commission). However the recommendations contained in the land reform and land law commissions are yet to be implemented or effects of implementation are yet to be felt.

2.2 Land subdivision

Kibaara et al, (2009) in their study on the trends in Kenyan Agricultural productivity showed that household land holdings in Kenya have generally declined from 6.1 acres in 1997 to 5.8 acres in 2007 (Table 2.1). This decline was experienced in five out of the eight agro-regional zones, with marginal rain shadow registering the highest decline of 15% from 6.1 acres in 1997 to 4.4 acres in 2007. Western highlands, however, showed a slight increase in mean household land sizes from 2.2 acres to 2.4 acres during the period. The general decline in sizes of land holding reflected the effects of increased population pressures culminating into land subdivision in most areas of rural Kenya. The trends also showed regional differences in the size of household land holdings, with households in the High potential maize zone owning an average of 10 acres. Households in the Western highlands and Central highlands had the smallest land holdings of between 2 and 3 acres (Kibaara B.W. et al, 2009).

Table 2.1: Trends in mean land sizes owned (acres/Household)

Zone	1997	2004	2007
Coastal Lowlands	5.3	6.3	5.3
Eastern Lowlands [d]	6.7	5.6	6.4
Western Lowlands [d]	3.8	4.2	3.0
Western Transitional [d]	5.9	6.3	5.8
High Potential Maize Zone[d]	10.7	11.0	10.4
Western Highlands [d]	2.2	2.3	2.4
Central Highlands [d]	2.9	2.9	3.0
Marginal Rain Shadow [d]	6.1	5.1	4.4
Overall Sample	6.1	6.1	5.8

Note: [d] = declining sizes of land holdings.

Source: Kibaara B., et al, 2009:5.

The same researchers observed that the average cropped land per household has declined from 3.5 acres in 1997 to 3.4 acres in 2007. The declining trend in cropped area is also observed in all the regions except Eastern lowlands, where the average area increased from 3.1 acres to 4.0 acres between 1997 and 2007. The increase in area in the Eastern lowlands may reflect less intense land pressures in this less densely populated zone. They further observed that the mean land owned per household between the years 1997-2007 has declined from 6.1 acres to 5.8 acres and this was attributed to increasing rural population pressures and land subdivision.

In a study of food security in Kiambu District, research revealed that the high population pressure had resulted in high fragmentation of land, thus decreasing the average land holdings to about 0.8 hectares which necessitates intensive cultivation. An increasing number of farmers were migrating to more marginal land in the neighboring areas where traditional agricultural techniques are less appropriate. Land fragmentation is high and landlessness is a major problem affecting nearly 48.9% of the district's population (Kiambu District, 2002).

Groom et al, (2009) and Worden (2007) in their studies looked at the effect of land subdivision and sedentarization of pastoral lands on wildlife numbers and production in a savanna ecosystem of southern Kenya. The study used aerial counts over a period of 33 years to compare changes in wildlife populations on two adjacent and ecologically similar Maasai group ranches. During the period under study, one group ranch land was sub-divided and settled. The other remained communally owned under shifting seasonal use. Wildlife populations decreased sharply on the privatized ranch following land subdivision but increased steadily on the adjacent ranch where pastoralists continued mobile pastoralism. The results of multivariate analysis showed that sedentarization and settlement distribution accounted for wildlife declines on the sub-divided ranch. Both the direct displacement of wildlife and the reduction in grass production following a switch from seasonal to permanent grazing associated with sedentarization were causes of wildlife loss. Given the demand for title deeds among pastoralists to counter land losses, the resulting sedentarization was likely to become the biggest threat to wildlife in the East African savannas (Groom et al, 2009). Similarly, the accelerating pace of land subdivision in pastoral areas over the last decade had raised concerns that the effect of land fragmentation on migratory wildlife populations and pastoralists was spreading into the semi-arid and arid lands (Ntiati, 2002; Worden, 2007).

Thornton et al, (2003) in their study on mapping poverty and livestock in the developing world observed that the pastoral communities in East Africa are caught between new land tenure rules associated with the dissolution of group ranches and subdivision of communal rangelands, and the unchanged ecological exigencies of their dry land systems. Poverty among East African pastoral households is generally high. Research over the last three decades indicated a steady decline in tropical livestock units per capita in pastoral areas (Bekure et al, 1991, Rutten 1992) with a growing divide between wealthy and poorer pastoralists (Fratkin and Mearns 2003). Rising poverty and the trajectory of pastoral systems towards increasing privatization and fragmentation begs the question: *What is next?* The Maasai of Kajiado District, Kenya offered a strong example of a pastoral group in the midst of the economic and socio-political transitions that accompany the shift from communal land use to private ownership.

The trend towards land subdivision implies dramatic changes in pastoral land use from a system predicated on extensive seasonal movement and intensive, short duration grazing of successive areas of the pastoral landscape, towards one based on intensive, long term grazing of private parcels where households have fewer options for mobility. Pastoral households are also questioning the economic viability of individual parcels. Similarly, greater articulation between Maasai pastoralists and the larger Kenyan economy, and changing livelihood risks and expectations of pastoralists themselves have led researchers to predict a shift of pastoralists towards strategies that augment livestock production activities (Zaal 1999, Little et al, 2001).

Ontita E. (2006) in his study on small holder tea production and livelihood in Nyamira District, Kenya found out that land subdivision from father to his sons effectively provided inheritance of the land and focused the father and the son's development activities on their own land. It can be deduced from the scenario in Nyamira that land subdivision is taking place in all parts of the country and is facilitated by cultural values and beliefs of taking over property from the father among others. The same properties are inherited horizontally by the sons, grandsons, great-grand sons and name it. Land subdivision is taking place country wide in all farming communities and is facilitated by continuous inheritance of from generation to generation resulting in declining agricultural production.

KFSSG (2008) in their study reported that whereas rainfall received was normal in the high potential mixed farming livelihood zones of central, eastern, western and Nyanza highlands, lower crop output was envisaged in the country in the year 2008 due to a combination of factors, including declining arable land; inadequate investment in agricultural production; high input prices and impacts of post election violence. These livelihood zones, characterized by high population density and small land holdings are likely to experience food insecurity as land holdings are increasingly becoming smaller and the options of expanded production are limited. The study also exposed that land holdings of between 1-5 acres per household limits the viability of agricultural production and accelerates the migration of households to less productive land in the marginal agricultural areas. Therefore the declining arable land is a countrywide phenomenon that posses a big threat to agricultural production if left unchecked.

2.3 Land subdivision in the sugar industry

Survey conducted by KESREF on sugarcane land holdings in the Kenya sugar industry showed that there were declines in average sugarcane plot sizes in Mumias, Nzoia and Sony Sugar Zones from the year 1997-2000 (table 2.2). The situation is the same in the other Factory Zones not represented in the table above. The decline in sugarcane plot sizes was attributed to many problems among them being population pressure on land facilitating continuous land subdivision.

Table 2.2: Average sugarcane plot sizes (ha.) by factory zones: 1997-2000

Year	Mumias	Nzoia	SONY
1997	0.92	0.58	0.75
1998	0.92	0.69	0.71
1999	0.90	0.55	0.74
2000	0.89	0.56	0.65
General Average	0.91	0.60	0.71

Source: KESREF survey, 2000

The same survey found out that majority of the farmers (over 3,000) in sony sugar zone falling in sectors 1, 2 and 3 own between 0.1- 0.4 hectares and 82% of the total farmers own an acre or less. Only 660 farmers own over 2.0 Ha of sugarcane plot (Table 2.3). These sectors where mean land sizes are less than 0.4 hectares are occupied by the Luo and Abagusi tribes and land ownership is private. However, in Sector 4, which is occupied by Maasai tribe and land ownership is communal; about half of the farmers own more than 2.0 hectares each. This signifies the effect land subdivision may be having on sugarcane production based on the prevailing land tenure system and continuous land subdivision. The land tenure system in the study area exists mainly in two forms; private land and public land. The private land constitutes all agricultural land used by out-growers for sugarcane production and subsistence farming while the public land is made up of the Nucleus Estate land.

Table 2.3: Distribution of out-growers farmers by land sizes (Sector wise) in SONY zone

Range (Ha.)	Sector 1	Sector 2	Sector 3	Sector 4	All Sectors
0.1-0.4	3695	3121	3323	9	10148
0.41-0.8	1721	1544	1628	45	4938
0.81-1.2	327	487	464	78	1356
1.21-1.6	174	202	187	52	615
1.61-2.0	83	67	98	51	299
>2.00	245	145	115	155	660
Total	6245	5566	5815	390	18016

Source: KESREF Survey, 2000

The Sugarcane Census Report, years 2009 and 2010 (Table 2.4) revealed wide variations in out-growers mean plot sizes in all the sectors. The land holding trend depicted below shows that generally, land holding per individual in the sectors 1, 2, 3, 5 and 7 has marginally increased between 2009 and 2010.However a significant drop in mean holdings was noted in sector 4 where the mean holding decreased from 2.93 hectares to 1.63 hectares representing 44% drop.

Table 2.4: Changes in mean plot sizes between the years 2009 and 2010

	2009			**2010**			
sector	Number of farmers	Ha.	mean plot size	Number of farmers	Ha.	mean plot size	% change In mean plot size
1	9922	3625	0.37	8654	3643	0.42	13.50
2	7658	3184	0.42	5398	2811	0.52	23.80
3	5498	2939	0.53	5245	2922	0.55	3.80
4	789	2315	2.93	1260	2056	1.63	(44.40)
5	1906	833	0.44	1415	835	0.59	34.10
6	1375	1061	0.77	1200	803	0.67	(13.00)
7	1077	440	0.41	1374	587	0.42	2.40
Total	28225	14395	0.51	24546	13660	0.56	9.80

Source: Sony Sugar Company Ltd, the Sugarcane Census Report, 2009 and 2010

2.4 Conceptual framework

The conceptual framework analysis presents an illustration of the variables relationships used in this study. As indicated earlier, evidence from the document review and literature analysis motivated the researcher to undertake this study to analyze the effects of land subdivision dynamics on sugarcane production. The idea came from research done by other researchers and previous reports on land subdivision and sugarcane production. A cross-sectional overview of this conceptual framework illustrates underlying variable relationships and their terminology as would be used in the research.

The relationship between land subdivision and sugarcane production is conceptualized at a general level (Figure 1-1) as a relationship where land subdivision, at the farm level, impacts on a set of basic causal factors namely; hectares under sugarcane production, cost of production and the net farm income which in turn may be influencing the outcome of sugarcane production. The independent variable, family size, affects the hectares under sugarcane depending on the number of sons in the family. Where there are many sons the frequency to subdivide increases and the net income of the farmers' declines as subdivision continues. Similarly if the nature of land holding is leasehold the tendency to subdivide is reduced. The intermediate effects of land subdivision on sugarcane production are cost of sugarcane production and net sugarcane income that re-cycle back to the farm level in a vicious circle. The government and company policies play a moderating role by providing guidelines on which the relationship between land subdivision and sugarcane production are based. The relationship also provides feedback to the policy makers so that reviews of the policies can be tailor made to the problems of the industry.

Therefore, this research was seeking to analyze the effects of land subdivision dynamics on sugarcane production by empirical determination of how these factors influence sugarcane production in Sony Sugar Zone, Kenya.

Independent Variable (I.V) **Dependent Variable (D.V)**

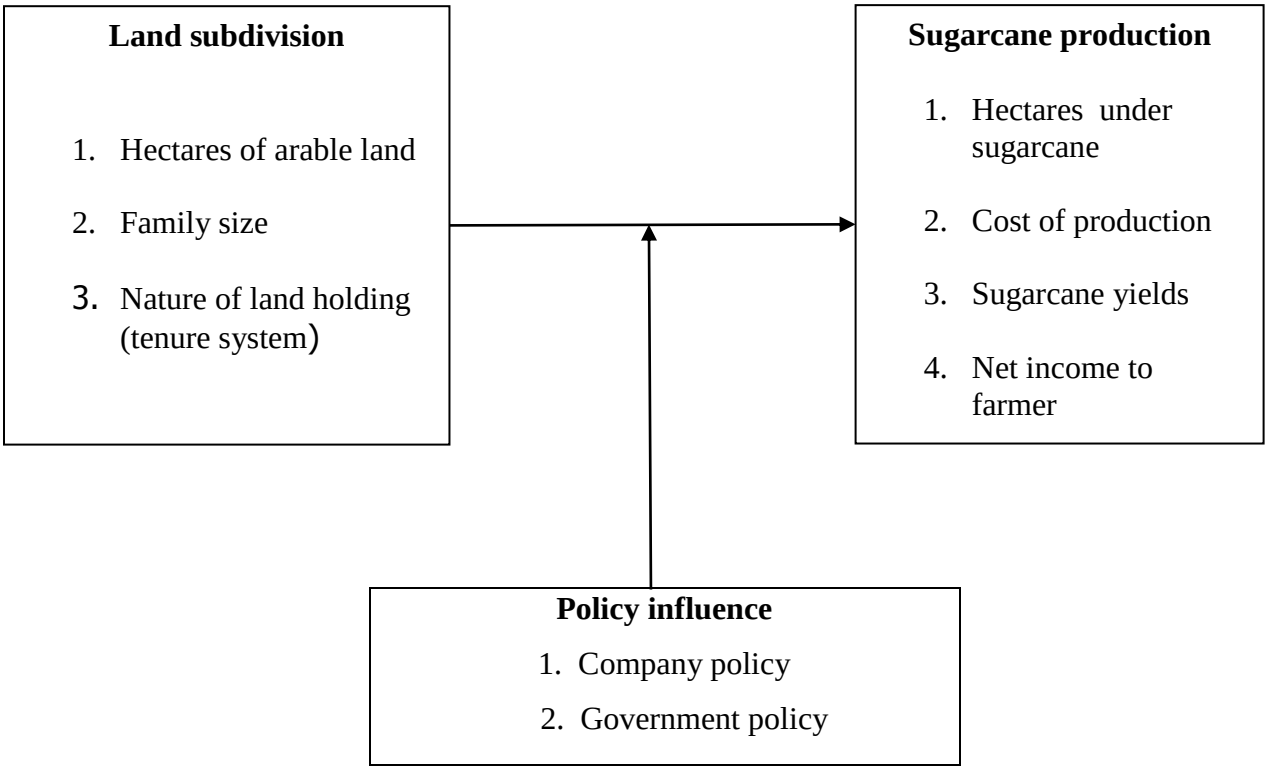

Figure 1-1: Relationship between land subdivision and sugarcane production.

Source: Author

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Research design

This research used a quasi-experimental design *(non-equivalent control group)* that uses pretest – posttest control group design without randomization. Pretest and Posttest allowed for comparison of the relative sugarcane production between the subdivided sugarcane plots (experimental) and the non subdivided plots (control groups).

3.2 The Study Area

The study was conducted at Sony Sugar zone. The zone has a catchment area of approximately 60,000 hectares of arable land spread within the seven districts of Homa Bay, Gucha South, Transmara, Kuria, Migori, Uriri and Rongo. However, only 15,000 hectares was under contracted sugarcane as at November, 2010 (Sony Sugar cane census report, 2010/11).

3.3 Target Population

The study targeted 718 farm households spread over the Seven Sectors of Sony Sugar Zone. The sampled households have been growing sugarcane continuously on the same parcel of land (plot) for the last ten years.

3.4 Sampling procedure and Sample size

The research used a two-stage cluster sample technique for the primary data collection. In the first stage, a representative sample of seven (7) purposively selected Sectors were chosen and in the second stage, a representative sample of 72 farm households who are the land holders and also the owners of the sugarcane grown on those plots were selected through systematic sampling as represented in table 3.3.

Table 3.3: Population and sample size

Sector	Population of study	Sample size
1	231	23
2	130	13
3	154	15
4	81	8
5	53	5
6	50	5
7	19	2
Total	718	72

Source: Sony Sugar cane census report 2010

The secondary data involved assessment of sugarcane production of all the 92 farmers who have used the same plot for sugarcane production from the year 2000 to 2010. The production data for the selected farmers were compared over time. The farmers whose plot area did not change over the period formed the control group while those whose plot area reduced formed the experimental group.

3.5 Methods of data collection

Primary Data was collected through face-to-face interviews with the land holders owning the sugarcane plots, participant observations and field visits. Secondary data was collected through perusal of Sony sugar documents and office records of the farmers to generate information and the results were entered in a data collection sheet (Table 3.4).

Table 3.4: Secondary Data Collection Sheet

		CONTROL GROUP				EXPERIMENTAL GROUP			
		Land holdings without sub-division				Land holdings with sub-division			
		Year 2000		Year 2010		Year 2000		Year 2010	
No.	Plot No.	Ha	Tonnage	Ha	Tonnage	Ha	Tonnage	Ha	Tonnage
1									
2									
3									
,,									
,,									
142									

Source: Author.

3.6 Data collection tools/instruments

Collection of primary and secondary data was done during the month of May, 2011. The collection employed methods such as document analysis, survey questionnaire, participant observation and field site visits.

3.7 Validity

The accuracy or trustworthiness of measurements was ensured through improving both internal and external validity. The questionnaires were presented to professionals in the field of Agribusiness to critique for reliability and validity before administration. They were also reviewed by the supervisors to ensure that the research objectives would be achieved during administration.

3.8 Reliability

Data gathered from secondary sources; management staff and extension staff, strengthened the reliability of the findings.Further, a demonstration of the validity was sufficient to establish the

reliability. The other measure that also enhanced the dependability of this study was the examination of both the process and the product of the research for consistency.

3.9 Methods of data analysis

The data collected was entered and analyzed by simple descriptive analysis. The processing of descriptive statistics for numeric data involved examining/editing, categorizing, ordering and calculating frequencies, percentages, means and standard deviations. The Chi-square test of independence was used to test differences before and after land subdivision. The chi square was used because of the nature of data; small sample sizes and its suitability for testing differences before and after scenario. The variables were tested for statistical significance to determine differences between variables before and after relationships (statistical inference) with decision-making criteria at the critical alpha (α) of 0.05 significance level.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Gender of the respondents

The respondents were asked to state their gender. The results were summarized and are presented in table 4.1 below.

Table 4.1: Composition of respondents by gender.

Gender	Total	percentage
Male	52	78.8
Female	14	21.2
Total	66	100.0

Source: Survey Data, 2011

The result showed that of all the respondents; 78.8% were male while female accounted for only 21.2% .This implies that Sugarcane farming is predominantly a male occupation.

4.2 Respondents distribution by age

The respondents were asked to state their ages. The results are presented in table 4.2 below.

Table 4.2: Age of respondents

	Sectors							
Age (years)	1	2	3	4	5	6	7	Total
18-25	2	0	0	1	0	0	0	3
26-35	3	1	3	4	1	0	0	12
36-45	6	1	3	2	0	3	1	16
46-55	5	4	5	0	1	1	1	17
>55	5	6	2	1	3	1	0	18
Total	21	12	13	8	5	5	2	66

Source: Survey Data 2011

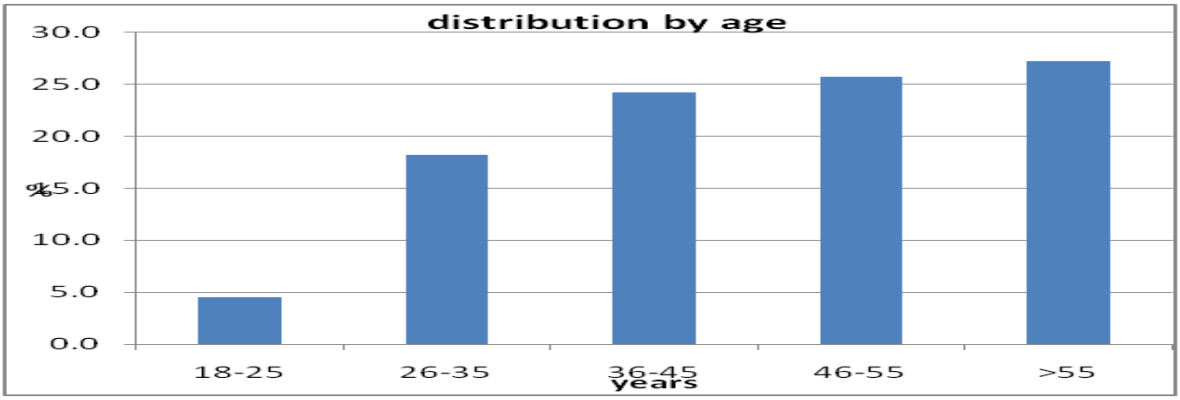

Figure: 4-1: Age profile of respondents
Source: Survey Data, 2011

Analysis of the data revealed that 77% of the respondents are above 36 years while only 4.7% are between 18 to 25 years (Figure 4-1). Therefore sugarcane farming is a business carried out by all irrespective of age.

4.3 Level of education of respondents

To know their level of education, the respondents were asked to state the highest level of education they attained. The results are presented in table 4.3 below.

Table 4.3: Level of education

Sector	Primary and below	secondary	college/university	Total
1	7	8	6	21
2	6	4	2	12
3	3	10	0	13
4	3	4	1	8
5	4	1	0	5
6	1	3	1	5
7	1	1	0	2
Total	25	31	10	66

Source: Survey Data 2011

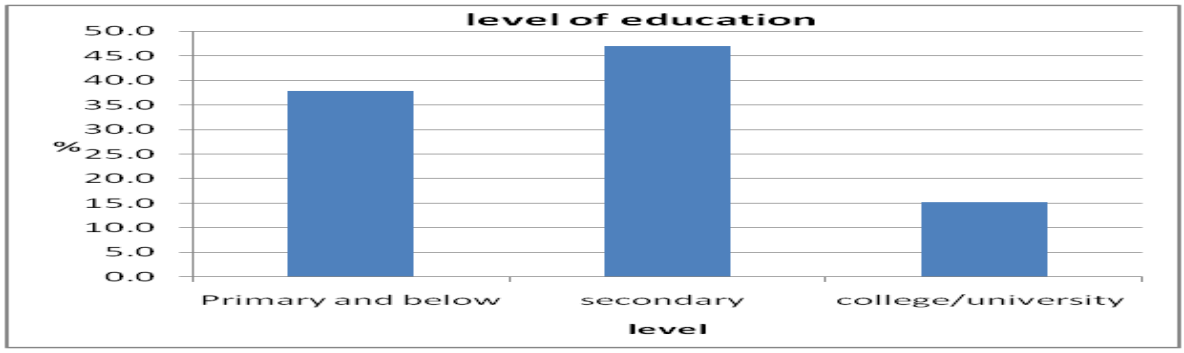

Figure 4-2: Level of education

Source: Survey Data, 2011

The results showed that 84.9% of the respondents are educated to the level of secondary and below while only 14.1% have college /University certificates (Figure 4-2). Sugarcane farming therefore is carried out by none professionals. The lack of professionalism may compromise the understanding of sugarcane farming as a business.

4.4 Acres of arable agricultural land owned by farm households

The respondents were asked to provide information on the amount of arable land they owned. The results are presented in table 4.4 below.

Table 4.4: Acres of arable land owned by respondents

Sector	Less than 5	Between 6-10	More than 10	Total
1	8	8	5	21
2	3	7	2	12
3	4	5	4	13
4	1	1	6	8
5	0	4	1	5
6	1	4	0	5
7	1	0	1	2
Total	18	29	19	66
%	27.3	43.9	28.8	100

Source: Survey Data, 2011

The result (Table 4.4) showed that over 72% of the respondents own over 6 acres of arable land. Suitable land therefore is not a limitation to sugarcane production since the farmers have reasonable land for economic sugarcane development.

4.5 Number of years as contracted sugarcane farmer.

To know the respondents' experience in sugarcane growing they were asked to provide information on the period they have been contracted to Sony Sugar. Their responses are presented in table 4.5 below.

Table 4.5: Duration as contracted farmer

Sector	< 5 years	6 - 10 years	11 - 15 years	>15 years	Total
1	4	4	5	8	21
2	1	3	2	6	12
3	0	2	4	7	13
4	2	3	0	3	8
5	0	1	1	3	5
6	1	2	1	1	5
7	0	0	0	2	2
Total	8	15	13	30	66
%	12.1	22.7	19.7	45.5	100

Source: Survey Data 2011

The data collected (table 4.5) revealed that 45.5% of the respondents have been contracted to Sony sugar for over 15 years, 19.7% have been contracted for 11-15 years and only 12.1% have been contracted for less than 5 years. This implied that majority of the respondents are not new to sugarcane production and are acquainted with the challenges of sugarcane production.

4.6 How the land used for sugarcane production was acquired

Land for sugarcane farming is acquired from different sources. The respondents were asked to state how they acquired the land they are using for sugarcane production. The results of this are presented in figure 4-3 below.

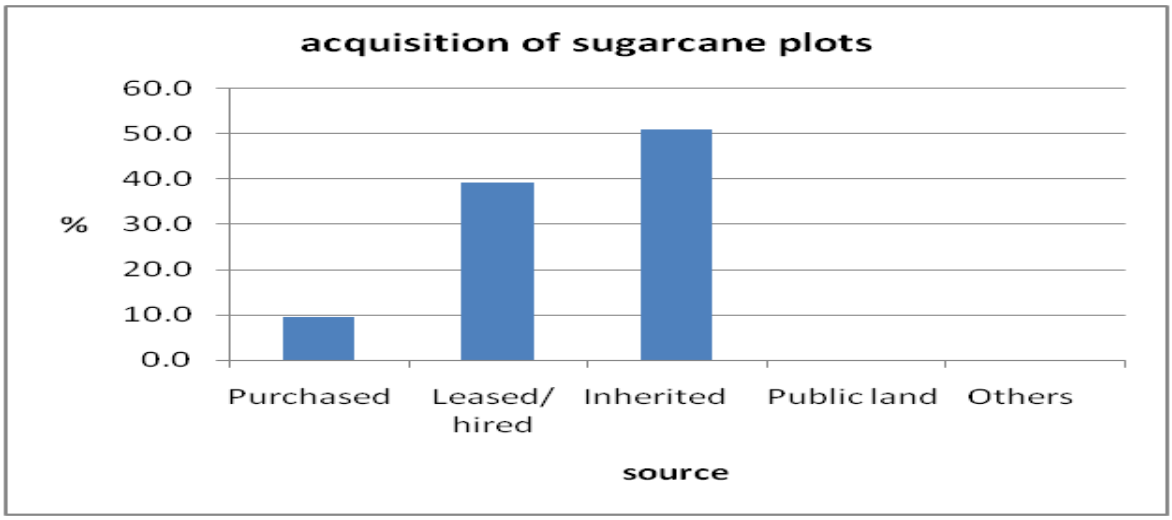

Figure 4-3: Acquisition of sugarcane plots

Source: Survey Data, 2011

The results depicted in figure 4-3 above revealed that 51% of the land currently under sugarcane production is inherited while another 39.4% is leased. Due to inheritance the land sizes tends to get smaller over time such that a time will come when the available land will not be economical for sugarcane production.

4.7 Reasons for subdivision of land.

To understand why respondents were subdividing their land they were asked whether they have ever subdivided their land and the reason as to why they subdivided their land. The reasons given by the respondents were summarized and presented in figure 4-4 below.

Table 4.6: Confirmation of land subdivision

	Sectors								
Response	1	2	3	4	5	6	7	Total	%
Yes	2	6	3	1	1	2	0	15	22.7
No	19	6	10	7	4	3	2	51	77.3
Total	21	12	13	8	5	5	2	66	100

Source: Survey Data 2011

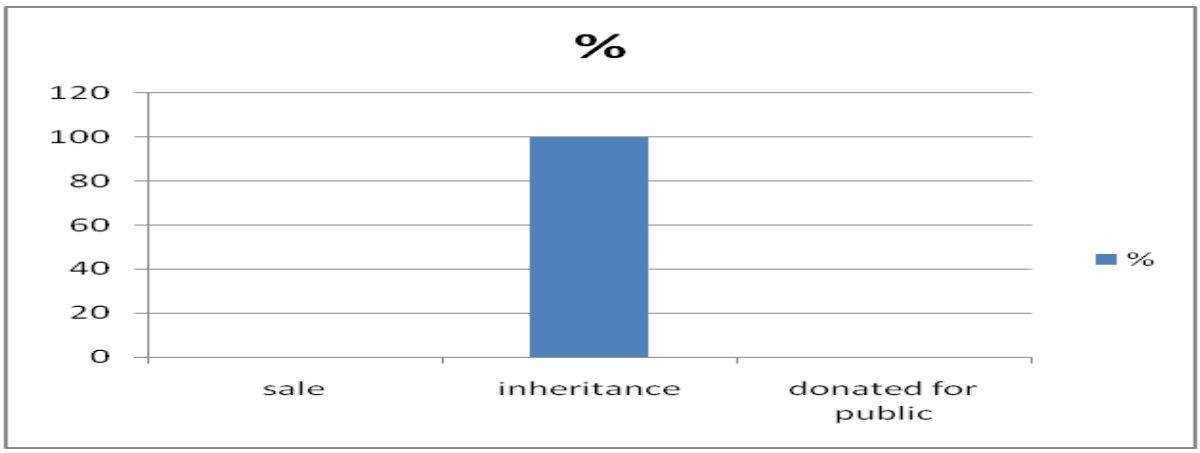

Figure 4-4: Reasons for Land Subdivision
Source: Survey Data, 2011

As depicted in Figure 4-4 above, the result showed that all the respondents who have subdivided their land did so to facilitate inheritance.

4.8 Ranking of factors of land subdivision and how they favour sugarcane production as a result of land subdivision

To understand the causes of land subdivision the respondents were asked to rank how some selected factors like inheritance, sale of land, family size congestion and size of land influence land subdivision. The results are presented in table 4.7 below.

Table 4.7: Rank the following factors how they favour ssugarcane production as a result of land subdivision

Land holding Factors	Most favourable 5	Very favourable 4	Favourable 3	Moderately favourable 2	Negatively favourable 1	$\sum f_i$	$\sum w_i f_i$	$\frac{\sum w_i f_i}{\sum f_i}$
Inheritance	4	5	7	11	39	66	122	1.85
Sale of land	23	19	11	6	7	66	243	3.68
Family size congestion	6	8	11	14	27	66	150	2.27
Size of land	1	3	10	16	36	66	115	1.74

Source:Survey data, 2011

Analysis of the data showed that the respondents' ranked inheritance, with an average of 1.85, as moderately favouring to negatively favouring sugarcane production. Similarly, the size of land owned by the land holder, with an average of 1.74, was identified as a constraint since it was negatively favouring sugarcane production. Family size congestion with an average of 2.27 was found to be moderately favouring sugarcane production. This may be because the family composition includes female gender who does not inherit land from parents or the family members could still be staying in one compound and using the rest of their land for sugarcane production. On the other hand sale of land, with an average of 3.68 was found to be very favourable to sugarcane production. This could be due to the fact that those who purchase land use them for sugarcane production so as to recover the cost of purchase. In general the respondents agreed that sugarcane production is indeed being decelerated by land subdivision. Land subdivision is therefore a challenge to viable sugarcane production. With the ever increasing human population the land sizes are bound to get smaller hence affect economic production of sugarcane.

4.9 The extent to which land subdivision has affected sugarcane production.

The respondents were asked to rate how land subdivision has affected sugarcane production. The results are presented in the table 4.8 below.

Table 4.8: Extent of effect of land subdivision on sugarcane production

Land holding Factors	Very favourable 4	Favourable 3	Moderately favourable 2	Negatively favourable 1	$\sum f_i$	$\sum w_i f_i$	$\frac{\sum w_i f_i}{\sum f_i}$
High cost of production	22	19	18	7	66	188	2.85
Low Sugarcane yield	6	2	31	27	66	119	1.80
Low Net income	29	20	12	6	66	206	3.12

Source :Survey data, 2011

From the analysis, the respondents ranked low sugarcane yield (average of 1.80) as the factor that is negatively favoured by land subdivision.However high cost of production and low farmers net income,with averages of 2.85 and 3.12 respectively, are directly affected by land subdivision. As land subdivision occurs the net income decreases and conversly, as land subdivision increases the cost of production increases.The analysis also showed that land subdivision moderately favours lease of land by the land holders.These factors collectively therefore results into reduced sugarcane production.

4.10 Secondary data analysis

The secondary data (appendix 2) were statistically analyzed using chi-square test of independence with decision-making criteria at the critical alpha (α) of 0.05 significance level. The plots whose area did not change over the period were treated as the control group while those whose area changed were treated as the experimental group. From a total of 92 samples collected, 44 sub divided plots and 21 non-sub divided plots had reduction in production while 5 sub divided plots and 22 non sub divided plots did not have reduction in production. The analyzed results are presented in tables 4.9 below.

Table 4.9: **Crosstabulation of status of subdivision × production of farm (Tons)**

	Production of farms (tons)		
	Production Reduced	Production not reduced	Total
Sub divided land	44 (E_{11})	5 (E_{12})	49
Not sub divided land	21 (E_{21})	22 (E_{22})	43
Total	65	27	92

Source: Survey Data, 2011

$$\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

Where; O_{ij} represents the observed frequency and

E_{ij} represents the expected frequency calculated.

$$\chi^2 = \frac{(44-34.620)^2}{34.620} + \frac{(5-14.380)^2}{14.380} + \frac{(21-30.380)^2}{30.380} + \frac{(22-12.619)^2}{12.619}$$

$$= 2.541 + 6.118 + 2.896 + 6.974$$

$$\chi^2 = 18.529$$

The calculated chi-square of 18.529 is greater than the critical value of 3.841 (from the table) implying that land subdivision reduces tons of sugarcane produced. This is due to reduced

number of farmers putting their small parcels (because of land subdivision) of land into sugarcane production. The net result is that less tonnage is available for sugar factories production and therefore the deficit in sugar production shall continue to be experienced.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of findings

The first objective of the study was to determine the effect of land subdivision on hectares under sugarcane production. The results in figure 4-3 show that 51% of the land currently under sugarcane production is inherited and another 39.4% is leased. Further, the data collected during the study indicates that inheritance and the size of family land negatively favours sugarcane production (Table 4.7). However, sale of land favours sugarcane production. This may be due to the fact that those who purchase the land use it for sugarcane production.

The second objective was to establish the relationship between land subdivision and cost of sugarcane production. The data collected (Table 4.8) showed that land subdivision is favouring high cost of sugarcane production and low farmers' net income.

The last objective of the study was to establish the relationship between land subdivision and productivity (yields) of sugarcane plots. The study findings revealed that land subdivision has no effect on sugarcane yield (Table 4.8). This implies that the farmers' small plots are maintained well.

5.2 Conclusion

The study concluded that land subdivision is taking place in the entire Sony Sugar zone. Land subdivision is negatively impacting on sugarcane production (table 4.9). The declining plot sizes in the Sony Sugar zone is the cause of decreasing income to the sugarcane farmers. With the small plot sizes farmers are not able to realize economies of scale and therefore do not realize profits from the business.

The other challenge being paused by continuous land subdivision is the uncertainty in food security. This is because land for agricultural activities is continually reducing such that dedicating land for food crop production and commercial production of cash crops is becoming

difficult and therefore farmers have to compromise on what to produce and how much of the limited land to dedicate for the same.

5.3 Recommendations

The study recommends that farmers should be sensitized more about the advantages of taking up cane farming as a business and be able to dedicate adequate land for sugarcane production so as to realize economies of scale. The study further recommends that farmers should consider forming cooperatives societies so as to pool resources together (plots/farms) to reap a better return due to economies of scale and reduce unit cost of production.

The government should legislate on the minimum land allowable for subdivision. On the other hand the government and the miller companies should sensitize the farmers on the demerits of land subdivision. Such sensitization should target the families so that they can have common homesteads and dedicate reasonable land for crop production.

5.4 Areas for further research

The implications of land subdivision to agricultural production and to sugarcane production in particular are far reaching. This study recommends for further research on determination of the economic plot size for sugarcane production in the Sony Sugar zone.

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APPENDICES

APPENDIX 1:

SURVEY QUESTIONNAIRE

Name of Interviewer…… Interview Date: ……..…

INSTRUCTIONS: Note: 1.Only persons of 18 years and above are eligible.

2. Please answer by putting a tick (√) ***where appropriate.***

SECTION A: GENERAL RESPONDENTS INFORMATION

Name of Respondent ……..…… (*Optional*)

a) Gender: Male ( ) Female ( )

b) Age: ……years

c) Level of Education (*Tick one*)

1) Primary and below ( ) 2) secondary ( ) 3) college/university ( )

d) Sub-Location: ……..……Field No: ……Plot No……..…….

SECTION B: LAND SUBDIVISION

1) How many acres of land do you own?

a) Less than 5 [ ] b) Between 6-10 [ ] c) More than 10 [ ]

2) You have been a contracted sugarcane farmer with Sony Sugar for how many years?

(a) Less than 5 years (b) 6 – 10 years (c) 11 – 15 years (d) Over 15 years

3) How did you acquire the land you are currently using for sugarcane farming?

a) Purchased [ ]

b) Leased/ hired [ ]

c) Inherited [ ]

e) Public land [ ]

f) Others [ ] (please specify)……..

…….

4) Out of the total area you have under sugarcane, how many acres fall under these categories:

	Less than 1 acre	between 2-5 acres	more than 6 acres
a) Leased land	[ ]	[ ]	[ ]
b) Inherited land	[ ]	[ ]	[ ]
c) Purchased land	[ ]	[ ]	[ ]

5) Have you ever subdivided your land? a) Yes ( ) b) No ( )

6) If yes, why did you subdivide your land?

a) For sale ( ) b) Inheritance by family ( ) c) Donated for public use ( )

d) Others ( ) *pleas*e *specify*……

7) On a scale of **1-5** (5 being the highest) kindly rank the following factors how they favour sugarcane production as a result of land subdivision.

Land Holding Factors	Most favourable 5	Very favourable 4	Favourable 3	Moderately favourable 2	Negatively favourable 1
Inheritance					
Sale of land					
Family size congestion					
Size of family land					

8) To what extent do you agree that Land Subdivision has affected sugarcane production in respect to the following factors:

Land Holding Factors	Very favourable 4	Favourable 3	Moderately favourable 2	Negatively favourable 1
High cost of production				
Low sugarcane yield				
Low net income				

SECTION C: SUGARCANE PRODUCTION

a) How would you describe the current sugarcane production (in tons per acre) in your area compared to 5 years ago?

i) Increasing ( ) ii) Decreasing ( ) iii) No change ( )

b) In your own analysis what would you say concerning current cost of sugarcane production per acre compared to 5 years ago?

i) No change ii) about 10-30% more iii) Over 30 % more iv) less by >10%

c) How has the size of land you have been using for sugarcane farming changed compared to ten years ago?

Increased by		*OR*	*Decreased by*	
i) Less than 10%	[ ]		Less than 10%	[ ]
ii) 10-20%	[ ]		10-20%	[ ]
iii) 21-40%	[ ]		21-40%	[ ]
iv) Over 40%	[ ]		Over 40%	[ ]

SECTION D: POLICY INFLUENCE

a) In what ways do you think the Government policy of setting maximum and minimum land holding per individual going to influence availability of land for sugarcane farming?

i) Facilitating ( ) ii) Restricting ( ) iii) No effect ( ) iv) Others ( )

b) How does Sony Sugar Company policy (that requires farmers to use a maximum of two thirds of their agricultural land for sugarcane production leaving one third for food crop) influence sugarcane production?

i) Discourages ( ) ii) Motivates ( ) iii) No effect ( )

c) For SONY SUGAR Company to give farmers sugarcane farming contract, farmers are expected to dedicate at least a half an acre (0.2 ha.). How easy has this been to your farmers over the periods (years) tabulated below

	Very easy	Easy	Difficult	Very difficult
i) Between 1980-1990	[ ]	[ ]	[ ]	[ ]
ii) Between 1991-2000	[ ]	[ ]	[ ]	[ ]
iii) Between 2001-2010	[ ]	[ ]	[ ]	[ ]

Thank you very much for your kind collaboration.

APPENDIX 2

SECONDARY DATA

EXPERIMENTAL GROUP

			Year 2000		Year 2010	
S/N	Plot no.	Sector	Ha	Tonnage	Ha	Tonnage
1	423	1	0.6	71.9	0.2	16.4
2	354	1	0.8	14	0.7	50.1
3	319B	1	0.4	41.7	0.3	43.1
4	694A	1	2	146	1.3	100
5	1071A	1	0.4	40.9	0.3	30.1
6	35	1	0.4	26.6	0.3	34.9
7	160A	1	0.4	67.6	0.2	83.2
8	802C	1	0.8	56.1	0.6	33
9	1045	1	2.1	171.5	0.1	236.6
10	508C	1	1.2	46.4	1	60.1
11	627B	1	0.6	13	0.5	55.8
12	923	1	0.4	20.9	0.3	48.8
13	813D	1	0.3	16.5	0.2	15.4
14	87D	2	1.8	250.7	0.9	86.2
15	51A	2	0.8	71	0.6	87.5
16	49H	2	0.7	45.2	0.4	22.6
17	987C	2	1.1	90.7	0.9	92.3
18	205A	2	0.4	14.7	0.2	17.8
19	454B	2	0.4	42.3	0.3	17.2
20	456	2	2.1	200.2	1.9	235.7
21	802	2	1.1	23.5	1	24.8
22	1145	2	0.6	33.8	0.3	24.1
23	60D	2	0.8	27.1	0.5	28.5
24	37D	2	2.4	297.3	2.2	189.9
25	1029D	3	0.8	38	0.6	64.2
26	1883B	3	0.3	35.1	0.2	10.7
27	648D	3	0.3	33.6	0.2	19.6
28	139C	3	1.1	91.1	0.8	23.3
29	307C	3	0.9	68.2	0.7	37.8
30	124A	3	0.5	15.9	0.4	15.3
31	8J	3	0.2	3.1	0.1	34.1
32	137D	3	2.5	77.7	2.1	229.4
33	150A	3	0.4	7.4	0.3	17.7
34	25	3	0.3	28.1	0.1	9.0
35	490B	3	1.6	105.9	1.47	67.2
36	173B	3	2.8	126.4	1.1	125.3
37	173B	4	2.8	126.4	1.1	125.3
38	119A	5	0.9	78.3	0.6	40.3
39	242	5	0.6	24.1	0.2	74
40	60	5	0.6	27.7	0.3	29.1
41	1364	5	0.7	67.9	0.5	48.8
42	178G	5	0.4	25.1	0.2	16.7
43	918	6	2.4	107.4	0.5	60
44	1333C	6	0.9	86.4	0.8	70.2
45	90A	6	0.9	51.7	0.1	19.7
46	641A	7	1.1	16.6	0.5	22.9
47	499C	7	0.6	29.1	0.5	63.3
48	281A	7	0.8	58.4	0.1	19.7
49	665C	7	0.4	44.5	0.2	26.1

CONTROL GROUP

			Year 2000		Year 2010	
S/R	Plot No.	Sector	Ha	Tonnage	Ha	Tonnage
1	603B	1	4.7	799	4.7	464.5
2	172B	1	0.2	28.7	0.2	29.4
3	607A	1	0.7	13.7	0.7	63.2
4	582	1	0.4	25.5	0.4	39.2
5	1203C	1	0.4	32.9	0.4	33.8
6	857A	1	0.1	16.9	0.1	31.4
7	354A	1	0.4	23.6	0.4	72.8
8	677	1	0.5	10.8	0.5	47.7
9	38B	1	0.5	29.6	0.5	19.7
10	28B	1	0.2	40.8	0.2	4.9
11	147B	2	0.6	84.9	0.6	46.9
12	294	2	0.4	17.6	0.4	17.3
13	105	2	0.5	28.3	0.5	122.3
14	471A	2	0.4	27.6	0.4	2.7
15	532D	2	0.3	14.7	0.3	13.9
16	430D	2	0.4	16.9	0.4	13.5
17	424B	2	1	126.4	1	88.6
18	451A	2	0.2	35.6	0.2	38
19	93A	3	1.2	52.7	1.2	37.8
20	105A	3	0.2	19.2	0.2	11.2
21	130B	3	0.1	7.7	0.1	7.4
22	130D	3	0.3	14.2	0.3	33.8
23	2516C	3	0.3	31.4	0.3	47.2
24	216C	3	0.8	48.9	0.8	68.1
25	44C	3	0.4	50.3	0.4	41.5
26	106E	3	0.4	10.3	0.4	4.4
27	183C	3	0.5	21	0.5	29
28	264F	3	0.4	37.6	0.4	33.2
29	86C	3	0.3	18.7	0.3	19.2
30	1359A	3	0.8	107.8	0.8	53.3
31	1A	4	4.7	635.4	4.7	533.7
32	124	4	6.5	1129.1	6.5	1285.9
33	46A	4	0.8	104.6	0.8	95.6
34	12D	4	5.3	699.4	5.3	860.6
35	39A	5	0.8	44.8	0.8	85.9
36	80B	5	0.3	15.8	0.3	59.8
37	111E	5	0.2	6.7	0.2	20.9
38	423	6	1.1	40.4	1.1	38
39	333	6	0.4	14.6	0.4	34.7
40	602A	7	1	97.8	1	18.4
41	448	7	0.7	25.3	0.7	88.6
42	1554	7	1	95.8	1	20
43	635B	7	0.2	44.5	0.2	54.9

Source: Sony Sugar Company; Out growers AMS records; Years 2000 and 2010