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Analysis of Smallholder Sugarcane Farmers' Livelihood Assets in Relation to Food Security in Mumias Sub- County Kenya

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Abstract
Seventy five percent of the African population live in rural areas, majority being smallholder farmers who depend on agriculture for their livelihoods. In Kenya, over ninety percent of the sugarcane out-growers are smallholders, and rely on sugarcane farming as their main source of livelihoods. However, sugarcane farming though popular has not been able to sustain smallholder farmers' livelihoods and food security. While sustainable livelihoods depend on the access to and control over assets, namely, human, social, physical, natural, and financial capital; livelihood assets define options available to households and constraints on households in pursuit of their livelihood options such as food security. Thus in understanding the livelihoods of smallholder sugarcane farmers', this study analyzed livelihood assets in relation to food security in Mumias sub-County, Kenya. The study was premised on the Sustainable Livelihood Theory and employed Mixed Methods Research Design. A random sample of 261 farmers drawn from a population of 1,907 smallholder sugarcane farmers in Lureko Location, Mumias sub-County, Kenya participated in the survey. To validate emerging issues from survey, 50 smallholder sugarcane farmers purposefully selected, participated in Focus Group Discussions. Analysis of data involved qualitative and quantitative methods based on the study objectives and research questions. The study observed that smallholders' have low asset base, which threaten their options for food security.
Keywords: Smallholders, Sugarcane, Livelihood, Assets, Food Security

1. Introduction

Smallholder farmers are critical to sugarcane production in Kenya, and supply over 92% of the industries mill requirement (KSB, 2014). The growth in sugarcane farming, besides increasing demand for households' asset, resulted into a threat to smallholder farmers' livelihoods and food security (Isabirye, *et al.*, 2013). Smallholder sugarcane farming is a dominant feature in the socio economic lives of households residing in Mumias sub-County, yet food security is an issue of concern (GoK, 2011, Kidula *et al.,* 2011). According to Borton and Shoham (1991) food insecurity occurs in situations where food is available but not accessible because of an erosion in people's entitlement to that food. Risks in sugarcane farming erode smallholder farmers' livelihoods, and their inadequate capacity to manage risks, results in households being trapped in a cycle of food insecurity. However, diversity of assets are known to enable smallholder farmers become more resilient to shocks and raise their incomes for enhanced food security (Scoones, 1999). It is evident that, the more assets people have, the less vulnerable they are, and the greater the erosion of people's assets, the greater their vulnerability (Moser, 1998). This means that access to, control over, and ownership of assets enable people create stable and productive livelihoods (Meinzen-Dick, *et al.,* 2011); and sustainable livelihoods are key determinants of food and nutrition security (Frankenberger & McCaston, 1998). This study therefore analyzed smallholder sugarcane farmers' livelihood assets in relation to food security in Mumias sub-County Kenya.

2.0 Background of the Study

Livelihood assets are the material and social resources on which livelihoods are built, and define the context which influences households, the options available to and constraints on households in pursuit of their livelihoods (Scoones, 1999). In Mumias sub-County, smallholder farmers rely on sugarcane farming as their main source of livelihood (GOK, 2011); despite studies showing that most communities growing cash crops in Kenya struggle to put food on the table (Langat, *et al*. 2011). Frankenberger and McCaston (2001) argue that livelihood secure households are food secure, and households have secure livelihoods when they are able to acquire, protect, develop, utilize, exchange and benefit from assets and resources (Ghanim, 2000). Thus this study seeks to understand the relationship between livelihood assets and food security among smallholder sugarcane farmers in Mumias sub-County, Kenya. According to Deere and Doss (2006) distribution of assets within the household is critical to household and individual well-being, as measured by outcomes such as food security. In addition, a combination of livelihood assets and agricultural technology yields more income, improved food security and improved access to and use of other assets (Manyong, *et al*., 2006). Thus, strengthening livelihoods by reinvesting in assets creates a virtuous circle for further strengthening of livelihoods (Karanja, *et al*., 2010).

3.0 Theoretical Framework

This study is grounded on the sustainable livelihood theory which focuses on the strengths and assets that people own to ensure their livelihoods. These are represented by five key categories of capital that people can draw from to achieve positive livelihood outcomes such as increased income, well-being, and improved food security (DFID, 1999). The Sustainable Livelihood Framework (SLF) is based on the premise that the resource and asset base of people is fundamental to understanding the options open to them, the strategies they adopt to attain livelihoods, and the outcomes they aspire to (Ellis, 2000). It argues that the poor have assets and choices, and development is not just about increasing income but about broadening livelihood related choices (Morse, *et al.*, 2009). It is a practical tool that outlines a holistic approach to the design and monitoring of food security and livelihood interventions. This study therefore used the Sustainable Livelihood Theory in analyzing assets available to smallholder sugarcane farmers highlighting the interconnections among the assets, and relating them to livelihood outcomes, specifically food security in Mumias sub- County, Kenya.

4.0 Literature review

Smallholder farmers' are a critical mass in sugarcane production (Isabirye, *et al.*, 2013), but are challenged with limited agricultural resources (Food and agriculture Organization (FAO), 2006, Monroy, *et al*., 2012). Tegemeo Institute (2010) for example, indicate that 95% of smallholders work on less than four hectares of land. Despite the Sugar Industry in Kenya relying on smallholder farmers to supply 92% of raw material required for milling (KSB, 2014), sugarcane farming has not been able to sustain livelihoods and food security of smallholder farming households who depend on it for a living (Waswa *et al*., 2012). Being a highly profitable enterprise, sugarcane plantations often displace other farming systems once introduced, marking the shift from agriculture as a way of obtaining food to a process for accumulating capital (Isabirye, *et al,* 2013). But smallholder farmers are disadvantaged since they have little capital to invest (De Janvry & Sadoulet, 2005).

Assets available to the household represent the basic platform upon which the household livelihood may be built (Morse, *et al.*, 2009); and access to more assets such as land enable greater adoption of technology, leading to more income and food security (Manyong, *et al*., 2006). In Mumias sub-County, women are more involved in actual farming activities (Kidula, *et al.*, 2011; Waswa*, et al.*, 2009). Thus instances of under nutrition among women farmers affects their ability to work, prepare food and care for children, hence exposing households to a cycle of food insecurity (Black, *et al.*, 2008). Specific investments in human and social capital besides business and sectoral organization are therefore needed to enable new ways of organizing people and markets to work for the poor (Poole & de Frece, 2010). This study therefore examined the livelihood assets of smallholder sugarcane farmers and its effect on food security in Mumias sub-County, Kenya. This in turn will enable identification of appropriate entry points for support of livelihoods in broadening their livelihood options.

5.0 Methodology

This study used Mixed Methods Research Design in collecting information from a sample of smallholder sugarcane farmers in Mumias sub-County, Kenya. Use of sequential explanatory strategy, a strategy of mixed methods research design involved collection and analysis of quantitative data followed by collection and analysis of qualitative data. Qualitative results were used to assist in explaining and interpreting the findings of the quantitative study. Lureko location of Mumias sub-County was purposefully selected for this study based on prior information that it had individuals with characteristics relevant to the research questions. That is, majority of farmers have average land holding of 0.45ha/household and approximately 98% are contracted by Mumias Sugar Company for sugarcane production. Household questionnaires were used to collect data from a sample of 261 smallholders randomly selected to participate in the survey, from a target population of 1,907 smallholder sugarcane farmers. Sample size was determined based on the analytical plan that involved both quantitative and qualitative analysis methods. Additionally, there was minimal variability in the issue of interest among the target population.

Further to this, Key informant interviews (KII) and Focus group Discussions (FGDs) were used in collecting data from a purposively selected sample of 50 smallholders. To collect data during FGDs the asset pentagon based on five sets of assets (social, human, financial, natural and physical) required for livelihoods was used. This helped to collect and present information about people's assets visually, thereby bringing to life important inter-relationships between the various assets. The asset pentagon measured asset base on a range of 1-4 represented as presented in Figure 1. The information collected, a narrative with thick, rich description was classified by counter checking process, comparing, contrasting and corroborating information from the survey, KII, and FGDs based on the theoretical framework outline, research questions and objectives. This was categorized and synthesized as per emerging themes. Data entry involved coding to put meaning to the data, and was summarized by enumeration and searching for relationships in the data. Independent sample t-test for the equality of means was used in determining the difference in means of male and female samples for household characteristics and livelihood assets. Pearson's Product moment correlation coefficient was used in determining

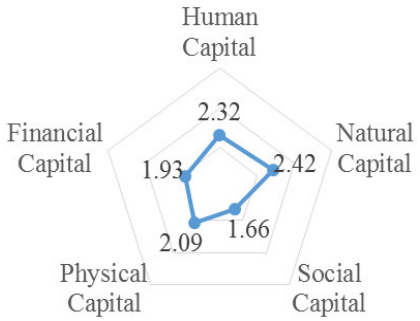
the relationships between livelihood assets and food security of smallholder sugarcane farmers.

6.0 Discussion

This session discusses the data analyzed under the following themes: smallholder sugarcane farmers' livelihood assets and Relationship between smallholder sugarcane farmers' livelihood assets and food security.

6.1 Smallholder Sugarcane Farmers' Livelihood Assets

Analysis of smallholder sugarcane farmers' livelihood assets was done using the asset pentagon and frequency tables. The asset pentagon based on five sets of assets (social, human, financial, natural and physical) required for livelihoods was used in mapping and analysis of smallholder farmers' livelihood assets. Smallholder farmers' asset base was measured on a range of 1 – 4. Figure 1 shows a general low asset base among smallholder sugarcane farmers in Lureko. This agrees with De Janvry and Sadoulet (2005) that smallholder farmers are disadvantaged since they have little capital to invest, and depend on family labor with subsequent low asset base. Monroy, *et al.* (2012) adds that smallholder farmers have inadequate technical capacity and limited capital and infrastructure.



Key:

0.5- 1.49	Inadequate Assets	2.5- 3.49	Average Asset Base
1.5- 2.49	Low Asset Base	3.5- 4.49	High Asset Base

Figure 1: Household Livelihood mapping of Lureko Smallholder Sugarcane Farmers

Descriptive statistics of household survey data was examined using frequency tables and presented in Table 1:

Table 1: Analysis individual of Livelihood assets

Percent Asset base	Inadequate (0.5 - 1.49) (%)	Low (1.5 - 2.49) (%)	Average (2.5 - 3.49) (%)	High (3.5 - 4.49) (%)
Human	0.8	69.3	28.8	1.1
Social	18	72.8	8.1	1.1
Physical	0.8	82.3	16.5	0.4
Financial	3.4	87.8	8.8	0
Natural	0.4	57.1	42.1	0.4

Table 1 shows that 69.3 percent of the study participants had low human capital. Human capital measured by power to labor, health, nutrition, skills and knowledge of the smallholder sugarcane farmers influenced food security. A similar observation was made by Maponya (2008) that the level of education, health status of family members and skills enable them to pursue different livelihood strategies and achieve food security. Educated mothers, are better informed about caring for children, and are more likely to allocate scarce household resources to nutrition and healthcare, hence influencing children's nutrition (United Nations Development Program (UNDP), 2012). Strengthening human capital may therefore offer opportunities to promote food and nutrition security.

Smallholder sugarcane farmers' social capital measured by group membership and relations of trust, is inadequate to low, influencing their bargaining position and participation in decision making. This agrees with Abenakyo *et al.* (2008) that households with high and medium social capital develop enhanced problem solving and bargaining skills, do research and empower more individuals to participate in decision making. Building social capital such as networks, membership in groups, social relations and access to wider institutions in society, may be a powerful way to improve smallholder sugarcane farmers' livelihoods and broaden opportunities for food security

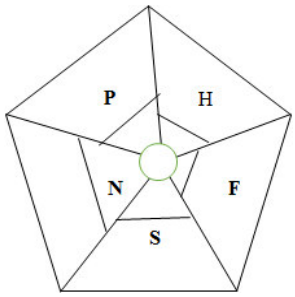
Low physical capital was observed among 82.3 percent of the study subjects. Physical capital measured by access to shelter, transport services, farm equipment and livestock was reported as limiting opportunities for food security. This agrees with Tegemeo Institute (2010) that households with greater access to roads,

communication and other forms of infrastructure have a broader range of economic opportunities compared to those with less access, hence increased range of activities for food security. In addition livelihoods of smallholder farming households is constrained by inadequate infrastructure, weak institutions, and restricted access to markets (World Bank, 2008). It therefore implies that investment in basic infrastructure and market organization may have a positive implication on community development and food security.

Smallholder sugarcane farmers' financial capital measured by access to regular income, credit and savings was observed to be inadequate to low. Further investigations in FGDs revealed that, smallholder farmers' access to financial capital such as credit is constrained by challenges facing the sugar industry. This results to low agricultural productivity and subsequently financial uncertainties among smallholders. A similar observation was made by Farm Africa (2010) that appropriate financial, technical and social support enable smallholder farmers to increase their production and incomes in sustainable ways, and increase their economic viability. Developing strategies to enhance smallholder sugarcane farmers' financial capabilities are likely to increase resilience to unexpected shocks, promote access to other livelihood assets and improve opportunities for food and nutrition security.

The community is endowed with diverse natural capital. While the study subjects had limited access to other assets, 42.1 percent recorded average access natural capital, measured by availability of land, water, and wildlife from the natural forests. Natural forests within the study area were observed to play an important role as a source of energy for food preparation and generating additional income to buy extra food. Forests enabled households to access wild foods such as rabbits for domestic consumption and market. A similar observation was made by Maponya (2008) that biodiversity can provide the basis for natural product development, ecotourism and other activities which are important for income generation in local economies. Enhancing access to and use of natural capital, is likely to create positive implications on the economy and food security status of the society.

The findings of the baseline survey were confirmed by FGDs. Figure 2 illustrates mapping of the community's livelihood assets during FGDs.



Key:

P- Physical Assets
H- Human Assets
F- Financial Assets
S- Social Assets
N- Natural Assets

Figure 2: A sample livelihood map of smallholder sugarcane farmers

The FGDs revealed that a larger proportion of land in the study area is contracted for sugarcane farming. Thus the prevailing sugar industry challenges drive smallholders to depend on minimal portions of land to earn a living. Majority having inadequate access to resources, overuse natural resources or expand agricultural land by removing buffer zone vegetation and modifying natural habitat, hence negatively impact on food security. Similar findings were made by Manyong, *et al*. (2006) that access to more assets such as land enable greater adoption of technology, leading to more income and food security. Fairtrade (2013) further points out that smallholder farmers typically eke out a precarious existence on small plots of land, sometimes in remote areas, faced with rising costs for essentials like fertilizer and fuel, little access to credit to invest in their businesses, and increasingly erratic weather conditions. This means that improving access to, control and use land by smallholders will enable greater adoption of technology, leading to more income and food security

Independent sample *t*-test was used in comparing the sample means of male and female farmers in relation to their access to livelihood assets and presented in Table 2.

Table 2: Independent Sample *t*- test for Equality of Means for Individual Assets

		Levene's Test for Equality of Variances		T-test for equality of means		
		F	Sig.	t	df	Sig. (2-tailed)
Wildlife as resource available to households	Equal variances assumed	.961	.328	3.275	259	.001
	Equal variances not assumed			3.395	178.865	.001
Household participate in relationship of trusts	Equal variances assumed	.216	.643	-2.672	259	.008
	Equal variances not assumed			-2.630	156.731	.009
Households access to regular income	Equal variances assumed	1.44	.231	2.515	259	.013
	Equal variances not assumed			2.680	192.346	.008

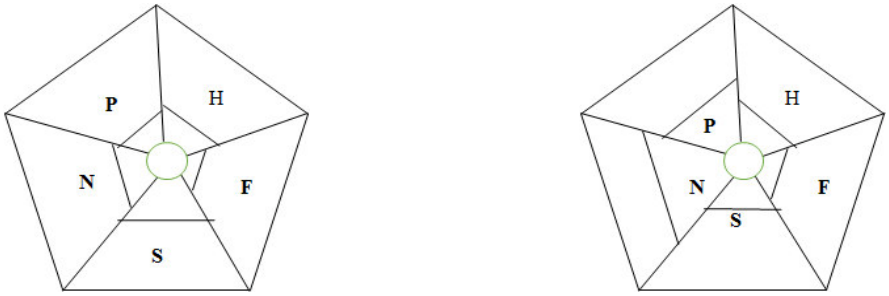
From Table 2, the t-test for equality of means for various measurements of livelihood assets showed a significant difference between male and females in relation to access to wildlife (t = 3.275, p = 0.001, two tailed), access to regular income (t = 2.515, p = 0.013, two tailed) and participating in relationships of trust (t = 2.672, p = 0.008, two tailed). The study did not give sufficient evidence to show significant difference in means in terms of access to skilled labor, good health/nutritional status, skills/knowledge, land, water, forest, group membership, shelter, transport, farm machinery, livestock, savings, access to credit, and insurance. This could be attributed to sampling method.

In analysis of capitals, an independent sample t- test for equality of means did not give sufficient evidence to show difference between male and female farmers in relation to social, physical and human capitals. However, Table 3 shows that there exists a significant difference between means of male and female farmers in relation to access to natural capital (t = 2.465, p= 0.014, two tailed) and financial capital (t = 2.563, p = 0.011, two tailed). This agrees with World Bank (2009) that women have limited savings to cushion them against external shocks.

Table 3: *t*-test for Equality of Means for Various Measurements of Livelihood Assets

		Levene's test of equality	T-test for equality of means	
		F	t	Sig. (2-tailed)
Human Capital	Equal variances assumed	1.142	.946	.345
	Equal variances not assumed		.969	.334
Natural Capital	Equal variances assumed	3.391	2.465	.014
	Equal variances not assumed		2.592	.010
Social Capital	Equal variances assumed	.580	-1.584	.114
	Equal variances not assumed		-1.571	.118
Physical Capital	Equal variances assumed	.181	1.423	.156
	Equal variances not assumed		1.394	.165
Financial Capital	Equal variances assumed	.002	2.563	.011
	Equal variances not assumed		2.621	.010

The community livelihood mapping reconstructed in Figure 3 confirmed the findings of the *t*-test. It illustrates that male farmers are more accessible to natural capital (wildlife, forest, land and water) compared to female farmers.



Key:

P- Physical Assets
H- Human Assets
F- Financial Assets
S- Social Assets
N- Natural Assets

Figure 3: Group Livelihood Mapping for Female and Male Farmers respectively

Further investigations during FGDs confirmed that male farmers have more access to regular income and wildlife compared to female farmers. This was attributed to the fact that men are more involved in other

non-farm activities such as hunting, which besides the higher regular income gives male farmers more opportunities to access financial capital than female farmers. A similar observation was made by IFAD (2013) that, farming livelihoods are based on the availability of natural resources and access to land whether through private ownership or recognized rights is critical for a secure agricultural-based livelihood. Inadequate access to land by female farmers in many cases, prevents access to other resources such as credit, thus limiting female farmers from making investments to improve productivity and sustain their food security (Farm Africa, 2010). It is therefore expected that building smallholder sugarcane farmers' livelihood assets will empower both male and female farmers to exploit opportunities for food security.

Table 4 shows that agriculture is the main source of livelihood in the study area, with sugarcane being the predominant crop grown. This agrees with GOK (2011) that the population in the region relies on sugarcane farming as their main source of livelihood.

Table 4: Smallholder Sugarcane Farmers' Livelihood Assets

Income Sources	Frequency	Percent (%)
Agricultural	110	42.1
Off-farm	3	1.1
Both	148	56.7
Total	261	100.0

Out of the sampled population 42.1 percent rely entirely on agriculture as the sole source of livelihood; while 56.7 percent of the population integrate farming and other related non-farm activities. A similar observation was made by African Union (AU) (2009) that approximately 60% of the population in Africa derives its livelihood and income mainly from farming, livestock production, and related activities. This means that building livelihood assets, smallholder sugarcane farmers may foster new strategies to broaden opportunities for food security.

6.2 Smallholder Farmers' Perception on Livelihood Assets and Food Security

The study employed descriptive statistics using frequencies to analyze the relationship between livelihood assets and food security as perceived by the farmers. Perception is important since smallholders' behavior are based on the perception of what reality is. Out of the sampled population, 99 percent agreed that access to livelihood assets promotes food security. This is in line with Frankenberger and McCaston (1998) that sustainable livelihoods are key determinants of food and nutrition security. Focusing on individual assets, Table 5 shows that 99.6 percent of the study subjects were in agreement that access to land promotes food security. A similar observation was made by Globopolis (2013) that smallholder farmers' access to land and necessary natural resources is fundamental for the production of food. This means that in promoting food security, it is critical to consider smallholder farmers' access to land.

Table 5: Analysis of Smallholders' Perception on how Assets Influence Food Security

Assets' influence on Food Security	**SA**	**A**	**U**	**D**	**SD**
Land	83.5	16.1	0.4	-	-
Labour	96.2	3.8	-	-	-
Agricultural implements/tools	96.2	2.7	1.1	-	-
Employment opportunities/ income	95.4	3.4	1.1	-	-
Credit facilities/loan	88.1	9.2	1.1	1.5	-
Shelter/ housing	64.8	21.8	4.6	6.9	1.9
Infrastructure (roads, transport etc)	86.2	8.4	1.9	3.4	-
Livestock / cereal stocks	98.1	1.9	-	-	-
Knowledge	95.4	4.6	-	-	-
Extended family/ social support	82.4	15.3	0.8	1.5	-

Table 5 shows that all study subjects observed that access to labor, knowledge, livestock and cereal stocks promote food security. Additionally, majority of the study subjects perceived that agricultural implements, employment/income opportunities, stocks and knowledge are key in promoting food security. The study provided evidence that food security opportunities are also influenced by access to credit facilities, access to shelter/housing facilities, social support and infrastructure. Ninety nine percent of sampled population observed that farmers with adequate resources are more food secure in comparison to those with less resources. This agrees with Meinzen-Dick, *et al.* (2011) that increasing control over assets enables more permanent ways out of poverty compared to measures that aim to increase income and consumption alone. This implies that, enhancing smallholder sugarcane farmers' access to assets is critical to promoting food security.

Pearson's product moment correlation coefficient was further used to measure the correlation between livelihood assets and food security. Table 6 shows that there is a strong positive correlation between livelihood assets and food security.

Table 6: Correlation between Livelihood assets and Food Security

		Measure of food security	Livelihood Assets
Measure of food security	Pearson Correlation	1	.583**
	Sig. (2-tailed)		.000
	N	261	261
Livelihood Assets	Pearson Correlation	.583**	1
	Sig. (2-tailed)	.000	
	N	261	261

**. Correlation is significant at the 0.01 level (2-tailed)

Table 6 provides the correlation of 0.583 between livelihood asset and food security and the significance of the coefficient which is 0.000. This indicates that the coefficient is significant at 0.05 level, confirming that there is sufficient evidence to show a relationship between livelihood assets and food security. A similar observation was made by Manyong, *et al.* (2006) that assets have direct and indirect impact on livelihood outcomes such as income and food security. Strengthening livelihood assets of smallholder sugarcane farmers is therefore critical to broadening opportunities for food security in Mumias sub-County, Kenya.

7.0 Conclusion

Smallholder sugarcane farmers in Mumias sub-County rely on sugarcane farming as their main source of livelihood; and their livelihoods are defined by low capabilities and high levels of food insecurity. This study showed a strong positive correlation between livelihood assets and food security among smallholder sugarcane farmers in the sub-County. Livelihood assets are known to define the options available to households and constraints on households in pursuit of their livelihood options such as food security. This implies that strengthening smallholders' access to social, physical, financial, natural and human assets may expand their livelihood options and use of available assets in promoting sugarcane production and food security. It is therefore critical that policy makers and policy implementing organs consider and support policies that promote access to, control over and use of livelihood assets in promoting food security within the sugarcane growing zone. There is also need for further studies to identify the underlying causes for smallholder sugarcane farmers' low asset base so as to develop practical strategies for improving livelihood approaches and interventions that broaden food security options in Mumias sub-County, Kenya.

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