



SPATIAL LAND USE MANAGEMENT STRATEGY ON SUSTAINABLE LIVELIHOOD IN VIHIGA COUNTY, KENYA

EKABTEN BONFACE ERUTE

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Sustainable Livelihood in Vihiga County,
Kenya**

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Exceller Open



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DEDICATION

To my mother Anne Nakeremwa Adhiambo whose love and care continue to sustain me

&

My children, Brent Emmanuel and Eluid Bishop

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ABSTRACT

In many developing countries, the land is a resource that has remained a major asset on which people's livelihoods have been determined. In Kenya, for instance, over 80% of its socio-economic development is derived from land. However, this great role played by the land as illustrated from various studies may not be realistic with the continued application of unsustainable land use management strategies. The scenario is even worsened by various internal and external forces currently being experienced globally. This therefore, calls for re-engineering of the strategy to redeem the role played by land in sustaining livelihoods. The study examined the effect of spatial land use management strategy on sustainable livelihoods in Kenya with emphasis on households in Vihiga County. The specific objectives were to assess the current spatial land use in Vihiga County, examine the determinants of spatial land use strategy, evaluate the influence of spatial land use strategy on people's livelihoods and analyze the challenges attributed to the use of the strategy. The study was based on Bid-Rent Function Theory as propagated by Alonso. The study adopted an analytical research design and mixed methods approach. The researcher drew philosophical inspiration from the pragmatic worldview that is a problem entered and more focused on real world issues. The target population was 110,000 mainly comprising households and Heads of Departments at the County. Multi-stage and systematic random sampling techniques and Glenn's statistical tables were used to determine a sample size of 385 respondents in respective sub-counties and wards. Instruments for data collection were; questionnaires, interview schedules, focused group discussions, Desktop Review, satellite imagery and observation. Data was analyzed both descriptively (mean, mode, median and variance) and inferentially (Chi-square and Pearson's Product Moment correlation coefficient). Qualitative content was achieved through thematic analysis. At significance level of 0.05 the hypothesis was rejected implying that other factors which affect livelihoods cannot be neglected. Although from the study findings, geo-physical, social, economic and political dimensions were identified as major determinants of spatial land use management in Vihiga County, agriculture and commerce were more prevalent land uses. Land has emerged as a key resource in which people's socio-economic livelihoods are determined. Local accountability on resource use and management is critical in reducing vulnerability through restraining external stress, minimizing shocks and providing safety nets in order to limit the severity of poverty. Although association of local accountability on resource use was found to be weak, this can only be achieved if the capabilities households are enhanced and there is equity. Since variables used in planning complement each other; they should be presented as a coherent package. While numerous challenges were cited in the area of study that were either from internal or external sources, strengthening the linkages between existing policies and the anthropogenic activities has the potential to generate both benefits and dis-benefits which may be captured by the twin concept of pump and tunnel effects to circumvent the application of the strategy for attainment of the desired spatial balance for sustainable livelihoods.

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OPERATIONALIZATION OF TERMS

Land use patterns - Ways in which various livelihood activities are practiced

Land tenure - A way of regulating rights, access and control of land for the mutual benefit of the land user and the government

Land management - The way a given land use is administered by humans

Spatial land use - Usage of space by people for settlements and development activities

Spatial planning- The methods used by the public sector to influence the distribution of people and activities in spaces of various scales

Livelihood system - A dynamic relation that integrates both opportunities and assets available to a group of people for achieving their goals and aspirations

Sustainable livelihoods- It is a systematic approach that links issues of poverty reduction, sustainability and empowerment processes

Land policy- A legal framework that defines the use of land in order to regulate the competing users

Land-use Policy - An expression of the government's perception of the direction to be taken on major issues related to land use and the proposed allocation of the national land resources over a fixed period of time

Freehold - Land registered by any person with unlimited right to use and disposal

Community land- Land lawfully registered/ held, managed or used by specific community on the basis of ethnicity, culture or similar community interest as community forests, grazing areas, shrines or water catchments

Public land - Land lawfully held/occupied by any state organ, conservancies, water bodies and any land not classified as private or community land under the constitution.

Natural resources - Physical non-human factors and components, whether renewable and non-renewable including rocks, minerals, and fossil fuels and other sources of energy

Surplus - A profit or 'residual' accruing to land; resulting from some advantage

Rent Gradient - A representation of the decline in rent with distance from market (center)

Intensive Agriculture - A system of farming characterized by relatively high levels of factor inputs (capital [including fertilizer] and/or labor] per unit of land

Bid Price - Prices that the household (firm) would be willing to pay at varying locations in order to achieve a given profit

Central Place - A settlement which provides one or more services for the population living around it

Hierarchy - A systematic arrangement of the classes of an object

Informal determinants - Private sector organizations that recognize land as capital asset

Formal determinants - A legal institutions that regulate the usage of land

LIST OF ABBREVIATIONS AND ACRONYMS

ABM- Agent-Based Model
ASAL- Arid and Semi-Arid Land
CoK- Constitution of Kenya
CPT- Central Place Theory
CIDP- County Integrated Development Plan
Df- Degrees of freedom
ESP- Economic Stimulus Programmes
FAO- Food and Agricultural Organization
GIS- Geo-Spatial Information Systems
IUNC- International Unit for Conservation of Nature
ISUDP- Integrated Strategic Regional and Urban Development Plan
ITCZ- Inter-Tropical Convergence Zone
KNSB- Kenya National Bureau of Statistics
KNEAP- Kenya National Environment Action Plan
LUCIS- Land Use Conflict Identification Strategy
MCA- Multi-Criteria Analysis
NEMA -National Environment Management Authority
NLC- National Land Commission
NLP- National Land Policy
QUAN- Quantitative
QUAL- Qualitative
RC- Response code
SDG- Sustainable Development Goals
SLUM-Spatial Land Use Management
UN-United Nations
UNCED-United Nations Conference on Environment and Development
WARMA- Water Resource Management Authority
WCED- World Commission on Environment and Development

CHAPTER 1: INTRODUCTION

1.1. Overview

This chapter presents the framework from which the study was based. It seeks to bring to the core the concept of development and how nations worldwide have been muddling through the traditional methods in search of appropriate strategy for sustainable livelihoods. Other key issues discussed in this chapter include: background of the study, statement of the problem, study objectives, research questions, research hypotheses, justification, limitations and significance of the study.

1.2. Background of the Study

In many developing countries today, a vast majority of households depend on the land and other natural resources for satisfying their immediate needs and achieving their long-term livelihood ambitions. Land has continued to hold a central position in human existence and development. Land is directly a requirement for life as emphasized on sustainable development goal 15 (UN, 2016). Also under or above, land are numerous resources that man can access to meet his day to day needs. Since time immemorial, humans have used land and its resources to meet their material, socio-cultural and spiritual needs. For instance, land has been used for the provision of food, clothing and shelter; for producing a large variety of goods and services; for moving around and transporting goods; for mining of precious metals; for recreation and leisure; for attaining social status and prestige; for spiritual satisfaction; and for claiming territorial sovereignty (Briassoulis, 2000). The spatial arrangements of these activities clearly demonstrate how human beings try to satisfy their daily needs using the resource of land.

In this process of meeting their needs, they have modified and still continue to modify land in various ways and intensities. Land use patterns are the most clearly visible result of human interaction with biophysical environment. These land use types include residential, commercial, industrial and agricultural uses (Koomen, 2007). Natural forests and grasslands are converted into agricultural and grazing areas for crop and livestock production, to urban and industrial land, and to infrastructure (roads, dams, etc). Wetlands are drained and converted into agricultural, residential, recreational and industrial uses. Land is mined to obtain ores, minerals, and stones. Cropland undergoes intensification, marginalization, abandonment, or conversion to urban and recreational (tourist) uses. Abandoned land may be reforested or it may be degraded further.

The fundamental controversies in different personal attitudes towards land use are of significant importance and they lie at the root of many issues and conflicts in the use of land (Mather, 1986:2). The potential of land to meet individual household needs and generate income at the national level to keep the National economies growing faces many challenges such as population growth, declining availability of land, degradation of land resources and changes in international land markets. Settlements are experiencing urbanization, sub-urbanization, or de-urbanization. Residential areas can be converted into commercial areas and vice versa, high-income neighborhoods may also turn into slums, and so on.

Introduction

These human induced activities have caused diverse and mostly adverse impacts on both society and the environment (Meyer, 1990). Several ancient writers have also documented the destruction of natural areas as a result of overgrazing, fire, and other human activities. Marsh (1965) has described how people used and modified land to serve various purposes and in the process altering, the environment in order to survive.

Because of the significant role played by land in supporting livelihoods, various strategies have been evolved so that we do not only utilize it, but also manage it in a magnificent way. For instance, after the 1960s and 1970s, numerous studies documented the detrimental impacts of human activities that began to cause worldwide concern and action. In 1987, the Brundtland report introduced the notion of sustainable development in the political arena; the quest for sustainable use of land resources became an important policy and planning goal. This was later translated into a search for a policy and planning approach to direct land use towards sustainable pathways.

The recognition of this importance in the context of global environmental change and sustainable development is perhaps best reflected in the launch, in 1993, of the Land-Use and Land-Cover Change (LUCC) Core Project/Research Program, under the authority of the International Geosphere-Biosphere Program and the International Human Dimensions Program (Meyer & Turner, 1994). While most of these strategies are applicable to different forms of land use management, many scholars have had various perspectives to extend to which they have been able to achieve the desired results. This, in fact, is a clear illustration of how earlier strategies, which were applied on land management, did not yield the desired results with regard to land use.

UNEP (2002) classifies 61% of the population in Sub-Sahara Africa as agriculturalists whose major occupation is the cultivation of crops or livestock rearing. The increase in cultivation has reduced biodiversity and vegetation cover and has fragmented habitats to such an extent that some of Sub-Saharan Africa's resources are lost and land has been sub-divided to very uneconomical sizes (Nathan 1989, Lambin 2003). The per capita available land at the world level has reduced from 0.39 ha in 1961 to 0.27 ha in the 1990s, while the land/man ratio in Africa has decreased from 0.62 ha in 1965 to merely 0.26 ha in 1995. In countries like Rwanda and Malawi, this figure has even dropped to barely 0.15 ha. Reduction in vegetation cover has reduced the potential of land to absorb carbon dioxide from the atmosphere resulting to its high concentration and also high soil erosion rates that are now common description of environmental change. All these adverse effects are attributed to the influence of human activities on land (Verheye, 1997).

In Kenya, for example, agriculture remains the backbone of the economy. It is the single most important sector contributing approximately 25% of the country's GDP. Over 80% of the Kenyan population derives their livelihoods, directly or indirectly from agriculture. Given its importance, the performance of the sector is also important for poverty reduction since most of the vulnerable groups like pastoralists, landless, and subsistence farmers, also depend on agriculture as their main source of livelihood (Republic of Kenya, 2005).

The land question, as land tenure and land use, cannot be handled only as an issue of agricultural development, but, in fact, the land question is in the center of social and political organization since land involves the development of a whole society and its processes. In traditional societies, the concept of land extends beyond the production purpose but holds also important social and spiritual values. Quite often, land is the only available resource on which rural families can rely to build their lives. Thus, access to land is usually regulated through belonging to a social

group like a clan, tribe or community which is in contrast with the western mechanisms of land markets. Although informal markets are a reality in rural Africa, its perception is different from western context, since African land does not only belong to the present users, but also to the unborn and the ancestors. (Kanyinga, 1998)

In Kenya, for example, land means different things to different people and groups of people; to farmers and pastoralists, land is a resource and a key element of living, while to elite, land is a marketable commodity and access to profits (Mwagore, 2002). As a nation, politicians and administration view land as a sovereign entity whose boundaries reflect a social, cultural and political identity. This has resulted in an unavoidable competition between different interests and attitudes towards land.

The current realities such as population growth, urban development and agricultural expansion, threaten to ruin the intricate balance that exists between different land use types in Kenya. This intensive pressure on land and its impact on farm production and the environment preoccupies almost every government, both in developed and developing countries. The effects of these changes on their physical surroundings cannot be ignored (Lambin,2001) and must be examined since changes in land use impact soil, biotic diversity, water and the atmosphere (Sal 2000; Lambin *et al.*2001). This, in turn, directly relates it to environmental issues of global relevance, which affect the ability of biological systems to support human needs (Vitousek, 1997, Schneider & Pontius Jr, 2001, Koomen *etal.*2007). As a result, it has created imbalances and unsustainable use of land to support livelihoods. The destruction of Mau forest complex, for example, has had adverse effects on the general environment which, in turn, directly affect people's lives.

Although land policy defines the use of land in order to regulate the competing users, West (1986) divides land policy into three dimensions; environmental, spatial and land tenure. Virtanen (1995) further explains that, land policy means the operations of public authority in tenure questions and promoting, especially the legal intentions of land use policy. In Kenya, because of the sensitivity of land matters, land use and management is entrenched in the Constitution under Article 260. Also, to emphasize the importance of land in economic development, the linkages with other sectors have been highlighted in Kenya Vision 2030.

The institutionalization of the National Land Policy (NLP) in 2009 proposed establishment of an efficient and equitable institutional framework for land ownership, administration and management. Indeed, the policy states that; the government shall establish a National Land Commission (NLC) to carry out land administration and manage efficiently, equitably and sustainably. To this end, the following land laws have been enacted: the National Land Commission Act, 2012, the Land Act, 2012 and the Land Registration Act, 2012. Also the Environment and Land Court Act, 2011 and the Urban Areas and Cities Act, 2011 are laws at National and County Government level to guide on land use management with the key objective of achieving sustainable livelihoods of the people in Kenya. While Kenya has embraced the use of some of these laws by domesticating some of the international treaties, not all the strategies that arise thereof are applicable to the Kenyan situation. In this respect, the operationalization of SLUMS will be crucial in ensuring that this noble role played by land as a resource is not only realized but also sustained over a long period of time.

1.3. Statement of the Problem

Land, a key factor of production, has emerged as a resource that man cannot do without both in the developed and developing countries. This is clearly demonstrated by the numerous activities that are either taking place on, under or over-land to sustain livelihoods. In third world countries, for instance, various dimensions of development in the form of economic, social and political seem to thrive well on land.

The appropriate usage of land, however, is a function of various strategies applied, in that it has diminished the potential of the large part of the population to meet their basic needs making the issue of development elusive, increased incidences of poverty and sky-rocketing of unemployment. The continued destruction of natural habitats like forests and wetlands for the cultivation of crops and settlements and over-cultivation of arable land has led to land degradation. This is further compounded by ever increasing population that is exerting a lot of pressure on land thus affecting its carrying capacity, the global climate change effects (acid rain and drought), and land-use conflicts like development interventions versus conservation. Even the traditional approaches like shifting cultivation are no longer applicable because of the diminishing land sizes.

Arising from the above, micro-economic strategies adopted by advanced and many other developing countries for land use management are still faced with challenges since they remained externally imposed, they were tailored to address a specific problem at that point in time and were biased models (socio-economic and or sector specific). Indeed, even the policies that have been applied to transform land use have not, in any way, helped salvage the situation as evidenced in the current land degradation and loss of arable land. But it's also important to appreciate the inequalities of these regions and the underlying opportunities therein in terms of development that need to be sustainably exploited in order to improve the livelihoods within and between communities. However, the big question today is not how big the size of land is but what matters is its organization so that we can realize a balanced development. Thus, the adaptability of various land uses has been a shortcoming in achieving sustainability.

Some theorists like Alonso and others on their studies on the land-use have argued that land is elastic, however, today; it's not the presence of land that determines its ability to support livelihoods but rather its quality and the type of activities on it. What's needed is to critically examine the relationship between the use of land and the output that may be derived from its use, that is, the sustainable component. The ability of land to continue meeting the needs of households might not be sustained if appropriate land use management strategy is not formulated or integrated and adopted to halt and reverse land degradation, loss of biodiversity, drought and desertification, and loss of arable land. This study, therefore, examined the effect of spatial land use management strategy on sustainable livelihood in Kenya with emphasis on households in Vihiga County.

1.4. Study Objectives

The main objective of the study was to examine the effect of Spatial Land Use Management Strategy on Sustainable Livelihood in Vihiga County, Kenya.

1.4.1. Specific Objectives

- To assess the current Spatial Land Use activities on sustainable livelihood
- To examine the determinants of Spatial Land Use Strategy in Vihiga County

Spatial Land Use Management Strategy on Sustainable Livelihood in Vihiga County, Kenya

- To evaluate the influence of Spatial Land Use Strategy on sustainable livelihood
- To analyze the effects of the challenges attributed to various land use activities on sustainable livelihood.

1.5. Hypothesis

- Ho₁: There is no significant effect of land use determinants on sustainable livelihoods
- Ho₂: There is no significant statistical influence of spatial land use strategy on sustainable livelihoods.

1.6. Justification of the Study

Although the land may be viewed as elastic, today, however, it's not the presence of land that determines its ability to support livelihoods but rather its quality and the type of activities on it. Currently, many scholars are working towards areas that influence how land is managed (strategies).

The pressure exerted on land as a result of the effects of climate change across the world has been acknowledged as a key threat to attaining sustainable development. This therefore, has called for the need to adopt environmentally sustainable methods that preserve and enhance soil and ground-water through the adoption of best farming practices (smart agriculture) and heeding early warning systems to facilitate adaptation to climate variability and change.

While population increase as evidenced from population census may be a blessing, the effects on land use remain disastrous because land sizes have remained the same and yet they are a primary requirement for survival which every person depends upon for day to day needs.

Development is a social process since it is a creator and organizer of space. Spatial forms reflect a social process and enable people to perceive more emphatically how efficient a particular development approach would work. However, as efforts are made to meet this noble objective, sustainable use of land has been put in danger both from internal and external forces.

Traditional strategies that were employed to mitigate land degradation like shifting cultivation are no longer applicable because of population explosion and other factors have called for a paradigm shift in matters related to land use management. An appropriate strategy that is not biased towards the socio-economic perspective of development but rather a holistic and sustainable development is more preferred as demonstrated in this study.

The concept of sustainability is central to spatial planning as it incorporates long-term objectives for the Counties as well as the integration of social, political and environmental with economic considerations. This study has demonstrated how various determinants of SLUMS influence people's sustainable livelihoods in Vihiga County. (Improved income, diversification, reduced degradation and balanced growth)

It can, thus, be concluded that, in the process of making land a source of livelihood has put everything viable and not viable at competition thus leading to mismanagement, deforestation, landslides, pollution and ultimately underproduction. Arising from above, the researcher found it ultimately necessary to undertake this study in order to contribute ideas and share experiences from other scholars in the field of development to save mankind from disastrous effects that are attributed to unsustainable usage of land.

1.7. Limitations of the Study

The study was limited to households in the twenty-five (25) wards in Vihiga County. It was confined within spatial land use, land use management and how this impacted on people's livelihoods.

A majority of the respondents' educational background was low and this created some difficulties in administering the questionnaire. To mitigate on this, the research assistants were recruited from within the county of Vihiga and the wording of the questionnaire was simple but objective. Also, some respondents were skeptical about the items in the questionnaire even though orientations had been made. The vastness and heterogeneity of the study area was addressed by proportionately distributing respondents as per population census and choosing the most appropriate sampling technique. The findings in the study were limited by the extent to which the respondents were honest, careful and unbiased in responding to the survey instrument.

The generalizations made in the study were limited to the population in Vihiga County in the obtained database although a response rate of 95.6 percent was above tolerable rates for the study (Hart, 1987). This helped lower the margin of error while generalizing the results.

1.8. Significance of the Study

The study demonstrated how various determinants of Spatial Land Use Management Strategy could lead to improved livelihoods within the Sub-Counties that form the larger Vihiga County. For example, the location of Vihiga County in the western region is in itself significant in the sense that its neighboring four (4) Counties (Nandi, Siaya, Kisumu and Kakamega) can exert influence on livelihood activities that relate to land-use.

This strategy fosters an understanding of a region's diversity by assessing the different land use management patterns while at the same time striving to overcome traditional ideas of sustainable land use management. The findings of the study can be used by policymakers and other researchers to develop a model that can broaden the user's view of the future land use management strategy by giving a realistic representation of how this strategy would work. This strategy could further offer an effective way of integrating social, economic, cultural, political and environmental datasets, enabling a number of holistic spatial land use scenarios to be generated and evaluated by local planners that can lead to a paradigm shift in planning and implementation of development programmes in the Counties, while the recommendations of the study can be used by National and County Governments to develop a long term institutional framework for sustainable development.

CHAPTER 2: LITERATURE REVIEW

2.1. Overview

This chapter presents a synthesis of literature significant to the study. It has various land use management systems in order to establish the gaps therein.

2.2. Land Use Management Strategies

In many developing countries today, 'the resources of the land' is the most important issue that affects people's livelihood. A major breakthrough in land use planning methodology dates back to the 1960s with the introduction of the land capability concept. This approach was developed to identify and classify areas to be allocated for different agrarian activities like irrigation, mechanized farming, grazing and forestry (Klingebiel and Montgomery, 1961). Later in 1970s, there was an attempt to add value to the results of soil surveys in order to determine land use potentials and to promote land use patterns according to land potential. This led to the Framework for Land Evaluation which provided a solid and unique technical basis to compare the present and potential performance of different land uses on different lands (FAO, 1976).

Indeed, over the years, a series of guidelines has been produced dealing with land evaluation for different land uses such as rain-fed agriculture, irrigated agriculture, grazing, and forestry. The comparison of the suitability of these different land uses for specific, mostly biophysical conditions, identifying the most suitable land use between the alternatives and allocating land according to this optimization process was generally considered as land-use planning (FAO, 1993).

The land is directly a requirement for life as emphasized on Sustainable Development Goal number 15 (UN, 2016). Land use is formed by an individual choice that is made by considering the factors of land production: the physical nature of the land and its location, available capital and its distribution and the availability and the cost of labor within the social and political climate in which they operate (Mather 1986). However, the process of decision-making about the use of land is extremely complex since it needs decisions about the types of use, the intensity of use and the form of management and these are dependent on the objectives and goals of the land user and the decision-making process that he/she takes part (Mather 1986).

Land use patterns are the clearly visible result of human interaction with the environment (Koomen, 2007). Despite many human interests, land is not only for human use, but it's a basis of rich biodiversity and environmental needs. This competition has resulted in conflict and ultimately unsustainable use of land in the struggle to realize balanced development. The current loss of biodiversity, drought and desertification, land degradation and loss of arable land can be attributed to the lack of a clear land use management strategy.

The fundamental controversies in different personal attitudes towards land use are of significant importance and they lie at the root of many issues and conflicts in the use of land (Mather *et al*, 1986). At the institutional level, optimal land use and forms of land management often represent a compromise between political and economic criteria and outcomes aim to offer room for future changes in land use. The potential of land to meet individual household needs and

generate income at national level to keep the National economies growing faces many challenges such as population growth, declining availability of land, degradation of land resources and changes in international land markets. Mather (1986) further states that, the existing land use carries the legacy of the past and the relationship of this legacy to the present state, especially in economic sense, is a key variable in decision making. This, in essence, makes it difficult to make radical changes and modifications in the nature of change whenever it's deemed necessary. But we have also seen government interference with land use and the decision making about it through policy and other supporting legislation for example in the field of agriculture (Mather 1986:74-79). Government, in many cases, is also a major land owner and land user in its own right.

In Kenya as in other developing and developed countries, land means different things to different people and groups of people. For example, to farmers and pastoralists land is a resource and a key element of living while to elite, land is a marketable commodity and access to profits (Mwagore, 2002). As a nation, politicians and administration view land as a sovereign entity whose boundaries reflect a social, cultural and political identity. This has resulted in unavoidable competition between different interests in and attitudes towards land. In particular, depending on which perception one holds, it directly influences the type of land management strategy to embrace as a people.

2.2.1. Kenya's Agro-ecological Zones

Although Kenya lies on the East African plateau, the rift valley breaks it along the border. Landforms range from coastal plains through the wilderness (dry Nyika plateau) to savannah grasslands and the highlands on both sides of the rift valley. Soja (1968:7) further classifies Kenya into physical geographical regions, namely, the coastal plain mainly fringed with mangroves, lagoons and coral reefs stretches approximately 65km wide. The arid low lands are characterized by scarce and erratic rainfall, usually less than 500mm/year and the region is mostly covered by scrub bush. However, several small highland enclaves diverge from the plateaus. 'The Kenya highlands' is a series of higher plateaus and volcanic surfaces mainly in altitudes between 1200 and 3000 meters. This makes the highlands receive higher rainfall than the lower plateaus. The soils in the highlands are mostly composed of volcanic soils and are the most fertile in Africa. The Lake Victoria borderlands, in which Vihiga County lies, are composed of heavily eroded, non-volcanic plateau surfaces. This region has fairly reliable and evenly distributed rainfall that exceeds 760mm/year.

Generally, the climate in Kenya is dry and hot. This is influenced by the country's location to the equator and its position on the Indian Ocean seaboard. The annual rainfall distribution follows a strong seasonal pattern which varies regionally following the movement of the inter-tropical convergence zone (ITCZ) and the altitudinal differences. Although main rains come between March and May, short rains occur between October and December. Kenya also experiences recurrent droughts; major drought occurs after 8 months to 1 year and minor droughts every 2 to 3 years (Mwagore, 2002: 18-19).

The suitability of certain area into a particular land use pattern can be estimated by lands agro-ecological potential that is determined by climate and other agro-ecological factors such as hydrology and terrain. According to Lundgren (1975:223), these agro-ecological zones are, in fact, eco-climatic zones defined in terms of climate but described by reference to their vegetation and

land use (as land cover). In Kenya, these zones are divided into six zones according to their ecological land use potential. In the high potential zones (highlands), rainfall is high and soil is rich, while low potential zones suffer especially from lack of rainfall and are characterized as arid and semi-arid lands (ASALs). However, rainfall in Kenya is not enough for rain fed agriculture except in the highland areas and in the coastal zone (the medium potential areas) that together form 20% of the total land area, while the ASALs cover the remaining 80% (semi-arid 20% and arid lands 60%). Thus, over 50% of the total land cover is arid with extremely low and erratic rainfall.

The major land cover types in Kenya are forests, savannahs, grasslands, wetlands, fresh and saline water bodies and deserts. Forests cover 1.7% of the total land area (Odete, 2004). But, even if the gazetted forests are included, total coverage is about 2% of the country's land area (Odete *et al.* 2004). These forests are, however, fragmented into many small units. Indigenous forests grow mainly in the high potential areas in the central highlands and coastal zones. In the ASALs, forests are found in isolated mountain ranges and narrow strips along rivers (Mwagoreet *al.* 2002).

In the recent past, forest cover has been declining as a result of invasion of forests for settlement and agricultural use being the most destructive. But it's worth noting that as forests disappear, so do water catchment areas because the forests are not there anymore to control the circulation of water, this further causes destruction of ecosystems and direct water shortages. Deforestation is also a major factor contributing to soil erosion that is a considerable problem in Kenya. Both wind and water erosion are quite active; water erosion is predominant in the rainy areas and the highlands and wind erosion in the ASALs. The driving force behind this problem is the removal of vegetation cover which exposes the soil surface to external impacts, such as wind and rain drops. This results to loss of soil nutrients and infertility of sub-soils to such an extent that they no longer sustain vegetation and plant growth. As a result, soil moisture-storage capacity is lost and thus eroded soil is even more vulnerable to further erosion. Further, erosion causes definitive land degradation and siltation of rivers and the ocean.

Equally extensive desertification remains a large question in Kenya. Desertification process occurs mainly within dry land ecosystems thus affecting the ASAL areas, especially the most arid areas in Northern Kenya. This is further aggravated by climatic variations such as droughts, together with inappropriate human activities and under-appreciation of ASAL as an ecosystem. Mwagoreet *al.* (2002) observes that desertification is extending at the rate of 18-40 km per year further exacerbating the situation.

Population pressure remains a key challenge to maintaining the already fragile ecosystems. It has been observed that about 50% of the population lives below the poverty line (less than 1 USD/day) and un-employment is high, estimated at about 40% of the labor force (The World Fact book, 2004). Every decision has some impact on the environment, especially regarding the physical environment. Land use management and control are to identify, govern and direct these impacts. Thus, decisions on land use – land use policy both in short and long terms are crucial in determining future development.

2.2.2. Land Use in Kenya

Land use in high and medium potential areas is primarily agriculture, including dairy farming. Cash crops follow a pattern of agro-ecological potential and temperature variations. According to the Kenya National Environment Action Plan (NEAP) report (1994), these few high

and medium potential areas support about 80% of the Kenya's population, mainly in urban centres, forests, lakes and industry. ASALs, on their behalf, support only 20% of the population but about 50% of the national livestock herd and a major portion of wildlife resources in Kenya. Land uses in semi-arid areas are characterized by agro-pastoralist and the aridest areas by pastoralist. However, in the recent past, irrigated flower farming has emerged as a major type of land use alongside agro-pastoralist.

The problems concerning land use in Kenya include: falling agricultural productivity, and degradation due to inappropriate soil and soil erosion, land-use conflicts caused by urban and industrial expansion and prolonged unpredictable droughts. These are products of different factors as land use is determined and controlled by, for example, climate, soils and agro-ecological potential, labor technology and markets. In Kenya, the climate and especially rainfall is the key primary feature determining land use and planning. This, therefore, limits the use of land to sustain livelihoods (NEAP, 1994).

It's worth noting that Kenya's population is dependent on land and its resources. Since the highlands have mostly been taken into use, the ASALs are used to cushion the continuously increasing population pressure, which further increases the environmental constraints in these areas. Because of the varying physical conditions and unsustainable land-use practices, land in Kenya is heavily over-used. Mwangi (2002) observes that, in western Kenya where Vihiga County lies, the agricultural potential is greatly under-utilized and the land use practices do not support profitable production.

2.2.3. Land Policy

Land-use policy is primarily an expression of the government's perception of the direction to be taken on major issues related to land use and the proposed allocation of the national land resources over a fixed period of time. It consists of measures and guidelines which the government shall implement to achieve optimal utilization and management of, and from which laws governing land administration are drawn (Kenya Republic, 2009). The land is not just a commodity to be traded in the market; rather it should be protected by both policy and law. This is mainly because land is an economic resource that should be managed productively. Land is a finite resource which should be utilized sustainably and it plays a significant role to members of the society in which members should have equitable access for livelihood. Land also is a cultural heritage which should be conserved for future generations.

However, the existing laws in Kenya pursue economic productivity at the expense of other equally important values. Further still, these policies and laws have largely neglected the need to ensure equity, sustainability and the preservation of culture in the utilization of land. As a result, many Kenyans have been deprived of access to land and disruption of indigenous culture and conservation systems. Thus, it will be prudent that any policy should seek to facilitate the protection of the different forms of tenure and guarantee its security for the benefit of society.

2.2.4. Spatial Land Use

Spatial planning refers to the methods used by the public sector to influence the distribution of people and activities in spaces of various scales. Discrete professional disciplines which involve spatial planning include land use, urban, regional, transport and environmental

planning. Other related areas are also important, including economic and community planning (Mather and Alexander, 1996). Spatial planning takes place on local, county, national and international levels and often results in the creation of a spatial plan.

Spatial planning gives geographical expression to the economic, social, cultural and ecological policies of society. It is, at the same time, a scientific discipline, an administrative technique and a policy developed as an interdisciplinary and comprehensive approach directed towards a balanced regional development and the physical organization of space according to an overall strategy.

Spatial Planning and Land Use Management envisages guiding and informing on; directions or patterns of growth, major transport routes, special development areas or zones for targeted management to redress past imbalances and, conservation of both the built and natural environment. This further could aid in decision making on particular types of land use which should be either encouraged or discouraged, and areas in which the intensity of land development could be either increased or reduced.

Although, Urban Areas and Cities Act 2011 outlines the objectives of integrated urban areas and regional planning with emphasis on the provision of physical and social infrastructure, transportation; environmental management and disaster preparedness, it also emphasizes on the importance of planning both at National and County Governments. Sessional Paper No.3 of 2009 on National Land Policy for Kenya seeks,

“To guide the country towards efficient, sustainable and equitable use of land for prosperity and posterity”

Spatial plans should indicate desired patterns of land use management within Counties, while at the same time advance integrated and sustainable development.

From the reviewed literature, it is clear that land use management is a very complex process, which possesses many challenges for planners, ecologists and governments alike. Although the current policy and legislation acknowledges prudent management of land in and around cities, urban areas and rural areas via integrated development plans and spatial development frameworks, it's also true that it is not often achieved due to the lack of a clear strategy to guide its sustainable use. Thus, the researcher envisages that this strategy will better integrate environmental aspects into spatial plans, and provide for rural-urban growth scenario that may assist County and National Governments in planning for sustainable development.

2.2.5. Urban Growth

The concept of continued urban growth is not a new one; it is a given fact that the urban environment is constantly growing and changing and it has been so ever since the first human settlements. One of the main factors responsible for urban growth, and in effect urban sprawl, is the phenomenon of urbanization. More than half the globe's population (roughly 3.3 billion) is currently living in urban settlements. It is further anticipated that this total may rise to 61 % (roughly 4.9 billion) as early as 2030 and that most of this urban growth will be in developing countries and more specifically in Africa. The recognition of this anticipated growth at the global level was acknowledged when sustainable cities and communities were identified as Sustainable Development Goal number 11 (UN, 2016). This is mainly because urban areas have been identified as engines of growth for many economies around the world. The most likely reason for this is that

most African countries are currently in an urban transition phase, as they are systematically changing from predominantly rural societies to predominantly urban societies (Fair, 1982; Friedmann & Wuff, 1975). This transition is mainly fueled by the combination of population growth and economic change. Although Kenya has an urbanization rate of average 39% which is much lower than the World and African average of 50%, it is still expected to grow in urbanized population by approximately 1% per annum (UN, 2007).

With this knowledge at hand, governments and planners need to plan proactively and be prepared for the potential growth that may transpire. To achieve this, it has to be understood that there are certain forces at work that influence urban morphology and consequently cause the spatial changes observed in urban areas and in cities. These forces include: demand, supply, political policies, and economic growth, social development of a society, economic growth of a society, and industrial development (Long, 2007). The fact that these forces differ in their effects from one urban area to the next, has the effect that it is very difficult to predict how urban areas will develop and land uses might change. One way to assist policy makers and planners in this challenge of managing urban growth in Kenya is to attempt to predict these changes by means of modeling approaches such as land use suitability modeling and land use change modeling.

The Draft National Urban Development Policy envisages providing a framework and inspiration for inclusive and sustainable development in the country and contributing to the achievement of broader national development goals as articulated in vision 2030 and MTP (2008-2012). This ensures orderly, competitive and sustainable urban development that enhances physical, social and local economic development of the urban areas. It further improves the linkages and lives and livelihoods of millions of the poor and marginalized in the county.

2.2.6. Sustainable Development

The term 'sustainable development' was first coined by the International Union for Conservation of Nature and Natural Resources in their *World Conservation Strategy* of 1980 (Dresner, 2002:30). The *World Conservation Strategy* was aimed at government policymakers, conservationists and developers (MitCham, 1995:316), and foreshadowed many of the ideas that would later emerge in *Our Common Future* (better known as the Brundtland report). Since the launch of *Our Common Future* by the United Nations' (UN) initiated, World Commission on Environment and Development in 1987 (WCED, 1987), sustainability has become a very important issue in international politics (Deelstra, 1998:17). The Commission proposed a new approach towards managing the environment and development by integrating two strains of thought: the need for socio-economic development and the need to limit its harmful impacts on the physical environment (WCED, 1987:48 - 57). This integration evolved the concept of sustainable development which was redefined (Dresner, 2002:31) by the Brundtland Report (WCED, 1987:54) as "... development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

The Commission's conception, however, if what sustainable development would be was more complex than the simple one-sentence definition presented above (Dresner, 2002:32). They expanded by stating the fact (WCED, 1987:54-55): "The concept of sustainable development does imply limits - not absolute limits but limitations imposed by the present state of technology and social organization on environmental resources and by the ability of the biosphere to absorb the

effects of human activities. But technology and social organization can be both managed and improved to make way for a new era of economic growth ... Sustainable development is not a fixed state of harmony but rather a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with future as well as present needs."

This new definition proposed by the Brundtland Commission came at a point in history when awareness was growing that, unless humanity adapted its use of natural resources, the global implications for future generations could be dire and catastrophic (Brundtland, 2007; Mitcham, 1995). However, the message portrayed by *Our Common Future* was not one of doom or defeat, but one of hope, which stated that man had the capability to save the fragile relationship between itself and the biosphere via sustainable development (Brundtland, 2007).

The aims set forth by *Our Common Future* were, however, general in nature and aimed at a global scale (Deelstra, 1998), and for them to be effectively implemented on local scales, they had to be translated into action plans for local communities. Many such attempts were made internationally through initiatives such as the *Sustainable Cities and Towns Project* in Europe (Brundtland, 2007), but more had to be done. This realization along with the impact of the Brundtland Report (Mitcham, 1995), led to the first Earth Summit (the United Nations Conference on Environment and Development) held at Rio de Janeiro, Brazil in 1992, where many governments and international agencies pledged their support for sustainable development (Dresner, 2002).

2.2.7. Agenda 21

A total of 172 governments participated in the 1992 Earth Summit Conference, and 108 of these Governments were represented by their heads of state. The Summit intended to focus global concern on the emerging environmental and development crisis (Dresner, 2002), and was the pinnacle of a long endeavor of planning and negotiations among all Member States of the United Nations (UN), which eventually led to the adoption of Agenda 21 (UN, 1997). Agenda 21 is a global policy framework guiding governments around the world in the implementation of sustainable development (Schwabe, 2002; Dresner, 2002) via a set of developmental and environmental objectives (UN, 1992).

The Agenda 21 refers to earth's development in the twenty-first century (Deelstra, 1998), and thus aims to guide that development in a sustainable manner (Urquhart & Atkinson, 2000). According to Paragraph 1.3 of Agenda 21, this can be achieved by addressing current problems and preparing the world for challenges yet to come (UN, 1992). At this stage, it's important to realize that Agenda 21 is voluntary and only a framework, and that it's the responsibility of national governments to formulate their own national strategies, plans, policies and processes to ensure that sustainable development is implemented in their respective countries (Schwabe, 2002).

Therefore, it's important to ensure that the strategies, policies and plans should enhance the integration of environmental and development issues by means of reviewing existing economic and environmental policies at all scales of government; integrate environmental and development issues at all levels of government by means of strengthening institutional structures; involve concerned individuals, groups and organizations at all levels of decision-making by means of improving facilitation mechanisms; and establish domestically determined procedures for the integration of environmental and development issues in decision-making (UN, 1992:64).

Agenda 21 highlights the role of citizens and non-governmental organizations (NGOs) in a bottom-up approach which is in line with the spirit of devolution in Kenya towards the realization of sustainable development, and thus emphasizes the use and development of human resources for realization of this noble objective (Dresner, 2002:41). According to Marx (2003:18), the goals set by Agenda 21 can only be successfully achieved if all sectors of government and society effectively participate in the mission towards sustainable development. Since the Earth Summit in 1992, Kenya has actively participated in global sustainability, highlighted challenges to sustainable development; and provided an action plan for the implementation of sustainable development in the country. Even though Kenya does not have a strategy solely dedicated to sustainable development, efforts have been made at various sectors of the economy to embrace sustainable development.

2.2.8. Social Development

The Habitat Agenda states that social development will be achieved through the eradication of poverty and the creation of productive employment conditions (UNCHS, 1996:48). Poverty is one of the biggest threats to sustainability and is in many cases the cause of negative phenomena, such as crime and hunger. This has also been echoed previously on Millennium Development Goals (MDGs) and now Sustainable Development Goals (SDGs) as goal number 1 (UN, 2016). In order to wipe out poverty, policies aimed at creating equal and fair employment opportunities, improving access to resources, promoting rural development, developing human resources and promoting strategies for meeting the basic needs of all, are crucial (UNCHS, 1996:48). The Habitat Agenda further seeks to promote the provision of basic services in human settlements; promote social integration and eliminate all forms of discrimination; ensure gender sensitive planning and management of human settlements; and develop the potential of young people and prepare them for the responsibilities of the development of human settlements.

The execution of these actions is crucial if social development is to be achieved. Social development, therefore, marks the first of three equally important fundamentals of sustainable human settlement (UNCHS, 1996:48-56).

2.2.9. Sustainable Development in Relation to Land Use Management

Sustainable development concept was promoted by spreading attention from the Brundtland Commission in 1987 on the need for land use planning (Owens & Cowell, 2002:13). This was further stimulated by scientific evidence by human-induced change in critical natural systems on matters related to environment (Selman 1996:12). The United Nations Conference on Environment and Development declared the importance of production and implementation of strategies or plans in addressing the interrelated problems of environment and development (UNCED, 1992).

The emergence of strategic planning and sustainable development, as an objective of development, planning and especially land use planning was seen as a means to promote sustainable development (Owens & Cowell 2002:16). This, indeed, reinforced the important role of planning as reconciling development and conservation. However, it's important to appreciate the important role of values, legitimate interests, rights and obligations that are constantly in conflict

with policies and decision makers. This, therefore, reinforces the important role of citizen's participation in matters affecting them and especially land use management.

Lein (2003) contends that the predominant threat to sustainability in land use emanates from the stress imposed on the natural system when land is changed from its natural state to some other form. Thus, sustainable development is associated with three fundamental principles as echoed in *Our Common Future* (1987) - Intergenerational equity (futuraity) i.e. one generation should hand on the earth to the next generation in at least good condition as it inherited (Selman, 1996), Intra-generational equity (social justice) which relates to importance of containing the principle of human needs within sustainable environment and Trans-frontier re-generational equity which emphasizes that sustainability in one locality, region or country cannot be achieved at the expense of environmental conditions elsewhere, but the responsibility for any impacts of activities needs to be accepted at the same place.

Arising from above, everyone, especially the poor, should have equal rights and the possibility to satisfy their needs and to benefit from the use of the resources within and between countries. As earlier mentioned, land use planning is highly political in nature because it depends on political power. Indeed, the sustainability of land use is determined by the flexibility of regulating policy as emphasized in *Our Common Future* (1987) that sustainable development requires "an administrative system that is flexible and has the capacity for self-correction."

It is imperative that planners, ecologists and economists should work together in an integrated manner to reach the different sustainable development goals, such as economic development and environmental protection. Hence, the importance and value of detailed ecological data for spatial planning purposes have to be accepted and invested. Only once accurate environmental data focused on protecting critical biodiversity areas, detailed agricultural data indicating the prime agricultural land, and the economic indicators are included into planning processes for sustainable development to be realized.

In conclusion, therefore, sustainability and sustainable development is a crucial topic in current international politics. Although the National Government has made an excellent effort to integrate the concepts of sustainability into policy and legislation, the effective implementation thereof on ground and by extension at the County level is still relatively poor. The important role that County Governments have to play (as emphasized in Agenda 21 and the Habitat Agenda) in achieving sustainable development in the new dispensation should not be overlooked. It is vital that further efforts should be made to achieve sustainable development at County levels. To achieve this, the importance of integrated environmental management, by means of integrating social and environmental planning should be emphasized.

2.3. Models and Theories in Land Use Management

Explanatory frameworks are concerned with defining particular processes, behaviors and other phenomena as they exist in reality and are also concerned with why these phenomena or processes come to existence and they might change over time and space (Spatial organization), (Chapin and Kaiser 1979). The descriptive concepts that are discussed below derive from economic theory and aim to relate theory with real -world situations by looking at land use as an economic phenomenon that is crucial for sustaining livelihoods.

In view of the above, the researcher reviewed three classical concepts that relate to land use: the concentric-zone concept, the Sector concept and Multi-nuclei concept. Amongst these, the multi-nuclei and the concentric zone concepts deal with general patterns of land use, while the sector and zonal theories are used to describe changes in basic arrangements of land use patterns.

2.3.1. Concentric-Zone Concept

Burgess conceptualized the concentric zone model to explain the composite effect of market forces upon land use. The Burgess concept was developed in the 1920s basically to explain the ecological processes in which he visualized a series of five concentric zones. At the core is the “loop” or the central business district with its shopping areas, its theatre districts, its hotels, its office buildings, its banking houses and other businesses that seek a central location. In small communities, these business functions intermingle, while in large cities they form more or less distinct sub-districts. Burgess acknowledges that, as growth occurs, each inner zone of the generalized diagram tends to spill over to the next outer zone, following what the human ecologists refer to as a sequence of invasion-succession (Burgess 1925 and Burges, 1929).

It's worth appreciating that, when the concentric theory was being advanced, the rate of progression of the rippling tendency depended on economic expansion in the city and the rate of population growth. However, in more recent times, it may well depend on the rate of decentralization of the middle income groups in response to neighborhood deterioration and the existence of new employment opportunities and new housing in the suburbs.

The works of Burgess are quite instrumental to this study in many ways. First, most of our urban areas have been planned based on the concentric theory with the confinement of many activities at one point, i.e. the CBD. These areas have created a lot of conflict between various land uses that are scrambling for space to run their day to day activities. This calls for proper planning for various land users to co-exist in harmony.

Burgess, in this theory, also stresses the importance of locating activities depending on the level of magnitude and affordability since this affects the low-income earners, which constitute a larger part of the population by mitigating on transport costs. This, therefore, calls for the development of necessary infrastructure that supports the growth of various sectors of the economy and to a larger extent, livelihoods.

The concept of CBD, in theory, can be equated in this study to the urban areas and cities as enshrined in the devolved form of government. The existence of the Counties has created opportunities and threats that require to be streamlined in order to reap the benefits of devolution. There is a need, therefore, to map the County regions (sub-counties) according to its endowments to have balanced development.

2.3.2. The Sector Concept

The sector concept, as propagated by Hoyt ten years after Burgess Work, provides a theoretical description of land use patterns which takes into account the irregularities that tend to develop in its use. This theory provides some new insights that lead to theoretical explanation of the patterning of residential land uses in terms of wedge –shaped sectors radial to the city center and along established lines of transportation (Hoyt, 1939).

This concept holds that different income classes of the city tend to be found in distinct describable in terms of sectors of a circle centered on the CBD. The high rent of residential areas can be identified in particular sectors, and there is gradation of rentals downwards from high rental areas in all directions. High rent areas are conceived as having a dominant influence on the direction of residential area growth and exhibiting various growth characteristics.

The sector concept provides more detailed explanation of residential patterns of land use than advanced by the concentric-zone formulation, particularly in distinguishing the dynamics of growth process. However, Hoyts theory has been criticized on the grounds that it's too general and in reality, most zones contain more than one land-use. Also this theory doesn't consider the impact of urban renewal schemes which today informs the paradigm shift in planning.

2.3.3. Multiple Nuclei Concept

The multi nuclei concept and its hypothesis is built around the observation that frequently there is a series of nuclei patterning of urban land use rather than the single central core as postulated by the other two theories discussed above (McKenzie (1933).

Harris and Ullman (1945) and Ullman (1962) further expanded on this concept in their essays on the nature of cities by acknowledging that, cities are, sometimes, distinct entities in the original metropolitan area that persists as centers as growth fills in the areas between them and which sometimes emerge as new centers as urbanization proceeds.

Arising from the work of Harris and Ullman, it's evident that there are four factors that tend to contribute to the emergence of separate nuclei in urban land-use patterns. First, the natural clustering tendency among certain types of activities that find it mutually profitable to locate together as evidenced in medical centers, retail centers, etc. secondly, the interdependence of certain types of activities and their need for closer physical proximity. Thirdly, some centers appear to accommodate activities that may have no particular affinity for one another, but are inimical to other uses by virtue of the traffic they generate. Lastly, there is a related factor of high land costs or high rents, which have the effect of attracting or repelling users in the process of nucleation and which ultimately determines the various patterns of land uses. All these recognize the conception of urban land use configuration.

2.4. Micro-economic Models of Land Use

Land use models deal with describing activities of land consuming actors and their competition for land in an urban setting. These actors are households, firms and retail establishments, each with particular requirements for space and access to jobs, schools and markets. Describing the spatial distribution of these activities at present and projecting future land uses are the two main aspects of these models: the rationale that regulates the location of activities and how land rent or land values emerge from the process. The theories developed under micro-economic approach start by adopting the conceptual framework of classical and neo-classical economics. These models also consider interaction among these activities through the transportation network.

Location theory is basically concerned with the geographic location of economic activity and seeks to address the questions of what economic activities are located where and why. The location of economic activities can be determined on a broad level such as a region or metropolitan area, or

on a narrow one such as a zone, a county, a sub-county or an individual site. The models and theories examined in this study are aimed at relating theory with real-world situations by looking at land use as an economic phenomenon. The theories with the most relevance to this study are discussed below.

2.4.1. The Von Thünen Model of Rural/Agricultural Land Use

Johann-Heinrich gave a predictive model of rural development around an idealized isolated urban center, imposing several simplifications in an attempt to focus on some of the fundamental processes at work in settlement patterns and rural economic activity. Von Thünen was interested in the natural laws that govern rural land use, that is, the best way for farmers of different goods to locate their farms within an Isolated State so that they can minimize their profits (von Thünen, 1826).

Although von Thünen emphasized that his findings had no claim to universality, they were meant for generalizations towards discovering laws that govern agricultural prices in relation to land use patterns. This could further be compared to creating a laboratory in which the interplay between a small number of processes could be studied, and causal mechanisms between economic inputs and geographical patterns could be explored (Peet, 1969).

Von Thünen's approach was considered in terms of the global properties of a city and surrounding areas. The assumptions listed before are instrumental in maximizing efficiency and minimizing overall costs to the city as a whole. A rural planner who buys into this theory might be tempted to effect maximum efficiency through land zoning or some other centrally imposed order. However, most of the forces attributed to creating these conditions occur from the bottom up, and much of what is observed as a global pattern is, in fact, the emergent result of many individual actions (Chisholm, 1981).

It is not readily apparent to everyone how a society composed of such selfishly motivated participants, bereft of any higher motivation and lacking any centralized authority, could produce a market that spatially conforms to von Thünen's idealization, which gives an optimum solution for society in terms of overall costs and efficiency. Indeed, von Thünen observed that, this spatial optimization can occur spontaneously through the interactions of selfishly motivated individuals, without any external forces working on them (Holland, 1995 and Axelrod, 1984).

The objective of the researcher in this study was to gain some understanding as to how individual actions and motivations at the household level can translate into a global pattern such as that predicted by von Thünen. For example, a livestock farmer, whose land needs are high, per acre productivity is low, and transport costs are cheap, would ideally have land further away from a market than farmers in the other agricultural categories; however, if an individual livestock farmer is able to acquire land closer to market for a reasonable cost, it's reasonable to assume that the farmer will want to acquire that land thinking of his or her own economic gain. Personal economic considerations will probably outweigh any altruistic notions of what kind of farmer would be best suited for the land. The Thünen model suggests that accessibility to the market (town) can create a complete system of agricultural land use.

Even though Von Thünen's model was created in a time before factories, highways, railroads, UPS, and i-phones, it is still an important model in geography, demonstrating the balance between land cost and transportation cost in producing a cost-effective product.

2.4.2. Weber's Theory of Industrial Location

Weber's theory, called the location triangle, sought the optimum location for the production of a good based on the fixed locations of the market and two raw material sources, which geographically form a triangle. He sought to determine the least-cost production location within the triangle by figuring the total costs of transporting raw material from both sites to the production site and product from the production site to the market. The production site, therefore, will be located near the raw material sources (Weber (1929).

Another major contribution to location theory was Walter Christaller's formulation of the central place theory, which offered geometric explanations as to how settlements and places are located in relation to one another and why settlements function as hamlets, villages, towns, or cities. This, in fact, is a manifestation of the administrative structure at the national and county governments in Kenya.

2.4.3. Christaller's Central Place Theory

A Central Place is a settlement that provides one or more services for the population living around it. Christaller built upon the works of von Thünen and Weber and attempted to explain the size, number, and distribution of clusters of urban centers and institutions. Christaller believed that, in order to explain the spacing of urban places over the landscape adequately, it was necessary to create a set of governing assumptions. Christaller assumed that all areas have an isotropic (all flat) surface, evenly distributed population, evenly distributed resources, similar purchasing power of all consumers and consumers will patronize nearest market, where transportation costs are equal in all directions and proportional to distance (Christaller, 1933).

Christaller found it possible to model the pattern of settlement locations using geometric shapes by examining and defining the functions of the settlement structure and the size of the hinterland. In this model, each settlement is situated in the center of the region it serves. Logically (assuming no restrictions), this should result in a circular complementary (market or service) region. Thus, the most efficient shape for a service area (in the Christaller model) is not a circle, but a hexagon because the hexagons interlock into one another, and form a nested hierarchy which makes it easier to serve all areas.

In this simplistic situation, the central-place theory model is deterministic because if one knows the location and the range of two central places, the location of all other places on the plane can be seen. However, the pattern of cities predicted by central place theory may not hold because of the failure to meet initial assumptions. For example, production costs may vary not only because of economies of scale, but also by natural resource endowments (i.e. not a homogeneous plain) and non-economic factors (culture, politics, and leadership) are important but not evenly distributed as illustrated in the study area.

Central place theory does a good job of describing the spatial pattern of urbanization, location of trade and service centres. It can also aid small-town community economic developers to secure quite specific and relevant information about what kind of trade or service enterprise will likely work or not in a given region or County.

In conclusion, Christaller's model will never be found in the real world because large areas of flat land are rare and government intervention can dictate the location of industry because of the regulatory mandate of various arms of government. Perfect competition is unreal since some firms

make more money than others and people vary their shopping trends by not always going to the nearest centre since people or resources are never perfectly distributed. Christaller envisaged each centre with a particular function whereas there are many which change over time.

Although a major tenet of central place theory was that producers tend to locate as far as possible from competitors, firms may recognize the advantages of agglomeration and the benefit of centrality that result from adjacent location, a situation that is currently visible at the counties.

2.5. Spatial Interaction Models

The first spatial models were mainly based on gravitational analogy something derived from the aggregate approach. Instead of looking at individual molecules of an urban area, spatial interaction is more interested in the behavior of whole masses, and the relationship among them. Proper regional theory was a result of regional gravitational analogy that was carried out through more empirical testing.

In spatial interaction model, the gravity form states that “interaction between any two zones is proportional to the number of activities in each zone (masses), and inversely proportional to the friction imposed by the particular infrastructure that connects them. If a system is composed of more than two zones, flows between any particular pair of zones have to be restricted by combined effect of all other zones present in the system”.

The number of trips based on the spatial interaction modes is a result of the points of attraction and production variables and trip generation factor. Spatial models can be alternatively used to measure the potential of a particular zone with respect to others. This kind of analysis can be useful for diagnosis to determine the development potential of a zone or to determine the optimal location of an industry with respect to a particular market.

The spatial interaction models mainly focus on the aggregate since both space and activities are grouped into discrete categories unlike the case of micro-economic models which focus on the behavior of individual units. Spatial interaction models define zones containing a large number of activities instead of analyzing particular points in space. Their rapid growth has been attributed to their simplicity in application and reality to actual cases (Barra, 1989).

The aggregates interact with generating flows of different kinds which can be of a concrete nature such as trips, migrations, and movement of commodities or of a more abstract nature such as dependencies, diffusions and opportunity. Each zone is described in terms of a number of attributes and the zones are linked to one another by means of infrastructure depending on the nature of flows.

Models of location seek to stimulate the location of residents in an urban area. The model assumes that there had been an increment in population which will be allocated to zones as a function of accessibility. Accessibility is, thus, measured based on the number of attracting activities in a given zone such as the number of jobs and services among others. The size of zones depends, on the other hand, on the increase in population and the vacant land available (Hansen, 1959).

2.5.1. The Evolution of Land Use Models

The first traces of land-use suitability modeling can be traced back as far as the late 19th century, when two landscape architects superimposed transparent sheets of paper on a window to view multiple site characteristics at the same time. This technique came to be known as sieve

mapping and was later used for site suitability analysis by town planners in Scotland and England. As observed from the prior mentioned works, it is clear that a variety of different methodologies exist for the spatial application of Multi-Criteria Analysis (MCA) in the form of suitability analysis (Carr and Zwick, 2007).

Many models that have been used in land use management had limited success in attainment of sustainable livelihoods. An analysis of reviewed literature indicates that there are numerous and different land-use management strategies that have been developed in recent years (Semeels and Lambin, 2001), and various authors have discussed the principles of some of these models, as well as the future directions of research on the subject (Briassoulis, 2000; Agarwalet *al* 2002; Verburget *al* 2004; Koomenet *al* 2007). However, almost all existing land-use change modeling and simulation approaches differ immensely in theoretical backgrounds, starting points and range of applications. Some of these models focus on urban growth changes, while others concentrate on deforestation or changes in pasture land (Koomenet, 2007).

The use of spatial modeling in land use management orientated processes allows planners and decision-makers to experiment with different '*what if*' scenarios (Longley 2005:366), which have the potential of broadening the idea of what may happen in their area of jurisdiction. Land use management, for example, is a highly dynamic and diverse field as observed by Veldkamp & Lambin (2001:4). It aims to predict *how* and *where* land use changes might occur on the earth's surface. However, it is important to realize that no model of a physical system will ever flawlessly replicate reality (Longley *et al*, 2005:366). Indeed, a land-use suitability model in spatial planning can help reduce the uncertainties about the future and potentially play a vital role in understanding the processes at work towards sustainable development (Koomenet *al*, 2007:2).

2.5.2. The Land Use Conflict Identification Strategy (LUCIS)

The conceptual basis for LUCIS stems forth from Eugene P. Odum's classic "Strategy for ecosystem development" (1969), and was developed over a period of 10 years (Carr & Zwick, 2007:10). The development and use of land use suitability model in spatial planning by Odum (1969:268) proposed four general land use types which had to be maintained in a certain balance to ensure the efficient exchange of energy and materials between them. Odum (1969) acknowledges that, this exchange would assure the mutual benefit between land-types. The four land-types were condensed into three categories for the LUCIS model.

The LUCIS utilizes the Arc GIS geo-processing framework, and more specifically the weighted overlay tool, to analyze suitability of land for the utilization of different land uses, and to inspect the land use conflicts that may transpire. One of the most distinct characteristics of LUCIS is that it aims to identify potential land use conflicts that may arise between urban, agricultural and conservation land uses. After conflicts have been identified, LUCIS uses the land use scenario results to allocate land for possible future urban growth (Garr and Zwick, 2007).

2.6. Synthesis of the Theories and Models

The respective theories developed under microeconomic approach start by developing the conceptual framework of classical and neo-classical economics. They regard the location of activities as an outcome of a combined market mechanism involving three key elements: land, commodities and transport with each playing a significant role. For example, land is required for

production, function or satisfaction of residential needs, while transportation is required to move commodities or labor (Odum, 1969). The reviewed theories considered land to be a large featureless plain (ideal state) and infinitely available so that in principle, there would be no need to pay for it. In fact to them, what gives land a differential quality is the cost of travel or accessibility, and it is ultimately the main factor generating land values. But in reality, this is not the case since there are other factors that define how land can be used. For example, the landscape, the overlapping land uses among others (Christaller, 1933).

Also, the theories look at the process of activity, location and rent from the point of view of individual resident or firm. Thus the activities will compete for consumption of land and once the equilibrium is reached, a choice would have been made with regard to a particular size, the cost of land and transport they have to pay to optimize their utility. However, for any equilibrium to be realized, there is need to model various land use patterns and determinants into a system that is more pragmatic to the current realities in space (von Thünen, 1826).

Another limitation revolves at the way space and activities are presented. Microeconomic theories are basically disaggregated in their approach since their analysis centers on the behavior of individual units. These models also treat space as continuous variable, yet it is impossible to represent diversity that is manifested in urban and regional geography.

Although theoretical developments are important, their achievements cannot be matched with by practical applications. This is because most economists after establishing theoretical frameworks resorted to essentially linear or log-linear econometric models for the empirical work. For example, Alonso (1964) does present a very simple linear model as empirical, evidence of an otherwise highly elaborate theory.

Additionally, in his regression analysis to rural communities, Mushinski (2002) concludes “incorporating explicit geographic interdependence between establishments in a place and sources of supply and demand in neighboring areas exists, and is particularly significant on the supply side.”

In conclusion, although the models reviewed above, provide great insight into the analysis of land uses, the researcher adopted the Alonso’s model and applied its concept to the Kenyan situation. This entailed identifying various land uses before allocating it for certain uses and inculcating in the model, strategies (traditional and modern) that would ensure sustainable use and management of land.

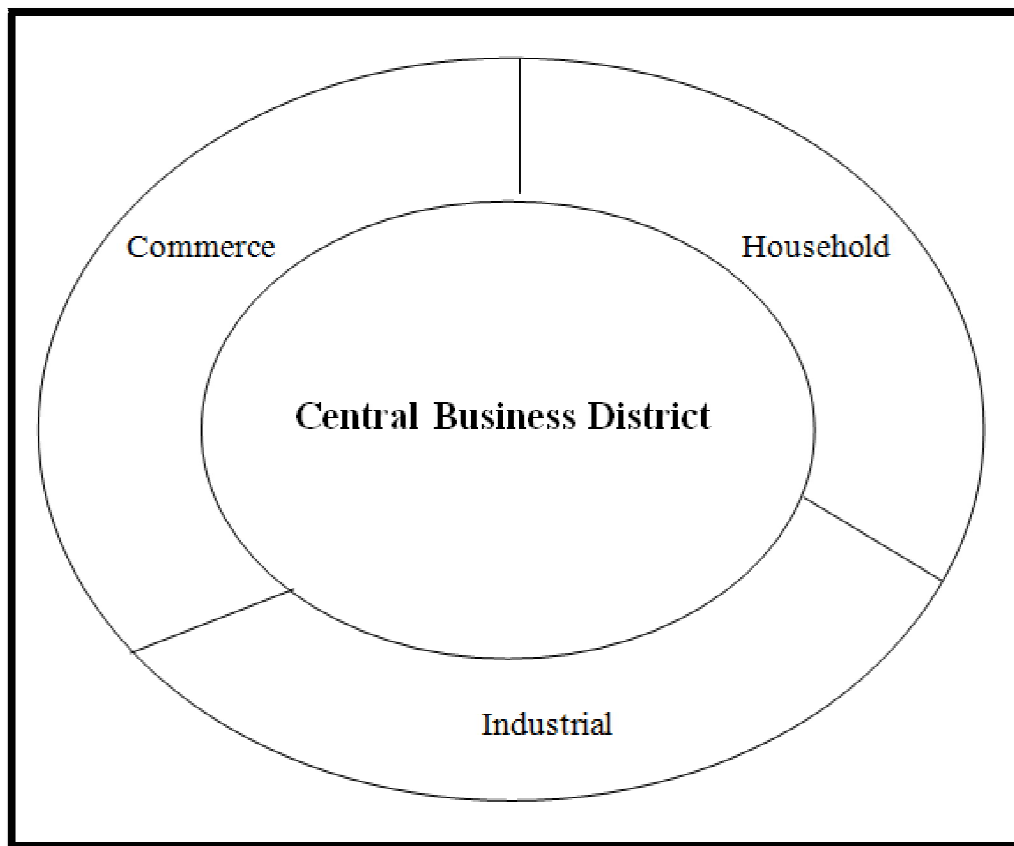
2.7. Theoretical Framework as Based on Alonso’s Bid-Rent Function Theory

This study was based on Bid-Rent Function theory as developed by Alonso (1964). The theory explains how preferences in the demand side (land) and the location opportunities on the supply side are mediated through market mechanisms while appreciating the constraints imposed by man and or nature to determine a particular type of land use. According to this theory, each land use type has its rent gradient or bid rent curve. The curve sets the maximum amount of rent any land use type will yield for a specific location. Households, commercial establishments, and industries compete for locations according to individual bid rent curve and their requirements for access to the city centre. All households will attempt to occupy as much land as possible while staying within their accessibility requirements. Since land is cheaper at the fringe of the city, households with less need for city center accessibility will locate near the fringe; these will usually be wealthy households. Poor households require greater accessibility to the city center and

therefore will locate near the center, competing with commercial and industrial establishments. This will tend to create a segregated land use system, because households will not pay commercial and industrial land prices for central locations.

Alonso further explains his theory by focusing on an individual that enters the market, wishing to buy land and faces the double decision of how large the parcel should be and how far away it should be from the city center. This is based on the assumption that, the buyers have perfect knowledge of the cost of land and transportation (Waugh, 2002:392). Also, since individuals are rational beings, they have enough money to spend on three entities: land, transportation and composite goods. By combining these three elements, the individual can decide on a location to buy. The assumption in this model is that, land value decreases further away from the city, while transportation costs increase further from the city center (Pacione, 2005).

In the second stage of this theory, Alonso derives bid price curves (as in the bid-rent theory, taking the other two elements into account as well) for the individual in order to find his/her individual equilibrium (the place where the three elements are at its optimum for the individual).



*Figure 1: Theoretical Framework of Land Use Management
Source: Bid-Rent Function Model as Propagated by Alonso (1964)*

William Alonso (1964) built upon the Thünen model to account for intra-urban variations in land use which takes into account things like population density, employment, transportation, etc. He attempted to apply accessibility requirements to the city centre for various types of land use (housing, commercial, and industry) as illustrated in Figure 1 above. Indeed, each land use type has

its own rent gradient or bid rent curve. The curve sets the maximum amount of rent any land use type will yield for a specific location. Households, commercial establishments and industries compete for locations according to individual bid rent curve and their requirements for access to the city center.

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The Bid-Rent theory is based on the assumption that the highest bidder in the free market will obtain the use of a particular piece of land. The bid price curve shows the different prices the individual will be able to pay for land at different distances from the CBD, whilst still enjoying feeble satisfaction (Waugh, 2002). The bid price curves are unique to each individual and an individual will choose his location where the highest level of satisfaction is associated with the best price. In the last stage of his theory, Alonso achieved a theoretical equilibrium for the whole market. He stated that the most central location in the city will go to the individual with the steepest bid price curve. The individual with the second steepest bid price curve will get the next site outward from the city and so on (Chapin & Kaiser, 1979).

This model explains the process by which individuals bid for land and how the owner sells it to the highest bidder. This model implies that land uses will be decided manually on the basis of who buys land and where. Through the evaluation of the above-discussed models it has been determined that the urban structure tends to develop outward towards cheaper and more open, accessible land. Alonso (1964) makes an interesting point when he states that poorer people live on land with higher value than people that are privileged.

According to this model, the most expensive land is within the CBD of the city, while land further away from the CBD is cheaper and is used to develop residential areas away from industries and noise, but at the same time, the more accessible land is, the higher its cost is. This phenomenon can explain why peripheral areas develop and satellite suburbs appear. Thus, land located near main transport routes will have higher value and is more likely to be used for development (Waugh, 2002; Pacione, 2005). It is evident from the model that, development will occur along main transport routes and it can sprawl outwards towards the periphery of the city in the form of horizontal growth and ribbon development. These principles will be taken into consideration by the researcher while formulating and testing a new approach to spatial land use management.

Although Alonso's theory provides great insight into the analysis of land use and its suitability, the researcher adopted its concept and applied to the Kenyan situation with emphasis to Vihiga County as shown in Figure 2.

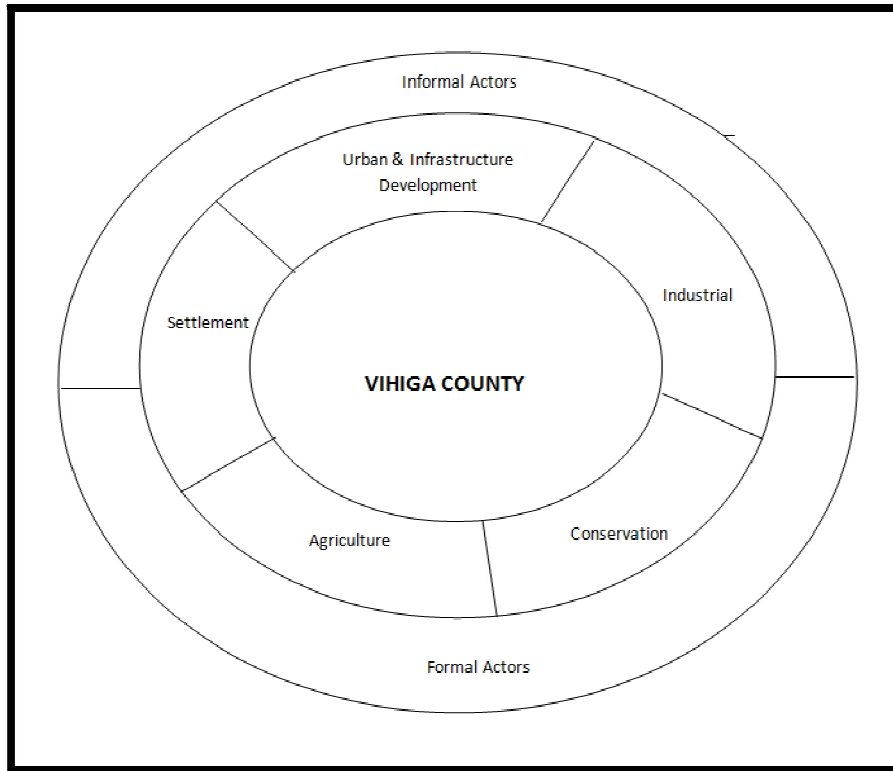


Figure 2: Modified Theory of Alonso
Source: Author 2016

The researcher modified the Alonso’s model and integrated it with sustainable livelihoods approach to develop a more comprehensive framework that does not only bring to the core the gaps identified for spatial land use management, but also in attainment of sustainable development. Vihiga County, in relation to the study, represents a region in which various land use activities in the form of agricultural production, conservation of environment, settlement of people, industrial, urban, and infrastructure development are distributed over space. This is further influenced by formal actors that consist of legal institutions that regulate the use of land and informal actors (private organizations) that recognize land as a capital asset.

Since sustainable livelihoods is a systematic approach that links issues of poverty reduction, sustainability and empowerment of the people, it also has the flexibility to tap into kinds of adaptive responses and utilize them as entry points to policy making. Although human sustenance and livelihoods is anchored on people’s interactions with the natural environment, the existing policy framework and the connectivity through provision of necessary infrastructure need to be enhanced in order to make development more holistic. Indeed, all these revolve around the natural asset- land as a resource. But the critical question today is

“Is it possible to produce and consume resources and also realize our livelihood aspirations without jeopardizing the capabilities of each other or of future generations in maintaining at least the same level of opportunities?”(Dercon and Khrishan, 1996)

For the purpose of this study, livelihoods are the means, activities and entitlements by which people make a living. These activities span from agricultural activities, trading, casual labor, provision of low cost transportation (bodaboda) and hawking. Indeed, a livelihood system is a

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dynamic relation that integrates both opportunities and assets available to a group of people for achieving their goals and aspirations with and exposure to arrange of beneficial or harmful ecological, social, economic and political perturbations that may help or hinder a group's capability to make a living (Noble, 1992).

A livelihood is only sustainable if one can cope with it, recover from and adapt to stresses and shocks, maintain and enhance opportunities for the next generation. The concept of sustainable livelihoods builds on these foundations and can help in the formulation of policies and programs that are cognizant of various risks and opportunities faced by communities and individuals help them harness their coping and adaptive strategies, and encourage sustainable use of natural resources so as to create an enabling environment for sustainable livelihood patterns. The most important element of sustainable livelihoods is the notion of mutuality and reciprocity. It provides a lens through which the reciprocal relationship between the people and their environment can be viewed. In this regard, people are neither cast as powerless objects nor as free agents who can become whatever they choose. This creates a feedback loop between the people and the political, social, cultural and economic situations in which they find themselves in (Cekan, 1992).

This integrated approach helped the researcher build a better understanding of spatial land use management as a strategy in the study through the analysis of macro, micro and sectoral policies which, in one way or the other, can cause adverse effects on people's livelihoods. Through identification of existing unexploited investment opportunities, the risks, assets, entitlements, livelihood activities and knowledge bases of the households in and within the study area with a view to seeking ways in which spatial land use management strategy can lead to sustainable livelihoods in Vihiga.

Also, arising from reviewed literature, it is evident that, although the principles of land use management remain the same, the differences in their application clearly affect the inner workings of the strategies with regard to data inputs and variables of land use. Although many disparities exist between and within regions, most of the modeling approaches, reviewed in this study, have similarity in that they assisted the researcher in identifying and allocating potential land for future land use but are in many cases somewhat elementary and tailored to address a particular problem at a given time. Most of these are biased economic models with limited emphasis on sustainable land use management {Schneider and Pontius (2001), Semeels and Lambin (2001) and Wassenaar *et al*, (2007)}.

Thus, to operationalize the model, the researcher developed a conceptual framework that brought on board critical elements of sustainable livelihoods for identifying the linkages between different variables for determining the effectiveness of Spatial Land Use Management Strategy for sustainable livelihoods in Vihiga County, Kenya.

2.8. Conceptual Framework

The model below gives the researchers conceptualization of the key issues we need to ascertain for SLUMS to work and Sustainable livelihoods to be achieved. As illustrated in the model and operationalization of SLUMS, the researcher considered the current land use activities undertaken by respective households in the area of study. These included: agricultural activities, quarrying and mining, urban and industrial development, settlement, a forestation and conservation purposes. It was also important to understand the determinants of various land uses in relation to sustainable livelihoods. This entailed examining the role of informal and formal actors

in land use management, the effect of population explosion, land tenure systems and acreage under production, the available technology for use and the quality of land in terms of fertility. Further, the researcher evaluated the influence of the strategy on people's livelihoods by considering economic, social-cultural, political and environmental dimensions of land use. The challenges attributed to the use of the strategy were analyzed in two perspectives: internal and external causes.

However for the desired level of sustainable livelihoods to be achieved, the SLUMS must strike some balance with regard to applicability of the strategy in land use management and sustaining the needs of respective households. As shown in Figure 2.3, sustainable livelihoods is achieved when households are able to embrace diversification of production, improved income for families, reduced environmental hazards, there's balanced growth in various sectors of the economy, co-existence and compatibility of different land uses, and maintenance of land carrying capacity. The directions of the arrows indicate the influence of the SLUMS on sustainable livelihoods. Thus, policies should aim at circumventing the challenges that may affect the application of the strategy in attainment of sustainable livelihoods at large.

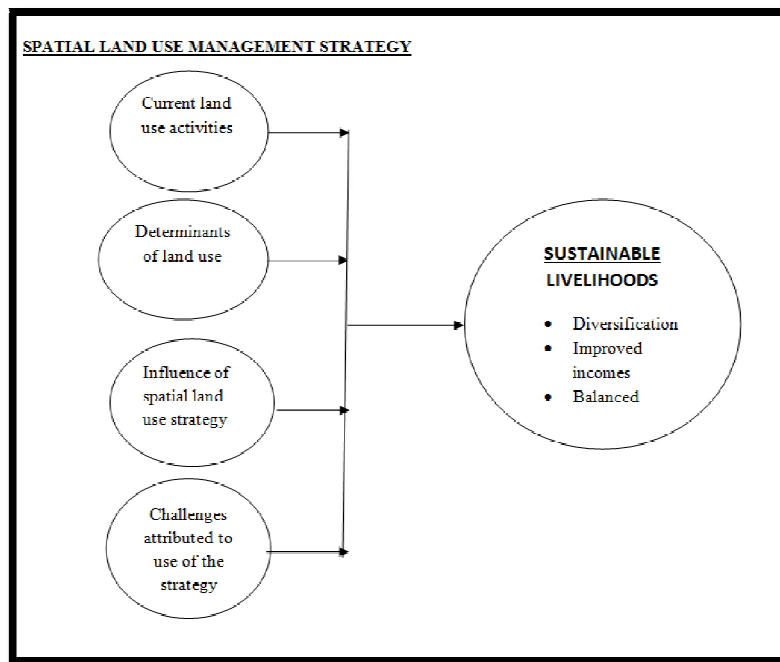


Figure 3: Conceptual Framework
Source: Researcher's Perception, 2016

From the conceptual model, development contains a multiplicity of activities that need to be coordinated in space. Since development is a social process, it is also a creator and organizer of space in which various livelihood activities are anchored. Thus, decisions must be made about the location, types of investment, management of these activities and thus, in most cases, at a cost effective resource management objectives. Indeed, all variables used in planning complement each other and therefore, they should be presented as a coherent package. Counties are new spatial entities with diverse regional organization (natural or human), which may belong to different

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domains (political, economic, socio-cultural and ecological), and may not necessarily coincide with administrative or geographical areas.

In spite of the diversity, Counties are expected to spur development through integrating key variables linked to land use management (land use planning, land policy and rural-urban linkages) and sustainable livelihoods (land carrying capacity, diversification/heterogeneity of land use, reduced environmental hazards, enhanced co-existence and compatibility, increased food production and ultimately people striving to attain balanced development). However, as seen from the model, sustainable land use can only be achieved through prudent management of socio-economic activities, cultural attributes, population pressures and the politics of the day through development of appropriate policy response. In this era, modern technology (GIS) can be used to mitigate any challenges arising from the implementation of the model that may be beyond human control. People's participation is crucial because they can inculcate traditional approaches to modern for sustainable development.

CHAPTER 3: RESEARCH METHODOLOGY

3.1. Overview

This chapter explains the procedures and methods the researcher used in collecting data for spatial land use for sustainable livelihoods in Vihiga County, Kenya. It starts with an exploration of the concepts of the research design and approach as it was selected and applied. It further discusses pragmatism, the philosophical world view and its association with epistemological and ontological perspectives that guided the study. This chapter also covers the study area and how sampling of the study objects or population was undertaken. It paid focus on the trustworthiness of the data that was collected and how ethical issues that related to the study were dealt with. This chapter will seek to justify the relevance and the validity of the processes that guided and supported the study.

3.2. Research Design

The study adopted Analytical Research Design. The researcher embraced this design because it involves critical thinking skills and evaluation of facts and information relative to the research being conducted. This design, in particular, attempts to establish why the current land-use is the way it is or how it came to be. Thus, the researcher formulated the research questions with the view to trying to unravel the underlying truth of the effect of Spatial Land Use Management Strategy on Sustainable Livelihoods in Vihiga County, Kenya. Although there are many different methodologies used in different research, the researcher adopted mixed methods approach because it still relies on data collected with either qualitative or quantitative approaches. The mixing, therefore, enriched the quality of this study. In the next section, the researcher will bring to the core how mixed methods research approach was applied in the study, the philosophical paradigm of the research, the procedure of inquiry and how data was generated.

3.2.1. Mixed Methods Approach

The contemporary research problems require a more comprehensive and nuanced effort. Because of this, the researcher adopted mixed methods approach as it provided the researcher with more choices and options to consider on how to collect data for the study. Also, the study exploited the bridge that provides the approach to enrich the quality of any study by drawing from the strengths and minimizes the weaknesses if only one approach was used.

The study embraced mixed methods because mixing qualitative and quantitative data during collection and analysis provided deeper insights and a more complete picture of the phenomenon and triangulated research yielded results that were more comprehensive and reliable than those generated through single methods (Razum & Gerhardus, 1999).

In order to bring more clarity and understanding, complementaries helped the researcher enhance results with the second source of data while abductive inspiration was particularly useful during piloting the study since this enabled the researcher to generate the ideas that shaped the study. Mixed methods provided a framework for answering different questions that cannot be exclusively answered by either qualitative or quantitative approaches, and also it provided a greater repertoire of tools to meet the objectives of the study. Through initiation, it was possible to

develop new perspectives of phenomena under study and stimulate further research at the end of this study.

Further, mixed methods allowed for offsetting weaknesses and providing stronger inferences of each approach, while strengths were built upon, thus providing stronger and more accurate inferences of research findings (Bryman, 2006 and Creswell and Clark, 2007).

3.2.2. Philosophical World Views

Philosophical ideas are primarily hidden influence on the conduct of research. For this reason, then, it was essential for the researcher to identify and pay special attention to this study. The term 'world view' refers to basic set of beliefs or frameworks of thought that influence the researcher's choice of research design. It relates to the development of knowledge and nature of the knowledge so created (Saunders, 2009: 107). This is important because values usually have an impact on the research in the way we decide to undertake and pursue it. Although these may not lead to any form of discord, some observers may accuse the researcher of untold bias (Dyer, 2003: 1005).

A paradigm is an interpretive framework that is guided by a set of beliefs and feelings about the world and how it should be understood and studied by the researcher. Indeed, this orientation may be shaped by the researcher's area of discipline, experiences and beliefs (Creswell, 2009).

3.2.3. Pragmatism

The researcher applied pragmatism, a world view that is associated with mixed methods approach, in this study because it is a more pragmatic approach that is not bound by a single frame of reality but rather through multiple stages of data collection and or analysis. Also, it enabled the researcher to get a better understanding of a phenomenon through a combination of reliability of empirical counts with a validity of lived experience. Further, this world view arises out of actions, situations and consequences rather than incident actions. The main assumption is the belief that knowledge is not abstract philosophy but practical and it works to answer research questions and solve problems as developed by the researcher (Saunders *et al*, 2009: 119).

Indeed, this asserts the reason for which the researcher chose to adopt an analytical research design for this study. The researcher envisaged developing workable solutions to problems related to spatial land use management by laying emphasis on the research problem, while at the same time employing pluralistic approaches in search of knowledge for sustainable livelihoods in Vihiga County, Kenya.

The pragmatic approach relies on a version of adductive reasoning that moves back and forth between induction and deduction by first converting observations into theories and then assessing those theories through action. The interaction between knowledge generated under qualitative and quantitative research approaches enriches the choice of mixed methods used in this study (Morgan, 2007).

Pragmatism was suitable for this research approach because it is not fixed to any one system since it draws freely from both qualitative and quantitative assumptions. Pragmatists agree that research occurs in social, historical, political and other contexts as exhibited in the scope of this study (Creswell, 2003). Also, pragmatism gave the researcher the freedom to choose from the approaches, techniques and procedures that were applied in the study. Through pluralistic approach, it was possible to use several approaches for data collection and analysis. However, the

researcher acknowledged the fact that different approaches to research can only be validly combined when the logical combination between each approach has been established and that the criteria used to evaluate the research has been made clear. On this basis, then, the strengths of one approach compensated the limitations of the other (Flick, 2002).

3.2.4. Application of Mixed Methods in the Study

The application of mixed methods in the study entailed embracing the procedures that guide its use by emphasizing the importance of timing, weighting and mixing as discussed below (Clark and Creswell, 2007:79-85).

3.2.4.1. Timing

Timing is about when data was being collected. The researcher collected qualitative and quantitative data simultaneously and sequentially. However, this depends on the availability of respondents during the study. The researcher conducted a separate analysis of data collected in order to maintain clarity of the results obtained.

3.2.4.2. Weighting

This concerns the relative importance given to different approaches that were applied by the researcher in the study. This study embraced (QUAN or QUAL) as a dominant approach and for this reason quantitative data was given more weight because of the researcher's epistemological view and other practical issues related to data access and data types.

3.2.4.3. Mixing

The researcher mixed data at collection in the field, during analysis and interpretation stages of the study or at all the three stages. This view is also held by Saunders *et al.* (2009: 151-152) that data can be merged by embedding one data type on another, transforming and integrating two different data types together or that can be presented separately and then connected to answer a particular research question(s).

3.3. Target Population

The target population for this study was drawn from Vihiga which is the geographical location of the area under study (Neuman, 2006:224). The population of Vihiga County was approximately 554,622 as per National Population and Housing 2009 census (Republic of Kenya, 2009), with a population density of 1,078 persons per square km, one of the highest in the country. This population is composed of 47.8 % male and 52.2% female respectively. The County population is estimated to have grown to 572,577 persons in 2012 and is projected to grow to 603,856 persons in 2017 (KNBS, 2013). The researcher, while acknowledging the implication of the anticipated population increase over the period of this study, chose to draw the target population from census results of 2009 because it is a more reliable source. Arising from the above, the researcher assumed that an average household in Vihiga County has five (5) members. Thus, the target population for the study was approximately 110,000 households. Figure 3.1 illustrates how the target population and sample size for the study was determined.

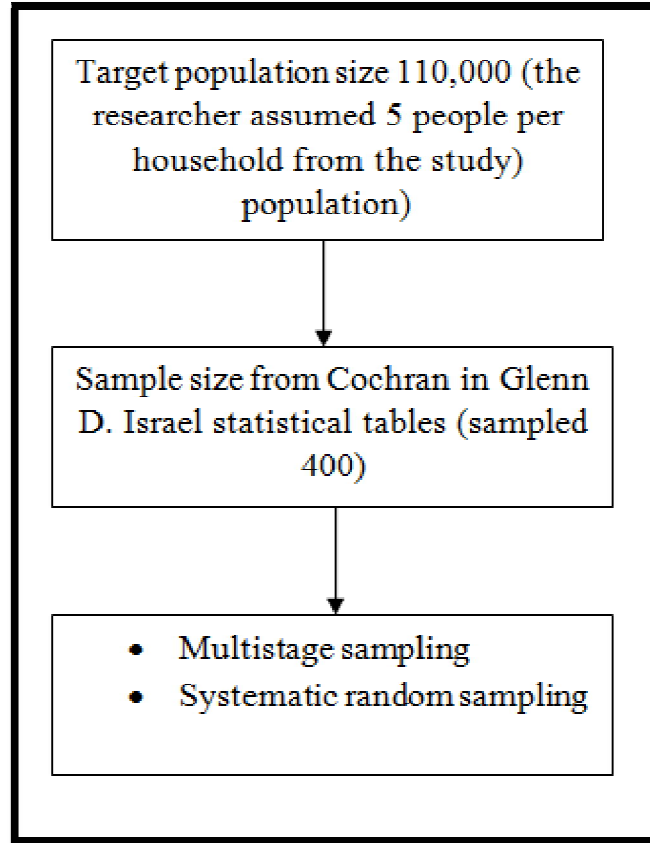


Figure 4: Determination of Target Population and Sample Size for the Study

Source: Researcher's Perception, 2016

3.4. Sample Size

The determination of a sample size is assumed to be a function of various factors that impact on the study. While acknowledging this, the researcher, in particular, paid attention to the probability of type 1 error, given that the alternative null hypothesis is true, the probability of type 11 error, given that the alternative hypothesis is true and the difference sought i.e. the difference one would not like to miss, and the presumed standard deviation of the outcome i.e. the anticipated value of the measure of variability of the outcomes. For purposes of generalization, it was essential that the sample size is appropriate, such that the results are representative, and that the statistics can show associations or differences within the results obtained from the study (Fox, 2007:4).

Sample size determination tables derived from Cochran (1963:75 in Glenn D. Israel 2009: 1) were used to obtain a representative sample of 400 respondents for the study as shown in Table 1 from a target study population of 110,000 people. Cochran (1963:75) formula that was applied to yield a representative sample for proportions has illustrated in the formula below.

$$no = \frac{Z^2 pq}{e^2}$$

Where; no is the sample size, Z^2 is the abscissa of the normal curve that cuts off an area α at the tails ($1 - \alpha$ equals the desired confidence level, e.g., 95%), 1 is the desired level of precision, p is the

Spatial Land Use Management Strategy on Sustainable Livelihood in Vihiga County, Kenya

estimated proportion of an attribute that is present in the population, and q is $1-p$. The Z value found in statistical tables is the area under the normal curve.

For $\pm 3\%$, $\pm 5\%$, $\pm 7\%$, and $\pm 10\%$ Precision Levels, where Confidence Level is 95% and $P= 0.5$. Population size Sample Size (n) for Precision (e) of:

	$\pm 3\%$	$\pm 5\%$	$\pm 7\%$	$\pm 10\%$
500	a	222	145	83
600	a	240	152	86
700	a	255	158	88
800	a	267	163	89
900	a	277	166	90
1,000	a	286	169	9
2,000	714	333	185	95
3,000	811	353	191	97
4,000	870	364	194	98
5,000	909	370	196	98
6,000	938	375	197	98
7,000	959	378	198	99
8,000	976	381	199	99
9,000	989	383	200	99
10,000	1,000	385	200	99
15,000	1,034	390	201	99
20,000	1,053	392	204	100
25,000	1,064	394	204	100
50,000	1,087	397	204	100
100,000	1,099	398	204	100
>100,000	1,111	400	204	100

Table 1: Glenn's Statistical Table for Determining Sample Size

Source: Adopted from Glenn (2009)

a = Assumption of normal population is poor (Yamane, 1967), the entire population should be sampled

$$n = \frac{Z^2 pq}{e^2}$$

e^2

A sample frame was developed to guide the identification of the respondents as shown in Table 2. However, the researcher sampled 385 respondents with 9 respondents partially filled the questionnaires and 6 questionnaires could not be retrieved from the respondents. The researcher achieved a response rate of 96.3% which was, according to the researcher, sufficient enough to proceed with the study.

Research Methodology

Sub-County	Area in Square Km	Population Census 2009	Sampled Population	Response Rate
Hamisi	156.4	148,259	115	96.3%
Emuhaya	94.5	89,147	50	
Vihiga	90.2	91,616	75	
Sabatia	110.9	129,678	80	
Luanda	85	95,923	65	
Total	537	554,622	385	

Table 2: Study Population and Distribution Pattern

Source: Research Data 2016

The figures shown in Table 2 above were obtained from Sub-County administrators and the County statistical office in Vihiga County.

3.5. Sampling Procedure

Sampling is the process of indicating the object of the study, i.e. who or what will be studied and why (Lohr, 2009:420). In order to ensure that the sample is as representative as possible and at the same time grappling with the constraints imposed by the regional set-up of Vihiga County, the nature of the topic, resources available and limited time for the study, the researcher made some trade-offs in order to mirror the study population as possible. This view is supported by other scholars like Serem, Boit & Wanyama, (2013) and Webster, (1985).

Multi-stage cluster sampling was conducted at the Sub-County because of the heterogeneity of the study population and systematic random sampling in each of the 25 wards where every Kth household was sampled proportionately to the Sub-County population. The chief officers and directors of respective departments in the county, local administrators and opinion leaders who offered in-depth information without being extreme were purposively sampled. Purposive sampling technique allowed the use of cases that have the required information with respect to the objectives of the study.

Also, focused group discussions were conducted in all the five (5) Sub-Counties with key informants and administered interview schedules to Heads of Departments of Land, Surveys, Physical Planning, Environment and Natural Resources, Transport and infrastructure, and Economic Planning. Their views were inculcated into the study because of their perceived knowledge in matters relating to land use and sustainable livelihoods (Creswell, 2009).

In order to address the aspect of bias that is majorly attributed to non-probability sampling i.e. not all members of the target population have a chance to be included in the study sample, mixing of quantitative and qualitative data addressed this limitation in the study. To address the discrepancy between characteristics of the population and that of the sample (sampling error), the researcher minimized the error by selecting a large sample that was proportionate to the population census as shown in Table 2 (Serem, Boit & Wanyama *et al*, 2013).

3.6. Data and Data Collection Instruments

A survey was conducted to collect primary data, while secondary data was collected by content analysis. The survey method was used in this study because it enabled the researcher to

administer questionnaires and responses were recorded (Neuman, 2006). The survey commenced after acquiring research permit and the research authorization letter from the National Commission for Science Technology & Innovation (NACOSTI) and authorization by the County Government of Vihiga to undertake the study (Appendices 3, 4 & 5). All Heads of Departments at the Sub-Counties were also contacted for permission before the commencement of the survey process.

Content analyses were performed by reviewing literature relevant to study in order to clarify the topic, identify the gaps and suitable theories and justify the value for the study (Leedy and Ormrod, 2005:142). Secondary data was collected from files, books, pamphlets, office manuals, journals, and policy papers to complement primary data.

3.6.1. Closed- ended Questionnaires

The (400) questionnaires consisting of structured questions were administered to the respondents with the help of research assistants, while some were self-administered in all the twenty-five wards (25) in the area of study. Two research assistants were assigned to collect data in each of the five Sub- Counties. They also read the questionnaires to the respondents in the language they understood to bring clarity. The structured questions were preferred because they limit the subjectivity of responses with its numerical scale and enable quantitative analysis of results obtained which were also aligned to specific objectives of the study.

3.6.2. Documents Review

Documents helped the researcher confirm, modify or contradict study findings (Blaxter, Hughes & Malcolm, 2001). In particular, it enabled the researcher to pay attention on analysis and interpretation, and compliment data where they do not constitute primary data themselves. Yin (2000) adds that, documents are not only stable, exact and broad, but are also reliable since they are not created as a result of a research context. Thus, documents reviewed helped reconstruct past events as well as on-going processes that reflect rationality and enhance the accuracy. Some of the reviewed documentary sources included: public documents like government surveys, National Land Policy, Kenya Vision 2030, legislations, historical records, print media, and private journals, diaries or letters (Taylor, 2002).

Also documents at the County departments of Lands , Physical Planning and Surveys, Economic Planning, Culture and Social Services, Transport and Infrastructure, Trade and Tourism, Water, Forestry and Environment, Statistics, Education and Agriculture, County Integrated Development Plan (CIDP) and Vihiga County Development Profile amongst others in order to gain more insight on matters related to the study.

3.6.3. Interviews

The researcher conducted face-face or one-on-one, in person interviews with government officers, at the quarry and mining sites. The researcher interviewed by phone especially for field officers like surveyors and held focused group discussions in the five sub-counties (Emuhaya, Luanda, Vihiga, Sabatia and Hamisi). The interview schedules were self-administered by the researcher in order to have control over the line of questioning, while the participants provided historical information that were relevant to the study. Questions were designed to address a particular research objective or answer a specific question.

3.6.4. Observations

The observed data was recorded on field note books concerning the behavior and activities of individuals at the research site. The recording was done in both structured and unstructured way (using some prior questions the researcher wanted to know). Observation was also done by way of complete participation or no participation. This method enabled the researcher to have first-hand experience with respondents on matters relating to the current land use activities, the determinants of Spatial Land Use and their influence on sustainable livelihoods of the respondents. Also, any unusual aspects that were noticed during observation and could aid in answering research questions for the study were recorded.

3.6.5. Audio- Visual Materials

This data was collected in form of photographs, video tapes, computer software, and film amongst others. This provided the researcher with an opportunity to directly share reality on matters related to land use and how households could attain sustainable livelihoods. This form of data collection was also creative since it captured attention visually as illustrated in chapter five of this study.

3.6.6. Satellite Imagery

The researcher embraced the use of technology (GIS maps as illustrated in Figure 5, Figure 4.2 & Figure 5.1) to give a true presentation of various land use activities without any bias. This, in particular, enhanced the reliability of the data collected during the study.

3.7. Pilot Study

The pilot study was conducted in Siaya County (Gem Constituency) and Nandi County (Aldai Constituency) because of their close proximity to Vihiga County. The researcher administered a set of structured questionnaires to appraise its responsiveness, estimate time required to answer the questions and confirm its viability to the study. The pilot study covered fifty (50) respondents not included in the study's sample population. From the pilot results, the researcher learnt that some of the questions on current land use activities were repeated in the section of dimensions of livelihoods in the questionnaire and also the best time to interview. The questionnaire also proved to be too long, taking approximately one and a half hours to administer. Some participants were uncomfortable with the time since they had other issues to attend to. The results of the pilot study were discussed with the supervisors in order to make the required adjustments in the instrument before administering in the final survey. The major objective of piloting was to test the instruments' reliability, validity and objectivity as discussed below.

3.8. Validity, Reliability and Objectivity

Validity and reliability are closely related terms which have been defined differently by different authors. Validity and reliability are usually complementary concepts, although reliability seems easier to achieve if the measure is precise and observable (Neuman, 2006:197). Thus, validity and reliability are necessary to get distinctive results.

3.8.1. Validity

Validity refers to whether the variables measure what they are intended to measure. Validity is, therefore, concerned with whether the findings are really about what they appear to be about (Saunders et. al., 2009: 157). There are three types of validity, namely: criterion, content and construct validity as discussed below (Ballinger, 2000:101). Furthermore, the study needs to be both internally and externally valid to allow for generalizations (McClung, 1988:148). Internal Validity refers to the extent to which the research design and the data that it yields allows the researcher to draw accurate conclusions. Triangulation of data collection methods (questionnaires and content analysis) was applied to ensure internal validity was achieved (Leedy & Ormrod, 2005).

External Validity refers to the extent to which the results of the study can be generalized (Silverman 2005, Saunders *et al.* 2009: 158). This was achieved in the study by use of real life settings, drawing a large sample and probability sampling procedures were used to enhance representativeness.

The validity of the data collection instruments used to collect data was measured by deriving all the questions from the study's objectives, and checking each question to determine its contribution to the objectives (Glenrose, 2012: 121). Content validity of research instrument used in this study was assured by a meta-analytic comparison with earlier studies using similar designs and favorable observations from experts (supervisors) reviews. Meta-analytic comparison results showed significant content convergence.

3.8.2. Reliability

Reliability refers to the dependability or consistency of the research results (Neuman, 2006:196). It is the degree to which the same results would be obtained in repeated attempts of the same test (Gall & Gall in Ballinger, 2000:102 Silverman, and 2005).

To test the internal consistency of the items listed on the instrument used, the researcher established the reliability coefficient of 0.85 using Test-retest method. Spearman Rank Correlation was used to determine the reliability of test scores. A reliability of 0.5 was considered high enough for the instrument to be used for the study (Feuerstein, 1986).

To ensure reliability, items were also prepared by means of factor analysis before they qualified for use in the hypotheses testing. The factor analysis statistical technique was employed to reduce the original large data from the questionnaires into factors conducive for use in hypotheses testing (Andy, 2013:665). Principal axis factoring method was also used to ensure that only a shared variance is used to cluster variables together.

Reliability can also be improved when pilot tests are done and one or more versions of a measure are developed and tried before applying the final version (Neuman, 2006: 197). This was achieved while piloting study to pre-test the reliability of the questionnaire.

3.8.3. Objectivity

Objectivity refers to the extent to which findings are free from bias (Silverman, 2005), or the inter-subjective agreement on what multiple observers agree to as a phenomenon (Robson, 1993). The researcher and research assistants conducted multiple interviews so as to generate

themes across respondents, spot checks by the research team also confirmed the objectivity of the data collected, and the use of standardized data collection instruments increased the objectivity.

3.9. Data Processing and Analysis Methods

Data in masses of figures say nothing and can be extremely confusing since the human mind cannot consume disorderly data (Ramari, 2013: 111 citing Mutea, 2007). Processing data was essential for ensuring that all relevant data for making contemplated comparisons and analysis was considered in the study. It involved editing and coding collected data so that they are amenable to analysis.

3.9.1. Editing

Editing of data is a process of examining the raw data (especially in surveys) to detect errors and omissions and to correct these errors where possible. It entails careful scrutiny of the completed questionnaires to assure that the data are accurate, consistent with other facts gathered, uniformly entered, as complete as possible and have been well arranged to facilitate coding and tabulation (Kothari, 2004: 122).

Data editing for this study was done at two stages, in the field and central editing. Field editing consisted of the review of the reporting forms by the investigator for completing (translating or rewriting) what the respondent has written in abbreviated and/or in illegible form at the time of recording the responses. This type of editing was necessary in view of the fact that individual writing styles often can be difficult for others to decipher. It was done as soon as possible after questionnaire administration, preferably on the very day to avoid forgetting (Kothari, 2004: 123).

Investigators were, however, advised not to correct errors of omission by simply guessing what the informant would have said. Field editors kept in view the following points while performing their work: They followed instructions given to them for the editing purpose; while cancelling out an original entry for one reason or another, they just drew a single line on it so that the same may remain legible; they made entries (if any) on the form in some distinctive color and that too in a standardized form. Editor's initials and dates of editing were placed on each completed questionnaire.

Central editing was undertaken when all questionnaires had been completed and returned to the researcher. This editing implied that all filled questionnaires should get a thorough editing by the researcher himself. The researcher corrected the obvious errors such as an entry in the wrong place, entry recorded in months when it should have been recorded in weeks and double entries. Also, inappropriate or missing replies, the researcher determined the proper answer by reviewing the other information in the tool, and struck out an answer if the same is inappropriate and he had no basis for determining the correct response.

3.9.2. Coding

Coding is the process of assigning numerals or other symbols to answers so that responses can be put into a limited number of categories or classes. Such classes should be appropriate to the research problem under consideration. They must also possess the characteristic of exhaustiveness (having a class for every data item) and also that of mutual exclusivity (a specific answer that can

be placed in one and only one cell in a given set). Another rule that was observed in coding was that of uni-dimensionality where every class was defined in terms of only one concept (Kothari, 2004: 123).

Coding was necessary for efficient analysis as it helped reduce several replies to a small number of critical classes of information needed for analysis. The advantage of coding data was that it made data manageable (Neuman, 2006:460). Codes included on questionnaire as pre-set codes for variables with limited categories enabled coding at data collection stage. Coding at collection stage was done when there was a limited range of well-established categories into which the data could be placed. Codes were included on questionnaire as categorized.

Further, coding was done after data collection where responses were unclear. To ensure that the coding scheme captured the variety in responses, the research assistants had to wait until data from the first 50 to 100 cases were available to aid develop the coding scheme/ codebook (Saunders et al., 2009: 424).

3.9.3. Data Analysis Methods

Data analysis is the computation of certain indices or measures along with searching for patterns of relationship that exist amongst data groups. The main aim was to discover patterns in data that point to theoretical understanding of social life (Babbie, 2004:376). Analysis entailed estimating the values of unknown parameters of the population and testing of hypotheses to draw inferences (Saunders et al., 2009: 428-467).

Descriptive analysis was carried out first after entering data in the SPSS computer software and checking for errors. This was useful in this initial stage as tables and diagrams were used to explore and understand data, while emphasizing the importance of using it to guide choices of analysis techniques (Saunders et al., 2009: 428). It also gave the researcher some flexibility to introduce previously unplanned analyses to respond to new findings. Each diagram and table was structured and labeled clearly to avoid possible misinterpretations in later sections.

Since descriptive analysis largely deals with distributions of one variable in respect of another variable (uni-dimensional, bivariate or multivariate analysis), the researcher carried out correlation analyses to establish the correlation between two or more variables in the study. Causal analysis was also done to establish functional relationships existing between two or more variables, while correlation coefficient was used to assess the strength of relationship between dependent and independent variables.

The coefficient of determination for example can take on any value between 0 and +1. For example, to measure the proportion of the variation in a dependent variable (improved incomes) can be explained statistically by the independent variable (current land use activities). This, therefore, implies that, when all the variations in number of households realizing improved incomes can be explained by the current land use activities, then coefficient of determination will be 1. If 50 percent of such variation can be explained, then the coefficient of determination will be 0.5, and if none of the variation can be explained, the coefficient will be zero. This causal analysis is also termed as regression analysis.

Inferential analysis was used to carry out the various tests of significance for testing hypotheses in order to determine with what validity data can be said to indicate some conclusion or conclusions. It was also used to estimate the population values (Kothari, 2004:130). In scientific

research, it is mainly on the basis of inferential analysis that the task of interpretation (i.e., the task of drawing inferences and conclusions) is performed.

SPSS (Statistical Package for Social Sciences) software was used for analyzing collected data (Dzis, 2008: 39). It was used to reduce the data into manageable size through factor analysis to identify the structure underlying them. Reliability testing was conducted for each of the extracted factors to ascertain the degree to which the items making up the scale agreed, thus find out whether all the variables, collated on one factor, have internal consistency and measure the same underlying constructs (Brace *et al*, 2003; Bryman & Cramer, 2004; Hair *et al*, 2006; Pallant, 2005 in Dzis, 2008: 46).

Content analysis takes a holistic and comprehensive approach towards analyzing data in a step-by-step process reducing complexity and filtering out the main points of analysis. In particular, it helped the researcher to understand the complex social phenomena and enhanced theory-guided analysis through triangulation (Dzis, 2008: 46). In particular, content analysis helped understand the current land use activities and the influence of various dimensions of livelihoods in Vihiga County.

The theory-guided analysis, offered a chance to compare and complement primary data collected from respondents with secondary data from the content analyzed (Dzis, 2008: 47). This enabled the researcher to compare findings in this study with existing theories and past studies on Spatial land use management and sustainable livelihoods. This analysis also ensured the quality of content analysis, especially validity. Although statistical techniques helped to analyze primary data, content analysis was used to combine and integrate for interpretation, to achieve results convergence.

3.10. Ethical Issues

Ethical issues are concerns, dilemmas and conflicts that arise over the proper way to conduct research because ethics define what 'moral' research procedure involves (Neuman, 2006:129). It entails weighing the study's potential for good, that is, its ability to provide a valid answer to an important question, against its potential for harm.

Ethics, therefore, relates to questions about how the researcher formulates and clarifies the topic, designs research and gains access, collects data, processes and stores the data, analyzes and writes up findings in a moral and responsible way (Saunders *et al*, 2009: 184). This means that the researcher has a moral and professional obligation to be ethical, even when the research subjects are unaware of or unconcerned about ethics, especially regarding their economic and socio-cultural status and negative perception in the society as may be depicted in this study.

Ethical issues were of importance throughout entire research. It required integrity from the researcher, research sponsor and even the respondents. Thus, the researcher had to strike a balance between the choice of the research topic, the expected quality of the research, the existing knowledge and satisfaction of the assessment requirements of MOI University.

Indeed, it is a Commonwealth requirement that all projects involving human subjects meet certain standards and have written approval from the accredited ethics body (Dzis, 2008: 139). The researcher, therefore, applied and obtained ethics approval in writing before commencing the data collection process from MOI University's School of Human Resource Development under which this PhD was being undertaken and a research permit from NACOSTI (Appendix 4).

The researcher minimized ethical problems associated with questionnaires by adopting questions that are clearly not designed to explore responses and avoidance of the in-depth interview situation, where the ability to use probing questions leads to more revealing information (Dale *et al*, 1988). Also, written statement was given to respondents outlining the purpose and nature of the study which assisted the respondents to make an informed choice as to whether or not to participate (Saunders *et al*, 2009: 196). The research assistants were instructed to exercise utmost care to ensure that all data collected were handled confidentially and no photographs or audio recording were taken without the permission of the respondents.

Ethical issues extend to the analysis and reporting stage of research work (Saunders *et al*, 2009: 196). Although it is difficult to maintain confidentiality and anonymity before and during the reporting stages, the researcher exercised care to ensure that the objectivity limits the distortion of research conclusions and associated recommendations.

A further ethical concern could stem from the use made by others of the conclusions reached by a research and any course of action that is explicitly referred to or implicitly suggested, based on the data. In view of the above, conclusions arrived at and recommendations made in this study, should not in any way cause harm due to decisions made during implementation (Saunders *et al*, 2009: 200).

CHAPTER 4: STUDY AREA

4.1. Overview

This chapter gives a synthesis of the study area by bringing to the core the key livelihood strategies that are derived from various land use activities by the residents of this County. In particular, this chapter will look at the location of the County, its population distribution, physical and natural conditions that may impact on land use, socio-economic activities and natural resource management. These are further discussed in the sections below.

4.2. Location and Size of Vihiga County

Vihiga County is one of the 47 Counties established by the Constitution of Kenya (GoK, 2010). Vihiga County borders Nandi County to the East, Kakamega County to the North, Siaya County to the West and Kisumu County to the South. The County is made up of five Sub-Counties namely: Luanda, Emuhaya, Hamisi, Sabatia and Vihiga. Vihiga County lies between longitudes 34°30' and 35°0' E, and latitudes 0° and 0°15' N. The County covers a total area of 531.0 Km². The County is 33km from East to West and 19 km from North to South. The equator cuts across the Southern part of the County at Maseno near Kisumu County.

Vihiga County is located in Western region of Kenya, in the Lake Victoria Basin. Its altitude ranges between 1,300 m and 1,800 m above sea level and slopes gently from West to East. This physical location in itself makes Vihiga County unique in the sense that apart from exploiting the potential within its jurisdiction, it can equally tap on the opportunities that focus on key livelihood strategies practiced in the neighboring counties to her benefit.

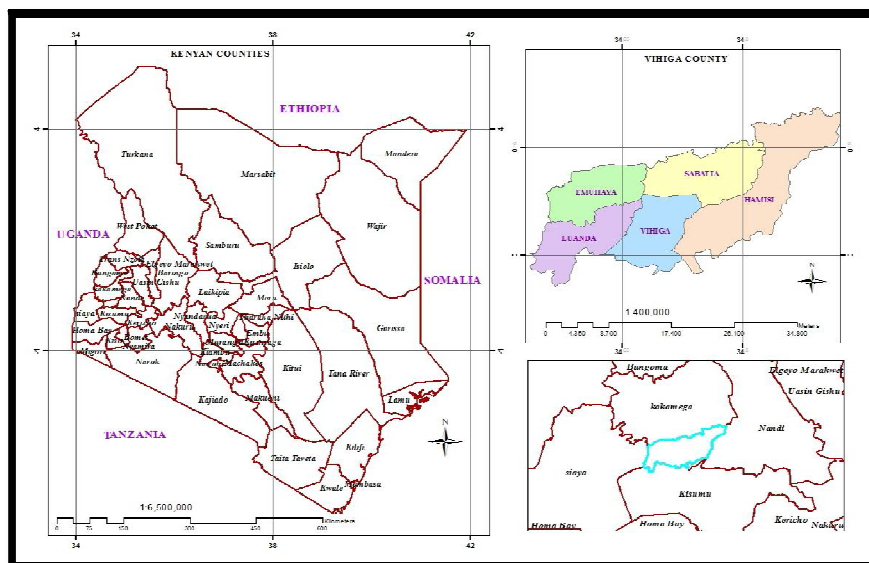


Figure 5: Map of Kenya Showing Location of Vihiga County

Source: KNBS 2016

4.3. Physiographic and Natural Conditions

The County is located on the Eastern part of the Rift valley. Generally, the County has undulating hills and valleys with streams flowing from Northeast to Southwest and draining into Lake Victoria. There are two main rivers, Yala and Esalwa, which drain into Lake Victoria. The County experiences high river- line erosion. Consequently, the eroded soils are swept to Kisumu County where they are deposited mainly as building sand which people in Vihiga County end up purchasing when carrying out construction works albeit at a very high price.

The soils in the County are mainly sedimentary in nature and support various farming activities which include cash crops like tea and coffee. The abundant rainfall in the County enables rearing of livestock, crop farming, fruits and other horticultural crops vital for sustainability of agro- based industries. Arising from this type of soils and climate, residents in the County usually have two planting seasons in the year. During long rains, crops such as maize, sweet potatoes, and beans are grown for subsistence use in most parts of the County. The rocky hills dot many parts of the County notably in South Maragoli, Jepkoyai, and Gamoi and around Kima. These hills are composed of granitic rocks which form one of the unexploited resources and they are also an example of how disastrous human activity can be to the natural ecosystem in attempt to sustain their livelihoods.

4.3.1. Ecological Conditions

Vihiga County is categorized into two main agro-ecological zones, the upper and lower midlands. These zones dictate the land-use patterns and population settlement in the County. The upper midland zone, comprising Hamisi, Sabatia and parts of Vihiga Sub-Counties, is well-drained with fertile soils. Many residents in this zone practice crop farming like tea, coffee, maize, beans, and bananas because of its high potential. The lower midland zone, comprising Emuhaya and Luanda Sub-Counties, has the red loamy sandy soils derived from sedimentary and basalt rocks.

4.3.2. Climatic Conditions

The County experiences high equatorial climate with well distributed rainfall throughout the year with an average annual precipitation of 1900 mm. The rainfall ranges from 1800 – 2000mm. Temperatures range between 14°C - 32°C, with a mean of 23°C. Long rains are experienced in the months of March, April and May which are the wettest, while short rains are experienced in the months of September, October and November. The driest and hottest months are December, January and February with an average humidity of 41.75 %. This climate supports a variety of crop farming such as coffee, tea, and horticultural crops and rearing of livestock.

Study Area

4.4. Administrative and Political Units

Sub-county	No. of Divisions	No. of locations	No. of sub-locations	Area (Km ²)
Sabatia	2	8	31	110.9
Vihiga	1	5	18	90.2
Hamisi	4	8	28	156.4
Emuhaya& Luanda	2	16	52	173.5
Total	9	37	129	531.0

Table 3: Administrative Sub-division by Sub-Counties

Source: Vihiga County Commissioner's Office, 2016

Vihiga County is divided into five administrative Sub-Counties namely: Hamisi, Emuhaya, Luanda, Sabatia and Vihiga. The County is further sub-divided into nine divisions, 37 locations, and 129 sub-locations. The administrative information is summarized in Table 3. The County covers a total area of 531.0 Km². Emuhaya and Luanda Sub-Counties are the most expansive at 173.5 Km², followed by Hamisi at 156.4 Km², Sabatia at 110.9 km² and Vihiga at 90.2Km².

4.4.1. Political Units (Sub-Counties and Wards)

SUB -COUNTY	SABATIA	VIHIGA	HAMISI	EMUHAYA	LUANDA	TOTAL
No of Wards	6	4	7	3	5	25
Names	Chavakali, Busali Wodanga, W. Maragoli N. Maragoli Izava/ Lyadyuwa	Lugaga/ Wamuluma C. Maragoli S. Maragoli Mungoma	Tambua Banja Jepkoyai Shiru Muhudu Shamakhokho Gisambai	N.E Bunyore C. Bunyore W. Bunyore	Luanda Township Luanda South Emabungo Mwibona, Wemulabi	

Table 4: County Wards by Sub-Counties

Source: Vihiga County Assembly, 2016

Vihiga County has five Sub-Counties and twenty five electoral wards as shown in Table 4. 2. The Sub-Counties are: Sabatia, Vihiga, Hamisi, Emuhaya and Luanda.

4.5. Population, Size and Composition

According to the National Population and Housing Census (2009), Vihiga County had a population of 554,622, with a population density of 1,078 persons per square km, one of the highest in the country. This consists of 47.8 % male and 52.2% female population. Although the County population is estimated to have grown to 572,577 persons in 2012 and is projected to grow to 603,856 persons in 2017 (KNBS, 2013), the researcher, while acknowledging this implication of the

anticipated population increase over the period of this study, chose to draw the target population from census results of 2009 because it is a more reliable figure (554,622). Arising from the above, the researcher assumed that an average household in Vihiga County has five (5) members thus giving approximately 110,000 households as a target population for the study.

The County's demographic profile depicts a youthful population comprising 46 percent of persons aged below 15 years. This basically implies that there is high dependency rate by this youthful population which equally creates pressure on respective households to meet their respective needs.

4.5.1. Population Density and Distribution

SUB-COUNTY	Area Km2	Pop 2009	Density	Pop 2012	Density	Pop 2015	Density	Pop 2017	Density
Hamisi	156.4	148,259	948	156,594	1,001	165,399	1,058	174,698	1,117
Emuhaya	94.5	89,147	944	94,150	996	994,53	1,052	105,044	1,112
Vihiga	90.2	91,616	1,016	96,767	1,073	102,208	1,133	107,954	1,197
Sabatia	110.9	129,678	1,169	136,968	1,235	144,670	1,305	152,804	1,377
Luanda	85	95,923	1,132	101,316	1,192	107,012	1,259	113,029	1,329
COUNTY	531	554,622	1044	585795	1103	618742	1165	653529	1231

Table 5: Population Projections by Sub-County

Source: KNBS, Vihiga, 2015

As shown in Table 5 in 2012 projections, Sabatia had the highest population density of 1,235 persons per Km² followed by Luanda with 1,192 persons per Km², Vihiga with 1,073 persons per Km², Hamisi with 1,001 persons per Km² and Emuhaya with 996 persons per Km². In 2015, the population densities are projected to increase to 1,235 persons per Km² for Sabatia, 1,052 persons per Km² for Emuhaya, 1,133 persons per Km² for Vihiga, 1,259 persons per Km² for Luanda and 1058 persons per Km² for Hamisi. In 2017 they are expected to increase further to 1,377 persons per Km² in Sabatia, 1,112 persons per Km² in Emuhaya, 1,197 persons per Km² in Vihiga, 1,329 persons per Km² in Luanda and 1,117 persons per Km² in Hamisi. The county population is projected to grow to 653,529 by 2017 with a density of 1,231 persons per square km. This projected increase in population implies that there will be more pressure on land and other resources supporting livelihoods (KNBS, 2015).

4.6. Socio-economic Profile

The researcher found it important to review the socio-economic profile of Vihiga County in order to gain an in depth understanding of the prevailing conditions and how this will enhance the findings of the study.

4.6.1. Education, Science and Technology

The high population growth rate in the County poses great development challenge to the County as it exerts a lot of pressure to the existing and already overstretched socio-economic

Study Area

facilities which are incapable of coping with the demand. This means that more effort should be directed towards expansion of the existing institutions and employment of more teachers.

Majority of the 82.1 percent of the population aged 15 years and above are able to read or write while 15.2 percent of the same category are able to neither read nor write. A majority, 79.1 percent of the population is literate. There is need, therefore, to improve on literacy levels in the County by enhancing enrolment to institutions of learning (CIDP, 2015).

The County has a constituent college of Masinde Muliro University in Kaimosi and other learning centres for other universities in Chavakali, Mbale, Kaimosi, Ebunagwe and Luanda. There is an institute of science and technology in Kaimosi, 3 teachers training colleges and 21 youth polytechnics. There are also several unaccredited commercial and ECD colleges spread across the County. The County Government has established Medical training college in Mbale.

4.6.2. Health Services

The County has one public County referral facility at Mbale and Kaimosi Mission Hospital, a faith-based facility. There are three Sub-County level 4 facilities in Sabatia, Hamisi and Emuhaya. There are also 18 health centres, 32 dispensaries and 34 private and mission based facilities. The average distance to the nearest facility is 5 Km. The doctor/population ratio is 1:85,000, whereas that of nurses to population ratio is 1:24,000 as compared to national doctor population ratio of 1:16,521. The shortage of doctors and other medical staff implies inadequate healthcare service. The economic importance of the sector is greatly centered on population management mechanisms through family planning activities, disease morbidity control (CIDP, 2015).

4.6.3. Transport and Infrastructure

The road network in the County, although well planned, is in dire need of repair and periodic maintenance in order to meet expected standards. The poor state is exacerbated during the rainy season leading to huge losses to farmers as transporters charge high rates.

The County has a total of 1,058.2 Km of roads managed by different authorities (KURA, KeRRA and KeNHA). Of these, 201.5 Km are bitumen; 373.7 Km are gravel surface, while earth surface roads cover approximately 500 Km. The County is also traversed by 2 km railway although it is not functioning (CIDP, 2015).

4.6.4. Environment, Natural Resources, Water and Forestry

The water sub-sector promotes and supports the integrated water resource management and development approach towards enhancing water availability and accessibility. Households with access to piped water comprise 2.7 percent, whereas 64 percent of the households are served with protected springs, while 25.3 percent are unprotected. The average distance to the nearest water point is about 0.5 Km. The proportion of households with roof catchment systems stands at 8 percent (IDP, 2015).

In the towns and urban areas of the County, the leading causes of environmental hazards are lack of sewerage and drainage systems, congestion in densely populated areas and unplanned urban areas. The consequences of environmental mismanagement are decreased food production, increased intensity of droughts, excessive non bio-degradable materials (plastics) and disease epidemics. National environmental Management Authority (NEMA), which is the National

Government supervisory body on environment matters, has taken the lead in enforcing the Environmental Management Coordination Act (EMCA). Vihiga County does not have major economic viable mining activities, however, sand harvesting along the rivers, quarry activities and minimal ballast mining in the hills covered by granites are some of the economic activities in the County.

The main forest type is the tropical rain forest covering a total area of 4,160.9 hectares. These are Kibiri forest consisting of indigenous and exotic tree species on a 3,691.3 hectares and Maragoli forest consisting of 469.3 hectares of exotic tree species. However, the Maragoli forest has since been destroyed by human activities. There are also community forests for cultural rites and private forests owned by individuals and churches. Due to human encroachment, most indigenous forest species have been destroyed and exotic trees now dominate most farms in the County. Eucalyptus form about 70 percent of the tree species grown in farms. Vihiga County is one of the most densely-populated Counties in Kenya.

4.6.5. Industrialization, Trade and Tourism

The County has one tea processing factory situated at Mudete market in Sabatia Sub- County and miniature milk processing factories. Total tea production is estimated to be 10.6 million Kgs annually. Milk production is 2.7 million liters which does not meet the County's demand, hence there is need to expand milk production.

The County has 209 market centres and two major towns namely: Mbale and Luanda. There are 2,258 retail and 83 wholesale traders licensed to do business. Most of the trading centers lack adequate basic facilities like water, electricity and solid waste disposal sites. In addition, there are four fresh produce markets and two horticultural markets in Chavakali-complete and Mudete.

The County has great potential for domestic and international tourism. The sites include forests, hill of vision and heritage areas including the Mungoma cave, bird's sanctuary and Wagevere rocks embossed with foot prints in Matsigulu. The County has a rich culture with Maragoli, Bunyore and Tiriki festivals observed annually. Besides, opportunity exists in the development of cultural tourism, inadequate entrepreneurial skills, shrinking land sizes, inadequate physical infrastructure and limited access to credit facilities are the main challenges that impede the development of this sector. There is need to exploit high potential in the tourism sector to meet the increased demand in this industry.

4.6.6. Culture

The County has rich culture from the Tiriki, Maragoli, Banyore and the Terik. The County has also cultural sites which include: Mungoma caves, Maragoli hills and Matsiguli foot prints (famously known as Jesus foot print).

4.6.7. Land Tenure

The average farm size in the County is 0.4 hectares for small scale farming and 3 hectares for a large scale. The fertile land is found in Sabatia, Hamisi and Emuhaya Sub- Counties that are also densely populated. The high concentration of population is witnessed even in the rocky areas such as Maragoli hills and the flat swampy parts of Luanda.

Study Area

In terms of land use, 98.7% of the land is under subsistence farming, while 1.3% is under residential. The main land use types include livestock, crop farming, tree planting fish farming and settlements. Other land-use activities are brick making, murrum, sand and stone quarrying for construction purposes. The increase in settlements has reduced available arable land for livelihood activities. Most of these activities are undertaken in rural areas where the majority lives (CIDP, 2015).

Proportion of parcels whose owners have title deeds is 28.3percent while the rest is still under the ownership of grandparents. A few women own land titles due to cultural barriers. This has made it very difficult for those who would like to access credit from financial institutions for investment due to a lack of collateral. Most investments are in the form of grants and donations that cannot meet key development aspirations. This is even made worse by the high poverty situation in many households. The high population density in the County has also led to further sub-divisions of land into uneconomical land sizes.

Although most of the people in the County own land, atleast 3% of the total population is landless. Some of the landless have invaded Maragoli and Kibiri Forests for settlement. Others have immigrated to neighboring Counties like Siaya, Nandi, Kakamega, Trans-Nzoia and Bungoma. Most land in the County are privately owned thus the County Government has less land for public utilities.

4.6.8. Agricultural Production

Crop production is the mainstream of the County's economy and contributes about 64 percent to the County's income. Agriculture employs the majority of people in rural areas as well as those in the urban areas indirectly. The Acreage under food and cash crop production in the County is approximately 40,000 and 8,000 respectively. The main food crops produced are maize, beans, millet and sweet potatoes. Maize and beans are the main crops produced with annual production currently estimated at 90,000 and 20,000 bags respectively per annum. The majority of farmers plant these two crops as food crops. However, most of what is produced ends up in markets to supplement family incomes. Tea and coffee are the main cash crops grown in Vihiga County. However, production of coffee has been on a declining trend and efforts should be made to promote it. The continuous planting of Eucalyptus trees has not only reduced acreage under food crops but has had a deteriorating effect on the productivity of land in the region. The County Government is providing subsidies to farmers to improve crop production.

The average farm size in the County is 0.4 hectares for small scale and 3 hectares for large scale farming. This contributes to the low yield per unit area for most farming households. This situation is worsened by the growing population and further sub- divisions of land into smaller uneconomical parcels.

The livestock sub-sector focuses on livestock production, development and promotion of animal health through veterinary services. The main types of livestock kept in the County are zebu cattle, dairy cattle and poultry. The annual milk production is 6,195,099 liters. Chicken is the main poultry reared with a production of 10,585,000Kgs, although guinea fowls rearing are emerging in some parts of the County. Beekeeping is also undertaken in the County. Honey production stands at 65,555Kgs annually. Rabbit keeping has also been embraced in the County.

The County has 1,634 farmers engaged in fishing activities mainly in established fish ponds. Most of the fish ponds were started under the ESP (Economic Stimulus programmes) in 2011. These fish ponds cover a total area of 44.7 ha with the main fish species bred being tilapia and cat fish. The County Government also intends to establish at least one hatchery in each Sub-County as a source of fingerlings, and freezers to preserve the fish before reaching the market.

4.7. County Planning

The preparation of Vihiga County's Integrated Strategic Regional and Urban Development Plan (ISUDPS) was initiated in 2012 by the Department of Urban Development in the defunct Local Government. This plan is consistent with Kenya Vision 2030 and the provisions of County Government Act of 2012 and Urban Areas and Cities act of 2011, and the Physical Planning Act Cap 286. The main objective was to achieve sustainable development through well planned and coordinated Urban and Regional Planning.

It was envisaged that, upon completion, it will go a long way in addressing long term policy issues like population, explosion, agricultural development, conservation of environment and natural resources, physical and social infrastructure and services, poverty, natural hazards and disasters, climate change effects, transport and communication, industrialization, eco-tourism and sustainable tourism and rural-urban linkages among others. This plan was also to guide the development of existing and emerging towns as a result of the devolution. Most urban areas have outdated plans which require to be re-planned by use of modern technology (GIS).

CHAPTER 5: DATA PRESENTATION, ANALYSIS, AND INTERPRETATION

5.1. Overview

This chapter covers the presentation, analysis and discussion of the data that was collected from the field with the ultimate goal of ascertaining the objectives of the study. The findings of the study are presented as per research objectives in light of SLUMS and its impact on people's livelihoods.

5.2. Respondents Background Information

Understanding background information was particularly important for the researcher because human capital is a key driver of sustainable livelihoods for many households. This included: age distribution, marital status, and level of education, occupation and income distribution. These are further illustrated in Table 7.

5.2.1. Sub-County Population Distribution

In order to determine the demographic distribution of respondent across the study area, the researcher adopted the existing political and administrative boundaries that sub-divided Vihiga County into five (5) Sub-Counties and twenty-five (25) electoral wards. This distribution was important to ensure that every area was represented in the study. Population density represented the geographic determinant of comparative advantage for many households. Indeed, Scherr, Pender and Duron (2001) contend that population density can influence both crop choices and production techniques. As seen from the study area, the fragmentation of land parcels into very uneconomical sizes implied that it is virtually difficult to do mechanized farming in many parts of the County.

Sub- County	Frequency	Percentage
Emuhaya	50	13.0
Hamisi	115	29.9
Luanda	65	16.9
Sabatia	80	20.7
Vihiga	75	19.5
Total	385	100.0

Table 6: Distribution of Respondents in the Sub-Counties

Source: Research Data 2016

The total number of respondents for the study was 385. The respondents were distributed proportionately to census population per Sub-County. This was important in order to understand their spatial relations in terms of land use and how the respondents are sustaining their livelihoods. From Table 6 above, it is evident that, Hamisi and Vihiga Sub-Counties recorded the highest number of respondents as compared to other Sub-Counties. The Sub-Counties are also unique in their

location and even the socio-economic and cultural activities, which are practiced within them, have far reaching implications in defining the spatial land use management in Vihiga County.

5.2.2. Socio-demographic Characteristics of the Respondents

The researcher while trying to understand SLUMS went beyond establishing what is articulated in objectives by analyzing the socio-demographic characteristics of the respondents. This entailed analyzing age distribution, marital status, the level of education, occupational status, their income and the number of dependants in each household. This analysis also gave a synopsis of people's involvement in matters dealing with SLUMS and also this demographic information was used as mediating variable in the study. In particular, the researcher was able to delve deeper on how the respondents on day to day basis fulfill their livelihood needs.

A household being the unit of study is composed of people who strive to meet the needs for themselves and or for other members of the family. The researcher narrowed the study to a household which formed the unit of study because people's livelihoods revolve around what they are engaged on to meet their basic needs. In particular, in terms of how adequate the stock and flows of food and cash are. This further enhances household's ability to cope with shock and stresses that are associated with the deficiency of key livelihood supporting assets (Sen, 1984, 1987). This may be through ownership of land, livestock, and rights to grazing, fishing, and stable employment with adequate remuneration; or through varied repertoires of activities. This was analyzed through cross tabulation of various socio-demographic characteristic of the respondents.

The study showed that most of the household heads were aged above 35years. This implied that they were adults who could comprehend critical issues the study sought to address and also they were in position to appreciate what is happening in relation to matters attributed to SLUMS. But, in as much as everyone can participate in matters related to SLUMS, age of the respondent brings in special attribute of management that contributes to sustainable development in terms of being able to make informed decisions. Age also comes with special attribute of dependency, especially for the young and the elderly who cannot fend for themselves.

Characteristics	Number and Frequency (%)
Age Distribution	
18-25	86
26-35	75
Above 35 years	124
Totals	285 (100%)
Marital Status	
Single	18
Married	270
Widower	66
Widow	08
Divorced	23
Totals	385 (100 %)
Education Level	
None	3
Primary	99
Secondary	173
College	87
University	23
Totals	385 (100 %)
Occupation Status	
None	25
Casual	179
Formal	75
Informal	48
Totals	327 (100 %)
Income Distribution	
None	3
Less than 1000	75
1000-5000	144
5000-10000	138
Above 10000	25
Totals	385 (100 %)
Number of Dependents	
1	66
2	109
3	82
4	63
5	60
Totals	380 (100 %)

Table 7: Socio-demographic Characteristics of the Respondents

Source: Research Data 2016

Although the sex of the respondent has no significant effect on income, it does influence some land management and in-put decisions. The gender of the household head can influence the

choice of household strategy. For example, male household heads exhibit greater inertia to change in general than younger ones. This view is also held by Briassoulis H. (2000). In many set-ups, this responsibility lies with the household head. Ascertaining the status of the house head was particularly crucial because it influences the choice of a livelihood strategy. The study showed that, although many household heads are male, their spouses are equally involved in in-come generating activities, like casual labor on farms, jua kali business and day care in homes for those involved in formal employment. In return, they are paid a wage which is, later, used to support other members of the family. Single (and frequently female) household heads have different outlooks and life expectations than those married and with many children. In the latter case, all the actual number of “decision-makers”, who may be more than one and may affect the overall decision on which livelihood strategy to be pursued, coincidentally, depend on land.

Ascertaining the marital status of the respondent was important because married families are more stable and are more likely to stay on their parcels of land and strive to support the livelihoods of their families by performing various on-farm activities. Depending on what they decide to do and how to do, may have adverse effects on the land they own and its future use. Single and divorced families, for example, may opt to seek other alternative means of survival like seeking employment elsewhere, thus reducing pressure on available parcel of land.

For some people, education is enabling, and to others it is disabling and diminishes one’s capability to contribute to sustainable livelihoods. Indeed, households with an average level of education have more of their members working on off-farm (often in better paying occupations) and are likely to be more receptive to only a few technologies to improve their livelihoods. A majority of the respondents in the area of study have attained the secondary level of education. This therefore, implies that they are well equipped with knowledge to understand strategies related to SLUM and the skills that can contribute to sustainable livelihoods. Education plays a major role in shaping the way people live. For example, continued reliance on subsistence farming will imply that people have no other option but to give up in life because of failure to embrace diversification. Chambers and Conway (1991) concur that, those who are better off, usually have a wider choice than those who are worse off, and a wider choice is usually generated by economic growth.

Although a majority, 54.7% of the respondents earned their living through casual employment, the cost of their labor on average was relatively high. This may be attributed to the fact that since a majority of the respondents are literate, they are aware of the value of their labors which, in turn, may be dictated by the pressure to meet the needs of other members of the family. This further implies that since Vihiga County is an agricultural County, majority of the respondents are engaged on on-farms activities.

The number of dependants was critical in determining if a household may be able to gain a sustainable livelihood security in many ways. The study showed that 30.9% of the respondents had dependents in their households, which implies that when aggregation is done at the County level and the same compared with national census reports, it confirms the assertion that Vihiga County consists of very youthful population which, in fact, exerts a lot of pressure on land because of inheritance. This further has ripple effects that cut across the socio-demographic characteristic of the respondents as discussed above.

The highest number of dependents in a household was approximately two (2) members or 99%. The size of a household determines the availability of family labor and as such can still

influence both the use of technology and livelihood strategy. Equally, they may also find it easier to adopt labor intensive ‘production technology,’ while a high dependency ratio may suggest that there is scarcity of labor force.

The study revealed that many widowers ended up selling their parcels of land or rented it out, especially in cases where they had no dependent children in order to earn income for daily use. Also the high percentage of casuals and informal workers implies that these are some of income earning activities, especially for those who are not employed in the formal sector of the economy. The next section presents the data collected from the study as per the specific objectives.

5.3. To Assess the Current Spatial Land Use in Vihiga County

In order to visualize the current land use activities in Vihiga County, the researcher found it necessary to present the various livelihood activities as illustrated in Figure 5.1. These activities include basic grain farming, livestock rearing, and tea production, mixed basic grain, forestry and mining.

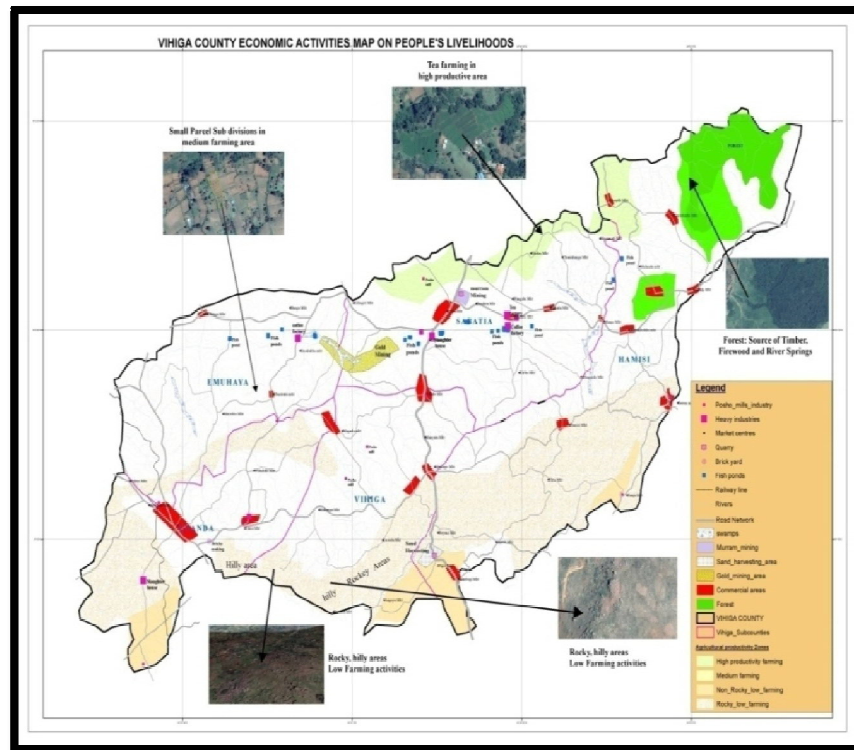


Figure 6: Map of Vihiga County Showing Current Land Use Activities
Source: Research Data, 2016

5.3.1. Current Land Use Activities

In order to achieve any meaningful development, one of the most fundamental prerequisites is the use of the land resources in a way that meets the needs to the people and creates the surplus necessary for growth. This, therefore, explains the important role of agriculture in enhancing food security and economic development possibilities. In order to meet these objectives, households

engage themselves in various activities as illustrated in Figure 7. These activities provide food, cash and other goods to satisfy a wide variety of human needs.

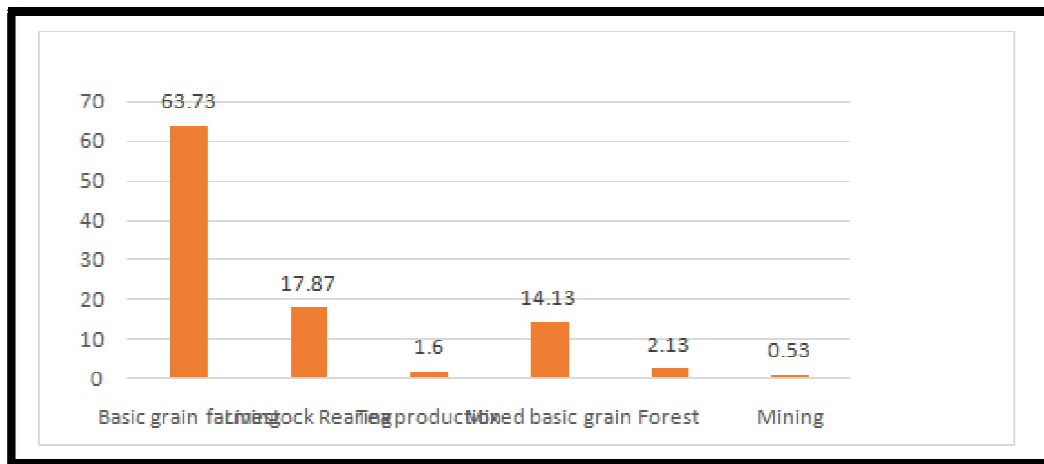


Figure 7: Current Land Use Activities
Source: Research Data, 2016

Socio-economic interactions play a major role in determining the manifestation of land use activities and their location in space. The spatial location of various land uses further influence livelihoods that sustain the economy of a place for any given area, community and or household.

The functional interaction based on the flow of economic activities can occur either within or between spatial localities. The economic activity can also reflect the type of livelihood strategy the respondents of the study area can adopt as illustrated in Figure 7. Thünen (1826) emphasizes that, economic considerations are critical land-use determinants as expressed in "Agricultural Land Use Theory". Most important among them is the transportation cost to markets and the sources of primary inputs, a function of distance or accessibility and of anticipated profits from the exploitation of a particular land parcel. The latter depends on the demand for the goods and services associated with a given land-use type. Changes in demand trigger changes in land use as they affect the associated profits. Profits are determined also by other factors such as cost (and availability) of labor, capital, and primary inputs (raw materials), the substitution potential among factors of production, the prices of final products and services associated with a particular land use, and state support (price supports, subsidies, tax exemptions, various economic incentives).

From findings of the study, approximately 64% of the respondents were engaged in basic grain farming. This form of livelihood strategy is necessitated with the diminishing household land parcels and the increasing population that is synonymous with the County's demographic structure. In fact, subsistence grain production is more dominant in young and poorer households as shown in the study. Indeed, the County statistics confirm that crop production is the main economic activity that contributes to 64% of the County's income and the biggest employer (CIDP, 2015). The main basic grain crops include maize, sorghum and beans that are grown in two seasons for domestic consumption, although the respondents allude to the fact that some of these products end up in the local market to raise money for day to day use at the household level.

Mixed grain farming is also practiced in low scale at 14.1% from sampled respondents. Mixed farming entails producing a variety of crops including fish farming. This is an attempt by various households and individuals to embrace livelihood diversification strategy in order to find new ways to raise incomes additional to that from the main agricultural and non-agricultural goods and services practices, while at the same time reduce environmental risk that may be as a result of unpredictable climatic conditions for sustainable livelihoods (Carter, 1997).

Tea production which is a major cash crop in Vihiga County is mainly produced in Hamisi, Sabatia and Vihiga Sub-Counties. Only 1.6% of the respondents are engaged in tea production. The diminishing land sizes, low yielding variety, high cost of farm inputs and lack of incentives (bonus to farmers) have reduced the acreage of land under its production. However, tea bushes can be spotted across the County albeit in small land parcels and tea buying centres (Bandas) are also visible within this vicinity where tracks from Mudete tea factory pick the produce for further processing.

Mining is among the least practiced activities within Vihiga County as illustrated in Figure 7 and this may be attributed to depletion of the mineral resource base. Sand harvesting along the rivers is another vibrant economic activity in the county that some members of the households rely on to support their families. Although quarrying activity was not very pronounced amongst the respondents, it remains a key catalyst in the construction industry and is a major concern for environmental conservation because it contributes immensely to land degradation. As a result, this has led to closing of some quarry sites by National Environmental Management Authority (NEMA) by enforcing the Environmental Management and Coordination Act (EMCA, 1999).

The study showed that 17.9 % of the respondents were involved in livestock rearing at the County, although this activity was highly practiced in Hamisi Sub-County. This was attributed to favorable climatic conditions and the occupants of the Terik community whose major activity is pastoralism. It's also worth noting that, on overall, there are other households in the County which rear at least one or two cows that produce milk to supplement family incomes across other sub-counties.

Forestry is also another current land use activity in Vihiga County. The total forest area is approximately 4,160.9 hectares. Indeed, 2.1 % of the respondents were engaged in forestry related activities that include conservation of forests that are owned by government, community and individuals. Hamisi Sub-County is highly regarded in conservation of forests as they have strong cultural attachment to it.

5.3.2. Reasons for Undertaking Various Land Use Activities

Quite often, major livelihood strategies of many households are not maximization of production profits, but minimization of risks for the provision of a continuous, steady and assured income.

Some households, however, have options for choice to navigate upon, but quite often they find themselves struggling to cope with the prevailing circumstances they find themselves in.

Sub-County	Reason for Carrying Out Various Land Use Activities				Total
	Suitable Climate	Fertile Soils	Availability of Ready Market	No Access to Land	
Emuhaya	19(25.3)	50(66.7)	0(0.0)	6(8.0)	75
Hamisi	33(30.0)	61(55.5)	15(13.6)	1(0.9)	115
Luanda	23(35.4)	24(36.9)	18(27.7)	0(0.0)	68
Sabatia	21(43.8)	21(43.8)	5(10.4)	1(2.1)	52
Vihiga	42(58.3)	27(37.5)	0(0.0)	3(4.2)	75
Total	138(37.3)	183(49.5)	38(10.3)	11(3.0)	385 (100)

Table 8: Reasons for Undertaking Various Land Use Activities

Source: Research Data, 2016

The study indicates that, 37.3% of the respondent's choice to engage on the above activities was informed by suitable climatic conditions. The high equatorial climate that is experienced across the County favors the production of a variety of food and cash crops like maize, beans, tea, and coffee, livestock rearing and horticultural crops. However, Vihiga Sub-County seems to enjoy comparative advantage because of its location (close proximity to Maragoli forest and Lake Victoria) which tends to influence weather pattern and ultimately a number of livelihood activities.

Soil fertility is the key to sustainable agricultural production. Although 49.5% of the respondents suggested that land parcels were fertile, this was mainly attributed to the use of artificial fertilizers. However, the continuous use of these artificial fertilizers and lack of diversification in crop production and farming methods is a key contributor to land exhaustion, thus affecting its use. The study showed that Vihiga Sub- County was highly affected because there is high erosion and this tends to wash away fertile soils to the lower basins. It is, therefore, evident that, soil fertility does affect land management practices and outcomes. For example, farmers are more likely to use herbicides on fertile soils in order to obtain better yield on than using crop residues on fertile land. Thus, household that owns more fertile land can obtain higher incomes from the sale of farm produce.

Availability of ready market was another factor that supported some of the activities that were undertaken by the respondents. For example the close proximity of Mudete Tea Factory encouraged farmers to produce tea in Sabatia, Hamisi and Vihiga Sub-Counties; forestry and forest products because of major construction works in the nearby Counties of Kisumu, Siaya and Nandi Counties; basic grain production in Emuhaya and Luanda Sub- Counties because of closer access to Lunada, Kilingili and Ebusiratsi markets. Thus, the activities that the respondents will ultimately decide to undertake and how, will define whether their livelihoods will be sustainable or not.

Some of the outputs that result from these activities are consumed immediately, and others go into short or long-term stores, to be consumed later or to be invested in other assets. But these investments will only occur when production leads to a surplus beyond immediate consumption requirements. Investments are made in enhancing or acquiring resources, in establishing claims, in gaining access, and in improving capabilities (Swift, 1989).

Resources that support livelihoods in this case may be enhanced through investing labor through terracing to improve the stock of soil, while capabilities may be enhanced through investment in (useful) education and training, and apprenticeship. All these, in turn, trigger a chain reaction that can make household livelihoods sustainable. Access to land had a weaker influence on current land use activities in Vihiga County, although, it deprived households of the opportunity to diversify their livelihood strategies because of diminishing land sizes.

5.3.3. Influence of Type of Labor on Land Use

Labor is a key factor of production in all major sectors (agriculture, commerce and industry) of any economy. The type of labor employed is closely related to the economic activity, its availability and the landscape in that particular area.

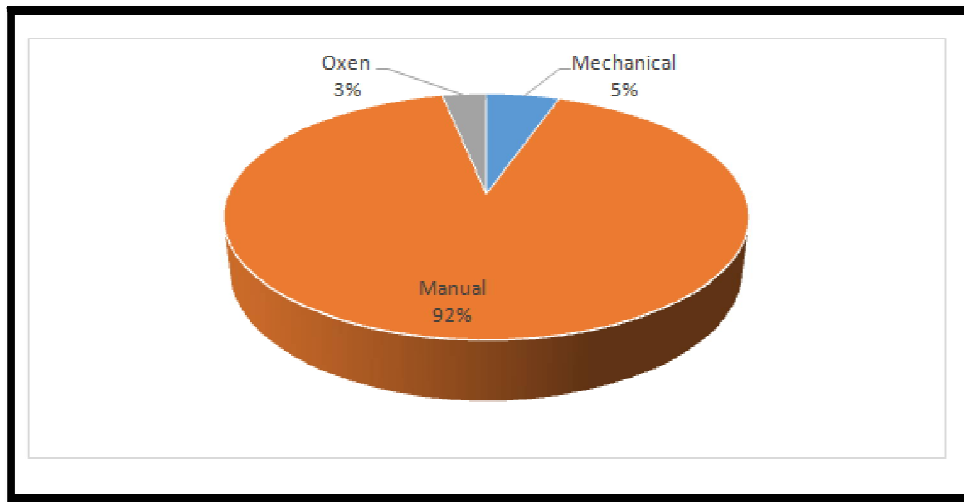


Figure 8: Type of Labor Available
Source: Research Data, 2016

As a form of physical capital, ownership of machinery and equipment has significant impacts on land management practices, input use, its productivity and income. Households that own machinery and equipment, in many cases, use less family labor and do not need to hire labor maybe because the opportunity cost for such farmers’ time is higher. Also, machinery and equipment help a household to maximize its basic assets (land but especially labor) to generate more income.

From Figure 5.3, 92% of the respondents performed manual work, while 5% practiced mechanized farming and only 3% used oxen respectively as a form of labor on on-farm activities. Indeed, this can be attributed to the fact that, since average land sizes range between 2-5 and 1-2 acres, and the prevailing land terrain, it will be very un-economical to embrace mechanized farming. Only parts of Sabatia and Hamisi Sub-Counties embraced mechanized farming i.e. 18% and 7.3% respectively. Manual labor is getting prominence simply because it’s cheap and readily available from a large section of the population. Although the use of oxen was practiced in some parts, its general use is diminishing a fact that is closely linked to economies of scale. A rising from the study, the researcher found that the use of oxen has insignificant impact on crop production and

household income. The choice of particular type of labor may also be attributed to the “push factors” that forced people to move to other localities in search for better opportunities and the “pull factors” when the opportunities become unsustainable in the long run. However, it’s important for the residents of Vihiga County to embrace agricultural intensification and livelihood diversification strategies in order to increase their income which can still be re-invested in the productivity of their landholdings (Tiffen, 1994).

5.3.4. Influence of Terrain on Land Use

The topography of an area plays a major role in determining how the land in that area can be used for general development purposes. The researcher alluded to earlier findings which established that a larger part of Vihiga County is composed of hills and valleys, i.e. Hamisi, Vihiga and Emuhaya Sub-Counties.

Land Terrain	Sub-County					Total
	Emuhaya	Hamisi	Luanda	Sabatia	Vihiga	
Valley	0	11	6	0	8	21
Hillside	32	75	19	42	56	227
Flat terrain	44	26	45	10	11	137
Total	76	112	70	52	75	385

*Table 9: Influence of Terrain on Land Use
Source: Research Data, 2016*

The study results in Table 9 above revealed that, Emuhaya and Luanda Sub- Counties had relatively flat terrain as compared to other Sub-Counties. This explains why some parts of Central Bunyore Ward occasionally experience perennial flooding during rainy season. Hamisi and Vihiga Sub- Counties are basically hilly and most of the respondents there practice tea farming. These hills in the two Sub-Counties are Munzatsi and Maragoli hills which also support quarrying and mining activities of many household. This partly also explains why it’s difficult to embrace mechanized type of farming in these areas.

The geo-physical condition of the terrain has a direct influence on land management strategies that a particular household can adopt in order to meet its socio-economic needs. For instance, to reduce erosion on hillsides, planting trees may be required to reduce surface run-off and terracing may be ideal for flat terrain. Failure to embrace either of these strategies may result in loss of soil fertility which, in turn, can affect household’s levels of productivity in on-farm activities.

Although other activities that influence land use are done on small scale, the intensified human activity has impacted negatively on large acreage of land parcels because of soil erosion, deforestation and un-reclaimed quarry sites.

5.3.5. Road Connectivity in Relation to Land Use

The development of road infrastructure is critical in opening up remote areas for development purposes. A good road network enhances communication and enables the farmers

and traders to interact easily, access markets, reduce costs and eliminate the middlemen who usually exploit many households for lack of information on current market trends.

A majority, 65% of the respondents, while appreciating the fact that the roads in the County are well maintained, could not distinguish between national trunk roads, KeRRA, KURA and County Roads.

Good road network can open up rural areas and allow resources therein to be exploited to support household livelihood activities. For example, quarrying at Masana in the Jepkoyai ward, Buyangu in West Bunyore and Banja wards were, only possible with good road network. Many developments are linear and this, in itself, explains the importance of road connectivity.

Areas, that are isolated, have continued to lag behind because opportunities in these areas remain untapped, social development (provision of health care facilities and education), which forms the basis for sustainable livelihoods, remains neglected. This is particularly evident in Vihiga, Sabatia, Luanda, Bunyore and Hamisi Sub-Counties, which have reported varying trends in terms of poverty levels.

Increased road connectivity is greatly associated with significant shifts in livelihood strategies, for example, tea production requires better road network as compared to basic grain production. In general, road development is associated with greater production of tea because it can reach the factory faster from tea buying centres (bandas), off-farm employment and higher use of some sustainable land management practices. Also, poorer people may move to areas where there are more roads and market opportunities because of reduced transport costs and ease of connectivity (von Thünen, 1826).

5.3.6. Influence of Mode of Transport on Land Use

Failure to access markets as reported earlier in the study is directly influencing how households can sustain their livelihoods. Indeed, a majority, 52% of the respondents walk on foot to various destinations on day to day engagements, while almost a similar 48% of the respondents use the common, convenient and reliable motorcycle (Bodaboda) as a means of transport. This, therefore, in terms of national standards, implies that, there are opportunities which have not been exploited to trigger the growth in this sector which could go a long way in enhancing the growth of the economy in general. Although public service vehicle are also used, its percentage is negligible amongst the sampled respondents.

Respondents, while acknowledging this challenge, still hope that both National and County Governments will continue to expand road network so that those areas that are still lagging behind in terms of development will be leveraged and make them more competitive in the national and global arena, since expanding connectivity is enhancing land use.

5.4. To Examine the Determinants of Spatial Land Use Management Strategy in Vihiga

The various determinants of SLUMS that the researcher managed to identify in the study included: the form of land ownership, land tenure security, the size of the land and family, the type of labor employed, and the quality of the land. The study findings are further discussed here below.

5.4.1. Form of Land Ownership

Land, as a key resource to support livelihoods, was deprived of future generations and gave birth to new forms of ownership i.e. freehold, communal and public land. In relation to land tenure, the issue of total ownership is instrumental since land ownership is regarded as a major issue that contains cultural, political, and practical problems. It is a practical problem, especially due to the lack of ownership documents. This fact has been recognized by the department of lands, housing and urban development in the County.

In Vihiga County, three key distinct forms of land ownership emerge such as freehold, communal and public land as illustrated in Figure 5. 6. A majority, 74% of the respondents own freehold land, 19% and 7% for community and public land respectively. Freehold for the purpose of this study is land registered by any person with unlimited right to use and disposal. Community land is a land that is lawfully registered, managed or used by specific community on the basis of culture, ethnicity or similar community interest as community forests, grazing areas, shrines, or water catchments, while public land is a land lawfully occupied by state organ, conservatives, water bodies as provided for under the constitution. As much as all the three play a key role in sustaining livelihoods, free hold ownership is prevalent in Vihiga County. (Kenya, Land Policy, 2009). This, therefore, implies that many households have the liberty to fully maximize the potential of their land parcels either by crop production, livestock rearing, mining or quarrying, a forestation or even sale to willing buyers.

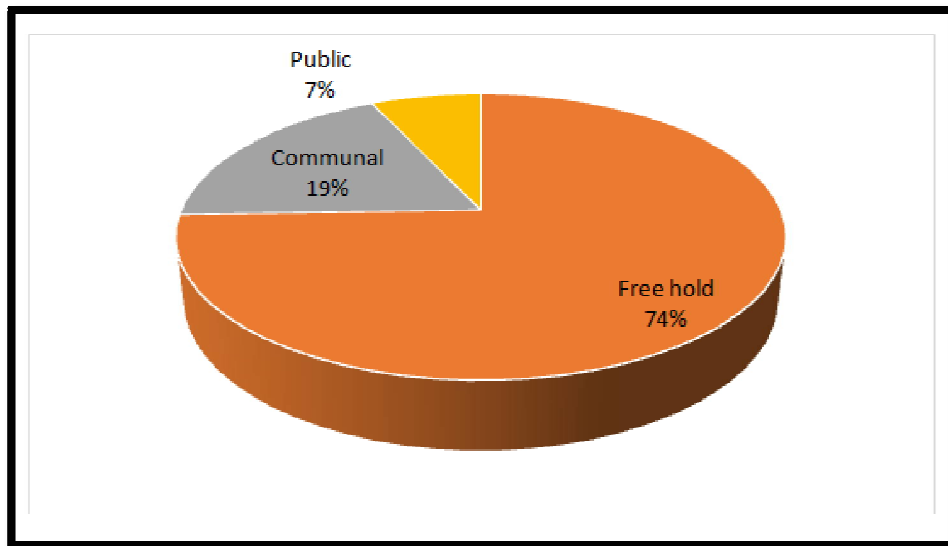


Figure 9: Form of Land Ownership
Source: Research Data, 2016

The researcher observed that private ownership of land (freehold) creates mainly two kinds of problems in Vihiga County that are rather fundamental. Although by law, men and women can officially own land, society has been reluctant to embrace it. In a long the inheritance for example, one piece of land is divided among the sons of the deceased, and daughters are left without any land.

As the land is divided several times, the land parcels become smaller and smaller and, finally, sooner or later, they are too small for any use. This problem is real in Vihiga County where population density per square kilometer is approximately 1,100 persons, the second highest after Kisii County. The fragmentation is more evident in Vihiga Sub-County. The continued discrimination of women in matters relating to land ownership, for example, does not acknowledge the changed conditions and livelihood requirements of today (Kenya, Census 2009).

Equally, there are large parcels of land in Vihiga County that belong to individuals who do not use the land themselves but, on one way or the other, have prevented the use of these farms by others in spite of it being good for agricultural production. These cases are dotted across the entire County.

Community land consists of land parcels that are conserved or used as cultural sites, forests and water catchment areas. However, due to population pressure, these uses have so far changed in the part of, or entire parcels have been transferred to schools, churches or under development initiatives to serve the general public. For example, during the creation of Kaimosi Friends University College, the community through the Church leadership gave out land for the university and relocation of Teachers Training College.

The presence of public land in Vihiga County is very small as shown above. This is mainly attributed to the fact that for many years Vihiga District as part of the larger Kakamega District and planners then failed to anticipate that at one time land will be required for public use.

This problem is also recognized at the national level in Kenya where in many cases, the absentee land-owners do not need this land for their livelihoods and since the land is not put to maximum use, it's not a priority of the owners. This, therefore, implies that, there is no land left for all, although, their livelihoods are still based on land. The small percentage that exists is overstretched and this has forced the government to relocate some people to create space for public utilities. The County Government has resorted to do land banking across the County in order to address this problem.

However, it's important to note that many respondents acknowledged that, either form of land ownership social (community), economic and environmental dimensions touched on their livelihoods in one way or the other as shown in Figure 17.

Land Ownership	Sub-County					Total
	Emuhaya	Hamisi	Luanda	Sabatia	Vihiga	
Freehold	64	96	21	49	58	278
Communal	15	4	36	5	18	78
Public land	1	6	13	0	6	26
Total	80	106	70	54	82	382

Table 10: Form of Land Ownership at the Sub-Counties

Source: Research Data, 2016

The researcher while acknowledging land as a resource to support livelihoods, went further to analyze the distribution of the forms of land ownership per Sub-County in order to obtain an in depth understanding of the manifestation of this phenomena. The land question is a cross cutting matter affecting both National and County Governments where space for provision of public utilities, government offices and settlement of the landless has been and still is a teething problem.

In view of the above, the government, according to the County Lands Registrar (CLR), embarked on resettlement schemes across the country to address the land question. In Vihiga, for example, the researcher was reliably informed by key informants and local administrators that, some families were resettled in Kitale, Kibiri forest and in Shiru/Shaviringa to create space for government institutions such as Sabatia District Headquarters, current Vihiga County Headquarters, schools, and hospitals amongst others. Equally, there are substantive numbers of people who live on the land that they do not own, and in many cases unofficially without permission from the relevant public authority.

Indeed, if a new national settlement scheme was created to settle those who were displaced then, the question would be 'what went wrong?' Furthermore, this function is partially devolved. As a matter of fact, these people, who were resettled in the schemes, have legal rights and security over the land they live on because of Government ownership. This, therefore, implies that, people do not feel that this land, their lives and livelihoods are secured. Further, it confirms the fact that, land ownership is a function of land access and availability.

Since people do not own the land they are living on and cultivating, they might not be willing to invest in it, nor, will they have the interest to protect these land, for example from deforestation. The consequences of this are well illustrated, especially in Maragoli hills where there are no trees and vegetation cover, thus resulting in gully erosion partly due to the people's ignorance.

5.4.2. Reasons for Form of Land Ownership

The current form of land ownership can be traced back to the arrival of colonial rule which not only distorted the traditional set-up, but also destroyed indigenous resource management systems which were not owned by anyone. This new arrangement introduced a new dimension to rights of ownership that were typically commercial.

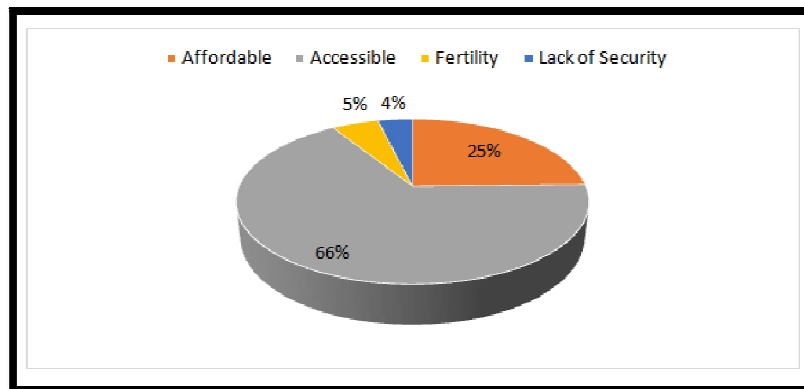


Figure 10: Reasons for form of Land Ownership
Source: Research Data, 2016

A rising from the study findings, a majority, 66% of the respondents, who owned freehold land, concurred that land was accessible in terms of availability in Vihiga County. This implied that, there are willing buyers and sellers at the current market rate for land for various uses. However, access to land is not the only binding constraint to poverty reduction. For example, increased access can promote diversification of livelihood strategies that have the potential to reduce minimum tillage and burning. Also 5% of the respondents acknowledged that, land prices are not very high in Vihiga as compared to other Counties that are more urbanized like Kisumu and Kakamega Counties. This, therefore, implies that, land is affordable in Vihiga County although land parcels close to the county headquarters have attracted very high prices. This is consistent with the findings of Von Thünen (1826) that land closer to the central city/market was more expensive, but transportation costs were lower.

Vihiga County being located in two distinct agro-ecological zones and with plenty of rainfall, the soil fertility is good for practicing agricultural production, although it did not form substantive reason for the type of ownership. Indeed, 25% of the respondents concur that soil fertility affects land management practices and outcomes. The Director department of agriculture in the county seems to agree with this view that because of soil exhaustion, many farmers are now using artificial fertilizers in bid to improve crop yield. The over-usage of these fertilizers has affected the balance of soil nutrients because of leaching (Vihiga, CIDP 2016).

5.4.3. Land Tenure Security

Land tenure security can be broadly referred to secure ownership of, or access to, resources and income earning activities that can be derived from land as a resource.

Land Security	Sub-County					Total
	Emuhaya	Hamisi	Luanda	Sabatia	Vihiga	
Yes	62	90	35	34	38	259
No	17	18	34	18	39	226
Total	79	108	69	52	77	485

Table 11: Land Tenure Security

Source: Research Data 2016

The study results shown in Table 11 above, confirmed that although many households in the County own land, little has been done by respective households to acquire their own land titles away from those initially owned by their forefathers. However, majority of the respondents who had land title were from Emuhaya and Hamisi Sub-Counties at 23.8% and 35.3% respectively. At the County level, it's estimated that 70% of land titles have not been processed from the time the first land adjudication was done, but the titles remain uncollected and or processed from land registry. This, therefore, implies that, they have no absolute ownership and thus cannot use their land parcels as collateral to secure capital from financial that could be used for gainful activities to improve their livelihoods. Also, ownership of land stimulates on-farm activities whereas a lack of own land can be expected to stimulate a household to look for off-farm work.

In fact, farmers may be more willing to invest in the land that is titled than in the land that has no title, even though this may be true for any land that is owned with or without formal title as seen from the study. But to the contrary, land ownership has little impact to a household income, which is consistent to earlier findings that, access to land is not the most determinant of poverty.

5.5. To Evaluate the Influence of Spatial Land Use Management Strategy on Sustainable Livelihoods

The activities that influence how a particular parcel of land is used can be broadly categorized into four dimensions: economic, social, political and environmental dimensions as discussed below.

5.5.1. Economic Dimension in Land Use

Looking at the current activities, the economic dimension of land use can be attributed to what the respondents do on day to day basis to earn a living. These engagements can result to increased availability of food for household consumption and the surplus beyond immediate consumption requirements can generate real income for other investments (Swift, 1989). The researcher assessed the economic dimension by investigating the steady and continuous stream of income from individual members of the household, increased food availability, efficiency of investment through cost benefit analysis and how they are able to maintain productivity in the face of stress or shocks such as drought, floods, inflation and social conflicts, and real benefits that are derived from prudent management of land (De Wit, 1996).

From the research findings, it was evident that there are numerous activities which take place on, under or over land to sustain livelihoods. Crop production is the mainstream economic activity in the County and contributes to approximately 64% of the County's income. Engagement in agricultural activities employs over 80% of the people in Vihiga. These findings are consistent with UNEP (2002) which classifies Sub-Sahara Africa as agriculturists. Although the production of basic grain is mainly done for food sustenance, the respondents disclosed that most of these grains end up in the market in order to raise extra cash to support the family in various respects. Because of the diminishing farm sizes, the average farm yield per unit area is relatively low for most farming households. This, therefore, implies that many people are forced to seek alternative means of survival by engaging in other income generating activities as casual laborers on tea farms, construction works, jua kali activities, and daycare services.

Tea production is widely practiced in Vihiga County although in small scale because of the shrinking land sizes. Tea production is a key economic activity that is employing approximately 50% of the population either directly on-farm providing casual labor (weeding the plantations and picking tea leaves) or off-farm engagement in the existing Mudete Tea Factory located in Sabatia Sub-County. Tea farmers also earn bonuses at the end of the year although the amount is relatively low. It's also worth noting that, tea production is also under threat because of unfavorable tea prices which has seen some farmers uprooting their tea bushes and switching to planting the famous eucalyptus trees with ready market locally and the neighboring Kisumu County for construction works.



Figure 11: Tea Production as a Main Economic Activity in Sabatia Ward, Vihiga County

Another economic activity is mining. Indeed, some of the respondents derived their livelihoods through mining of gold in Hamisi Sub- County-Muhudu ward, Luanda Sub-County – Luanda South ward and some parts of Sabatia Sub- County-Izava/Lyaduywa ward. This economic activity has greatly been hampered with lack of modern technology that can help the residents map out this mineral to determine its location, marketing (since national Government doesn't license local businessmen), depleted mineral reserves, insecure gold mines which have resulted to loss of lives and the traditional beliefs that are associated with gold mining. Figure 12 illustrates a gold mining pit that is dug using manual labor.

Since this activity is mainly done in small scale and in many cases without any organization, it's important for county government to build capacity of residents and empower them to transform this into a vibrant economic activity.



Figure 12: Gold Mining Pit in Muhudu Ward Using Local Technology

Spatial Land Use Management Strategy on Sustainable Livelihood in Vihiga County, Kenya

Quarry activities are predominant in Hamisi, Vihiga and Emuhaya Sub-Counties. The respondents involved in these activities earn a living, but they are either employed as casuals or self-employed. In the quarry sites as shown in Figure 13, some respondents work on granitic rocks to produce ballast for local construction works using local tools like masons hammer which is basically very labor intensive. Also, sand mining activities are prevalent along the rivers across the County which also has a significant effect on land management since big deposits of sand downstream may be the result of erosion upstream and the due destruction of the vegetation cover by human activity. The proceeds of their labor may result in a steady, continuous stream of income at different levels to individual households, communities, county and country through payment of taxes by respective firms.

It's estimated that approximately 70% of land area in Vihiga County is rocky. This, in itself, presents both opportunities and challenges for many households in the County. It's an opportunity because the presence of granitic rocks potential has not been exploited to the latter. For instance, developing the necessary infrastructure for mining the rocks will trigger a chain reaction that can stimulate key economic activities for many households who may be engaged in the sector.

The rocky landscape is a challenge to households because it impedes on the use of, for example, machinery as a physical asset to support livelihoods. Also, rocks because their physical natures are obstacles to diversification strategies that could cushion many households on natural shock and stress.



Figure 13: Quarrying as a Livelihood Activity in Jepkoyai Ward, Vihiga County

Another key mining activity is quarrying of murram for road infrastructure development in the county. Depleted murram sites are easily noticeable in Tigoi as shown in Figure 14, Buyangu, Banja, Vigetse and Munzatsi quarry sites to mention a few. All the above sites are depleted but they can be reclaimed by transforming it to other livelihood supporting activities like a forestation.



Figure 14: Depleted Quarry Site That Has Not Been Reclaimed in Tigoi Area, Vihiga County

Livestock rearing is also practiced in Vihiga County although in small scale because of the diminishing land sizes to support this economic activity. Through livestock production, households are able to sell milk and animals to supplement household income together with growing of trees for commercial purposes (poles and timber). Those households, according to Mather (1986), are able to maintain productivity in the face of stress or shocks like natural disasters, economic conjuncture and social conflicts because of their economic empowerment. It was also evident that those households which embraced best practices like diversification, observing land carrying capacity, soil conservation and land reclamation enjoyed real benefits derived from land use management. This, therefore, implies that, land, as a resource, is crucial in supporting activities of households that can lead to sustainable livelihoods.

5.5.2. Social Dimension in Land Use

Social sustainability refers to whether an individual, household or family can, not only gain, but maintain an adequate and decent livelihood. This can be viewed in two dimensions: a positive (proactive) dimension that entails enhancing and exercising capabilities in adapting to, exploiting and creating change, and in assuring continuity, while the negative (reactive) dimension entails, coping with stress and shocks. Indeed, the study revealed that the respondents are vulnerable to stresses and shocks that are either external (subject to) or internal, have the capacity to cope (IDS, 1989).

In addressing the social dimension of land use, the researcher assessed equitable access by the respondents to resources, information and services, local accountability for resource use and proper management, protection of acquired rights, respect for and valuing indigenous knowledge, local diversity and lifestyles and active participation of all stakeholders in policy and law development. Also appreciating social and cultural evolution of the respondents since it is part of the fabric that holds societal, cultural and spiritual needs.

Arising from study, the stresses the respondents of Vihiga County are experiencing are from rising populations, declining farm sizes, seasonal food shortages as a result of declining yields, declining resource bases, no fodder, grazing fields or water and the domestic cycle with its periods

of high ratios of dependants to active adults as explained in socio-demographic characteristic of the respondents in the area of study. These effects ultimately build up and their impacts are felt across the members of the entire household. From the study, the County has experienced shocks as a result of floods in Central Bunyore, and Lugaga Wamuluma Wards, and landslides in Banja and Tambua Wards. All these have led to displacement of households and loss of property. The associated causes of all these effects revolve around how land as a resource is used and managed (Evans, 1989).

Another social dimension of current land use on livelihoods is equitable access to resources, information and services. Some of the respondents have been deprived of access to this major resource-land, its endowments and capabilities. We have the landless, the urban and rural poor who have no equal opportunity to live a dignified life because they do not have land. In order to move out of poverty, the first step is to acquire land which unfortunately is beyond the reach of many poor people.

During the focused group discussion, the issue accountability was intensively discussed because there was concern from the participants that the resources and the environment were at risk and this could lead to worse situations. There is consensus that governmental and local accountability for resource use and good management was the responsibility of everyone. A case that kept on being made as reference was the depleted Maragoli hills which the locals entirely blamed the then government officials for blatant destruction. This is illustrated in Figure 15 below.



Figure 15: Depleted Maragoli Hill as a Result of Cutting Trees in Mungoma Ward, Vihiga County

In the traditional society, communities had their own way of coping with livelihood strategies. They had indigenous knowledge on resource management, embraced local diversity and rural populations and that, the resources available were to the benefit of entire humanity. This was, however, distorted with coming of the colonialists who displaced communities from their original habitats where they co-existed in harmony. This abrupt disruption induced shock and stress to communities.

Because of deprivation, they resorted to survival tactics and this has contributed to the destruction of indigenous forests for wood fuel and charcoal, the encroachment of riparian reserves

for cultivation amongst others. Sustainable development should embrace people's cultural and spiritual needs. Kaimosi hosted the first missionaries (Friends) who came to spread the gospel and others followed. It's mostly viewed that Vihiga County is a spiritual County with a number of denominations preaching their faith. This has impacted heavily on land use because majority of public land, especially the Kaimosi complex, is largely owned by the Friends church. Mungoma Caves in Vihiga Sub-County is closely associated with where elders conducted their prayers.

We also have the shrines in Hamisi for performing cultural rites amongst the Terik and the Tiriki. Equally, we have the caves in Bunyore where elders conducted the making of rain to save humanity from stress of drought. Other reserved areas that have historical significance include 'Jesus foot print'- Matsigulu in Central Maragoli and water catchment areas. This, therefore, implies that, with the current effect of globalization and commercialization of resource management, measures should be put in place to ensure that there is redistribution of wealth derived from land use to benefit the immediate households and the community at large.

5.5.3. Political Dimension in Land Use

The land question is at the center of social and political organization since land involves the development of a whole society and its processes. Sustainable development is only tenable when there is an appropriate institutional capacity to negotiate and implement the trade-offs between the different options. In many circumstances, this institutional dimension (formal and informal) is neglected or assumed to be in place. This ultimately affects the use and the transfer of assets to future generations to enable them to live quality life in the long run. It can be observed that in many African countries the capacity of institutions is wholly incompatible with their mandates to promote sustainable development. New institutions are created as a response to external factors, but are not perceived by governments and politicians as being really instrumental in addressing problems related to resource management, like several Ministries of Environment created after the Rio Conference (IUCN, 1991).

Indeed, when institutions are not empowered to execute their role or when they do not have the capacity to continue to perform their functions over the long term without being dependent upon external support, it is highly questionable that sustainable development can be achieved. This, in fact, has been the biggest setback in efforts to streamline the management of land as a resource. Many of the strategies remain externally imposed and the people are reluctant to embrace them.

In many cases, the institutions are incompatible with their mandates to promote sustainable development. In fact, new institutions are created as a response to external factors, but are not embraced by governments and politicians (e.g. several Ministries of Environment created after Rio Conference). At the national level, we have NEMA, WARMA, NLC and others that in spite of their existence have not achieved much. The destruction of Maragoli forest, for example, has been attributed to government officers and failure to manage exploitation of the available resources. Although the department of water, forestry and environment are supposed to manage the use of these resources, the departmental heads confided that they rarely get sufficient funds for government to run their programs. When institutions are not empowered to execute their mandate, then in the long run, without being dependent upon external support, it's highly questionable that we can achieve sustainable development.

When the researcher conducted interview schedules with heads of department, the matter that came out strongly was political interference (no political good will) in enforcing regulations and lack of sufficient financial support to be independent. This, therefore, implies that for sustainable development to be realized, we have to redistribute political and economic power to stakeholders so that they become part and parcel of the solution to the problems they are facing (DFID, 1999).

Further, it will be appropriate to empower the ordinary land users, participation of civil society in policy development, sharing of resources, and redistribution of wealth in order to reduce control of elite groups because land matters are very sensitive to politicians.

5.5.4. Environmental Dimension in Land Use

The environmental dimension in land use generally deals with maintaining a stock of natural resources above a certain quality threshold. The natural resources on, under or above land are greatly affected by the strategies that are employed in their exploitation. In assessing this dimension, the researcher investigated the measures that are used to preserve for example, biodiversity, depletion of resources, and use rate of non-renewable resources against the potential use by future generations and/or the orderly transition to renewable energy sources (WCED, 1987).

Land use patterns are the clearly visible result of human interaction with the biophysical environment. The basic controversies, however, lie on personal attitudes on the use of land and other competing uses. The environmental dimension of land use may entail maintaining a certain stock of natural resources above a certain quality threshold. This, therefore, implies that as these resources are exploited, efforts should be made to ensure that they are not depleted (Koomen, 2007).

At the local level, livelihood activities may contribute to soil erosion, declining water tables desertification and deforestation. On the positive side, livelihood activities can improve productivity of renewable resources like river water, soil, organic soil fertility, and trees. All these effects are related to land use management as households struggle to meet their day to day needs. Throughout the study, the incidences of the above practices were visibly seen (Mather, 1986)



Figure 16: Farming and Conservation of Environment in Mungoma Ward, Vihiga County

At the global level, livelihood activities can make net positive or negative contribution in the long term environmental sustainability of other livelihoods. This is in relation to pollution, greenhouse gases and global warming, depletion of ozone layer and the irreversible use of the world’s store of non-renewable resources. These effects are environmentally unsustainable because of their negative effects on livelihoods (Agarwal & Narian, 1991).

Livelihoods are also threatened by international trade and other agreements that reduce claims and access to global markets for livelihood products and to global common properties, for example sea food/fisheries. The challenge, however, is how to cushion the poor from these adverse effects which they do not have the power to control. The environmental dimension on sustainable livelihoods at the local level is illustrated in Figure 17

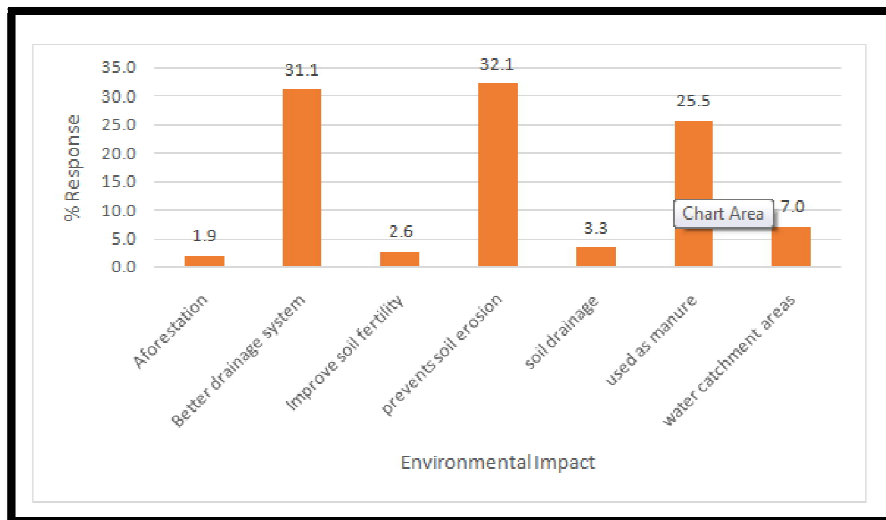


Figure 17: Environmental Dimension on Sustainable Livelihoods at the Local Level
 Source: Field Survey, 2016

5.5.5. Policy Used on Current Land Use

Any policy that is developed can have both positive and negative implications depending on the objective it's supposed to achieve in the long term. Policies can seek to enhance capabilities by being adaptable, versatile, well-informed and able to exploit diverse opportunities. Policies that enhance equity by giving priority to the capabilities, assets and access of the poorer, including women and minorities through redistribution, secure land rights, access to services like education, health and credit.

Policies that increase social sustainability by reducing vulnerability through restraining external stress, minimizing shocks and providing safety nets so as to limit severity of poverty through disaster prevention, family planning and counter seasonal strategies to provide income, food and employment for the poor are more desirable for enhancing sustainable livelihoods.

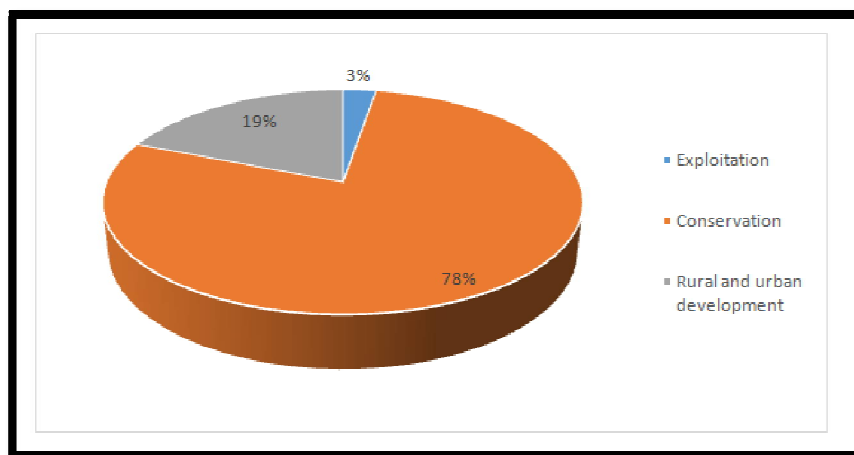


Figure 18: Appropriate Policy on Current Land Use
Source: Research Data, 2016

The researcher investigated the policies on current land use by classifying them into: those dealing with exploitation, conservation, and rural-urban development. A majority, 78% of the respondents suggested that a policy tailored to enhance conservation would be ideal in managing the current land use, 19% supported rural and urban development policy on land use, while 2.6% suggested that policy on exploitation of the resources on land was the ideal as shown on Figure 5.7. This, therefore, implies that, by embracing policy related to conservation, it would be recognized that, the same resources which are supporting current livelihoods are also expected to be used by future generations since some of these resources are non-renewable.

Current Land Use	Policy			Total
	Exploitation	Conservation	Rural and Urban Development	
Basic grain farmers	7	199	38	244
Livestock rearing	0	47	20	67
Tea production	0	6	0	6
Mixed basic grain	3	46	7	56
Forest	0	10	0	10
Mining	0	0	2	2
	10	298	67	385

Table 12: Policy on Current Land Use

Source: Research Data, 2016

The researcher while investigating the impact of ideal policy on current land use on community livelihood conducted cross tabulation between the current land use (production of basic grain, livestock rearing, tea production, mixed grain, forestation and mining) and the existing policies on exploitation, conservation and rural-urban development. Arising from the findings in Table 13, 98.8% of the respondents did not support the current policies on exploitation. This was mainly due to the fact that, the respondents felt that this policy was imposed on them and it's biased towards supporting the interests of multi-national companies that are foreign based.

A majority, 81.2% of the respondents, especially those who are engaged in crop production and forestation, supported a policy on conservation. This was attributed to the fact that agriculture is the main stay of the respondents and sustainable livelihoods is only tenable if the resource of land is not depleted. Also conservation policy was easily embraced because it was integrated within the main farming process. This included terracing, farm yard manure and the *shamba system* in government forest in Hamisi Sub-County.

The policy on rural-urban development was only supported by 7.2% of the respondents. This was due to the fact that large part of Vihiga County is basically rural. The only recognized urban centres are Luanda and Mbale towns. In relation to land use, a majority of the respondents felt that since the land in which they derive their livelihoods is their ancestral land, its use should not be regulated and given for the mixed land uses within the county.

It is evident therefore that, the policy on conservation should be strengthened while others formulated through public participation to directly address the challenges being faced by the respondents for optimum land use as a way to benefit the current and future generations.

5.5.6. Institution to Formulate the Policy

On formulation of current land use policies, the researcher sought to investigate the authority responsible on formulating the policies found to be ideal. The study revealed that majority, 83.9% of the respondents alluded to the fact that the County Assembly should formulate these policies since they have their representatives who are constantly in touch with them as compared to the

member of national assembly. Also the respondents preferred land issues to be devolved fully and not partially to the Counties.

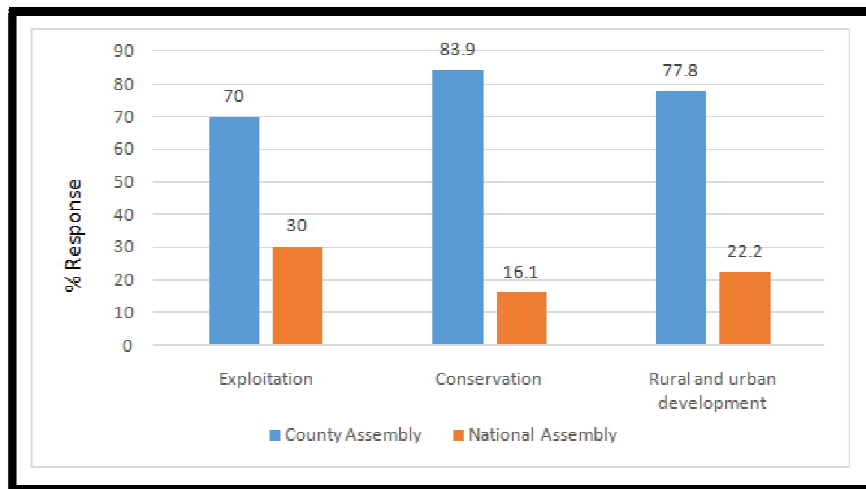


Figure 19: Institution to Formulate Policies

5.5.7. Influence of Human Activities on the Environment

Land use patterns are the most clearly visible result of human interaction with the biophysical environment. These land use type include: residential, commercial, agricultural and industrial uses. Also these activities convert natural habitats, forests, hills and wetlands for agricultural and livestock production, mining, and rural-urban development (Koomen, 2007).

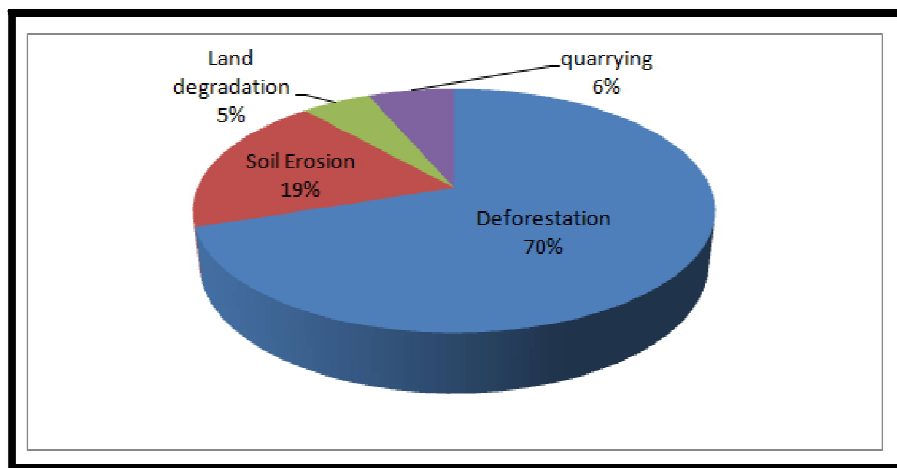


Figure 20: Effects of Human Activities on the Environment
Source: Research Data, 2016

The study revealed that, a majority, 76% of the respondents agreed that some of human activities affected the environment and to a large extend livelihoods of the communities within and outside the County. Some of the negative effects of failing to manage various land uses may lead to: poor crop yield, deforestation, soil erosion, land degradation and depleted quarry sites.

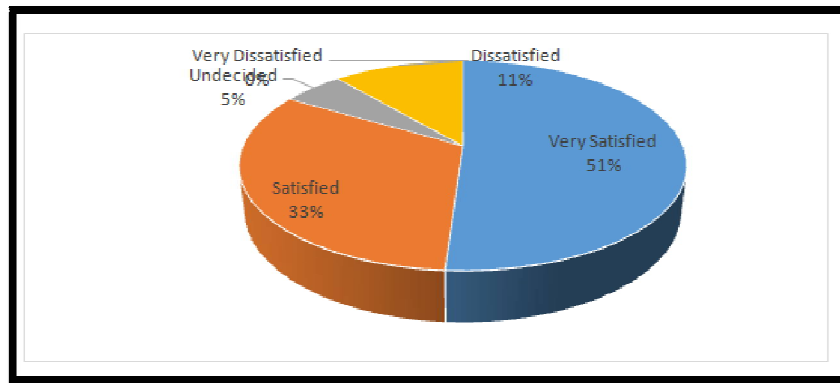
Arising from Figure 20, 70% of the respondents acknowledged that deforestation was the major cause of human induced activities that affect land use management. Also because of poor farming practices, destruction of vegetation cover is inevitable and this will definitely result in soil erosion whose further effects are cyclic in nature-loss of soil fertility-poor crop yield-unsustainable livelihoods.

5.5.8. Measures of Local Accountability on Resource Use and Management

To mitigate the adverse effects of human activities on land, various land use management strategies can be adopted to realize sustainable livelihoods. Thus, measures of local accountability on resource and management may include: diversification of livelihood activities, afforestation, terracing and adoption of coping mechanisms to harsh climatic conditions that are very unpredictable in the current times.

The study showed that, a majority, 86% of the respondents supported afforestation as an appropriate measure of local accountability, particularly in those areas where there has been deforestation. Diversification and adoption of coping mechanisms was 10% and 4% respectively because of the need to be adaptable to a dynamic environment that is prone to shocks and stresses.

5.5.9. Public Perception on Conservation Measures



*Figure 21: Levels of Satisfaction on Conservation Measures
Source: Research Data, 2016*

In order to determine the perception of the respondents on conservation measures, the respondents were asked whether they were very satisfied, satisfied, dissatisfied, very dissatisfied and undecided. The study findings showed that a majority, 51% were very satisfied, 33% were satisfied. These results implied that, conservation measures used at the study area were highly acceptable by the respondents.

5.6. To Analyze the Challenges Attributed to Various Land Use Activities on Sustainable Livelihoods

The researcher while appreciating various determinants of land use activities also did acknowledge that in pursuit of livelihood strategies challenges are bound to occur which need to be addressed. In this view, the challenges that were attributed to the current land use were classified

as external and internal. Their root causes were also discussed and how they impact on people's livelihoods.

5.6.1. Internal and External Challenges

Internal challenges are those challenges that arise from individual households livelihood strategies. These include: overreliance on subsistence farming, lack of diversification, population explosion, low absorption of technology and cultural attributes that some households have refused to let go like, land succession that results in fragmentation of land parcels into very small and uneconomical sizes.

On the other hand, external challenges are those challenges that no house has any control over their occurrence. These include: climatic changes (rains and drought), market forces, lack of government support (subsidies) and globalization effect (commercialization of a resource).

The researcher found that, a majority, 54% of the respondents claimed that most of the challenges they faced were generated by internal sources, while 46% were attributed to external challenges. This, therefore, implies that the respondents should embrace diversification strategy in order to manage the challenges related to various land use activities.

Root Cause of the Challenges	Type of Challenges		Total
	Internal	External	
Subsistence farming	37	0	37
Lack of Diversification	112	2	114
Climatic Changes	15	94	109
Market forces	4	34	38
Population explosion	11	16	27
Lack of government support	24	36	60
Total	203	182	385

*Table 13: Root Cause of the Challenges
Source: Research Data, 2016*

5.7. Discussion and Testing of Hypotheses

This section discusses the hypothesis testing and the analysis of the results. The test of hypothesis was done using the elements of participation where variables were given codes and entered separately in the SPSS spreadsheet for analysis. This was then followed by Cross-tabulation between SLUMS (independent) and sustainable livelihoods (dependent) as used in the study.

The chi-square values indicate the association between and the degrees of freedom at $p < 0.05$ level of significance. Spearman's rank correlation was further used to describe the results. This was chosen to give the measure of the degree of association between the independent and dependent variables, since it gives a complete picture of the nature, the strength and the direction of the relationships between the variables.

The value of the correlation coefficient ranges from -1 to 1. The positive or negative sign of the correlation coefficient indicates the direction of the relationship. The Spearman's correlation coefficients on the main diagonal are always 1.0 because each variable has a perfect positive linear relationship with itself. The absolute value of the correlation coefficient indicates the strength, with

the larger absolute values indicating stronger relationship. The significance of each correlation is also displayed.

The significance level is the probability of obtaining results as extreme as the one observed. If the significance is very small (less than 0.05) then the correlation between the two variables is significant and they are linearly related. Even if the correlation between the two variables is not significant, they may be correlated but there is no relationship.

5.7.1. Test of Hypotheses

The hypotheses were tested to find out the relationship between SLUMS on people’s sustainable livelihoods.

5.7.1.1. Test of Hypothesis (Ho₁)

- Ho₁: There is no significant effect of land use determinants on sustainable livelihoods

In determining the influence of the factors that significantly influence land use within the study area, Chi-Square values and levels of correlation were used. The researcher used chi-square values to indicate the association between the variables and the degrees of freedom at p<0.05 level of significance. Spearman’s rank correlation was further used to describe the results. This was chosen to give the measure of the degree of association between the independent and dependent variables, since it gives a complete picture of the nature, the strength and the direction of the relationships between the variables under study. The values of the correlation coefficient range from -1 to 1. The positive or negative sign of the correlation coefficient indicates the direction of the relationship.

Variables	Chi-Square			Correlation@	
	<i>x</i> ²	Df	Significance	P-values	Significance
Type of land ownership	10.868	10	0.000	0.008	-.028
Land Security	18.799	5	0.006	0.002	0.014
Size of Family	63.624	20	0.000	0.000	0.185
Size of Land	46.540	20	0.001	0.001	0.108
Type of Labor	32.372	10	0.023	0.000	0.030
Quality of Land	13.07	5	0.000	0.003	0.064

*Table 14: Relationship between Spatial Land Use Management and Community Livelihoods
Source: Research Data, 2016*

As shown in Table 14, the Chi-Square value for the type of land ownership to support sustainable livelihoods was 10.868 at 10 degree of freedom and a significance of 0.000 at 0.05. This indicates a strong relationship between the form of land ownership and community livelihoods. The correlation value was -0.028 and a significance value of 0.008 at p<0.01. This negative sign implies that either form of land ownership (freehold, communal and public land) can significantly influence the type of land use and the strategy to manage the activities being undertaken by respective households in their endeavor to fulfill their livelihood needs.

On the other hand, the Chi-square value for land tenure security was 18.799 at 5 degrees of freedom and a level of significance value of 0.006 at p<0.01. This implies that land tenure security

has a strong influence on community livelihoods since it has the potential to stimulate on-farm activities and lack of it can trigger off-farm work. All these can impact on household income and to a larger extent how they can sustain themselves. The correlation value was 0.014 and a significance value of 0.002 at $p < 0.01$. This implies that households with land tenure security (land title deeds) can be able to have collateral to secure capital from financial institutions to improve on their investments and living standards in general.

The chi-square test value for size of the family and land use management strategy was 63.624 at 20 degrees of freedom and a significance value of 0.000 at $p < 0.01$. This implies that the size of the family strongly influences the type of land use and its management strategy. Indeed, large families have the potential to fragment their parcels of land into small uneconomical sizes. Such land sizes as seen in the area of study cannot produce enough food to sustain the members of the household. The Spearman value was 0.185 and a significance value of 0.000 at $p < 0.01$. Size of the family has strong association in determining current land use since it can influence both a livelihood strategy and the type of the technology to be applied. Large families, for example, may opt to use own family labor on their farms to reduce costs of production by adopting labor – intensive production technologies.

Similarly, the Chi-square value for the size of land and sustainability of community livelihoods was 46.540 at 20 degrees of freedom and a significance of 0.001 at 0.05. This implies that land sizes have a strong influence on livelihoods of households. The average farm size in the County is 0.4 hectares for small scale farming and 3 ha for large scale. Since land sizes are shrinking, household are faced with a challenge of balancing between food production and settlement or cash crop farming and subsistence farming.

The Spearman correlation value was 0.108 and a significance value of 0.001 at $p < 0.01$. The positive sign implies that the land size has a strong association with community livelihoods. For instance, households with large parcels of land can easily diversify their production (mixed grain production, livestock rearing and cash crop production). It also becomes easier to embrace land management strategies through rotational farming and sub-dividing land for various uses (settlement, livestock rearing, afforestation, etc).

The Chi-square value for the type of labor on land use and people's sustainable livelihoods was 32.372 at 10 degrees of freedom and a level of significance of 0.023 at 0.05. This implies that labor, as a factor of production, has a strong influence on economic activity of many households. The type of labor employed by respective households in various sectors of the economy may also be influenced by the landscape of that area and its availability. For instance, it's not practicable to employ mechanized farming in hilly sloppy landscape and neither is it economical for use on small farms that are less than an acre as seen in the area of study.

The correlation value was 0.030 and a significance value of 0.000 at $p < 0.01$. This implies that there is significant association between the types of labor on a particular land use and community livelihood. For example, many households in Vihiga employed manual labor (family) on farms because the production of tea and mixed grain was labor intensive. Also the physical assets (machinery and equipment) owned by a household influenced the type of labor employed and land management practices.

The Chi-square result for the quality of land was 13.07 at 5 degrees of freedom and a significance of 0.000 at 0.05. This implies that land management practices are greatly influenced by

the quality of the land. For example, fertile soils have the potential to increase production to sustainable levels to various households. The Spearman correlation value was 0.064 and a significant value of 0.003 at $p < 0.01$. This implies that there is a strong association between the variables. For example, the continued use of fertilizer may have leaching effect, while at the same time, fertilizer may be used to improve already exhausted soils.

Arising from the findings in the study area, land management was not determined by the land ownership but highly determined by land security, size of the land, size of the family, type of the labor used, and quality of land i.e. soil fertility. These results reveal that regardless of the type of land ownership i.e. free hold, communal or public, there was sufficient land use in the study area.

5.7.1.2. Test of Hypothesis Two (H_{02})

H_{02} : There is no significant statistical influence of Spatial Land Use Strategy on Sustainable Livelihoods.

Item	Chi-square (χ^2)			Correlation	
	X Statistics	Df	Level of Significance	Value	Level of Significance
Economic Dimension (Crop Production)	49.151	25	0.003	- 0.450	0.000
Social Dimension (Education)	85.945	15	0.000	- 0.032	0.002
Political Dimension (Security)	23.011	15	0.000	- 0.735	0.000
Environmental Dimension (Afforestation)	85.030	35	0.000	- 0.057	0.004
Land Use Policies	23.83	10	0.008	0.039	0.000
Local Accountability	105.89	10	0.000	0.264	0.000

Table 15: Relationship between the Influence of SLUMS and Sustainable Livelihoods

Source: Research Data, 2016

In order to determine the relationship between spatial land use management and sustainable livelihood, Pearson’s Product Moment Correlation Coefficient and Chi-Square tests were conducted for economic, social, political and environmental perspectives of a livelihood. The result showed that there was a significant relationship between spatial land use and a household’s livelihood as indicated in Table 15. The Chi-square results for Spatial Land Use Management Strategy in terms of economic dimension (crop production) and its influence on respondent’s livelihood was 49.15 at 25 degree of freedom and a strong significance of 0.003 at $p < 0.05$. This means that there was a strong association between the two variables. Crop production, as an economic activity, greatly influences household’s engagements on land. For instance, through diversification, they produce more for consumption and the surplus can be sold to earn income, while observing land carrying capacity can reduce adverse effects of erosion. The Spearman value

was -0.045 and a significant value of 0.000 at $p < 0.01$. This negative sign implies that the numerous land use activities can impact negatively on livelihoods of the community unless right measures are put in place to ensure sustainability is achieved. In fact, many scholars have acknowledged that poverty is the greatest threat to sustainable land use management.

On the other hand, the Chi-square value for the social dimension of the strategy (education) and its influence on sustainable land use management was 85.945 at 15 degree of freedom and a strong significance of 0.000 at $p < 0.05$. The implication here is that there exists a strong influence between land use management strategy and people's sustainable livelihoods in that, educated people are more like to embrace best farming practices, and family planning to control population growth. The Spearman value was - 0.032 and a significance value of 0.002 at $p < 0.01$. This implies that although education is a major determinant of SLUMS and achieving sustainable livelihoods as shown in the findings of the study, the respondents are vulnerable to stresses and shocks that are either external or internal.

The Chi-square test for political dimension (land tenure security) was 23.011 at 15 degree of freedom and a strong significance of 0.000 at $p < 0.05$. This implies that there is a strong influence between land tenure security and land management strategy that can be applied for its sustainable use. This further implies that sustainable development is only tenable when there is appropriate institutional capacity to negotiate and implement the trade-offs between competing land uses. The Spearman value was -0.735 and a significance value of 0.000 at $p < 0.01$. This negative sign implies that even though there are institutions (formal) that are legally mandated to regulate the management of land, informal actors pose a big threat to sustainability because they usually operate outside the main established institutions. Also, for any strategy to succeed, it requires the political will to implement it and at the same time the synergy to manage external influence from other players. On environmental dimension (afforestation), the Chi-square value was 85.030 at 35 degree of freedom and a strong significance of 0.000 $p < 0.05$. This implies that there is a strong influence of afforestation practices as a strategy to manage the resource of land and support people's livelihood. The Spearman value was -0.057 and a significance value of 0.004 $p < 0.01$. The environmental dimension of land use entails maintaining a certain level of stock of natural resources above certain quality threshold. This negative sign implies that as these resources are being exploited, efforts should be made to ensure that they are not depleted. Also, livelihood activities may contribute to declining water tables, deforestation and desertification, and declining water tables.

Similarly, the Chi-Square Value for land use policies was 23.83 at 10 degree of freedom and a strong significance of 0.008 $p < 0.05$. This indicates that the formulated policies can be used to help enhance capabilities and equity, and at the same time, increase social accountability within and between communities. The Spearman value was 0.039 and a significance value of 0.000 $p < 0.01$. This, therefore, implies that land use policy should be seen to enhance a household livelihood and sustain its level of productivity. The Chi-square result for local accountability on land use was 105.89 at 10 degree of freedom and a strong significance of 0.000 $p < 0.05$. This implies that involvement of key stakeholders in community development programmes and political will to support these initiatives are crucial in attaining sustainable livelihoods since they are inter-twined. The Spearman correlation value was 0.264 and a significance value of 0.000 $p < 0.01$. This implies that there is a weak association between the variables and this calls for proper mapping of key

stakeholders and community participation in all matters affecting them as enshrined in the constitution. Indeed, policies that increase social sustainability are critical in reducing vulnerability through restraining external stress, minimizing shocks and providing safety nets in order to limit the severity of poverty.

Finally, based on the above statistical tests, the researcher rejected the null hypothesis and concluded that: there is a significant statistical relationship between Spatial Land Use Management Strategy on Sustainable Livelihood in Vihiga County.

CHAPTER 6: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1. Overview

This chapter presents summary of research findings as per the objectives of the study, conclusions drawn and recommendations for further action by policy makers and research.

6.2. Summary of Findings

6.2.1. The Current Spatial Land Use Activities on Sustainable Livelihoods

Although every Sub-County had different endowments by comparative advantages as reflected by the combination of bio-physical and socio-economic factors, each household in Vihiga County pursued different household strategies.

According to the findings of the study, approximately 64% of the sampled households were engaged in primary grain production mainly for domestic consumption, while other opportunities like off-farm work supplemented their incomes. This form of livelihood strategy is necessary for the diminishing household land parcels and the increasing population that is synonymous with the County's demographic structure. Indeed, the County statistics confirm that crop production is the main economic activity that contributes to 64% of the County's income and the biggest employer (CIDP, 2015).

Lack of diversification strategy and unpredictable climatic conditions was established as a critical hindrance to achieving sustainable livelihoods in Vihiga (Carter, 1997). Maize production has remained a priority to many households that cannot produce enough yields to last the next planting season.

Other land uses included: tea production as a significant cash crop with only 1.6% of the respondents engaged in, while forest cover is approximately 4,160.9 hectares. Although quarrying activity was not very pronounced amongst the respondents, it remains a key catalyst in the construction industry and is a major concern for environmental conservation because it contributes immensely to land degradation. This, therefore, calls for a holistic approach that is cutting across all sectors so that the concept of sustainable livelihoods is enhanced both at the household and institutional levels.

6.2.2. The Determinants of Spatial Land Use Management Strategy in Vihiga County

The major determinants of SLUMS in the study included: a form of land ownership, land tenure security, the size of the land and family, the type of labor employed, and the quality of the land.

Three key distinct forms of land ownership in Vihiga are freehold (74%), communal (19%) and public land (7%). As much as all the three play a key role in sustaining livelihoods, 66% of those who owned freehold land acknowledged that it was far easier to access land because there are willing buyers and willing sellers for land for various uses. Increased access to land can promote diversification of livelihood strategies that have the potential to reduce minimum tillage and

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burning practices. However, it's important to note that, although land might be affordable in some parts of Vihiga County, land parcels, close to the County headquarters, have attracted very high prices. This is consistent with the findings of Von Thünen (1826) that land, closer to the central city/market, was more expensive than those located on the outskirts.

The location of Vihiga County in two distinct agro-ecological zones with plenty of rainfall and fertile soils is good for agricultural production (CIDP, 2015). Indeed, 25% of the respondents concur that soil fertility affects land use management practices and outcomes. This is consistent with the view of the department of agriculture in the county because, many farmers, due to soil exhaustion, are now using artificial fertilizers in bid to improve crop yield. The over-usage of these fertilizers has affected the balance of soil nutrients because of leaching effect which, in turn, has reduced the productivity of these parcels of land.

Land Tenure Security is another determinant of Land Use Management Strategy. At the County level, it's estimated that 70% of land titles have not been processed from the time the first land adjudication was done. This, therefore, implies that they do not have absolute ownership and thus cannot be used as collateral to secure capital from financial institutions that could be used for gainful activities to improve their livelihoods. Also, ownership of land stimulates on-farm activities, whereas a lack of own land can be expected to stimulate a household to look for off-farm. However, land ownership has little impact on a household income, which is consistent with earlier findings that, access to land is not the only determinant of poverty.

The significant test on the influence of other determinants of spatial land use management strategy indicates that the size of the family, the acreage of the land, type of labor used, and land quality (fertility) had a strong association in determining current land use. These results also reveal that, regardless of the type of land ownership i.e. free hold, communal or public, there was sufficient access to land to support livelihood activities in the study area.

6.2.3. The Influence of Spatial Land Use Management Strategy on Sustainable Livelihoods

The influence of spatial land use strategy on people's sustainable livelihoods was examined in economic, social, political and environmental dimensions of development as discussed below.

6.2.3.1. Economic Dimension in Land Use

Crop production is the mainstream economic activity in Vihiga County and contributes to approximately 64% of the County's income. Engagement in agricultural activities employs over 80% of the people in Vihiga. These findings are consistent with UNEP (2002) which classifies Sub-Saharan Africa as agriculturists. However, the diminishing farm sizes are impacting negatively on the average farm yield per unit area for most farming households. To cushion this, people engage in other income generating activities as casual laborers on tea farms, construction works, jua kali activities, and daycare services.

Other economic activities include, livestock rearing, tea production, Gold mining and Quarry activities. It's estimated that approximately 70% of land area in Vihiga County is rocky. The rocky landscape is a challenge to households because it impedes the use of, for example, machinery as a physical asset to support livelihoods. Also, rocks, of their physical nature, are obstacles to diversification strategies that could cushion many households on natural shock and stress.

It was also evident that those households which embraced best practices like diversification, observing land carrying capacity, soil conservation and land reclamation enjoyed real benefits derived from land use management. Households which are able to maintain productivity in the face of stress or shocks like natural disasters, economic conjuncture and social conflicts live happier lives (Mather, 1986). This, therefore, implies that land, as a resource, is crucial in supporting activities of households that can lead to sustainable livelihoods.

6.2.3.2. Social Dimension in Land Use

The researcher viewed the social aspect of land use in two dimensions: a positive (proactive) dimension that entails enhancing and exercising capabilities in adapting to, exploiting and creating change, and in assuring continuity, while the negative (reactive) dimension entails coping with stress and shocks.

Vihiga County experiencing rising population, declining farm sizes, seasonal food shortages as a result of declining yields, declining resource bases, no fodder, grazing fields or water and the domestic cycle with its periods of high ratios of dependants exert stress on limited resources to support livelihoods. These effects are ultimately built up and their impacts are felt across the members of the entire household.

The County has also experienced shocks as a result of floods and landslides which led to displacement of households and loss of property. The associated causes of all these effects revolve around how land, as a resource, is used and managed (Evans, 1989).

Arising from the study, some of the respondents have been deprived of access to this major resource-land, its endowments and capabilities. We have the landless, the urban and rural poor who have no equal opportunity to live a dignified life because they do not have land. In order to move out of poverty, the first step is to acquire land which unfortunately is beyond the reach of many poor people.

Local accountability for resource use and good management was the responsibility of everyone. However, in Vihiga, the community and government agencies have not been very proactive in ensuring that this is achieved. This is particularly evident with presence of the depleted Maragoli hills which the locals entirely blamed the then government officials for blatant destruction. This has put both flora and fauna at risk which depend on this resource for survival.

Due to the current effect of globalization and commercialization of resource management, measures should be put in place to ensure that there is redistribution of wealth derived from land use to benefit the immediate households and the community at large. Also, sustainable development should be embraced to meet people's cultural and spiritual needs.

6.2.3.3. Political Dimension in Land Use

The land question is at the centre of a social and political organization since land involves the development of a whole society and its processes. Sustainable development is only tenable when there is an appropriate institutional capacity to negotiate and implement the trade-offs between the different options. In many circumstances, this institutional dimension (formal and informal) is neglected or assumed to be in place. This ultimately affects the use and the transfer of assets to future generations to enable them to live a quality life in the long run. It can be observed that in many African countries the capacity of institutions is wholly incompatible with their

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mandates to promote sustainable development. New institutions created as a response to external factors, are not perceived by governments and politicians as they are really instrumental in addressing problems related to resource management, like several Ministries of Environment created after the Rio Conference (IUCN, 1991).

Political interference (no political good will) in enforcing regulations and lack of sufficient financial support to be independent was cited as the biggest impediment to development. This, therefore, implies that for sustainable development to be realized, there's a need to redistribute political and economic power to stakeholders so that they become part and parcel of the solution to the problems they are facing (DFID, 1999).

Further, empowering the ordinary land users, the participation of civil society in policy development, sharing of resources, and redistribution of wealth will be appropriate in order to reduce the control of elite groups because land matters are very sensitive to politicians.

6.2.3.4. Environmental Dimension in Land Use

Since land use patterns are the most clearly visible result of human interaction with biophysical environment, the environmental dimension of land use emphasizes that, as the resources therein are exploited, efforts should be made to ensure that they are not depleted (Koomen, 2007).

Arising from the study, 76% of human activities affected the environment and to a large extent, livelihoods of the communities within and outside the County. Some of the negative effects of failing to manage various land uses were: poor crop yield, deforestation, soil erosion, land degradation and depleted quarry sites. Also, deforestation accounted for 70% of human induced activities that affected land use management. In order to mitigate the adverse effects of human activities on land, 86% of the respondents suggested afforestation as an appropriate measure of local accountability in resource use. These measures of local accountability on resource use and management should include: diversification of livelihood activities, afforestation terracing and adoption of coping mechanisms to harsh climatic conditions that are very unpredictable in the current times. The challenge, however, is how to cushion the poor from these adverse effects which they do not have the power to control.

6.3. *The Challenges Attributed to Various Land Use Activities on Sustainable Livelihoods*

The challenges were generally classified as external and internal depending on the source.

Arising from the study, 54% of the challenges were generated by internal sources, while 46% were attributed to external sources. External challenges were attributed to harsh climatic conditions, market forces, lack of subsidies, and competition from established firms, superior technology-irrigation, delayed payments, and land banking. The major causes of internal challenges include: addiction to subsistence farming, lack of diversification, low absorption of technology, lack of infrastructure development, excessive use of artificial fertilizers, sub-division of land to uneconomical sizes, commercialization of land and population pressure.

A majority, 87.8% suggested that internal problems could be addressed through diversification since this could cushion households in case of shocks that are beyond their control and for external challenges, 96.7% of the respondents concurred that these problems could be mitigated through development of policies and the political will to implement them would increase social

sustainability by reducing vulnerability through: restraining external stress, minimizing shocks and providing safety nets so as to limit severity of poverty through disaster prevention, family planning and countering seasonal strategies to provide income, food and employment for the poor.

Also, the County and National governments should create a sinking fund that can be used to support communities when faced with adverse effects of internal and external challenges.

6.4. Test of Hypotheses

Based on statistical tests, the researcher rejected the first null hypothesis (**Ho₁**) and concluded that there is a significant statistical relationship between determinants of Spatial Land Use Management Strategy on Sustainable Livelihood in Vihiga County. Also, the second null hypothesis (**Ho₂**) was rejected and concluded that there is a significant statistical relationship between Spatial Land Use Strategy on Sustainable Livelihood.

6.5. Conclusion

The land has emerged as a key resource in which people's socio-economic livelihoods are determined. This is demonstrated by numerous activities that are performed on, under and or above land for sustenance. The interactions between these activities play a major role in influencing their spatial location and distribution over space and ultimately define the economic activity of a household. In order to achieve any meaningful development, one of the most fundamental prerequisites is the use of the land resources in a way that meets the needs of the people and creates the surplus necessary for growth. This, therefore, explains the important role played by agriculture in enhancing food security and economic development possibilities.

Many households in Vihiga, as evidenced by limited asset portfolios, largely rely on family labor (unskilled) and small parcels of land to support their livelihoods. With the diminishing land sizes, it's virtually not practicable to produce enough food to sustain the household throughout the year. The same households are also faced with no other choice than to use their scarce assets to grow subsistence food crops like maize and beans. In fact, this livelihood strategy is strongly associated with poor bio-physical and socio-economic conditions and extreme poverty, which is the greatest threat to sustainable land use.

Also, arising from the study, households in Vihiga County seem to be trapped in the vicious cycle of producing basic grains which usually produce low yield for subsistence consumption and albeit using traditional technologies. Failure to embrace diversification in agriculture and other profitable income earning strategies like horticultural production, has kept many households in a state of perpetual poverty. This, therefore, implies that there is need to build upon the economic base created by agriculture by making it more efficient, dynamic, productive and competitive.

Since development is a social process, it's also a creator and organizer of space. Thus, decisions, therefore, must be made about the location, types of investment, management of activities and, in most cases, at a cost effective resource management objectives. For instance, educated people are more likely to embrace best farming practices and family planning to mitigate population growth, which are some of the determinants of Spatial Land Use Management Strategy.

There is need to exploit the demographic dividend that is unique to Vihiga County for gainful use instead of viewing it as a burden. This human capital that is available in the County is a

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potential that has not been fully utilized. In particular, the youthful population, which is in its most productive bracket, can be absorbed in various sectors of the economy for rapid growth.

Conservation entails maintaining a certain level of stock of natural resources above certain quality threshold. This, therefore, requires that when resources are being exploited, efforts should be made to ensure that they are not depleted since the same resources which are supporting current livelihoods are also expected to be used by future generations.

Sustainable livelihoods are only tenable when there is appropriate institutional capacity to negotiate and implement trade-offs between competing land uses. It's also worth noting that there are both informal and formal actors in any economy that may pose a big threat to the attainment of sustainable livelihoods depending on the nature of their manifestation. There must be political will to implement any policy and the synergy to manage external influence from other players that, in many occasions, tend to derail the attainment of desired goals. The objective of any policy should be able to enhance a household's livelihood and sustain its level of productivity.

Local accountability on resource use and management is critical in reducing vulnerability through restraining external stress, minimizing shocks and providing safety nets in order to limit the severity of poverty. Although association of local accountability on resource use was found to be weak, this can only be achieved if capabilities of households are enhanced and there is equity.

Indeed, all variables used in planning complement each other and therefore, should be presented as a coherent package. Counties are new spatial entities with diverse regional organization (natural or human), which may belong to different domains (political, economic, socio-cultural and ecological), and may not necessarily coincide with administrative or geographical areas.

In spite of all these diversities, Counties are expected to spur development through integrating key variables linked to Spatial Land Use Management Strategy (land use planning, land policy and rural-urban linkages) and Sustainable Livelihoods (land carrying capacity, diversification/heterogeneity of land use, reduced environmental hazards, enhanced co-existence and compatibility, increased food production and ultimately people striving to attain balanced development). However, as seen from the study findings and the researchers' interpretations, sustainable livelihoods can only be achieved through prudent management of socio-economic activities, cultural attributes, population pressures on land and the politics of the day through development of appropriate policy response. This policy response should circumvent internal and external challenges that are a threat to the attainment of sustainable livelihoods in Vihiga County and Kenya at large.

6.6. Recommendations

Arising from the study, since challenges attributed to Spatial Land Use Management Strategy are generated by either internal or external sources, strengthening the linkages between policy and the anthropogenic activities has the potential to generate both benefits and dis-benefits which may be captured by the twin concept of pump and tunnel effects. Equally, this can generate the desired spatial balance that is characterized by the presence of two-way relationship.

Since Vihiga is an agricultural county, diversification of agricultural production through the provision of subsidies, farmers training and creation of special economic zones with external

partners can have the potential to enhance food security thus cushioning many households from adverse climatic effects that impact directly or indirectly on food and livestock production.

At the national level, development of infrastructure is crucial in enhancing inter and intra-County development. Owing to the location of Vihiga County in the western region circuit, a good road network, for example, can boost movement of people and goods within neighboring counties which can have an effect of stimulating growth. In particular, development of infrastructure remains a key driver of economic growth since it helps open up the rural areas with many untapped potential.

External challenges of spatial land use management strategy are the greatest threat to the attainment of sustainable livelihoods. The researcher is recommending development of policies and the political will to implement them in order to increase social sustainability by reducing vulnerability i.e. restraining external stress, minimizing shocks and providing safety nets so as to limit severity of poverty through disaster prevention, family planning and countering seasonal strategies to provide income, food and employment for the poor. Empowering the ordinary land users, the participation of civil society in policy development, and redistribution of wealth in order to reduce the control of elite groups because of the sensitivity of land matters can highly contribute to a sustainable livelihood.

In conclusion, from the study findings above, both County and National governments should create a sinking fund that can be used to support communities when faced with adverse effects of internal and external challenges that may hinder the attainment of sustainable development.

6.7. Suggestions for Further Research

Since the study was confined to Spatial Land Use Management and Sustainable Livelihoods, the researcher suggests that in order to fully understand SLUMS, further research should be done on the following areas:

- Integrating Spatial Land Use Management Strategy on conservation of ecosystems.
- Evaluating the influence of external challenges of Land Use Management on socio-economic livelihoods.
- Diversification of livelihood strategies in the face of diminishing resource base.

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Spatial Land Use Management Strategy for Sustainable Livelihood in Vihiga County, Kenya grew out of PhD research Thesis. It delves into issues related to natural resource exploitation, management and livelihoods. It singles out on land as a resource, its role as an asset to support lives, challenges emanating from its management and policy recommendations for its sustainable use. This book details various land use strategies both at local and international levels, together with models and theories that have been in practice over the years. This book further shares insights from the research findings in the study area that relate to development as a concept that can be beneficial to governments, NGOs and scholars in their quest for sustainable development.

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