AN ASSESSMENT OF FACTORS INFLUENCING SMALLHOLDER FARMERS' WILLINGNESS TO ADOPT MUSHROOM PRODUCTION FOR LIVELIHOOD DIVERSIFICATION IN VIHIGA COUNTY, KENYA

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DECLARATION

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

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DEDICATION

This thesis is dedicated to my son Gadiel Jeylani and parents Mr. Samwel Amakoye and Mrs. Alice Akwela for their support and encouragement throughout my study.

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I am very grateful to God for the gift of life, enabling me to get to such a level academically, for physical and spiritual strength during the entire period as a masters' degree student.

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APM	Adoption Pathways Model
ASDSP	Agriculture Sector Development Support Programme
CMAAE	Collaborative Masters in Agricultural and Applied Economics
ETAM	Extended Technology Acceptance Model
FAO	Food and Agriculture Organization of the United Nations
FGDs	Focus Group Discussions
FNSP	Food and Nutrition Security Policy
GDP	Gross Domestic Product
HAMUSAVI	Hamisi Mushroom Savings Cooperative (Kenya)
HMS	Hedonic-Motivation Systems
HMSAM	Hedonic-Motivation System Adoption Model
IFAD	International Fund for Agricultural Development
KALRO	Kenya Agricultural and Livestock Research Organization
KSHS	Kenyan Shillings
KNBS	Kenya National Bureau of Statistics
MPTM	Matching Person and Technology Model

NALEP	National Agriculture and Livestock Extension Programme (Kenya)
PLWHIV	People Living With HIV
SAPs	Structural Adjustment Programmes
SDGs	Sustainable Development Goals
TAM	Technology Acceptance Model
UNCTAD	United Nations Conference on Trade and Development
USD	United States Dollar
VAB	Vihiga Agriculture Board (Kenya)
VIMPRO	Vihiga Mushroom Producers Group (Kenya)
WFP	World Food Programme

ABSTRACT

Poverty is a critical problem in many parts of the world, especially in the developing countries. This has necessitated policy makers to have a keen interest in seeking ways of improving livelihoods and alleviating poverty. Agriculture remains a key sector for spurring growth, overcoming poverty, and creating employment opportunities in sub-Saharan Africa. However, in areas where land acreage is small, it has become difficult to carry out any profitable agricultural production as a means of livelihood sustenance. There is need to identify enterprises that can be incorporated into the farmers' production processes that are economically viable. There is limited research on the drivers and the extent of willingness of smallholder farmers' to adopt mushroom production for livelihood diversification in Vihiga County in Western Kenya.

Using primary survey data from a sample of 240 smallholder farmers, this study assessed the factors that influence smallholder farmers' willingness to adopt mushroom production as a livelihood diversification option in Vihiga County. Systematic sampling was used to select the respondents, where every 3rd and 5th household was interviewed in sparsely and densely populated areas, respectively to ensure that each household had an equal opportunity at being interviewed. Densely populated areas were mostly found around shopping centres and near tarmac roads. Descriptive statistics used in data analysis included frequencies, percentages and means and they were presented in graphs and tables. These were employed in the characterization of farmers' socio-economic profiles. A binomial logit model was applied to assess the factors that influence awareness of mushroom production by the farmers in the study area and their willingness to adopt mushroom production as a livelihood diversification option.

Results show that 68.8% of the farmers in the study area were aware of mushroom production and 82.5% of the total respondents were willing to engage in mushroom production as a livelihood diversification option. From the logit analysis, the main factors that were found to have a significant positive influence on farmers' willingness to engage in mushroom production were age, gender, consumption of mushroom and total land size in acres per household.

Based on the results, it is recommended that the stakeholders in the agricultural sector in the study area begin awareness campaigns of mushroom production as a livelihood diversification option for smallholder farmers in the region. It is also recommended that mushroom production be included in the County's agricultural strategy. A training strategy on mushroom production could be enhanced by encouraging the farmers to be members of development groups. This is because the development groups are the main channel for information access on new agricultural production practices in the study area. The Agricultural Sector Development Support Programme (ASDSP) in the study area should allocate more funds for awareness campaigns and trainings to ensure that the farmers in the area have knowledge on mushroom production as a livelihood diversification option.

Key words: *Poverty, Land, Livelihood Diversification*

CHAPTER ONE: INTRODUCTION

1.1 Background Information

Agriculture can be used to deliver an annual economic growth rate of 10% if the right policies and frameworks are put in place (United Nations, 2000). In addition to its traditional contribution to improving food security and nutrition, agriculture remains a key sector for spurring growth, overcoming poverty, and creating employment opportunities in sub-Saharan Africa (Amare *et al*., 2017). To spur growth, agriculture requires diversification to high value crops and transformation of the smallholder agricultural sector from subsistence to an innovative and commercially oriented sector. Jack (2013) asserts that agriculture remains the main source of income and employment in the sub-Saharan Africa region, accounting for 34% and 64% of these, respectively. The World Bank (2007) identifies three key areas where improvements are critical if strong economic performance is to be sustained, namely infrastructure, agricultural productivity, and the investment climate.

Governments throughout the developing world have for many years had a keen and sustained interest in diversifying their rural economies and the economic activities of rural residents (Delgado *et al*., 1997). Diversification of rural livelihoods is the subject of scientific research because income from farming has come under pressure due to population explosion (Barrett *et al*., 2001). Rapid population growth and subdivision of land have resulted in small land acreage per household, thus leading to a concern that contribution to household incomes from agricultural activities may no longer be meaningful (Marenya *et al*., 2003).

Households combine and explore diverse strategies to act, cope and adapt to the ever changing economy (Valbuena *et al*., 2014). Ellis (1997) defines livelihood diversification as the process by which rural families engage in different activities and social support capabilities in order to improve their standards of living. This is the phenomenon where rural households engage in multiple activities that are either on-farm or off-farm and agricultural or non-agricultural activities in order to survive and to improve their standard of living. On-farm diversification includes the introduction of new crops into the farming systems or farmers investing in livestock, hunting, and fisheries. This is distinguished from 'off-farm' activities, which generally refer to activities undertaken away from the household's own farm, such as wage employment (casual labour) on other farms (Ellis *et al*., 2004). Livelihood diversification is thus characterized by shifting activities away from customary farming to other sectors, and it offers flexibility and well-being to households by widening their subsistence options (Gautam *et al*., 2016). Subsistence producers and small farm wage labourers in the rural areas of low-income countries constitute over two thirds of the global poor and food insecure populations (International Fund for Agricultural Development, 2010; Food and Agriculture Organization of the United Nations *et al*., 2014).A lot of evidence from the literature suggests that it is relatively better-off smallholders with sufficient assets who achieve successful livelihood diversification, mainly by exploiting opportunities and synergies between farm and nonfarm activities (Loison, 2015).

Generally, from the perspective of managing risk and associated vulnerability of rural households, and in some cases from a desire to increase incomes, farm diversification makes sense as a policy goal (Kimenju *et al*., 2008, Shiferawet *al*., 2015). For instance, better-off rural

households may diversify their farming practices and their non-agricultural employment to balance risks of possible market failure where the economy lacks adequate insurance mechanisms (Braun *et al*., 1991; Ellis, 1998). Such households may also diversify into off-farm employment to increase household income when the economy is improving. Poor farmers who cannot rely solely on agriculture normally use off-farm income diversification as a form of self-insurance (Barrett *et al*., 2001). Lack of skills and knowledge and significant barriers to entry for limited high-return opportunities tend to leave the poor with less diversified income portfolios and lower, more variable earnings (Liyama *et al*., 2008). In some geographic areas, especially areas where the payoff from agriculture is very low, off-farm diversification is practiced by farmers as a supplement to farming (Smith *et al*., 2001).

Diversification is associated with a rise in income and accumulation of assets and thus improves the livelihood of the household and moves the household from poverty (Abdul-Hakim *et al*., 2011). Livelihood diversification also reduces risks associated with traditional agriculture. This is because of the different opportunities for engagement. Factors such as experience, family size, educational attainment and physical assets of households can affect diversification activities (Khatun *et al*., 2012). Diversification not only expands the number of potential crop types for market, but it also improves agro ecosystem functioning by allowing for innovation in areas that exhibit impacts of climate variability (McCord *et al*., 2015). Kenya is yet to achieve a rapid growth in incomes in the rural economy and/or in the economy as a whole, but this can be done by first embracing agricultural transformation. In this transformation, individual farms need to

shift from subsistence-oriented production towards more specialized production that is oriented towards the market or other systems of exchange.

Mushroom is one of the high value crops that can be grown alongside other crops as a diversification option for both smallholder and large scale farmers in Kenya. Mushrooms are packed with nutritional value. They're low in calories, are great sources of fiber and protein, and are considered good for plant-based diets. They also provide many important nutrients, including B vitamins, selenium, potassium, copper, and vitamin D. And even though they're commonly white, they're packed with as many antioxidants as more colorful fruits and vegetables. Eating mushrooms may also help to prevent respiratory infections. Plus, mushrooms may be able to alter gut bacteria for the better, which could also help treat obesity.

Mushroom production is less demanding on land and other resources. For example, a three square meter plot of land can produce up to 1,000 mushroom sets in small polythene bags, with production all year round (the first harvest being 28-35 days after planting the crop). Use of idle structures and agricultural waste as substrate and its ability to bio-degrade offers opportunity for mushroom production, and this provides a more economical and environmentally friendly disposal system for such waste (Isikhuemhen *et al.*, 2000). Harvesting can be done fortnightly, with a kilo of mushroom going for as much as Kshs. 800 (1USD was equivalent to KSHS100 at the time of survey). Mushroom production can also be used as a better source of income compared to maize in the study site. This is more so important in regions like western Kenya where the farmers tend to specialize in the production of maize which may not be economical

given the land constraints in the region. This possibility is based on the fact that markets for staple food crops tend to develop more slowly than those for cash crops (Kimenju *et al*., 2008). Mushroom market therefore could possibly develop faster than the maize market in Western Kenya, especially for the smallholder farmers.

Mushroom is an important cash crop in Kenya, even though it is still produced at small-scale level in the country. Button *(Agaricus bisporus)* and Oyster *(Pleurotus spp)* are the two main commercially produced mushroom varieties in Kenya. The industry has a well-established private sector investment, with large scale commercial farms like *Agridutt* Ltd, *Rift Valley* mushrooms, *Online* mushrooms, *Devani* and *Kanchan* mushrooms being the key exporting companies that do not require out growers. Mushroom is also produced by small-scale farmers in the Western and Coastal regions of Kenya for the local markets which are households, hospitals, supermarkets and the open air markets. In order to access the export markets, some small-scale farmers have formed cooperatives, for example the Hamisi Mushroom Growers and Saving Cooperative, which markets their produce as a group. The major constraints affecting these small-scale mushroom farmers are inadequate supply of quality spawn, inadequate research and failure to identify best agricultural practices, and development of standards along the mushroom value chain (Odendo *et al*., 2012).

Vihiga County in western Kenya is an area with relatively small land parcels per household that are characterized by a rocky and rugged terrain. The Ministry of Agriculture county strategy's main focus in the study area is on dairy production (cow and goats), banana, pawpaw, French

beans, mushrooms, sunflower and local chicken production. The emphasis on these enterprises is on a commercial basis for income generation, though there are production challenges facing the farmers in the County. These challenges include unpredictable climate, lack of crop rotation that leads to soil exhaustion (with maize as the crop that is mostly grown) and decreasing soil fertility, rocky and rugged terrain, crop pests and diseases.

Figure 1 shows the traditional mushroom variety that was previously being consumed by the local community in Vihiga County but its production has been declining over time.

Figure 1: A picture of the traditional mushroom variety

Figure 2 shows the cultivated mushroom variety that is currently being produced by farmers in the study area. Its production has been necessitated by the fact that the traditional variety that grew wildly is no longer enough to sustain the local community in the study area.

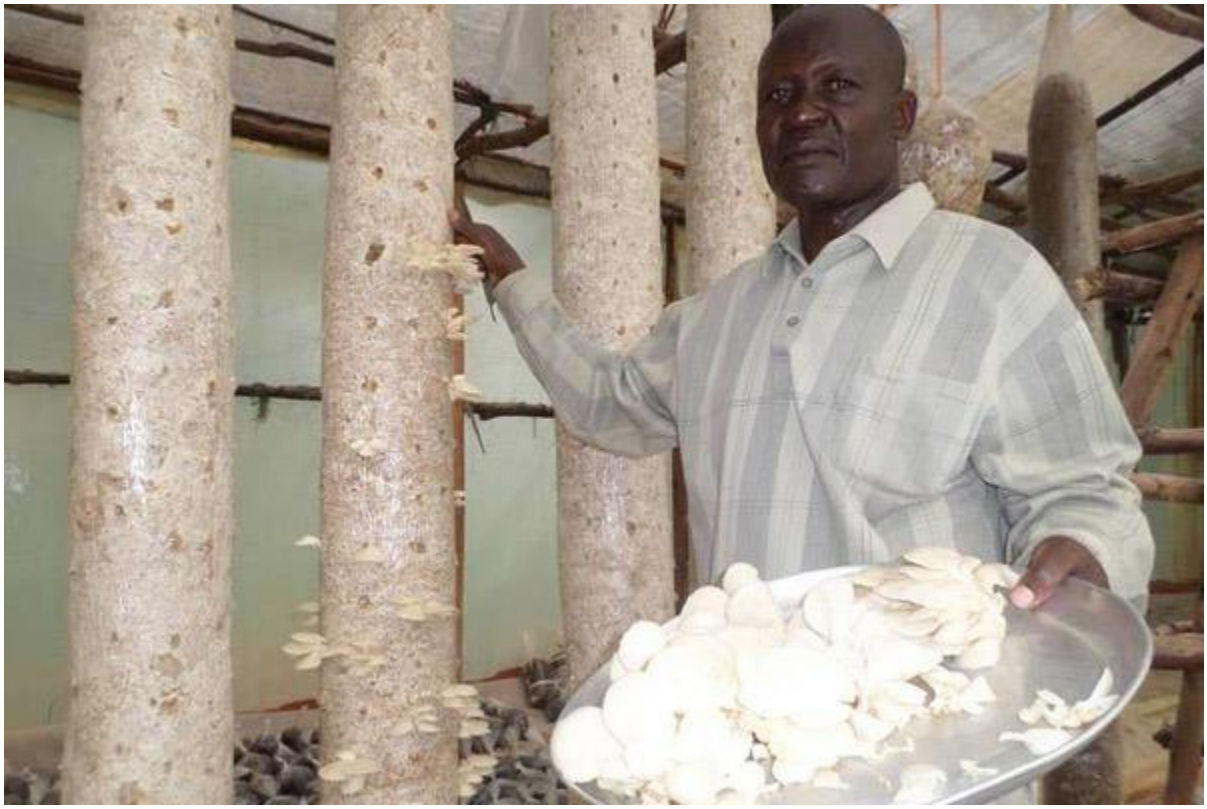

Figure 2: A farmer from the Vihiga Mushroom farmers' co-operative displaying his Oyster mushroom produce

1.2 Statement of the Research Problem

The ever increasing population in Kenya has put more pressure on the available land for agricultural production. The agricultural and forestry growth rate declined from 5.2% in 2013 to 3.5% in 2014 (KNBS, 2015). This has necessitated research into new technologies that require less land for profitable agricultural production, especially in areas where the existing farming practices have led to increasingly low production.

Livelihood diversification should be practiced by farmers as a way of risk aversion, yet not many farmers in Kenya are engaging in the most appropriate enterprises mix for maximum profitability in their respective regions. Severe land scarcity and population pressure tend to make households to engage in and pursue diverse activities as livelihood strategies (Gecho *et al*. 2014) and mushroom production offers a high value niche product with great potential to contribute to enterprise diversification and poverty alleviation, by utilizing agricultural wastes. However, mushroom production has not been fully exploited by farmers in Kenya. Farmers with small land parcels continue to languish in poverty due to lack of information on enterprises like mushroom production that require small land acreage for profitable production.

The main reasons why individuals and households pursue diversification as livelihood strategies are often divided into two overarching considerations, which are necessity and choice (Ellis, 2000). In the case of the farmers in Western Kenya, and especially Vihiga County, diversification into mushroom production would be a necessity because of the high population pressure, extreme poverty and poor state of land for profitable production of most of the other

agricultural products that are produced in that area. Thus, mushroom production as a livelihood diversification option has the highest potential compared to other enterprises in Western Kenya, given the current land constraints and production uncertainty, especially in areas with increasing population pressure that leaves the available land too small to be able to carry out any sustainable agricultural activity. Farmers in the study area engage mainly in maize production but employ poor agricultural practices that over time have led to a decline in production. Therefore, there is the need to identify new strategies that will assist the farmers in the study area to improve their livelihoods through diversification. The poor terrain in the study area has also made it almost impossible for most other agricultural activities to be carried out sustainably, and hence the need to come up with diversification strategies that would put this terrain constraint into consideration while achieving the goals of poverty reduction and improving livelihoods.

While the production of mushroom for both commercial and subsistence use in western Kenya is a lucrative economic activity, it has not been fully exploited by the smallholder farmers in Vihiga County. It is well suited to deal with the current land constraints in Western Kenya, yet its current production and local supply of 484.5 tonnes is way below its demand of 1,200 tonnes per annum thus necessitating importation.

Given that there exists little background information on mushroom production as a livelihood diversification option for farmers in areas facing land scarcity and that the drivers and the extent of smallholder farmers' willingness to adopt mushroom for livelihood diversification in Western

Kenya are also yet to be studied, this study aimed at determining smallholder farmers' willingness to adopt mushroom production and the importance of mushroom production as a livelihood diversification option for farmers in Western Kenya's Vihiga County.

1.3 Objectives of the Study

The main objective of this study was to assess the factors influencing smallholder farmers' willingness to adopt mushroom production for livelihood diversification in Vihiga County.

The specific objectives were:

1. To assess the awareness of mushroom production among smallholder farmers in Vihiga County.
2. To analyse the determinants of smallholder farmers' willingness to adopt mushroom production as a livelihood diversification strategy in Vihiga County.

1.4 Hypotheses

1. H_0: Smallholder farmers in Vihiga County are not aware of mushroom production.

2. H_0: Socioeconomic and institutional factors do not influence smallholder farmers' willingness to adopt mushroom production as a livelihood diversification option.

1.5 Justification

Mushroom production in Kenya has the potential to steer the country towards achieving the Sustainable Development Goals (SDGs) of poverty and hunger eradication, improved health (they are low in calories, great sources of vitamins, fiber and protein), improved environment and potential to boost the overall national economy (Gateri, 2012). Mushroom production could be one of the potential livelihood diversification options in Kenya, given the high demand for mushrooms, though little research has been done to establish the causes of low adoption of mushroom production as a livelihood diversification strategy. This study aimed at analysing the factors that influence smallholder farmers' willingness to adopt mushroom production for livelihood diversification in Vihiga County. Therefore, the study also sought to establish if mushroom production can be adopted as a livelihood diversification option for the farmers in areas with small land parcels since mushroom is a high value product with great potential to contribute to enterprise diversification and poverty alleviation as established by Isikhuemhen *et al*. (2000).

Assessing the factors that influence the smallholder willingness for adoption of mushroom as a livelihood diversification option assisted in identifying the factors that should be targeted by policy makers when designing policies that assist farmers who adopt mushroom production as one of their livelihood diversification options.

This research provided information to show what would influence the farmers venture into production of mushroom in Vihiga County as a livelihood diversification option. Given that livelihood diversification has been a topic of keen interest for most developing countries, the findings of this study may be expected to assist policy makers in structuring policies that favor livelihood diversification enterprises. Policies targeting food security can also be addressed, given that mushroom production will ensure that the people in the study area are able to get some income that would facilitate their access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

Figure 3 shows the rugged terrain in Vihiga County that makes it almost impossible to carry out most of the traditional agricultural practices that have been previously practised in the study area.

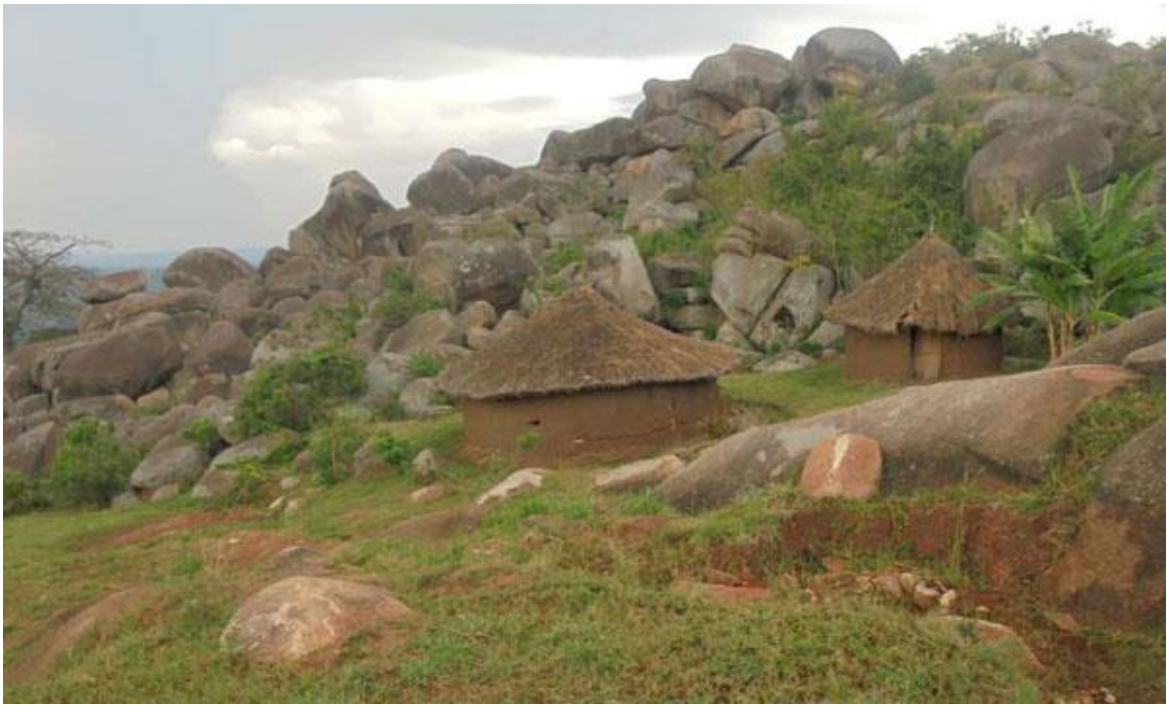

Figure 3: A picture showing the rocky terrain in Vihiga County

1.6 Organization of the thesis

Chapter one focuses on the background of the study, statement of the research problem and the objectives of the study. It also focuses on issues surrounding the justification of the study and the study area. Chapter two highlights a review of studies on livelihood diversification and how mushroom production is emerging as a livelihood diversification strategy. Chapter three presents the methodology, including a discussion of the theoretical framework. Chapter four provides a detailed discussion of the results, while conclusions and policy implications are summarized in chapter five.

CHAPTER TWO: LITERATURE REVIEW

2.1 Livelihood Diversification

Studies have been done in many countries to identify the constraints to livelihood diversification. The main constraints to diversification have been found to be poor policy formation, seasonality, lack of flexibility, lack of skills, time, institutions, lack of access to common property resources and lack of access to some means of diversification (Karim *et al*. 2012). The current study aimed at assessing these and other factors to try and establish the main factors that influence smallholder farmers' willingness to adopt mushroom production for livelihood diversification in Western Kenya.

Diversification is influenced by on-farm returns to labour time compared to off-farm earning opportunities (Singh *et al*. 1986). With a given piece of land plus farm infrastructure and equipment, and a given total amount of labour time, the household makes comparisons between the returns to using more of that time on the farm and those from deploying it in non-farm wage or other income-generating activities. Singh argues that the factors that increase the returns to time spent on farm activities would tend to reduce the motivation to diversify. Two such important factors are an increase in the prices of farm outputs or a rise in farm productivity, obtained, for example, by cultivating a higher yielding crop variety. Conversely, a rise in off-farm or non-farm wage rates, or greater opportunities to undertake remunerative non-farm self-employment, would increase the motive to diversify (Ellis, 2000). Although livelihood diversification is an important strategy that rural people may use to achieve sustainable

livelihoods, it is one that generally operates in conjunction with other strategies which also contribute to the formation of sustainable livelihoods. Two of the strategies which complement livelihood diversification are migration and agricultural intensification. Intensification is where there are increased average inputs of labour or capital on a smallholding, either cultivated land alone, or on cultivated and grazing land, for the purpose of increasing the value of output per hectare.

The best options for livelihood diversification generally relate to further development of existing activities. Occasionally, there may be opportunities to significantly improve an existing but small activity in response to a sudden change in circumstances. Developing more generic livelihood skills (such as improved education, business development skills) coupled with the provision of generic business services (such as information centres, micro-finance) will improve individual abilities to identify and seize new livelihood opportunities in a range of sectors (Gordon *et al*. 2010). Household level diversification has implications for rural poverty reduction policies because the conventional approaches aimed at increasing employment, incomes and productivity in single occupations, like farming, may be missing their targets. Household members especially from peasant families often refrain from adopting seemingly beneficial technologies and engage in production of low value crops that require extensive labour, or divert labour resources from agricultural production by sending household members away for seasonal jobs. This often results to them having to sacrifice quick monetary profits in favour of achieving long term sustainability of their livelihood systems (Stakhanov, 2010). Traditionally, it was believed that rural economy was purely agriculture. However, in the recent years, there has been a shift away from this belief

to its role in rural off farm contribution to economic growth, rural development and poverty reduction, as well as promoting growth and welfare by slowing rural urban migration (Lanjouw, 2013).

In low income countries in Asia, Latin America and Africa, across socioeconomic groups, people purposefully attempt to diversify their productive activities, sources of income, and household resources to secure their wellbeing and/or to respond to a crisis (Ellis, 2000). For instance, better off rural households may diversify their farming practices and their non-agricultural employment to balance risks of possible market failure where the economy lacks adequate insurance mechanisms (Ellis, 1998). They also may diversify sources of off-farm employment to increase household income when the economy is improving. Poor farmers who cannot rely solely on agriculture normally use off-farm income diversification as a form of self-insurance (Barrett *et al*. 2001). Chambers (1997) argued that poor people have to diversify sources of livelihood in order to survive in a risk-prone and uncertain world.

The governments in the developing world have gained interest in rural livelihood diversification to try and improve their economies (Delgado *et al*. 1997). In Sub-Saharan Africa, this interest has been made noticeable by the wave of liberalization which has driven concerns that heavy reliance on a few crops for cash income can, in an open market economy with widely fluctuating prices, lead to instability in income that threatens rural livelihoods. Most households that produce primarily for their own consumption, with small surpluses for sale, diversifying by

adding cash crops while continuing to produce for their own consumption, thereby increasing their income; diversification into salaried wage labour and remunerative non-farm businesses can also greatly increase total household incomes (Kimenju *et al*. 2008).

Past surveys on diversification provide data on the different sources of household income, and the motivations for undertaking diversification. One such survey conducted in Burkina Faso found that land constraints did not drive income diversification, but shortfalls in cropping income did. Changing terms of trade tended to pull farmers towards diversification strategies, but cash cropping activities did not substitute for non-farm diversification activities and income diversification was associated with those in higher income groups. The role and root of livelihood diversification were also found to vary according to the type of agro-ecological zone (Reardon *et al*. 1992).

Structural adjustment programs (SAPs) were introduced in some countries to try and reduce poverty while achieving economic growth. The SAPs were introduced to try and improve the economies of developing countries through funding by the World Bank and the International Monetary Fund but these had a negative experience. The negative experience prompted development practitioners to look for alternative development paradigms based on principles of privatization and deregulation of economic activities. However, these programs failed to achieve sustainable growth and poverty reduction in low income countries (Stakhanov, 2010). This necessitated the developing countries to come up with new approaches to help address poverty

and enhance economic growth. Since the early 1990s, development agencies have explored people centred 'bottom-up' approach. In this approach, the agencies concentrate on encouraging farmers to improve their livelihoods. This would in turn improve the economy instead of trying to change the economy in order to improve the farmers' livelihood. Guided by this paradigm, research has revealed that households with more diverse activities tend to exhibit lower vulnerability to food insecurity, greater resilience and adaptability to environmental and economic shocks. Such households also possess a greater repertoire of resources to use in their strategies to escape poverty, and achieve greater overall sustainability (Ellis, 2004).

The diversity of rural livelihoods in low income developing countries has been receiving increased attention in discussions about rural poverty reduction strategies. This is more so because rural economies carry a bulk of the population in most developing countries compared to the developed countries. It is further observed that livelihood diversification is a serious long term issue for policies concerned with reducing poverty in low income developing countries. However, farmers in rural areas in the developing countries are most vulnerable because of their lack of access to education, longer distances from markets and their low wealth status. They may also have the fewest opportunities to diversify in spite of the acknowledged importance of diversification as a strategy to accumulate income for consumption and/or investment and to spread risk. Although diversification is an important strategy through which rural people may work to achieve sustainable livelihoods, it is one that generally operates in conjunction with other strategies which also contribute to the formation of sustainable livelihoods. This is because

primary activities for some producers may become livelihood diversification strategies for others (Ellis, 2000).

Rural people in Africa and Asia do not normally diversify in livestock, crop or fish production to the total exclusion of other income generating activities. Rather, a majority of rural producers have historically diversified their productive activities to encompass a range of other productive areas (Karim, *et al*. 2012) which included both on-farm and off-farm strategies. He defined Livelihood diversification as attempts by individuals and households to find new ways to raise incomes and reduce environmental risk, which differ sharply by the degree of freedom of choice, and the reversibility of the outcome. It includes both on-farm and off-farm activities which are undertaken to generate income in addition to that from the main household agricultural activities, via the production of other agricultural and non-agricultural goods and services.

Crop diversification is one strategy that smallholder farmers may employ to reduce their vulnerability in the face of global environmental change (McCord, *et al*. 2015). Kimenju (2008) argued that rural households need to diversify to cash crops like cotton, tea, coffee and fresh produce which include horticultural products like flowers, vegetables and high value crops like mushroom. This diversification should be done while still producing for their own consumption with small surpluses for sale, and through these strategies incomes will be greatly increased leading to stabilization of total household incomes. High value crops such as mushroom ensure

that farmers get more income from commercialization of their produce. Mushroom fetches high prices at the market because of its high nutritional value, especially the protein content.

Previous studies such as Karugia *et al*. (2006), Marenya *et al*. (2003) and Oluoch-Kosura *et al*. (2004) show that in areas with low per capita land holdings, such as Vihiga, farm production may not offer an adequate opportunity as the basis for securing livelihoods even with intensification. The poor may face barriers to sustainable livelihoods in the off-farm sector because of low levels of physical and financial assets, thus leading to a downward vicious cycle that entraps them in poverty. This study is contrary to the findings of these three studies since mushroom is one of the crops that do not require huge tracts of land for profitable production.

Habib *et al*. (2009) in their value chain analysis of the mushroom enterprise in Rwanda, which included value chain mapping and assessment of mushroom market, found it to be a viable rural income generating activity. It has a high potential to generate revenue, thus serving as a supplemental or major source of income. Their findings support the finding of this study that mushroom has a high potential to improve the welfare of small holder farmers and can also help address the issue of poverty. In their study of mushroom production in Haryana, Ram *et al*. (2010) described all the mushroom marketing channels and did a cost benefit analysis for each and determined the best channels to be used by the different farmers under each production system. This was essential in determining the channels that needed to be invested in to improve productivity. The approach was good because it was able to determine the channels that would

get the farmers the maximum benefit for their produce, given the costs incurred. This study only focused on the willingness to adopt mushroom as a livelihood diversification option by the small holder farmers and not the marketing channels. However, marketing channel information is important for the farmers if they are engaging in this enterprise for marketing purposes.

Kimenju *et al*. (2008) suggested that when a country has reached a certain point in its development, increasing numbers of rural households gradually abandon a self-provisioning attitude to dedicate their time to a limited number of activities in which they can develop expertise and economies of scale. In this way, households begin to diversify in enterprises that sustain them. Therefore, rural households should focus on enterprises that are highly productive and that will improve and sustain their welfare. This calls for research that will enable stakeholders in different areas to identify the most viable enterprise mixes in different areas, because different regions face different production challenges. Given the current land and production constraints facing Kenya, engagement in mushroom production as a livelihood diversification option can assist the country to achieve both food and income security.

Odendo *et al.* (2010) acknowledged mushroom as an emerging crop in Western, Central and Coastal Kenya, yet they failed to carry out an assessment of the market potential, and identification of constraints and opportunities in the value chains. They also failed in the identification of business services that can address these constraints and opportunities. Logit analysis was used to evaluate the factors that determine the probability of entry into mushroom

production. The study found that the key issues that promote mushroom farming were training of farmers on mushroom production, regulation of production of quality spawn, provision of affordable credit to small-scale farmers and linking producers to market. Odendo *et al.* (2010) acknowledged that because mushroom is an emerging crop, limited research has been undertaken to provide clear information about its production and marketing. There is need for joint participation of all stakeholders to generate the missing information on mushroom production and marketing (Gateri *et al*. 2012). This study tries to address mushroom production challenges that were identified by previous research of mushroom by assessing the willingness of smallholder farmers in adopting mushroom production as a livelihood diversification.

2.2 Review of Adoption Models

The adoption process involves the five stages. First, adopters must learn about the innovation (knowledge); then, they must be persuaded of the value of the innovation (persuasion). After that they can decide to adopt it or not (decision); if they decide to adopt it, the innovation must then be implemented (implementation); and finally, the decision must then be reaffirmed or rejected (confirmation). There are several models that are used in explaining adoption.

The Matching Person and Technology Model (MPTM) (Scherer, *et al*. 2002). This model has accompanying assessment measures used in technology selection and decision-making, as well as outcomes research on differences among technology users, non-users, avoiders, and reluctant users. Research shows that although a technology may appear perfect for a given need, it may be

used inappropriately or even go unused when critical personality preferences, psychosocial characteristics or needed environmental support are not considered. The use and non-use of technology as conceptualized in the Matching person and technology model has been validated by many researchers in the medical field. This study sought to use a model that is more appropriate in the statistical field.

The Hedonic-Motivation System Adoption Model (HMSAM) (Lowry, *et al*. 2012). It is designed to improve the understanding of Hedonic-Motivation Systems (HMS) adoption. HMS systems are primarily used to fulfil users' intrinsic motivations. Instead of a minor Technology Acceptance Model (TAM) extension, HMSAM is an HMS-specific system acceptance model based on an alternative theoretical perspective, which is in turn grounded in flow-based cognitive absorption. In this model, we assume that the user's motivation is perceived by the satisfaction that is measured by the user's enjoyment of a given technology. In our case the smallholder farmers are pushed by the need to move away from poverty hence the model is considered as not appropriate for this study.

The Extended Technology Acceptance Model (ETAM) (Shih, 2004). It is done by adding external variables to the Technology Acceptance Model with an aim of exploring the effects of external factors on users' attitude, behavioural intention and actual use of technology. It has been applied in the acceptance of some healthcare technologies. In our study we focused only on the

household characteristics, both on farm and off-farm and did not consider any external characteristics hence rendering this model inappropriate for use in this study.

The Adoption Pathways Model (APM) is best suited to explain the adoption of new technologies (Lamb, *et al*. 2008). Adoption starts with the recognition of a need that seeks solutions through a technology and ends with the implementation of the solutions. The diffusion of the technology occurs in certain stages till saturation is achieved (Jabbar *et al*. 1998). Our study focuses on a technology that was introduced in Vihiga County and we are looking at the diffusion of this technology hence making this model the best for this study. The innovators that make up 3% of the population are the first ones to engage in a new technology, followed by early adopters (13%), early majority (34%), late majority (34%) and the laggards (16%) who are the last to engage in the new technologies. This is illustrated in Figure 4.

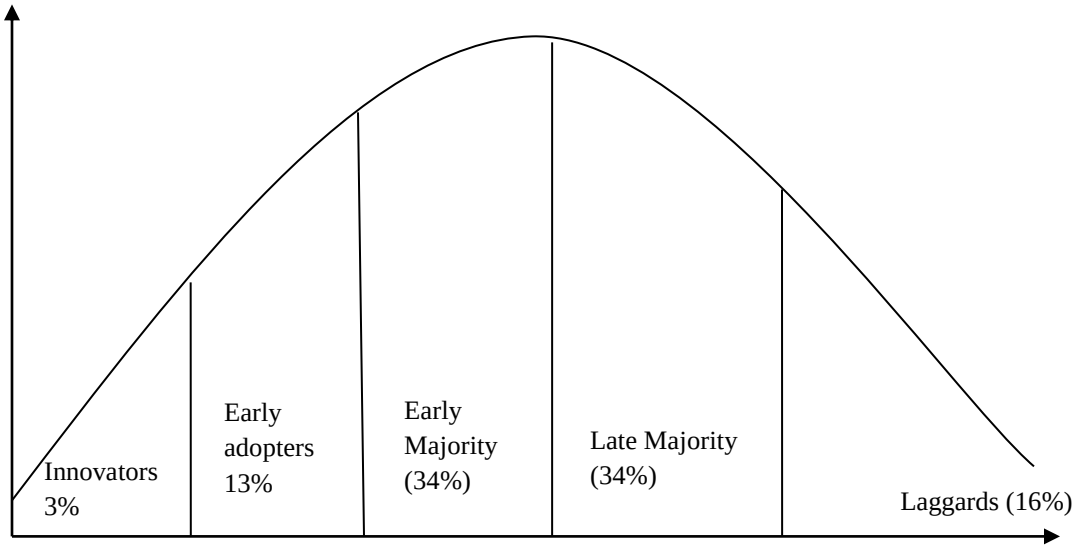

Figure 4: Adoption pathways model illustration

The laggards are risk averse and would not engage in a new technology till they have enough proof that they would benefit from the technology. Innovators are risk loving and are mostly targeted when new technologies are introduced because from them, the rest of the population will adopt the technology. Technological innovation and diffusion are essential for increasing agricultural productivity and intensification and for stimulating rural economic growth and poverty reduction (Shiferaw *et al*., 2015). This means that extension services are really vital in the diffusion of technology.

Risk and uncertainty are inherent in production. Therefore, farmers diversify into different types of enterprises to minimize the risk involved in engaging in production of a single enterprise. Some farmers opt for diversification into one or two enterprises while others engage in more than two enterprises to spread the risk. This study looked at the various enterprise mixes for the farmers in Vihiga County. The study also sought to establish where the respondents were likely to be found in the adoption pathways model based on their different characteristics.

2.3 Mushroom Market Characterization

Odendo *et al.* (2010) found that three broad channels are used by established mushroom producers in Kenya when marketing of their produce. Channel 1 for smallholder farmers, channel 2 for farmer groups and channel 3 for integrated farmer groups.

Channel 1: This is the channel for smallholder farmers who produce mushroom in small quantities. The smallholder farmers purchase spawn from private organizations and receive training on production from such organizations for example the HAMUSAVI cooperative. Once the mushroom is ready, it is either sold to the local populace from the farms or it is transported to the market where it is sold in small quantities to the local people or it is supplied to hotels and hospitals in the region that do not require the mushroom in large quantities.

Channel 2: This is the channel for mushroom producing cooperatives and associations who obtain spawn from private organizations or produce their own spawn. Once the mushroom is ready for the market, they sell to the local population, local market, hospitals and hotels. The difference between this channel and channel 1 lies in the quantity produced. In this channel, the production is higher than that in the first channel but lower than the producers in channel 3.

Channel 3: This channel is used by integrated farmer groups. Their production is more specialized and some groups even engage in value addition. They sell their produce both at the local and the international market. Production in this channel is on large scale.

Figure 5 shows how mushroom farmers can be categorized into the 3 groups based on their production strategies. Farmers in the study area producing mushrooms use the first channel for

marketing their mushroom. However, farmers who are members of the HAMUSAVI cooperative use the second channel for marketing their mushroom produce.

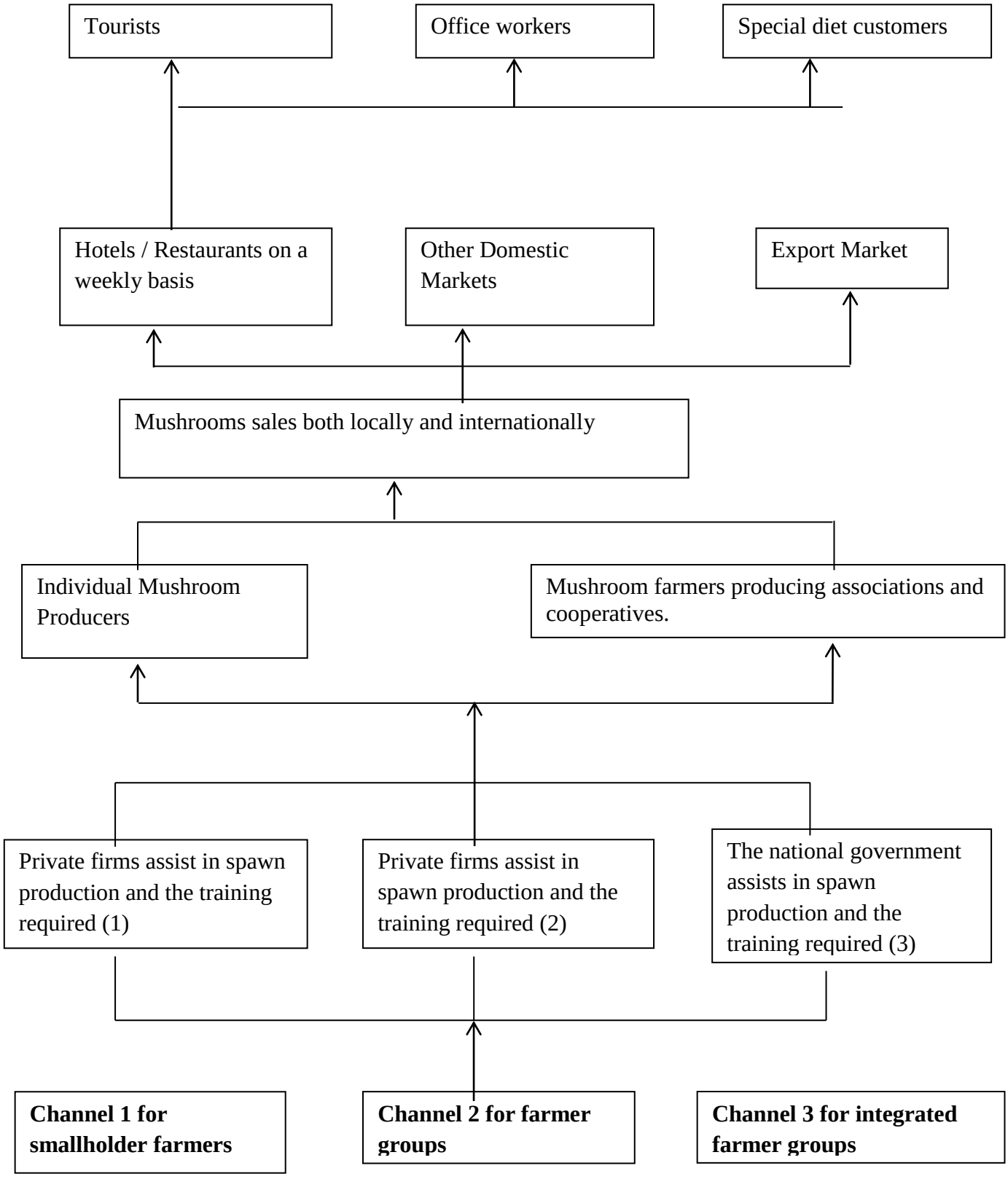

Figure 5: Mushroom Production and Market Characterization

2.4 Theoretical Framework

The theoretical foundation for the adoption analysis is drawn from the agricultural household model by Singh *et al* (1986). The model was chosen in this study because it focuses on utility maximization, given the resources at one's disposal. In this case, it focused on utility maximization by the farmers in Western Kenya, based on their subjective decision made to adopt mushroom production subject to the amount of available family labour to be committed to farm production in order to satisfy their consumption needs. This model is fundamentally based on farm operator's preferences and decisions to maximize utility, based on available cash, production techniques and time constraints. It is assumed that the farm operator's utility and production function depend on personal, farm and community characteristics that affect the production decisions. The decisions facing the farm operator involve deciding on the amount of labour to supply to the farm and off the farm, and the amount of other inputs to use or purchase so as to maximize utility, given prices, off-farm wages, and any other exogenous factors which shift the production function. Smallholder farmers have a dual character in that they are both producers and consumers, and the interaction of consumption and production within the household causes a unique form of decision making which distinguishes smallholder farmers from any other kind of production unit.

Mas-Colell *et al* (1995) and McElroy *et al* (1981) explain how to solve the utility maximization problem subject to the resources available. The agricultural household model considers 3 commodities that are available to a household: an agricultural staple (X_a), a market purchased

good (X_m) and leisure (X_l). We assume that the household is a maximizer of the utility function, so that:

$U = U(X_a, X_m, X_l)$, (1)

subject to a cash constraint: $P_m X_m = P_a (Q - X_a) - W (L - F)$

where,

U = Utility

P_m = Price of the market-purchased commodity and P_a = Price of a staple.

Q = Household production of the staple ($Q - X_a$ is the market surplus)

W = Market wage rate

L = Total labour input in production of Q

F = Family labour input in production of Q (so that if $L - F > 0$, Household hires labour; if $L - F < 0$, Household supplies off farm labour)

Equation (1) may be restated as:

U = f(X*a*, X*m*, X*l*) (1)

Based on equation 1, a household's utility is determined by the utility derived from the agricultural staple which they produce, the utility derived from purchased commodities and the utility derived from leisure, but it is subject to some constraints: cash constraint, time constraint

and production constraint. Cash constraint influences the quantity of the purchased commodity, thereby influencing the utility derived from the purchased commodity. The higher the market price of the purchased commodity, the less the quantity to be purchased and thus the utility derived from it decreases and vice versa.

Consider the time constraint: the household cannot allocate more time to leisure, or farm production or off-farm employment than the total time available to the household, so that:

$$X_l + F = T \quad (2)$$

where,

T = Total stock of household labour time

X_l = Time allocated to leisure

F = Family labour input in production of Q

Time constraint determines production. If a household allocates more time to leisure, then there will be less time allocated for production so that the quantity produced will decrease, hence decreasing their utility. A household should allocate their time between leisure, on-farm and off-farm employment in such a way that the utility derived after this allocation is the maximum possible given the resources at their disposal.

Consider the production constraint: this is the production technology that depicts the relation between inputs and output, so that:

$$Q = Q(L,A,K) \quad (3)$$

where,

A = Households' fixed quantity of land

K = Capital used in production of Q

L = Total labour input in production of Q

Production constraint is determined by the land and the labour available to the household.

The 3 constraints can be collapsed into one single constraint by substituting the production constraint into the cash income constraint for Q and substituting the time constraint into the cash constraint;

$$P_m X_m + P_a X_a + wX_l = \prod + wT \quad (4)$$

where,

$$\prod = P_a Q\,(L,A,K) - wL$$

The household's utility function can be written as a single equation,

$$\text{Max } U=U\,(X_a,X_m,X_l) \quad s.t. \quad P_m X_m + P_a X_a + wX_l - P_a Q(L,A,K) + wL - wT = 0 \quad (5)$$

where,

P_mX_m = Value of purchased commodity consumed

P_aX_a = Value of 'own' commodity consumed

wX_l = Value of leisure

$P_aQ(L,A,K)$ = Market value of Q

wL = Value of total stock of labour in production of Q

wT = Value of total stock of family labour

A household should ensure that they plan their production in such a way as to maximize on their utility while minimizing as much as possible on the constraints (Inderjit *et al*. 1986).

Model Assumptions

Assumption 1 specifies that a household can either choose to hire out its labour or use it to carry out its production activities.

Assumption 2 indicates that there are many risks involved in production and whenever a household engages in production they should be ready for the risks involved. The household model was the basis for this study.

Assumption 3 specifies that the household is a price taker, i.e. its activities do not affect the 3 prices in the model, that is P_a, P_m, and w

2.5 Conceptualization of Mushroom as a Livelihood Diversification Strategy

This study focused on smallholder farmers in Vihiga County who are assumed to be maximizing their utility from agricultural production based on the available resources. This conceptualization is based on the theoretical rationale of the Agricultural Household Model (Karttunen, 2009). The assumption is that the farmers in the study area want to maximize their utility from what they produce on their farms, what they purchase and their leisure subject to the money at their disposal. Livelihood diversification through mushroom production is assumed to ensure that the farmers increase the utility they derive from the same piece of land through increased incomes. Figure 6 provides a conceptualization of mushroom production as a livelihood diversification option for the smallholder farmers in Western Kenya. The figure is adapted from Frankenberger, *et al*. (2002) who used it to conceptualize household livelihood security assessments which is similar to this study's livelihood diversification option as a way of managing risk.

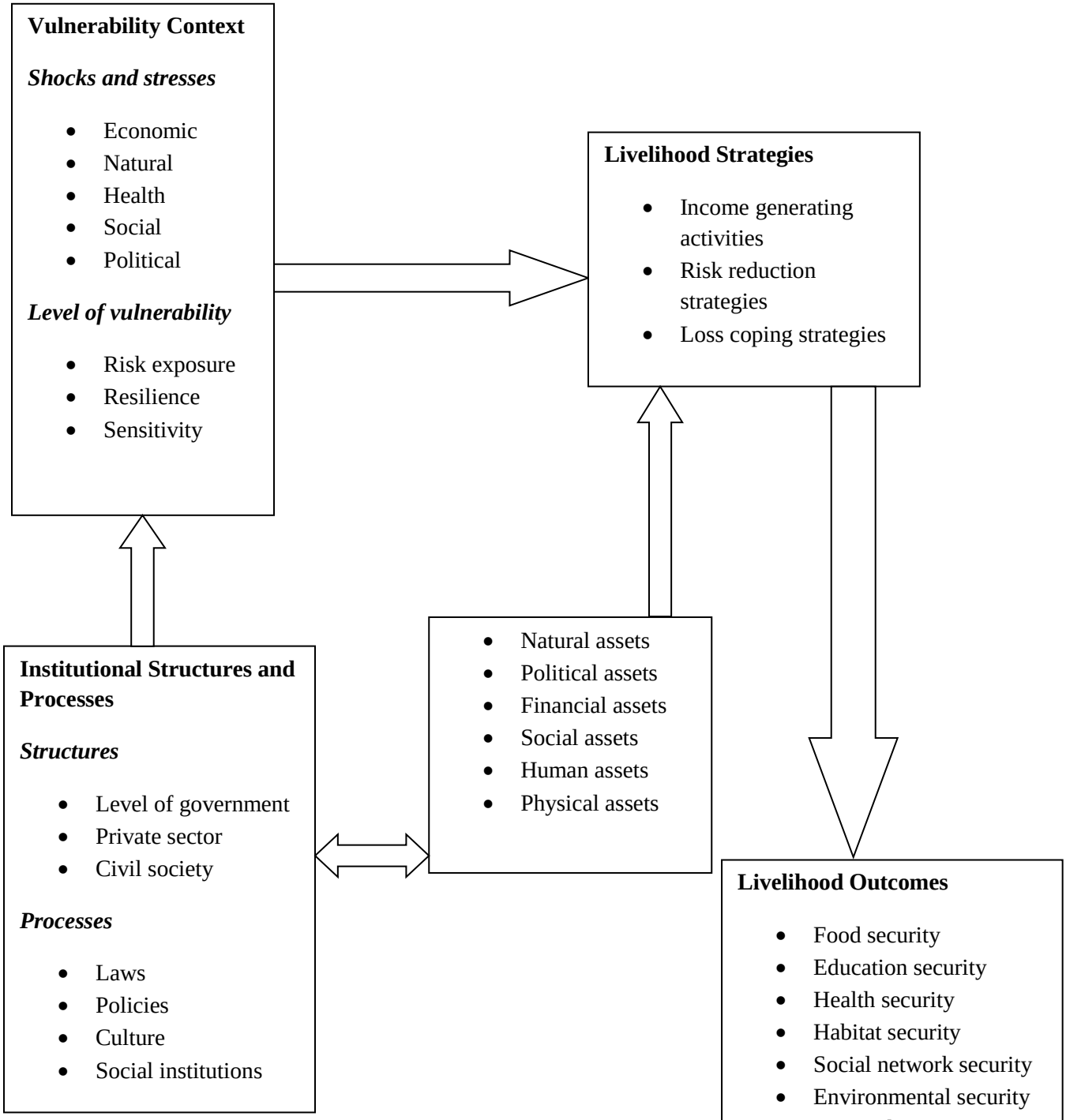

Figure 6: Conceptual Framework

Source: Adopted from Frankenberger, *et al*. (2002)

This study conceptualized livelihood diversification strategies as the process by which households construct a diverse portfolio of activities to help improve their living standards (Ellis, 2000). Livelihood activities in the study area were mainly agricultural activities, though, some farmers engaged in other off-farm and non-farm activities. The framework in Figure 6 describes an approach for understanding the context in which a household pursues its livelihood. The conceptual framework adopts the sustainable livelihood approach. In practice, livelihood security and food security are linked. Food production constitutes one of the most basic livelihood activities, and is a critical source of food access for rural households. The household's ability to purchase food in the marketplace is another determinant of food access, but it depends on household's ability to generate income. The primary cause of food insecurity is the continued lack of production of adequate amounts of food or to obtain sufficient income to purchase adequate amounts of food. A household's livelihood activities, moreover, enable it to manage risks, cope with stresses and shocks, and build or replenish assets. The household's livelihood security in turn is affected by its food security. Households with poor food access suffer more from illness or other physical disabilities thereby reducing their productivity. Mushroom production by a household in this case will ensure that the household has food for consumption and the extra money obtained from the sale of mushroom will enable the household to access more food. Therefore, adoption of mushroom production in this case will ensure that a household is food secure.

CHAPTER THREE: METHODOLOGY

3.1 Study Area

Vihiga County was chosen for this study. Respondents were from all the five constituencies namely; Hamisi, Vihiga, Sabatia, Luanda and Emuhaya.

The county was determined purposively. This was because mushroom cultivation is being introduced to farmers in the study area both for subsistence and commercial purposes so as to address the issue of poverty and improved nutrition among the locals. The high population density in Vihiga County at 1,045 persons per square kilometre and relatively small land size per household make it difficult to carry out most traditional agricultural practices that have been in the study area in the past sustainably. The high poverty rate of 41.8%, coupled with 31.5% of the population being in hard-core poverty compared to a country average of 19.5%, also makes Vihiga County a good area for research on alternative ways of improving people's livelihoods through livelihood diversification (KEBS, 2009).

Vihiga County is an administrative region in the former Western Province of Kenya whose headquarters are in Mbale, the largest town in the county. The county has a population of 554,622 (2009 census) and an area of 563 km². Vihiga County was split from Kakamega County in 1990. Vihiga has five constituencies namely: Hamisi, Vihiga, Sabatia, Luanda and Emuhaya. Vihiga County boarders Nandi County to the East, Kisumu County to the South, Siaya County to the West and Kakamega County to the North. It is one of the four Counties in the former

Western Province. The county lies within an altitude of 1,250-2000m above the sea level. The average temperature in the county is 22.5^0 C most of the year.

Figure 7 shows a map of Vihiga County and the Sub Counties where the respondents for the study were statistically obtained.

Figure 7: A map of Vihiga County

3.2 Sampling Procedure and Data Collection

A household in this study was considered to be a person or group of persons, related or unrelated, who live together and are answerable to the same head and share food. Vihiga County was purposefully selected for the study. This was because mushroom cultivation is being introduced in the study area to address the issue of poverty and improved nutrition. The small land parcels, extreme poverty and poor nutrition also made this area favourable for this study. Ion the second stage of the sampling, sub counties within Vihiga County were considered in the survey. In the third stage, a sample of the wards was randomly selected and the respondents were subsequently selected randomly from these wards.

The respondents were selected through systematic sampling. In areas where the homesteads were very close together, especially the study areas close to shopping centres and close to the main road, every 5^{th} household was interviewed. In areas where the households were sparse, every 3^{rd} household was interviewed. The main road or a shopping centre was often used as the starting point. A total of 240 households were interviewed. This sample size provided sufficient statistical degrees of freedom for policy inferences (Battachanya *et al*. 1977). Cochran's formula was used to calculate the sample size. We assumed that since the technology was in the introductory stage in the area only 10% of the population had adopted it.

$N_0 = (-2.53)^2 (0.1)(0.9)/(0.05)^2 = 230.4$

N_0 = Sample size

Using Cochran's formula the sample size was 230, however, a total of 240 households were interviewed.

The study used both qualitative and quantitative data that were collected in the survey. Part of the qualitative data was obtained through the focus group discussions (FGDs) with farmers and an extension officer from the Ministry of Agriculture. Household data was also collected using semi-structured questionnaires which were administered by trained enumerators. Interviewing was done at their respective homes to validate some of the responses obtained from the farmers through the FGD. The data collected included household characteristics, farm characteristics, farm enterprise investments and non-farm enterprise investments.

3.3 Empirical Analysis

3.3.1 Descriptive Analysis

Descriptive analysis was used to address the first objective. Different socio-economic characteristics were described using percentages and means while graphs were used to present the distribution of the various household factors.

3.3.2 Empirical Model

Each household was considered to be a utility maximizing unit subject to land, labour and capital constraints by either choosing to adopt mushroom production or otherwise. The decision made by the household was considered to be binary; decision to adopt mushroom production or otherwise. The binary Logit model was chosen because the properties of estimation procedures are more desirable than those associated with the choice of a uniform distribution (Pindyck and Rubinfeld, 1991). Utility was determined by a farmer's decision to engage in mushroom production or not.

Following Cox (1958), the functional form of logit model was empirically specified as follows:

$$Ln\ [P_x/(1-P_x)] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots\ldots + \beta_k X_{ki}$$

where,

i = the i^{th} observation in the sample

P_x = the probability that a household is willing to engage in mushroom production

$(1-P_x)$ = the probability of lack of willingness

β_0 = the intercept term

$\beta_1, \beta_2, \ldots\ldots\beta_k$ = the coefficients of the independent variables $X_1, X_2, \ldots\ldots\ldots\ldots X_k$.

In this model the dependent variable assumes binary values 0 and 1 wherein adoption of improved mushroom cultivation has the value of 1 or 0 otherwise. Binary choices are modelled in terms of probability distribution defined over the set of outcomes (Madalla, 2000).

$$Y_{i=}\begin{cases} 1 = willingness\ to\ adopt\ mushroom\ production \\ 0 = lack\ of willingness\ to\ adopt\ \ mushroom\ production \end{cases}$$

Y_i refers to the binary random variable

where willing to adopt Mushroom production, $_i$ refers to "the probability of the i^{th} farmer adopting mushroom production" as a livelihood diversification option (1=farmer adopts, 0=otherwise). X represents the vector of factors which were hypothesized to influence farmer's probability of willingness to adopt mushroom as a livelihood diversification option. These factors were hypothesized to include age, gender, marital status, education level, access to extension services, group membership, group meeting attendance, work status, awareness of mushroom production, consumption of mushroom, total livestock unit, cropping land total, total land size, amount spent on farming per month, average acreage under maize production and average acreage under bean production. The Binomial Logit Model was estimated using NLOGIT version 4.0 software (Green, 2007).The descriptive results were generated using SPSS version 16.0 software.

This model has previously been used in some other studies such as by Gislaine *et al*. (2012) who were able to establish the factors that influence the adoption of formal and informal mechanisms using the Binomial Logit analysis. From the results of the study, it was easy to point out the

factors that influenced the adoption of both the formal and informal mechanisms in the Minas Gerais state in Italy.

Odendo *et al.* (2010) also used Logit analysis to evaluate the factors that determined the probability of farmers engaging in mushrooms production. The dependent variable was binary, that is, engaging in mushrooms production or not, and Binary Logit was the model of choice for the study. This study borrows from Odendo *et al*'s study in that in both cases the decision made by the farmer was binary, to engage in production or not. Therefore, this study borrowed the model used for analysis from Odendo's *et al* (2010) studyThe results from this study will inform policy makers about the factors to target in the study area to encourage the farmers to engage in mushroom production as a livelihood diversification option.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Socio-Economic Characterization of the Respondents

Farmers' characteristics influence their farming decisions and are an important factor in understanding decisions related to a household's livelihood activities.

4.1.1 Demographic Characteristics

The study defined a household as people living and eating in the same house at the time of the survey. As shown in Table 1, about two-thirds of the sampled households in the study area were male headed, with the average age of the household head being 31 years. The sampled households in the study area had an average of 5 members. The largest sampled household in the survey had 11 members. The households with only one household member consisted of either unmarried men or senior citizens who were living alone because the rest of their families were living either in urban centres or further away from their current location in search of jobs or education. In all the households, the proportion of women in the household composition was lower than that of men. For the interviews conducted, most of the respondents were the heads of the households. About two-thirds of the household heads in the survey were widowed, separated or divorced. As a result, a big percentage of the children in the study area were being brought up by single parents or by old relatives who are mostly their grandparents.

Comparisons between farm size and cultivated area indicated that more than half of the land in the study area was under maize, beans and bananas. This was according to the farmers who

attended the FGD. Other crops grown in the study area included sorghum, cassava and sugarcane which are considered less remunerative than mushroom production. The high potential agricultural areas in the study area were found to be densely populated with relatively small land sizes per household. The land sizes were found to have a direct effect on livelihood decisions by the households in the study area. The regions within the study area where the terrain was not very rugged and not too rocky were found to be more populated. In Vihiga County, the average land acreage was 0.7 acres per household which is relatively small. A third of the respondents were not aware of mushroom production in the study area. However, four-fifths of the respondents were willing to adopt mushroom production for livelihood diversification purposes, but less than 3% of the respondents were actively involved in mushroom production. The majority were thus not involved in mushroom production due to a number of issues that were raised during the FGD and these included inability to access quality spawn, lack of knowledge and skills on production and lack of capital. Table 1 shows the distribution of the various socioeconomic characteristics of the farmers in the study area.

Table 1: Distribution of the Socio-Economic Characteristics

Variables	% of respondents (n=240)
Gender: Male	52.2
Marital status (married)*	37.6
Famer group membership	21.4
Main Occupation (farming)	40.0
Willing to start production	82.5
Consumption of mushroom	97.9
Awareness of mushroom production in the study area	68.8
Currently grow mushroom	2.5
Previously produced mushroom	9.2
Variables	**Average (n=240)**
Age (years)	30.7
Years of formal learning completed in school	6.9
Number of agricultural meetings attended in the last 12 months	4.0
Total land under crop production (acres)	0.7
Total farm size (acres)	1.0
Livestock equivalent	1.9
Expenditure per household per week (Kshs)	166.7
Farming cost per household per season (Kshs)	4,296.2

Source: Survey Data, 2014

Calculations to generate livestock equivalents were based on FAO (2005) Conversion Factors. Each of the livestock's average weight was compared to an average bull weighing 150kg. The Conversion Factors obtained were: Beef (1.0), dairy cattle (0.68), sheep (0.3), goat (0.3), chicken

(0.05), ducks (0.15) and turkeys (0.19). The calculations made it possible for each farmer to get a single Figure to represent the number of livestock owned.

4.1.2 Social and Human Capital

Livelihood activities in the study area mainly focused on agricultural activities although some farmers also engaged in other off-farm and non-farm activities. As shown in Table 1, less than a quarter of the respondents belonged to farmer groups. This factor has a great effect on projects that have been initiated in the study area that mostly target people who are in development groups and leave out people not in groups. These projects mostly end up unsuccessful because they target only a small percentage of the population. The average number of agricultural meetings attended per year was 4. As noted, only 21% of the respondents were in farmer groups. Since the channel that was mostly used for dissemination of information was farmer group meetings, only the people in groups obtained information directly from the source. Therefore, the majority of the farmers received information from the farmers in these groups, and as such information could be distorted, thus making it difficult for people not in groups to embrace the new projects for lack of proper information on new technologies in the study area.

Education has always been found to have an impact on economic growth. Lack of education has a detrimental effect on the society at large. From the study, the average years of formal education was 7 years. This means that most of the people had access to primary school education, but only few made it past this stage. For projects to be successful in the study area, it necessitates

undertaking of awareness campaigns on the importance of being members of development groups. This is because of the benefits that come as a result of group membership that include timely dissemination of information, provision of loans to improve agricultural production, participation in both government and non-governmental projects and participation in field days which enables the farmers to get practical skills on production. The farmers in Vihiga County mostly relied on government extension services. However, from the findings of this study, farmers complained of lack of adequate access to these services to the level they would have wanted. This is consistent with Muyanga *et al* (2006) findings that cited poor extension services in Kenya, indicating that the extension service sector in Kenya was underperforming. This study shows that most of the people in Vihiga County depended on agricultural production for their livelihood. On average, the total amount of land owned by each household was 1 acre which is quite small for farming, since, the homestead and pasture land were included in that acreage.

4.1.3 Mushroom Production

Majority of the respondents (68.8%) were aware of mushroom production in the study area, but only 2.5% of them produced mushroom, as shown in Table 1. Mushroom was being consumed by nearly all of the interviewed households; this means that there is a demand for the commodity in the study area. There is a mushroom deficit brought about by the decline in the availability of the traditional mushroom variety. All the people engaging in mushroom production in the study area were producing the *Oyster* variety, because it is the one that was introduced in the study area by the ministry of agriculture. In other parts of Kenya the *Button* variety is mostly produced.

The *Gernoderma* variety had been introduced and awareness was still ongoing but none of the farmers had engaged in its production because of the lack of skills involved in its production.

Information on mushroom production in the study area was made possible through public extension, private extension, and neighbours. However, neighbours had a very high influence on the awareness of information in the study area because people pass information every time they meet while conducting their daily activities. Two-thirds of the respondents obtained information through meetings compared to 0.8% who got it through the radio; the rest got it through other sources (Figure 8).

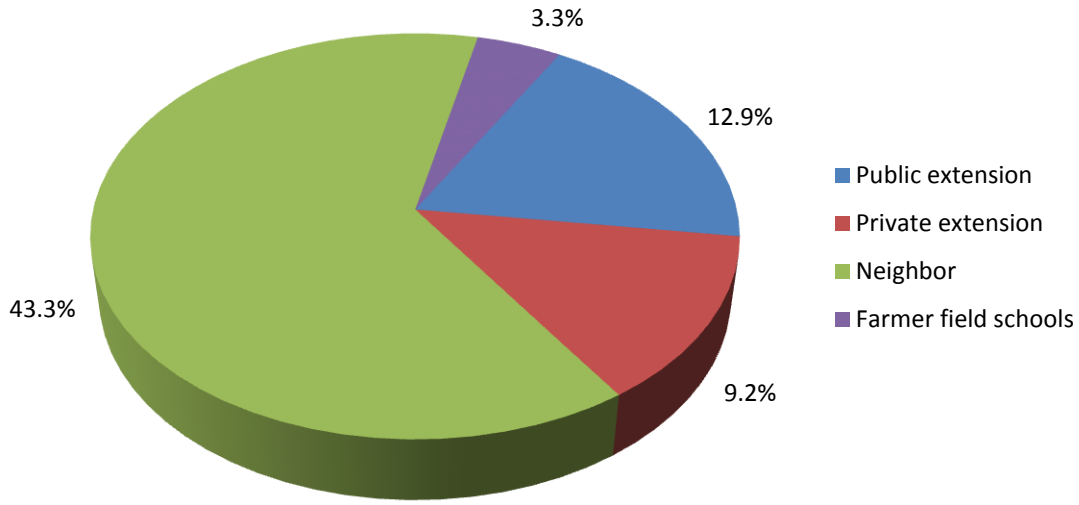

Figure 8: Mushroom information access channel

Source: Survey Data, 2014

Meetings were the most common channel used to pass information; these included group meetings, chief's barazas and informal meetings that involved neighbours meetings to share information on production matters or friends meeting to discuss matters that they perceived important for agricultural production. Less than 10% of the people currently not producing mushrooms have previously been involved in production. Those that stopped did so mainly because of poor access to inputs and lack of credit. The study shows that people who have not been involved in production were willing to start production mainly for home consumption and as a way to diversify their sources of income. Such people were of the opinion that mushroom production in the study area would be an alternative income source which would improve their welfare and livelihoods. In the study area, most farmers cited poor extension services as one of the challenges to mushroom production.

Most of the farmers in the study area cited challenges related to production and institutional factors that affect their current livelihood activities. Such challenges led to the decline in mushroom production, with some farmers completely abandoning mushroom production. This finding is consistent with the challenges cited by KNBS (2012). The above results show that there are livelihood challenges in the study area that call for policies that support alternative and effective livelihoods to assist the farmers exit the poverty web.

4.1.4 Livestock Ownership

Table 2 shows the average livestock numbers that were kept by each respondent. It shows that farmers in the study area were engaging in different livestock production options to try and

increase their income, spread risks and improve their livelihoods. This shows that the farmers in the study area understand the concept of livelihood diversification.

Table 2: Livestock Ownership (n = Number of respondents keeping them)

Types of Livestock	Lowest	Mean	Highest
Local dairy cow (n=171)	0	2	7
Exotic dairy cow (n=46)	0	2	5
Local bull (n=28)	0	1	3
Exotic bull (n=7)	0	1	2
Local dairy goat (n=43)	0	2	4
Exotic dairy goat (n=2)	0	2	3
Chicken (n=221)	0	10	32

Source: Survey Data, 2014

4.1.5 Crop Production Trend

Figure 9 outlines the land acreage versus the crops grown for maize, beans, bananas and sweet potatoes which were the main crops grown in the study area from 2012 to 2014. However, there were some other crops grown in the study area which included sorghum, sugarcane and cassava. Given an average land holding of 0.7 acres in the study area, the crops grown require more land for profitable production and hence were not yielding much returns. Most of the farmers in the study area did not follow the recommended agronomic practices especially with regard to spacing. They planted more crops than the recommended as they tried to maximize on the available spaces. Most farmers also depended on animal dung and mulch as a source of

fertilization for their farms. This meant that the soil did not have much of the required nutrients for maximum productivity. Despite the fact that the acreage allocated for maize increased (as shown in Figure 9) in the three years under study, the yield (as shown in Figure 10) continued dropping. Given that 40% of the households depended on farming as their main source of income, many households were adversely affected by the decrease in maize production because it is the enterprise that is depended on mostly by people in the study area.

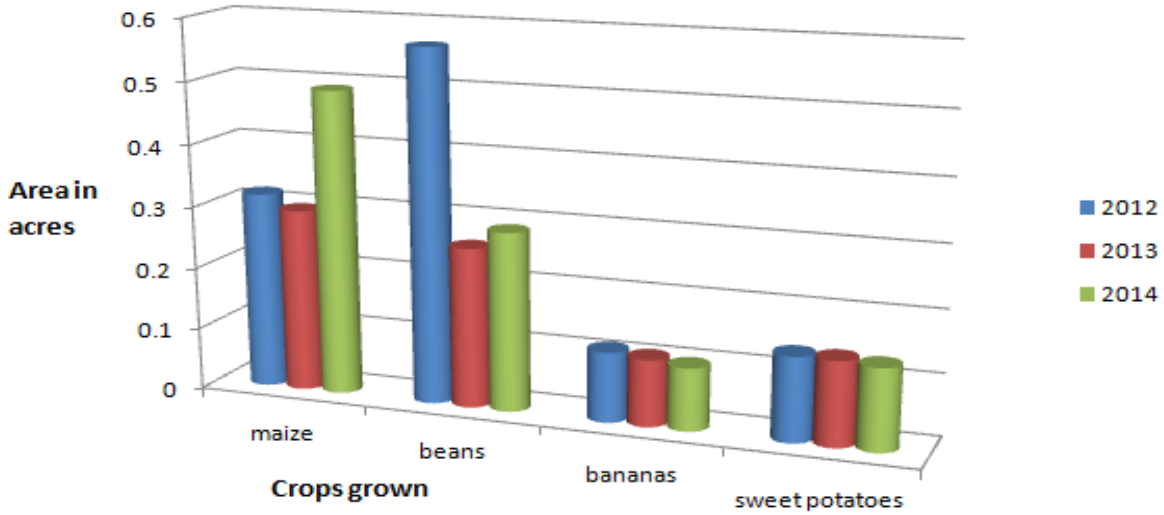

Figure 9: Crops grown against land acreage per year

Source: Survey Data, 2014

Figure 9 above shows how the land allocated for maize production dropped slightly to 0.28 acres in 2013 from 0.30 acres in 2012 but rose significantly to 0.48 acres in 2014, possibly to cater for the needs of the increasing population. A project that was found to be ongoing during the period of this study was the banana project. Farmers were being encouraged by agricultural officers from the County office to grow bananas instead of maize because of the expected high return

from bananas compared to that from maize per unit piece of land. Bean acreage went down to 0.25 acres in 2013 compared to 0.55 acres in 2012, but went up to 0.28 acres in 2014.

Figure 10 shows the average yield in kilograms for maize, beans, bananas and sweet potatoes from 2012 to 2014. Within the period under review, the yield of these four staples in the study area has consistently been dropping despite the increasing population.

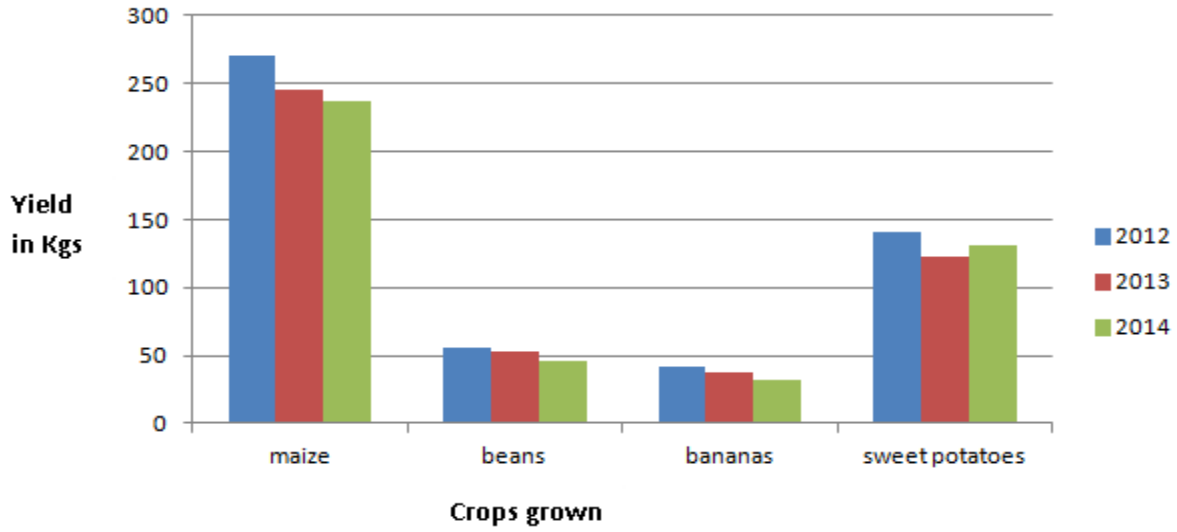

Figure 10: Crops grown against the yield per year

Source: Survey Data, 2014

Banana production and yield also went significantly down over the 3 years as shown in Figures 9 and 10. Most respondents attributed this to the fact that banana requires quite some time before maturity. Most of them preferred crops that mature faster to assist them provide food for their families within short periods of time. Sweet potato production has been increasing because most

farmers view the crop as a viable enterprise because it can be grown on the rugged terrain. It thrives well in that ecological region.

The above results show that there are livelihood challenges that call for policies that support alternative and effective livelihoods to assist the farmers exit the poverty web. These findings are consistent with Ochieng (2014) findings which show that there is need for the farmers to add other livelihood diversification options to their portfolio so as to reduce the shocks created by economic challenges facing their current livelihood activities.

Challenges such as unpredictable climate, lack of crop rotation that leads to soil exhaustion (maize is the crop mostly grown), decreasing soil fertility, rocky and rugged terrain, crop pests and diseases were identified from the FGD (focus group discussion) as the most binding constraints to livelihood diversification. Few extension workers in the study area, the inability of farmers to access production information due to the fact that ICT use in this area is very insignificant, small land acreage, agriculture being mostly for subsistence and not commercial purposes, overdependence on donor funding, delayed planting, theft, lack of irrigation systems in the study area, poor dissemination of agricultural technologies, too many enterprises on small pieces of land and use of traditional methods of farming were also identified as challenges to agricultural performance in the study area.

4.2 Assessment of the factors that influence smallholder farmers' willingness to diversify into mushroom production as a livelihood diversification option.

Table 3 shows the variables that were used in the binomial logit model for analysing the farmers' willingness to adopt mushroom production as a livelihood diversification option and also the results of the analysis.

The factors that were found to have a significant effect on farmers' willingness to adopt mushroom production as a livelihood diversification option were age, gender, marital status, work status, availability of a mushroom market in the study area, total cropping land and the total amount of money spent on farming per season.

Table 3: **Determinants of Farmers' Willingness to Diversify into Mushroom Production**

	Coeff.	**Std. Err.**	**Z**	**P>|z|**
Age	0.09**	0.04	2.01	0.05
Gender	2.10**	1.05	2.01	0.05
Marital status	-2.47*	1.40	-1.77	0.08
Work status	-2.09*	1.17	-1.79	0.07
Log of group meetings	0.15	0.38	0.39	0.69
Highest school grade	1.19	0.91	1.31	0.19
Awareness of mushroom production	0.06	0.92	0.07	0.94
Mushroom consumption	0.37	1.80	0.20	0.84
Availability of mushroom market	2.20***	0.87	2.55	0.01
Land under crop production	-2.92*	1.60	-1.82	0.07
Total land owned (acres)	1.53	1.33	1.15	0.25
Total livestock unit	-0.19	0.28	-0.70	0.49
Total amount spent on food per week	-0.00	0.00	-1.02	0.31
Total amount spent on farming	0.00*	0.00	1.70	0.09
Average acreage under beans	3.77	2.80	1.35	0.18
Constant	-7.34***	2.90	-2.53	0.01

Note: *** Significant at 1%, ** Significant at 5%, * Significant at 10%

Pseudo R^2 = 0.3789

Source: Survey Data, 2014

Using the binomial logit analysis on the survey data, the study found a strong positive relationship between smallholder farmers' willingness to adopt mushroom production as a

livelihood diversification option and age, gender, log of group meetings, highest grade of education, awareness of production, consumption of mushroom, total land owned in acres, total amount of money spent on farming per season and average land acreage. The study also found that smallholder farmers' willingness to adopt mushroom as a livelihood diversification option is negatively affected by marital status, work status, total land under cropping, total livestock unit owned and total amount of money spent by a household on food per week.

Age was found to have a positive effect on willingness to start mushroom production. The older people were willing to start mushroom production mainly because it was not considered as an enterprise that requires a lot of energy. In fact there was lobbying in the study area for people with disabilities to engage in mushroom production because it is the enterprise is considered not to be labour intensive. The old people are mostly placed in this category because of the lack of energy to engage in labour intensive activities. This result supports the findings by Olale *et al*. (2010) and Wanyama *et al*. (2010) who found that the households' experience of livelihood diversification options and the desire to diversify increase with age. A group of people living with disabilities in Hamisi was found to be engaging in mushroom production as a group venture. Gender was also a positive factor in the willingness of farmers to engage in mushroom production. More men were willing to start mushroom production compared to women. Being the bread winners in most families, men were more willing to engage in enterprises that would be considered as income sources so as to supplement their income. Marital status had a negative effect; the household heads that were not married were more willing to engage in mushroom

production because they are considered as the sole bread winners in their families and were thus more willing to engage in enterprises that can give a higher pay-off.

Households with farming as the main source of income were more willing to engage in mushroom production than the households that had other alternative sources of income, for example, the households engaging in business and those with members having off-farm employment. The more educated respondents were willing to engage in mushroom production. Perhaps this was because it is often assumed that the more educated people are more risk loving. Most educated people, for example the teachers and the people working in the county office, were willing to engage in risky ventures whose pay-off is high. The educated people were found to have several diversification options in their portfolio. This finding supports the findings of positive influence of education on livelihood strategy diversification from other studies, such as Olale *et al*. 2010.

Consumption of mushroom had a positive effect. This is the case because of the awareness of the mushroom market in the study area, in which the current supply does not meet the demand. Cropping area had a negative effect. The larger the acreage under cropping, the less likely the farmer was willing to engage in mushroom production. This is mostly because most farmers with large pieces of land already have their mind set to production of a given type of crop mainly maize, beans, sweet potatoes and bananas, and they will have specialized in these crops. Therefore, they will not be willing to engage in other enterprises. Total amount of money spent

on purchasing food per week had a negative effect. The higher the amount of money spent on food per week, the less likely the farmer was willing to engage in mushroom production. Families that spend less money on food per week were willing to engage in the production of mushroom. This is because such families mostly depend on consuming what they produce on their own farms. Since mushroom is grown for both subsistence and commercial purposes, poorer families would engage in it so as to get food for consumption and also make some money to purchase what they lack.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The study focused on the assessment of the willingness of smallholder farmers in Vihiga County to adopt mushroom production as a livelihood diversification option. Its purpose was to analyze the factors that influence the farmers' willingness to adopt mushroom production as a livelihood diversification option using the binomial logit model. Data was collected from 240 farmers.

Empirical results indicated that age, gender, log of group meetings, highest grade of education, awareness of production, consumption of mushroom, total land owned in acres, total amount of money spent on farming per season and average land acreage under crop production had a positive effect on farmers' willingness to adopt mushroom production as a livelihood diversification option. Marital status of the household head, work status, total land under cropping, total livestock units owned and total amount of money spent by a household on food per week had a negative effect.

5.2 Conclusions

From this study, it was concluded that diversification is vital for the well-being of the small-scale farmers in Western Kenya, and that mushroom production as a livelihood diversification option should be promoted for adoption by the farmers in Vihiga County given the land and topographic challenges in the region. Factors such as age, gender, work status and availability of a mushroom market should be considered when designing policies to promote adoption of mushroom as a livelihood diversification option for smallholder farmers in Vihiga County. Some farmers in the

study area were not actively engaged in groups, such as being members of a development group, thus enhancing their social capital. This factor negatively affected their access to important production information.

This study supports the findings by Asfaw *et al*. (2018) on the diversification drivers which include promotion of local crops, like mushroom in this case, which enhance household welfare. Therefore, smallholder farmers in the study area should be encouraged to diversify and engage in enterprises such as mushroom production, which help in improving their welfare.

5.3 Recommendations

Age and gender as attributes that are usually used by stakeholders in getting target population during the campaigns for the awareness of new production techniques should be given much focus in the study area. Development programs being introduced in the study area should mostly target the youth because most of the people currently living in the study area are aged between 19 and 35 years. Women in the study area should be targeted in mushroom awareness and production campaigns.

Awareness campaigns need to be done by the stakeholders in the agricultural sector in Vihiga County of Western Kenya region to educate the farmers on the importance of diversification to reduce the risks associated with agricultural production. Currently, most farmers in Vihiga

County are aware of mushroom production and market in the study area, but they are not actively engaged in its production.

The Ministry of Agriculture and the development partners in Vihiga County should promote policies and projects that will substitute maize production in favour of other viable commercial enterprises such as mushroom production that will enable the farmers to earn more income which they can in turn use to purchase the maize they require for food from other regions where maize production is favourable.

Mushroom production could be used to achieve the Food and Nutrition Security Policy (FNSP) objectives which are: achievement of good nutrition for optimum health, increasing the quantity and quality of food available and protecting the vulnerable populations. This would be achieved through coming up with mushroom awareness and promotion campaigns in areas with land as a constraint to production like Vihiga County

5.4 Limitation of the Study

Farmers in the study area kept very little or no records on their farm and non-farm enterprise activities. This meant that most of the data collected for the study was mainly based on farmer's memory recall. However, this limitation was overcome by engaging the farmers in lengthy discussions on their production over time in order to improve on memory recall and come up

with reasonable figures for their production over the period under study. Farmers should be encouraged to keep proper production records so as to assist in future research on production.

5.5 Suggestion for Further Research

This study focused on the assessment of the farmers' willingness to engage in mushroom production as a livelihood diversification option for farmers. Future research could be done on different production mixes for farmers in different areas with different land challenges in order to come up with the most profitable mix for the different farmers in Western Kenya and elsewhere. As an extension of the study, and given the decreasing land sizes that necessitate diversification in the country, more research should be done on livelihood diversification for farmers in different areas so as to come up with the best production mix that would help address nutrition and poverty for farmers in different areas.

REFERENCES

Abdul-Hakim, R. and Che-Mat, S. (2011). Does farmer's diversification into Non-farm employment reduce their likelihood of Poor? Evidence from Malaysia. *Journal of Business and Policy Research*. *16* (1):Pp145-155.

Amare, M. and Bekele, S. (2017). Nonfarm employment, agricultural intensification, and Productivity change: empirical findings from Uganda. *Agricultural Economics*. *48*: Pp 59-72.

Asfaw, S. Pallante, G. and Pala, A. (2018). Diversification Strategies and Adaptation Deficit: Evidence from Rural Communities in Niger. *World Development*. *101*: Pp 219 – 234.

Battacharya, G. and Johnson, R. (1977). Statistical Concepts and Methods. New York: J. Wiley and Sons https://doi.org/10.1002/bimj.4710220411

Barrett, C. Bezuneh, M. and Aboud, A. (2001). Income Diversification, Poverty traps And Policy Shocks in Cote d'Ivoire and Kenya. *Food Policy*, *26*(4):367–384.

Chambers, R. (1997). Whose Reality Counts: Putting the First Last, *London*. Pp (162-187).

Cox, D. (1958). The Regression Analysis of Binary Sequences (With Discussion). *J Roy Statistics Society B. 20*: Pp215-242.

Delgado, C. and Siamwalla, A. (1997). *Rural Economy and Farm Income Diversification In Developing Countries.* MSSD Discussion paper no. 20, International Food Policy Research Institute, Washington, D.C.

https://ageconsearch.umn.edu/bitstream/91855/2/pubs_divs_mtid_dp_papers_dp20.pdf

Ellis, F. (1997). Household Strategies and Rural Livelihood Diversification. *Journal of Development Studies*. *40* (4). Pp 1-38.

Ellis, F. (1998). Household Strategies and Rural Livelihood Diversification. *Journal of Development Studies, 35* (1):1–38.

Ellis, F. (2000). The Determinants of rural Livelihood Diversification in Developing Countries. *Journal of Agricultural Economics, 51*(2):289 – 302.

Ellis, F. and Allison, E. (2004). *Livelihood Diversification and Natural Resource Access. LSP Working Paper 9,* UN Food and Agriculture Organization (FAO), Livelihood Support Programme (LSP). http://www.fao.org/3/a-ad689e.pdf

Ellis, F. and Freeman, H. (2005). *Rural Livelihoods and Poverty Reduction Policies.* London: Routledge. https://www.researchgate.net/publication/44834223_Rural_Livelihoods_and_Poverty_Reduction_Policies

Everett M. (2003*). Diffusion of Technologies*, Fifth Edition.

FAO, IFAD and WFP (2014). *The State of Food Insecurity in the World.* FAO, Rome (2014) http://www.fao.org/3/a-i4030e.pdf

Frankenberger, R., Luther, K., Bacht, J. and McCaston, M. (2002). *Household Livelihood Security Assessments: A Toolkit for Practitioners*, Prepared for the PHLS Unit by: TANGO International Inc., Tucson, Arizona 2002. https://www.alnap.org/help-library/household-livelihood-security-assessments-a-toolkit-for-practitioners

Gateri, M. (2012). The untapped mushroom potential; *Hortfresh Journal*. *May-June 2012*. Pp 16-17.

Gautam, Y. and Anderson, P. (2016). Rural livelihood diversification and household well-being: Insights from Humla, Nepal. *Journal of Rural Studies*. *44*:Pp 239-249.

Gecho, Y., Ayele, G., Lemma, T. and Alemu, D. (2014). Rural Household Livelihood Strategies: Options and Determinants in the Case of Walaita Zone, Southern Ethiopia. 3: Pp 91-104.

Gislain, G. Cristina, L. and Luiz, M. (2012). Adoption of Regulation Mechanisms in the Productive Chain of Milk: An Analysis Based on Internal Factors of Companies. *Organizações Rurais & Agroindustriais, Lavras. 14* (2): Pp. 286-295.

Gordon, A. and Pulis, A. (2010). Livelihood Diversification and Fishing Communities in Ghana's Western Region. USAID Integrated Coastal and Fisheries Governance Initiative for the Western Region, Ghana. Pp 68.

GoK. (2007). *Kenya Vision 2030*. Nairobi: Ministry of Finance and Planning. Nairobi: Government Printer.

https://theredddesk.org/sites/default/files/vision_2030_brochure__july_2007.pdf

Green W. (2007). *LIMDEP version 9.0/NLOGIT version 4.0 Econometric Modelling Guide, Econometric software.* New York: Plainview.

Hussein, K. and Nelson, J. (1998). *'Sustainable Livelihoods and Livelihood Diversification'*, IDS Working Paper 69. https://www.ids.ac.uk/files/Wp69.pdf

IFAD (2010). *IFAD Rural Poverty Report***.** https://www.odi.org/projects/1434-ifad-rural-poverty-report-2010

Iiyama, M., Kariuki, P., Kaitibie, S., Kristjanson, P. and Maitima, J. (2008). Livelihood Diversification Strategies, Incomes and Soil Management Strategies: A Case Study From

Kerio Valley, *Kenya Journal of International Development* Published online 21 November 2007 in Wiley Inter Science. Pp 380-397.

Inderjit, S. Squire, L. and Strauss, J. (1986). *Agricultural Household Models: Extensions, Applications and Policy.* The John Hopkins Univ. Press, 335pp.

Isikhuemhen, O. Nerud, F. and Vilgalys, R. (2000). Cultivation studies on wild and hybrid strains of Pleurotus spp on wheat substrate. *World Journal of Microbiology and Biotechnology*; *16*: Pp 431 – 435.

Jabbar, M., Bayene, H. Mohamed-Saleen, S. and Gabreselassie, S. (1998). Adoption Pathways for New Agricultural Technologies: An Approach and an Application to Versitol Management Technology in Ethiopia. *Livestock Policy Analysis, Brief no. 16.*

Karttunen, K. (2009). *Rural income generation and diversification. A case study in Eastern Zambia.* https://www.researchgate.net/publication/47932460_Rural_Income_Generation_and_Diversification_A_Case_Study_in_Eastern_Zambia

Karugia, T., Oluoch-Kosura W., Nyikal R., Odumbe M. and Marenya P. (2006). *Access to Land, Income Diversification and Poverty Reduction in Rural Kenya.* http://erepository.uonbi.ac.ke/bitstream/handle/11295/16753/Access%20to%20land.pdf?sequence=1

Kenya National Bureau of Statistics. (2009). *Kenya Population and Housing Census Results*, Nairobi, Kenya: Kenya National Bureau of Statistics.

Kenya National Bureau of Statistics, (2010). *Kenya Population and Housing Census Results*, Nairobi, Kenya: Kenya National Bureau of Statistics.

Kenya National Bureau of Statistics, (2012). *Kenya Population and Housing Census Volume A: Population by Administrative Units*, Nairobi, Kenya: Kenya National Bureau of Statistics.

Kenya National Bureau of Statistics, (2015). *Kenya Population and Housing Census Results*, Nairobi, Kenya: Kenya National Bureau of Statistics.

Kelsey, J. B. (2013). "Constraints on the adoption of agricultural technologies in developing countries." Literature review, *Agricultural Technology Adoption Initiative, J-PAL (MIT) and CEGA (UC Berkeley).* https://www.povertyactionlab.org/sites/default/files/publications/ATAI%20Review%20Paper%20May%202013.pdf

Khatun, D. and Roy, B. (2012). Rural Livelihood Diversification In West Bengal: Determinants and Constraints. *Agric. Econ. Res. Rev*. *25*(1):115-124.

Kimenju S. and Tschirley D. (2008). *Agriculture and Livelihood Diversification in Kenyan Rural Households.* https://www.researchgate.net/publication/268298097_Agriculture_And_Livelihood_Diversification_In_Kenyan_Rural_Households

Kirimi, L., Sitko, N., Karin, F., Muyanga, M., Sheahan, M., Flock, J., and Bor, G.B. (2011). *A Farm Gate-To-Consumer Value Chain Analysis of Kenya's Maize Marketing System.* Pp 1-2.

Lamb, W. D. McCord, F. and Adams, P. (2008). Improving Pathways to Adoption: Putting the right P's in Precision agriculture. *Computers and electronics in agriculture. 61*. Pp 4–9.

Lanjouw, P. (2013). *Non-Farm Diversification, Poverty, Economic Mobility and Income Inequality: A Case Study in Village India*. World Bank Policy Research Working Paper No. 6451.

Loison, S. (2015). Rural Livelihood Diversification in Sub-saharan Africa: A Literature Review. *The Journal of Development Studies*. Pp 1125-1138.

Lowry, P.B Gaskin, J. Twyman, N. Hammer, B. Roberts, T. (2012). Taking 'Fun and Games' Seriously: Proposing the Hedonic-Motivation System Adoption Model (HMSAM). *Journal of the Association for Information Systems*. *14* (11): 617-671.

Maddala, G. (2000). *Introduction to econometrics* (3rd Edition) New Jersey: Prentice–Hall Inc.

Marenya, P., Oluoch-Kosura, W., Place, F. and Barrett, C. (2003). *Education, Non-farm income and farm investments in land scarce Western Kenya.* http://erepository.uonbi.ac.ke/handle/11295/49925?show=full

Mas-Colell, A., Whinston, M. and Green, J. (1995). *Microeconomic Theory*. Oxford: Oxford University Press. ISBN 0-19-507340-1.

Muyanga, M. and Jayne, T. (2006). *Agricultural Extension in Kenya: Practice and Policy Lessons. Tegemeo Working paper 26/2006.* Tegemeo Institute of Agricultural Policy and Development, Egerton University, Kenya. www.oerafrica.org/ResourceDownload.aspx?assetid=2325

Ochieng', J. (2014). *Analysis of Smallholder Farmers' Awareness Preferences for Biofuel Investments for Livelihood Diversification in Kenya.* Masters' Thesis.

Odendo, M., Kirigua, V., Kimenju, J., Wasilwa, L., Musieba, F. and Orina, M. (2010). *Analysis of Mushroom Value Chain in Kenya*. Nairobi: Kenya Agricultural Research Institute.

Olale, E. Henson, S. and Cranfield, J. (2010). *Determinants of Income Diversification among Fishing Communities in Western Kenya*. Selected Paper prepared for Presentation at the Agricultural and Applied Economics Association 2010 AAEA, CAES, and WAEA Joint Annual Meeting, Denver, Colorado, July 25-27, 2010.

Oleg, V. (2010). *Diversification and Livelihood Activities in Ghana's Households: Effects of HIV, Stress and Selected Socioeconomic Factors.*

Oluoch-Kosura, W., Marenya, P., Place, F. and Barrett, C. (2004). *Indices and Manifestations of Poverty: Informing Anti-Poverty Policy Choices.* A paper for bridging Qualitative and Quantitative methods of poverty analysis workshop, hosted by KIPPRA, Nairobi, Kenya, March 11, 2004.

McCord, P. Cox, M. Schmitt-Harsh, M. and Evans, T. (2015) Crop Diversification As A Smallholder Livelihood Strategy Within Semi-Arid Agricultural Systems Near Mount Kenya. *Land Use Policy*. *42* : Pp738-750.

McElroy, B. and Horney, M. (1981). *International Economic Review*. *22* (2): Pp 333-349.

Pindyck, R. and Rubinfeld, D. (1991). *Econometric Models and Economic Forecasts.* https://trove.nla.gov.au/work/2169631?q&sort=holdings+desc&_=1551881300022

Ram, S. Bishnoi, D. and Singh, A. (2010). Cost Benefit Analysis and Marketing of Mushrooms in Haryana. *Agricultural Economics Research Review*. *23*(1). Pp 165-171.

Reardon, T. Delgado, C. and Matlon, P. (1992). 'Determinants and Effects of Income Diversification Among Farm Households in Burkina Faso', *The Journal of Development Studies*. *28* (2): Pp 264-296.

Rider, S. Gordon, A. Meadows, K. and Zwick, K. (2001). Livelihood Diversification in Uganda: Patterns and Determinants of Change Across Two Rural Districts. *Food Policy, 26*(4):421–435.

Scherer, M. J. and Craddock, G. (2002). The Assessment of Assistive Technology Outcomes, Effects and Costs. *Technology and Disability*. *14* (3): Pp. 125-131.

Shiferaw, B., Kebede, T., Kassie, M. And Fisher, M. (2015). Market Imperfections, Access To Information And Technology Adoption In Uganda: Challenges Of Overcoming Multiple Constraints. *Agricultural Economics*. *46*: Pp 475–488.

Shih, H. P. (2004). Extended Technology Acceptance Model of Internet Utilization Behavior. *Information Management*. *41*(6): Pp 719-729.

Singh, I. Squire, L. and Strauss, J. (1986). *Agricultural Household Models: Extensions, Applications and Policy*, Baltimore: John Hopkins University Press.

Tibrichu, H. and Buykusenge, M.R. (2014). Enterprise Network Mapping Study in Rwanda. *The Journal of Peasant Studies*. *41*(3) : Pp 365-384

UNCTAD. (2000). *World Investment Report. Cross-border Mergers and Acquisitions and Development.* United Nations Conference on Trade and Development, New York and Geneva.

Valbuena, D. Groot, J. and Mukalama, J. (2014). Improving Rural Livelihoods as a "Moving Target": Trajectories of Change in Smallholder Farming Systems of Western Kenya. *Regional Environmental Change*. *15*(7): Pp 1395–1407

Von, B. and Pandya-Lorch, R. (1991). *Income sources of malnourished people in rural areas: a synthesis of case studies and implications for policy*. Washington D. C.

International Food Policy Research Institute (IFPRI). Working papers on commercialization of agriculture and Nutrition. *5*: Pp 1-46.

Wanyama, M., Mose, L. O., Odendo, M., Okuro, J. O., Owuor, G. and Lutta, M. (2010). Determinants of income diversification strategies amongst rural households in maize based farming systems of Kenya. *African Journal of Food Science. 4* (12), Pp. 754-763

World Bank, (2007). Ghana: *Meeting the Challenge of Accelerated and Shared Growth. Country Economic Memorandum Report No. 4093-GH*. Presented at the June 18–19, 2007 Consultative Group meeting.

Yazan, E. Nyariki, D. Wasonga, V. and Ekaya, W. (2012). Factors Influencing Transient Poverty among Agro-Pastoralists in Semi-Arid Areas of Kenya. *African Crop Science Journal. 20* (s1): Pp. 113 – 122.

APPENDICES

Appendix 1: Focus Group Discussion Questions.

University Of Nairobi

An Assessment of Factors Influencing Smallholder Farmers' Adoption of Mushroom for Livelihood Diversification in Vihiga County, Kenya

Focus Group Discussion Questionnaire

July, 2014

The purpose of this focus group discussion is to obtain preliminary insights on livelihood strategies and how mushroom could possibly serve as an alternative livelihood option.

Checklist for discussion

1. What are the general livelihood activities in this area and what are the main challenges faced.

2. Are you aware of mushroom production in the study area?

3. If mushroom production is introduced in this area, are you willing to adopt it as a livelihood diversification option?

4. What are the main challenges facing mushroom farmers in the study area?

Appendix 2: Household Survey Questionnaire

University Of Nairobi

Faculty Of Agriculture

Department Of Agricultural Economics

July, 2014

An Assessment of Factors Influencing Smallholder Farmers' Adoption of Mushroom for Livelihood Diversification in Vihiga County, Kenya

Introduction

Dear Sir/ Madam,

The University of Nairobi, Department of Agricultural Economics is conducting a research on livelihood diversification in Vihiga County, Kenya. The District Agricultural officer has granted us permission to conduct this survey on farmers. The objective of this study is to analyze the factors influencing the adoption of mushrooms for income diversification in Vihiga County .

The findings will offer important insights to assist farmers identify the most cost effective channels for production and marketing of mushroom. It may also assist the government and policy makers in structuring policies that will favor mushroom production in Vihiga County and help inform policies that will lead to the improvements in the livelihoods of the people of this area. This study targets farmers who are 18 years and above in these county. A total of 240

farmers will be interviewed randomly. The information gathered here will strictly be confidential and used for purposes of policy making.

I would like you to be one of the respondents of this survey. Can I interview you?

Questionnaire number …….. Date of interview……

Name of enumerator …….

Start time…… End time……

Division ……. Location ……

Sub location …… Village……

Name of respondent……

Mushroom production

1. Are you aware of mushroom production in this location? (a) Yes (b) No

2. How did you become aware of mushroom production in the study area?

    a) Public Extension
    b) Private extension
    c) Neighbours
    d) Farmer field schools
    e) Others

3. What was the channel used to get the information?

    a) Television
    b) Radio
    c) Phone
    e) Newspaper
    f) Notice board
    g) Billboard

d) Internet h) Others

4. Do you consume mushrooms? (a) Yes (b) No

5. Do you grow mushrooms (a) yes (b) No

6. If yes, which type?

a) Shitake

b) Oyster

c) Button

d) Local variety (specify)

e) Others

7. a) What are the production challenges?

Production challenge	**Very important**	**Important**	**Not important**
Poor access to inputs			
Lack of markets			
Crop pest and diseases			
Lack of credit			
Lack of skills			
Others			

b) Who are the main buyers?

Main buyer	Kgs sold
Local market (specify) Open air, Kiosk etc	
Middlemen	
Processors	
Exporters	
Group	
Restaurant	
Neighbours	
Others(specify)	

c) Do you plan to continue growing mushrooms? (a) Yes (b) No

If yes, why?

a) Profitability

b) Income diversification

c) Home consumption

d) Others

If no, why?

a) Lack of skills

b) Lack of markets

c) Lack of access to credit

d) Lack of access to buyers

8. Do you carry out value addition on the mushrooms after harvesting?

    a) Yes

    b) No

9. If yes, what type of value addition do you practice?

    a) Drying

    b) Refrigeration

    c) Making powder

    d) Packaging

10. How do you reach the buyers?

    a) The pick the produce at the farm

    b) Personal means (specify)

    c) Public transport (specify)

    d) Others

11. Do you think there is a market for mushrooms in the study area?

    (a) Yes (b) No (c) Don't know

12. If No, have you been previously involved in mushroom production? (a) Yes (b) No

    a) If yes, why did you stop?

Production challenge	**Open answer**
Poor access to inputs	

Lack of markets	
Crop pest and diseases	
Lack of credit	
Lack of skills	
Others	

b) If No, why?

Production challenge	**Open answer**
Poor access to inputs	
Lack of markets	
Crop pest and diseases	
Lack of credit	
Lack of skills	
Others	

c) Are you willing to start growing mushrooms in the near future? (a) Yes (b) No

If yes why?

a) Profitability

b) Income diversification

c) Home consumption

d) Others

13. Have you ever accessed credit for mushroom production?

a) Yes

b) No

14. What was the source of the credit?

a) SACCO
b) Bank
c) Microfinance institution
d) Farmer group
e) Friend
f) Others

15. What was the use for the credit?

a) Input acquisition
b) Value addition
c) Others

Land Ownership and Use

Category	Total land size	Owned	Rented	Borrowed
Crop production				
Livestock production				
Residential land				
Idle land				
Total farm size				

Livestock (Currently owned)

Livestock	Quantity owned	Sold (last 12 months)	Price of each	Total amount
1. Local dairy cow				

2. Exotic dairy cow				
3. Local bull				
4. Exotic bull				
5. Local dairy goat				
6. Exotic dairy goat				
7. Local buck				
8. Exotic buck				
9. Local sheep				
10. Exotic sheep				
11. Donkey				
12. Chicken				
13. Ducks				
14. Turkeys				
14. Others (specify)				

Weekly expenditure and Consumption

Commodity	**Amount produced from farm**	**Amount sourced outside farm**
Grains (specify)		
Vegetables		
Fruits		
Meat(fish,beef, chicken etc)		
Root tubers		
Others (specify)		
Expenditure	**Amount**	
Airtime		
Education		
Farming		
Utilities(water, electricity)		
Remittances		
Others (specify)		

Asset ownership

Asset type	**1. Owned 2. Hired 3. Borrowed**	**Quantity**
Tractor		
Vehicle (specify)		
Dryer		
Grinder		
Packaging machine		
Fridge/ Freezer/ cool boxes (specify)		
Others (specify)		

Appendix 3: Binomial Logit Commands

LOGIT; Lhs=WILLINGNESS TO ADOPT

;Rhs= AGE, GENDER, LN MEETINGS, HIGHEST GRADE, TOTAL LAND, MARITALSTATUS, WORK STATUS…..…….

;Marginal effect$