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Empirical Analysis of Livelihood Strategies and Food Insecurity in Turkana County, Kenya[φ]

***John Kamau Gathiaka**[*] **& Moses Kinyanjui Muriithi**[§]*

Abstract

The pastoral communities of Turkana in northern Kenya have for ages satisfied their economic, social, and cultural needs through nomadic pastoralism. But due to increasing frequency of drought and market shocks, the ability of age-old strategies to shield these pastoralists from poverty and food insecurity has declined. With only livestock and social capital as the main assets in a communal property regime, it is not clear which of the various livelihood strategies that these pastoralists pursue can shield households from drought and market shocks. This study investigates livelihood strategies as pursued by pastoralists in Turkana County with a view to identify strategies that can effectively shield households from shocks. Data for the study is sourced from the Kenya Integrated Household Budget Survey (KIHBS) 2005/06. Available literature is used to identify livelihood strategies in Turkana, while the KIHBS data is used to establish the population of people pursuing each strategy. Anova and Bonferroni tests give evidence of the existence of four livelihood strategies using food expenditure ratio as the categorizing variable. Multinomial logit regression is used to analyse the determinants of livelihood strategies. Findings, though not conclusive, suggest correlation between food insecurity and livelihood strategy. Policies that target to influence livelihood strategies may have implications on food security in Turkana, even though further analysis is required to confirm the association.

1. Introduction

The climate in Kenya is quite varied; ranging from humid-hot climate at the coast, through wet and cold climate in the highlands, to hot and dry climate in the arid and semi-arid areas (ASALs) of the northern parts of the country that include Turkana County. Despite their dryness, ASALs of Turkana are home to 855,399 people in 123,192 households (GOK, 2010). The main livelihood activity in the region is livestock production. Water, pasture, and labour are critical inputs in this activity, and during drought the first two inputs decrease considerably, necessitating livestock to be moved from place to place in their search.

As pastoralists migrate in search of water and fodder, their animals deteriorate and reduce in number. Competition for these inputs also triggers conflicts between pastoralists and agro-pastoralists; and among different pastoral communities. This forces some pastoralists to concentrate herds in a few areas that are thought to be

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[*] School of Economics, University of Nairobi: gathiaka@uonbi.ac.ke
[§] School of Economics, University of Nairobi: mkmuriithi@uonbi.ac.ke

safe, while leaving large tracts of unsafe pastures unused (UNEP/GoK, 2000). Such measures have negative consequences on the survival of livestock, and on environmental management.

During drought, several processes work on pastoralists adversely affecting their livelihoods. First, they face high animal mortality and reduced milk production. The animals also reduce in weight and market value. Thirdly, pastoralists are forced to sell off their livestock rather than lose them to starvation. The increased supply of animals during this time forces their price downwards. This erodes the purchasing power represented by the herds. Hence, the increase in livestock sales does not translate to higher incomes for the households (Orindi et al., 2008). Since livestock represents a source of food, income, savings, social status and income-security, their loss to drought is a major economic and social blow to pastoral households.

ASALs in Kenya are areas of weak physical infrastructure, poor information flow, scant veterinary and livestock marketing services, and general insecurity. In the event of a drought or an epidemic, outside help is slow to come (ibid.). An important policy question at this point is whether pastoral communities in Kenya can face imminent future droughts, but only suffer minimal hardships.

Over the years, pastoralists have developed innovative livelihood strategies to adapt droughts (see, Orindi et al., 2008; Davies & Barret, 2007; HPG, 2009). The main ones include stocking a mixed herd of grazers and browsers, herd-splitting with some animals being stowed away with relatives and friends far off, and generally stocking large herds of animals. Pastoralists also exchange livestock and animal products for grains to supplement their diets. In few cases, some pastoralists grow cereals during rainy seasons for own consumption, with surpluses either being stocked for later consumption, exchanged for animals, or sold for cash. Pastoralists also migrate with animals when pastures are exhausted (Bigsten, 1996).

Thus, after drought pastoralists rebuild stock by retrieving own animals kept with far away relatives and friends. They also draw from households whose animals survive the calamity, and this demonstrates the value of culture and social networks (Cheng, 2006; Davies & Bennet, 2007). Raiding animals from neighbours to restock after drought is a common social activity in pastoral communities, but in the recent past cattle raids have degenerated into violent conflicts and turned into a major source of insecurity. In the absence of cultural options to ameliorate their plight, victims turn to charcoal burning, petty trade, and low-wage employment.

Although many of these strategies have served pastoralists fairly well in the past, they may be inadequate today in shielding them from poverty and hunger. This is because droughts have become more frequent, and the ASALs are undergoing rapid socio-economic and climatic changes. Land alienation to create game reserves, private ranches, irrigation schemes, and encroachment into rangelands by sedentary farmers have particularly contributed to the destruction of traditional livestock routes to dry season pastures (Elias, 2008; Davies & Bennet, 2007). These activities threaten the sustainability of pastoralism in its traditional form.

Drought management systems in Kenya take two forms: government mitigation activities to minimize the impact of drought on production systems and livelihoods; and relief activities. Mitigation measures mainly include: emergency animal purchase, access to emergency grazing areas such as game reserves, access to water, livestock marketing interventions, animal health interventions, and cereals availability. Long-term management efforts mainly include early warning systems, contingency plans, and improved preparedness (e.g., sinking boreholes and building stores of cereals). Relief activities are mainly undertaken by NGOs and bilateral organizations to save the lives of those hit hardest. They include: provision of emergency food, water, shelter, medicine, and other humanitarian interventions. Also, the government created a ministry for the development of ASALs in 2008.

Although mitigation and relief efforts somehow cushion pastoralists from devastating effects of drought, they also encourage dependency and disrupt livelihoods (Swift, 2000). Pastoral communities are increasingly becoming sedentary during periods of adequate rainfall in anticipation of handouts during drought. Sedentary livelihoods are in discord with livestock mobility that is necessary for environmental sustainability in ASALs. The adoption of devolved system of government in 2010 might change the 'institutional context' of rural livelihoods in Kenya for better or worse. County governments may be able to focus closely on areas previously neglected by the central government. In 2011, the government announced discovery of oil in Turkana and this might translate to non-livestock income-earning opportunities for the local people. These changes expand opportunities for pastoralists to build pathways out of poverty.

The pastoralists need a paradigm shift. Economic realities dictate that they diversify and embrace little known or less appreciated economic activities to escape from poverty and food insecurity. They must modify their livelihood strategies to cope with the risks and shocks of ASALs. This may entail diversifying livestock keeping. Since livestock are more than just economic assets, pastoralists are better off diversifying into farm and off-farm activities having synergies with pastoralism (Haggblades et al., 1989). Through this way, the socio-cultural functions of pastoralism that give identity (Adriansen, 2006) and tie pastoral families together will be preserved. Diversifying into off-farm business activities has been found to be particularly useful in alleviating poverty among pastoralists with beneficial effects on livestock enterprise (Adriansen, 2006; Kristjanson, 2007; Stifel, 2010; Cunguara et al., 2011; Ng'ang'a et al., 2011). But what measures can induce pastoralists to diversify? The inducements should be effective and sustainable. Unfortunately, the right policies and the necessary institutional arrangements for livelihood diversification are unknown.

There are also constraints to diversification. Understanding them and how they can be overcome is an important step in helping pastoralists get through droughts with minimal hardships.

1.1 Problem Statement

Pastoral communities of Turkana in the northern Kenya prefer nomadic pastoralism to other livelihood strategies. This is the strategy that has satisfied

their economic, social, and cultural life for ages. Since droughts have now become annual events in Turkana, age-old livelihood strategies need some adjustments. This is necessary to reverse the annual pattern of hunger, starvation, and destitution arising from droughts.

Barret et al., (2001) argues that diversification is the norm for households that are particularly vulnerable to climatic shocks. Stifel (2010) adds that income risks associated with agricultural activities should be a strong incentive to diversify income sources. Pastoralists may have to diversify their livelihoods. This process will, however, be driven by household assets. Literature shows that in the pastoral area of Turkana, household assets are mainly livestock and social capital. Household financial and human capitals are weak, while land is communally owned. With only livestock and social capital as the main assets in a communal property regime, it is not clear whether any of the various livelihood strategies that these pastoralists pursue can shield households from drought and market shocks. If any of the strategies can shield households from shocks, it is an escape route out of poverty and food insecurity.

In view of the perennial hunger affecting most of the households in Turkana, there is the question which livelihood strategy can shield households from shocks. Information on such a strategy and its determinants is crucial if more households are to be encouraged to join it. Unfortunately, information in this regard is scant and cannot be inferred from studies done elsewhere because each locality has its peculiarities.

While many studies advocate diversification in raising household incomes, information on appropriate diversification strategies and the challenge this would entail for pastoralists in Turkana is lacking. Information gaps prevent the formulation of appropriate policies at local and national levels to encourage livelihood activities that can address the frequent problem of hunger and related poverty in Turkana. This study is about filling these gaps. It is expected its outcomes will be useful to policy makers and development practitioners involved in poverty alleviation and other social protection programs for pastoralists and communities living in the ASALs of Turkana and other parts of the country.

1.2 Objectives of the Study

General objectives

The broad objective of this study is to investigate livelihood strategies pursued by pastoralists in Turkana County and their association with food security.

Specific objectives

The specific objectives are three-fold, namely to:

1. Identify the livelihood strategies pursued by pastoralists in Turkana and their determinants;
2. Explore the determinants of livelihood strategy and food insecurity in the context of Turkana; and
3. Provide some policy suggestions from objective two.

2. Literature Review*2.1 Theoretical Literature on Livelihood Strategies*

The various ways in which different members of a family choose different economic activities to generate 'stores, resources, claims and access' define their livelihood (Chambers & Conway, 1992). Livelihood itself refers to "… stocks and flows of food and cash to meet basic needs" (Chambers, 1988). It is how individuals and households satisfy their demand for food and basic needs. The activities that household members undertake define livelihood strategy. The activities and the incomes earned are functions of assets at the disposal of the individual or household level (Dercon & Krishnan, 1996; Brown et al. 2006; Nielsen et al., 2012). A livelihood strategy encompasses the activity choices that household members make to generate the stocks and flows of food and cash, and to advance culturally and socially (Ellis, 1998; Barret et al., 2005; Cheng, 2006; Alinovi et al., 2010). Together these activity choices make up a household's occupation.

A household's assets, capabilities and interactions at the micro, intermediate and macro levels are the pillars that households use to climb out of poverty and destitution (Adato & Meinzen-Dick, 2002; Elias, 2008). Scoones (1998) shows that the policy environment (natural, economic, social, and governmental) impacts on livelihood resources (the capital assets at the disposal of a household) which through an institutional and organizational structure influences the choice of livelihood strategy by a household. The strategy choice results in some flows of food and cash that determine the well-being of a household. Similarly, livelihood outcomes have a reverse effect on livelihood strategy choice, livelihood resources accumulated by household and the policy options. Scoones' framework is shown in Figure 1.

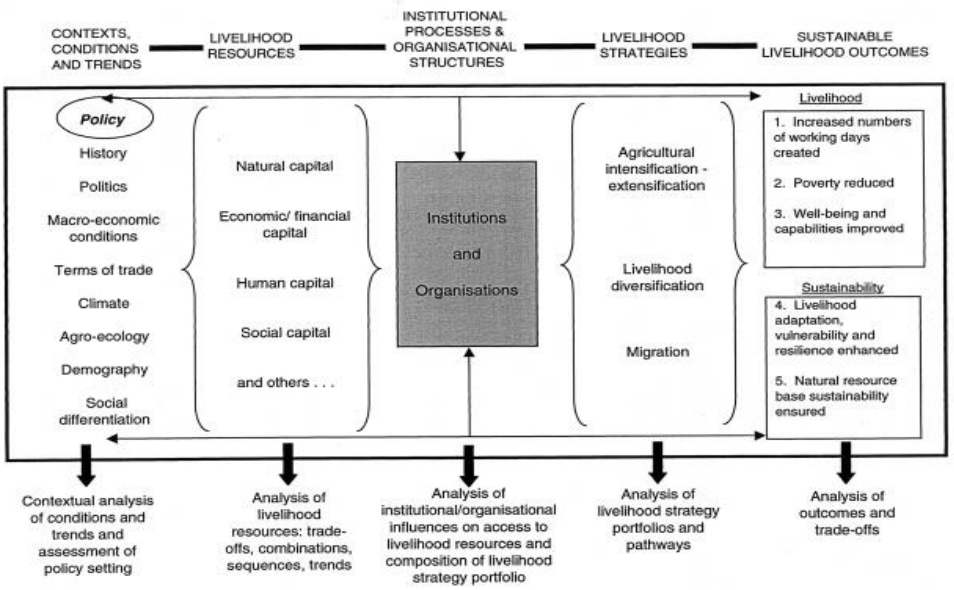

Figure 1: ***Sustainable Rural Livelihoods: A Framework for Analysis***
Source: Scoones, 1998.

The livelihood approach broadly presents household assets as a portfolio of five different types of resources. These are: natural capital (land, water, forests, air, biodiversity, etc.); physical capital (roads, buildings, energy resources, technology, etc.); financial capital (savings, cash, liquid assets, formal and informal credits, inflows of state transfers and remittances, etc.); human capital (education, skills, knowledge, health, nutrition, labour power, etc.); and social capital (social networks that increase trust, ability to work together, access to opportunities, reciprocity, informal safety nets, and membership to organizations) (see Chambers, 1997; Chambers & Conway 1992; Scoones, 1998; Adato & Meinzen-Dick, 2002). How a household allocates its assets together with the policy, institutional and organizational environments affect choice of livelihood strategy as well as its welfare (Carter & Barrett, 2006).

Individuals in a household may pursue multiple strategies that make up a livelihood. Rural households have been observed to pursue diversified livelihood strategies though the extent of diversification varies from household to household, and from one community to the other (Adato & Meinzen-Dick, 2002).

2.2 Theoretical Literature on Food Insecurity

Food is a basic need contributing to the health, productivity, survival, and well-being of people. Unintentional and regular absence of food consumption has adverse health effects that include serious damage to the physical and mental state of a person (Faye et al., 2011). Widespread hunger and food unavailability also pose social problems that promote crime and insecurity actions that divert attention away from priority areas. Anxiety about food in a country could undermine economic growth and people's welfare.

According to Clay (2002), food security or insecurity is essentially a phenomenon that relates to the nutritional status of an individual. For instance, nutritional outcome such as underweight, stunting or obesity is an individual outcome. The concern is with health (nutritional) and energy (calorie) needs of an individual, and whether these are being met; or run the risk of not being realized. Risk defines the vulnerability of an individual to being food insecure and may be chronic, transitory, or cyclical. When the main focus of analysis is household food security or insecurity, some assumptions must be made to define an appropriate notion of nutritional outcome for a household as a whole.

Assuming perfect income and resource pooling within a household, and no serious health problems for specific individuals, the nutritional outcomes for all household members should be similar. If the pooling of resources within a household is less than perfect, it is likely that the nutritional outcomes for household members are different. Some members of a household may have adequate nutrition, while others have inadequate nutrition. Thus, "… an operational definition of adequate nutritional outcome for the household can be based on the notion that *all* individual members achieve an adequate outcome" (Scaramozzino, 2006).

Although a household is an aggregation of individuals, it is important in food security analysis because this is where nutritional and calorie needs of individuals that make up the household are catered for irrespective of individual income status, or resource endowment. Thus, household food security is the application of the concept of food security to "… the family level, with individuals within households as the focus of concern" (Clay, 2002).

Available indicators of food insecurity are either objective or subjective. Objective measures include coping strategies index (Marxwel et al., 1992; 1994), food expenditure, individual anthropometric measures (weight-for-height, weight-for-age, or mid- upper-arm circumference for children, the criteria being at least two standard deviations below global reference values), dietary energy (caloric) and micronutrient intake (if below internationally agreed standards then individual is undernourished) (Barrett, 2010).

Through the access aspect, food insecurity is closely connected to household poverty and economic hardships reflected in per capita incomes and lower average incomes (Nord et al., 2004). Food availability and access are related to household economic and social resources. Poverty is a major constraint to a nutritious adequate diet. People living on less than a dollar a day often consume less than the recommended calories for a healthy and productive life and they are considered food insecure according to FAO's State of Food Insecurity in the World. To this extent, income sources and their yields are important considerations in any analysis of food insecurity.

Poor households are often unable to access nutritionally adequate diets. While it is arguable that not all currently poor people are food insecure, all poor people are nevertheless vulnerable to food insecurity (Scaramozzino, 2006). Current poverty and vulnerability to food insecurity are closely related (Banerjee & Newman, 1994; Morduch, 1994). Empirical results show that undernourished households overlap with food vulnerable households even though not perfectly (Christiaensen & Boisvert, 2000).

2.3 Empirical Literature on Livelihood Strategies

Many studies have found a positive relationship between rural non-farm employment and household welfare on average (Barrett et al., 2001; Lanjouw, 2001; Adriansen, 2006; Stifel 2010). The welfare is in terms of income, food security, reduced vulnerability, improved health, and general well-being in a household (Alinovi et al., 2010).

The Humanitarian Policy Group of the Oversees Development Institute (HPG-OGI) (2009) identifies four dominant livelihood strategies in dry pastoral lands across the Horn of Africa. In descending order of importance, they are: nomadic livestock-rearing of camels, cattle, sheep, and goats; nomadic agro-pastoralism combining extensive livestock rearing alongside subsistence rain-fed cereal production; sedentary farming of cereals and modest rearing of sheep and goats; and wage employment alongside collection and sale of bush products.

According to the HPG-OGI, the first strategy is the most common in dry lands. Poor households diversify into non-pastoral business activities as well as employment as a last resort in reaction to dwindling herds. Diversification for poor households is a survival strategy motivated by the consequences of drought. Distress-driven diversification into low return non-farm or non-pastoral wage activities is a safety net that cushions poor households from sliding further into destitution (Lanjouw, 2001).

Middle-level pastoralists diversify less while the relatively rich diversify more to accumulate more wealth (Cunguara et. al., 2011). Thus, wealth provides the 'pull' to diversify into non-pastoral income-generating activities with higher returns, while poverty 'pushes' victims into low-return non-pastoral activities (Barrett et al., 2001). Whether through pull or push factors, non-pastoral engagements serve as a genuine source of upward mobility for diversifying households (Lanjouw, 2001). It is also a critical source of synergy for pastoralism (Adriansen, 2006). A positive correlation is usually reported between household income and non-farm or non-pastoral participation (Stifel, 2010).

Diversification into commercial income-generating activities generates livelihood strategies that dominate alternatives in rural incomes and welfare (Stifel, 2010; Brown et al. 2006; Kristjanson et al., 2007; Nielsen et al., 2012). Non-agricultural commercial activities yield higher and steady incomes, yet many pastoral households appear to lead nomadic pastoral livelihoods exclusively.

Using data from the Kenya Integrated Household Budget Survey 2005-06, Alinovi et al. (2010) apply ward's cluster analysis technique to classify Kenyan households according to their livelihood strategies. They find significant differences in resilience between the six livelihood clusters that emerge and across the eight provinces of Kenya. While large-holder farmers are the most resilient, pastoralist are the least resilient.

Rural households pursue diversified livelihood strategies, though the extent of diversification varies from household to household and from one community to another (Adato & Meinzen-Dick, 2002). The activities are composed of either annual or seasonal formal-sector employment, informal trade, casual labour or self-employment in home gardens and food processing activities. It is important to note that, as much as livelihood diversification has been reported to affect household welfare positively, it is possible to have a declining welfare because of diversification. The efficacy of livelihood diversification will be affected by the form of property rights, that is, whether the natural resource is open access property, communal property, private, or state owned as seen in the tragedy of commons (Hardins, 1968; Fenny et.al., 1990; Fenny et.al., 1996).

By participating in market-based non-pastoral activities pastoralists not only improve their welfare but also sustain their pastoral activities. Adriansen (2006) finds that Fulani pastoralists of Senegal in West Africa have overcome the vulnerabilities of dry lands through trade in animals and engagements in non-

animal commerce. The Fulanis separate own herd from commercial animals, which are grazed separately and fattened for eventual sale. Income from animal sales and from other non-animal commercial activities (e.g., operating a village shop) is used to improve household welfare, and to move households to more prestigious livelihood strategies (e.g., having a household member attain relevant education to become a teacher of religion). The income is also used to advance commerce in the respective fields chosen, and to increase the stock of 'own animals'.

In a study of households' decision to engage in nonfarm activities in rural Mozambique, Cunguara et.al (2011) found that income, climatic shock, education, gender, and market access to be important determinants. They also found that a large household is more likely to diversify into non-farm activities than a small-sized household.

Examining the role of livestock holding on agro-pastoralists' choice of livelihood strategy in Mozambique, Ng'ang'a et al. (2011) find that differential access to markets and resource endowments or livelihood assets are the main determinants of the choice of a household's strategy and its risk profiles. Using household data from central and western Kenyan highlands, Brown et al. (2006) find that geographic location, family size, farming experience, access to credit, and remittances to be significant determinants of livelihood choice.

2.2 Empirical Literature on Food Insecurity

Empirical studies show that food insecurity in a household is associated with, among other factors, employment status of adult members of a household, family size, whether male-headship, whether practicing irrigation agriculture, participation in community organizations, education status of the head, and income size and reliability (Maharjan & Joshi, 2011).

In a comparative study of food insecurity experience across several cultures, Coates et al. (2006) find a common denominator—or a 'core'—to household food insecurity. In all but a few of the sampled cultures, concerns about insufficiency in the quantity of food consumed, inadequacy of the quality of food taken, uncertainty and worry about food availability, and social unacceptability of food consumed: these were all at the bottom of food insecurity experience. These cores coincide with the four domains of food insecurity identified in HFSSM studies in the United States: uncertainty/worry, insufficient quantity, inadequate quality, and social unacceptability. These domains—or cores—form the basis of universal food insecurity experience at a household level (Webb et al., 2006). Other sub-domains such as concerns over food safety and meal pattern disruption are only secondary in food insecurity experience.

2.3 Overview of the Literature

From the reviewed literature, it is clear that the livelihood strategy that a household chooses has a strong bearing on its welfare. Livelihood strategies thrive on many activities to satisfy household needs. In cases where a household income is not stable

or is prone to exogenous shocks, there is merit in diversifying the main income sources. Rural incomes fall in this class, and more so with respect to pastoralists. But even then, it is important to be clear on what activities to diversify into as it is possible for a household to become more vulnerable to shocks after diversifying.

Pastoralists are heavily dependent on livestock production for food and to meet basic needs. Since dry lands are areas characterized by frequent shocks (Ng'ang'a et al., 2011), pastoralists are often unable to meet their food and other basic needs. They need to move to higher-return livelihood strategies. But there are entry barriers. Some of the barriers to higher-return livelihood strategies identified in the literature include low household income, climatic shock, low education, female headship of a household, poor road infrastructure, and market access. Others include the absence of micro-credit facilities, lack of livestock promotion programs, and the lack of access to telecommunication facilities (Stifel, 2010; Cunguara et al., 2011; Brown et al., 2006; Alinovi et al., 2010).

From the reviewed literature, generalizations of livelihoods strategies can be made from national household surveys (e.g., Alinovi et al., 2010; Cunguara et al., 2011). This study utilized data from a national household survey to analyse livelihood strategies under communal property regime in Kenya.

3. Methods and Data

3.1 Analytical Method

Poor individuals and households are often unable to access food of adequate calories for a healthy and productive life. Poverty may lead to food insecurity. Although not all poor households are food insecure, all poor households are vulnerable to food insecurity. In addition, households that cannot afford food of adequate nutrition even when they spend all their income in buying food, are hardcore poor and food insecure. Thus, hardcore poverty may be a good proxy for food insecurity.

The Kenya Integrated Household Budget Survey (KIHBS) 2005 has calculated food poverty lines for Kenya using the Cost-of-Basic Needs (CBN). A caloric adequate consumption bundle is identified, and its cost estimated using reference prices. The consumption bundle is the food basket that is considered to be of adequate caloric value. Adequacy of the food basket is determined on the basis of daily recommended 2,250 kilocalories per adult equivalent per day, and food expenditure patterns in an area. The cost of this food basket was estimated at KES988 for rural Kenya in 2005/6, and it is the food poverty line. Any household not able to meet the cost of this food basket is considered to be food poor, while a household that cannot meet this basic food requirement with its total expenditure of food and non-food items is considered to be hardcore poor.

The hardcore poverty line can be viewed as a benchmark of access to nutritionally adequate food. Households falling within and below the line can be considered food insecure, while households above but within the neighbourhood of the line can be considered vulnerable to food insecurity from the perspective of access.

Poverty and food insecurity may be associated with livelihood strategies that households choose. According to the Random Utility Model (RUM) of Train (2003) and McFadden (1986) a household's activity choice is a random utility function. Faced with a set of alternative livelihood strategies, a household will choose a strategy that will maximize its welfare. Income sources suggest welfare outcomes (Nielsen et al., 2012). In vulnerable ASALs, food security is a major welfare concern (Cunguara et al., 2011; Ng'ang'a, 2011); raising the question whether households chose income sources that actually maximize welfare.

From the available literature, various livelihood strategies are identified in Turkana County based on income-generating activities. Pastoralism is the main livelihood strategy in the area, and 60 per cent of the population depends on it for their welfare. Among the Ngisonyoka pastoralists of southwestern Turkana, food (milk, meat, and blood) and money are derived exclusively from livestock slaughter or sales. The money is used to buy small household items consisting primarily of maize meal, sugar, tobacco, tea leaves, rubber tire sandals and cloth (McCabe 2010).

Other strategies in the area include employment (formal, casual, and in business), farming and fishing (Humanitarian Policy Group, 2009). Nielsen et al. (2012) argue that there is no rural livelihood strategy composed of only one economic activity. In pastoral areas livestock production is the main livelihood activity, and other activities are subsidiaries or alternatives forced on pastoralists by shocks.

According to the KIHBS 2005/06 data, the residents of Turkana draw livelihoods from pastoralism, agro-pastoralism, farming, business, livestock, and business. Some strategies have few or no people. The data also shows that diversification is the exception rather than the norm. Since income sources suggest welfare outcomes (Nielsen et al., 2012), that Turkana has the highest incidence of rural food poverty in Kenya as well as absolute poverty suggests barriers to higher welfare livelihood strategies. This study uses data from the KIHBS to identify the barriers.

3.2 Model Estimation

After identifying livelihood strategies, this study applies multinomial logit regression (MNL) to identify factors constraining households' access to diversified livelihood strategies. It borrows from the works of Dercon, (1996); Ellis, (1998); Brown, (2006); Elias, (2008); Barret, (2001); Elias, (2008); Cunguara et al., (2011); Ng'ang'a, (2011); Nielsen et al., (2012). .

Other discrete choice models such as the multinomial probit (MNP) could also be used for the same purpose, but MNL is preferred because of its wide usage and relative ease in computation. Many studies have shown that MNP and MNL are technically similar in their predictions (Dow & Endersby, 2004), and that they only differ in the assumptions they make concerning distribution of their error terms. While errors in MNL models are assumed to be independently and identically distributed (iid) across alternatives, MNP has errors that may not be independent and are assumed to follow a multivariate normal distribution (Greene, 2003). In MNL the assumption of

independence of irrelevant alternatives (IIA) requires that an individual's choice of an alternative relative to another should not change if a third and irrelevant alternative is introduced (Greene, 2003). MNL is also judged to be more stable in computing higher integrals without losing accuracy.

A household's food poverty status (y_i) may be associated with the livelihood strategy that a household has chosen according to the following structural equation:

$$y_i = y_i[P_i Q_i] \qquad (1)$$

where y_i is household i's food poverty and P_i is livelihood strategy. P_i is a function of Q_i, where Q_i represents a host of household factors such as demographic characteristics and asset endowments.

The reduced form of equation (1) is the random utility model (2) that identifies the barriers to the various livelihood strategies.

$$P_{ij} = V(X, A) + e_j \qquad (2)$$

where,

P_{ij} = the probability of household i being in livelihood strategy j where j=1, 2...,
X = individual characteristics of a household including age, sex, household size, etc.,
A = household assets including human, financial, social, physical, and natural capital, and
e_j = error term.

Equation (2) is a multinomial logit that was estimated using a maximum likelihood method. According to the livelihood framework, household assets include human, financial, social, physical, and natural capital. Human capital covers levels of education attainment by household members and their skills. Financial assets include remittances, credit facilities and savings. Social capital includes networks and peer effects. Physical capital may include number of livestock and communication gadgets owned by a household. Natural capital encompasses geographical factors of comparative advantage such as distance to the nearest market centre, distance to all-weather road, and climate. The marginal effect of the explanatory variables on a chosen alternative can be derived as in Green (2000).

The marginal effects or the marginal probabilities measure the expected change in the probability of a particular choice being selected with respect to a unit change in an independent variable (Long 1997; Greene, 2003). In the current study, marginal effect measures the expected change in the probability of being in a particular livelihood strategy with respect to a unit change in an independent variable.

3.3 Data

As mentioned earlier, this study utilized data from the KIHBS 2005/06 of the Kenya National Bureau of Statistics (KNBS). The KNBS is the official data collection and analysis arm of the Kenyan government operating under the Ministry of Planning and National Development. The KIHBS survey utilized the NASSEP IV framework that maps the country into enumeration areas and clusters. A cluster is the primary sampling unit with 100 households or so. The KIHBS sampled 1,339 (857 rural and 482 urban) clusters out of a possible 1800 clusters in the country, with probability proportional to size. In each cluster, 10 households (and a further 5 for replacing households that could not be interviewed for various reasons) were randomly picked. A total of 13,430 households (8610 rural and 4820 urban) spread over all districts in Kenya were interviewed between May 2005 and May 2006. The data relates to poverty, consumption patterns and living standards in a household; community aspects such as physical and social infrastructure, economic activities, security, and safety; and prices of consumer goods and services purchased by households.

Table 1: Definition of Variables Used in Econometric Estimations

Variable	Definition
Dependent Variable	
Livelihood strategy/category	Grouped into 4 categories as follows: Category 1: Specialized livelihood strategies of either pastoralism or farming Category 2: Diversified livelihood strategy of farming and pastoralism combined Category 3: Diversified livelihood strategy of pastoralism and business combined Category 4: Specialized business
Independent Variables	
Religion	Dummy variable indicating whether household head is non-religious = 0 or religious = 1
Occupation	Dummy variable indicating whether household head is self-employed = 0 or employed =1
Distance to water	Distance from household to nearest water source in kilometres.
Distance to energy	Distance from household to nearest electricity line in kilometres.
Gender	Dummy variable showing whether the head of the household is female = 0 or male = 1
Age	Age of household head in years
Cash remittance	Cash remittances received by a household in Kenya shillings within the year 2005/6
Credit	Credit received by a household in Kenya shillings within the year 2005/6
Household size	Number of individuals in a household
Attendance to school	Dummy variable describing whether household head has attended any schooling =1 no school=0
Shock	Proxied by the amount of money a household used to take care of a reported shock.
Marital status	Whether housed head is married = 1 or not married = 0

Source: Authors

4. Empirical Results and Discussion

4.3 Livelihood categories/strategies in Turkana County

This study identified five livelihood strategies in Turkana County: exclusive pastoralism, exclusive farming, exclusive business, combined pastoralism and farming, and combined pastoralism and business. These strategies can be further categorized into specialized agriculture (exclusive pastoralism or exclusive farming), diversified agriculture (pastoralism and farming), diversified agriculture and non-agriculture (pastoralism farming and business), and specialized non-agricultural livelihood strategy of business. This categorization is important in discussing correlation between livelihood strategy and food insecurity. Table 2 shows the percentage of people in each livelihood category that are food poor.

Table 2: Food Poverty in the Livelihood Categories/Strategies Found in Turkana

Livelihood category/strategy	Hard core poor households (%)
1. Specialized: agriculture (pastoralism or farming)	87
2. Diversified: agriculture (pastoralism and farming)	74
3. Diversified: agriculture and non-agriculture	100
4. Specialized: non-agriculture	66

Source: Authors' calculations from KIHBS data

In this analysis, hard core poverty is a proxy for food insecurity. Households that are unable to access the recommended food basket even when they devote all their expenditures (of food and non-food items) to buying food are more likely to be food insecure. Such households are food poor as well as poor in other resources. What is evident from these strategies is that although diversification could lead to some improvement in food status, diversifying into business can worsen the food status. In addition, non-agricultural activities (mainly business), when pursued on their own without mixing with pastoralism or crop farming, improve household food security status remarkably. Urban development in Turkana is an important policy towards the alleviation of food insecurity in the drought-prone region of Turkana.

The ANOVA test of whether there is any significant difference in food poverty arising from a household being in one livelihood category and not the other confirm the hypothesis. This is shown in Table 3. The F-statistic of 17.33 supports the independence of the categories.

Table 3: ANOVA Results for Differences in Food Poverty in Different Categories

Source	Partial SS	df	MS	F	Prob > F
Model	7.03011313	3	2.34337104	17.33	0.0000
Categories	7.03011313	3	2.34337104	17.33	0.0000
Residual	149.846685	1108	.135240691		
Total	**| 156.876799**	**1111**	**.141203239**		
Number of obs. = 1112 R-squared = 0.0448 Root MSE = .367751 Adj R-squared = 0.0422					

Source: Authors' calculations from KIHBS data

Bonferrori test to establish whether the four strategies are actually unique from each other established that the means between and among the categories is due to placement in a given category. The result supports the assumption that the categories are different from each other. This gives us the confidence to adopt discrete choice estimation of the determinants of the livelihood strategies since no two categories of strategies are similar in terms of their poverty status. Table 4 shows the Bonferrori results on mean differences in poverty in the four livelihood categories.

Table 4: Bonferrori Results of Mean Differences in Food Poverty in the Four Livelihood Categories

Livelihood category (i)	Livelihood category (j)	Mean difference (i) – (j)	Std. error	Sig.	98.75% Confidence interval	
					Lower bound	*Upper bound*
Specialized agriculture	Diversified agriculture	-.19295*	.00333	.000	-.2032	-.1827
	Diversif agric. & non-agric.	-.10872*	.00315	.000	-.1184	-.0990
	Specialized non-agric.	-.15406*	.00353	.000	-.1649	-.1432
Diversified agriculture	Specialized agriculture	.19295*	.00333	.000	.1827	.2032
	Diversif agric. & non-agric.	.08423*	.00259	.000	.0763	.0922
	Specialized non-agric.	.03889*	.00304	.000	.0295	.0483
Diversif agric. & non-agric.	Specialized agriculture	.10872*	.00315	.000	.0990	.1184
	Diversified agriculture	-.08423*	.00259	.000	-.0922	-.0763
	Specialized non-agric.	-.04534*	.00284	.000	-.0541	-.0366
Specialized non-agriculture	Specialized agriculture	.15406*	.00353	.000	.1432	.1649
	Diversified agriculture	-.03889*	.00304	.000	-.0483	-.0295
	Diversif. agric. & non-agric.	.04534*	.00284	.000	.0366	.0541

Note: *The mean difference is significant at 0.0125 level.

Source: Authors' calculations from KIHBS data

In so far as a given livelihood category has corresponding and unique food insecurity status, the choice of a livelihood strategy is important in efforts towards household food security. Due to cultural and other factors, most households (56.2 per cent) in Turkana pursue specialized agriculture, especially pastoralism as the foremost livelihood strategy. Unfortunately, pastoralism is among strategies most vulnerable to hardcore poverty and, by extension, food insecurity. The strategy of diversifying pastoralism through taking on board crop farming is associated with lower hardcore poverty, but the strategy is chosen by only 35.3 per cent of the households in the area.

Business is the least popular livelihood strategy with only 8.5 per cent of the households, yet the most viable livelihood strategy in poverty reduction. That the most viable livelihood strategy is the least popular, while the least viable livelihood strategy is the most popular, presents a major problem in poverty reduction and household food security. Thinking logically, if most people are not in the most viable livelihood strategy, there must be serious entry barriers to this strategy. The problem begs for answers on determinants of choice for each of the livelihood strategies, a task that is addressed in the next section.

4.4 Determinants of Choice of Livelihood Strategy in Turkana County

Multinomial logit (MNL) regression is used here to get the determinants of the choice for a livelihood strategy. Specialized agriculture (either pastoral or farming exclusively) is the base livelihood category in the discrete choice analysis. Table 5 presents the estimates of the coefficients of factors that determine choice between specialized agriculture (pastoralism or farming) and (1) diversified agriculture (pastoralism and farming), (2) diversified agriculture and non-agriculture (pastoralism and business), and (3) specialized non-agriculture (business only). The estimates are for both maximum likelihood coefficients and marginal effects.

Table 5: Mlogit Parameter Estimates of Determinants of Choice of a Livelihood Category in Turkana County and the Associated Marginal Effects *(Absolute T-Statistics in Parentheses)*

Variable	Category 2 Pastoralism + farming		Category 3 Pastoralism + business		Category 4 Business only	
	Coeff.	Marginal effect	Coeff.	Marginal effect	Coeff.	Marginal effect
Household size	-.405	-.064	-.189	-.1006	-.118	-.0001
	(7.30)	(7.25)	(2.95)	(1.50)	(1.38)	(0.190)
Gender (0,1)	.133	.018	-.280	-.018	-.277	-.003
	(0.59)	(0.49)	(0.89)	(0.82)	(0.53)	(0.64)
Age	-.024	-.003	.001	.001	-.076	-.001
	(2.55)	(2.53)	(0.12)	(0.67)	(2.51)	(0.76)
Marital status (0,1)	-.119	-.021	.140	.012	-.393	-.003
	(2.19)	(2.43)	(1.80)	(2.29)	(2.75)	(2.03)
Religion (0,1)	-.203	-.034	.0001	.003	.342	.003
	(2.33)	(2.49)	(0.001)	(0.42)	(2.15)	(1.82)
Attendance to school (0, 1)	.819	.138	.104	.008	1.57	.017
	(3.48)	(3.26)	(0.29)	(0.37)	(2.97)	(1.55)
Occupation (0, 1)	.249	.042	-.032	-.006	-.163	-.002
	(3.08)	(3.25)	(0.32)	(0.87)	(0.97)	(1.15)
Distance to water	-.012	-.002	-.005	-.001	.005	-.0001
	(2.03)	(2.21)	(0.92)	(1.37)	(0.58)	(1.25)
Distance to energy	-.004	-.001	-.005	-.0004	-.393	-.003
	(4.42)	(5.04)	(2.57)	(3.50)	(2.13)	(2.03)
Cash remittances	-.001	-.0001	-.0001	-.67	-.0003	-2.084
	(2.47)	(2.61)	(0.88)	(0.13)	(0.69)	(0.47)
Credit	.141	.026	.142	.010	-2.57	-.025
	(0.57)	(0.65)	(0.41)	(0.41)	(3.76)	(2.43)
Shock	-.001	-.160	-.0003	-.229	.0001	1.67
	(2.12)	(1.59)	(2.33)	(2.39)	(1.13)	(0.152)
Constant	2.18		-993		4.8	
	(2.25)		(0.79)		(2.26)	

Note: Log likelihood=-452 LR chi2(36) = 254 Pseudo R2 = 0.28 Prob>chi2 = 0.0000. The number of observations = 567. The base livelihood category is 1(specialized agriculture)

Source: Authors' calculations from KIHBS data

According to Table 5, the frequent droughts in Turkana provide shocks that discourage diversification into farming. Farming in the region is only practiced on a meaningful scale during rainy seasons, and under irrigation. The river valleys are important dry season crop-grown zones through irrigation.

Other variables that reduce the likelihood of a household diversifying into farming include the size of a household, the age of a household head, and the marital status of a household head. They also include the religious status of a household, distance from a household to water and energy sources, and cash remittances.

An increase in household size reduces the probability of a pastoral household diversifying into crop farming by 4 per cent. Larger households are more likely to spread the risk of climatic and other shocks by splitting their herds with each cohort moving to a far-flung grazing area under the care of a family member. This drought coping mechanism has been used by pastoral households for ages to sustain pastoralism under harsh climatic conditions.

Generally, individuals tend to become rigid and less inclined to try new things as they age. One-year increase in the age of a pastoral household head reduces the probability that the head will diversify into farming by 2 per cent.

In Turkana, marriage bestows onto a man livestock of his own from the family herd. Thus, marriage and the livestock given encourage a young household head to pursue pastoralism for a living. Marriage reduces the probability of a household head engaging in crop farming relative to pastoralism by almost 12 per cent.

A household that ascribes to some religion is more likely to remain pastoralists. Religion does not seem to favour diversification into crop farming. The association between religion and pastoral livelihood is, however, not apparent. There is need for further investigation to gain a clearer understanding of the association.

An increase in the distance to a water source and to electricity reduces the probability of a pastoral household diversifying into farming. Until recently when many boreholes have been sunk in the region, many households in Turkana lived many kilometres away from the nearest water source. When a household is located several kilometres away from a water source, it has only a small or no chance to grow irrigated crops.

Electricity is associated with urbanization. A household that is far away from electricity source is deep into the rural setup where traditional values reign supreme. In Turkana, pastoralism is a cultural practice deeply entrenched in the area. Cash remittances cushion households against the effects of shocks. Household that receive remittances are more likely to pursue the cultural occupation of pastoralism without worrying about shocks. This lowers their likelihood to diversify into farming.

On the other hand, attendance to school and self-employment outside pastoralism increase the likelihood of a household to diversify into farming. An additional year of schooling by a household head increases the probability of the household diversify into farming by around 13 per cent. Education shapes new perceptions towards life, in addition to weakening traditional myths and cultural practices.

A person in self-employment outside pastoralism will already have embraced a new perception towards life. For this reason, such a person has 25 per cent more likelihood to engage in farming than a pastoralist. Turning focus on pastoral livelihoods vis-a-vis a diversified livelihood of pastoralism and business, Table 5 shows that household size reduces the likelihood of a pastoral household to diversify into business. Other variables with the same effect are distance to energy source and climatic shocks.

The marginal effect of one extra person in a household (adult-equivalent adjusted) is to reduce the probability of a household diversifying into business albeit by an insignificant margin. An increase in household size reduces the probability of a pastoral household diversifying into business by 6.4 per cent. Increasing distance to the nearest electricity line reduces the probability of a pastoral household diversifying into business by close to 0.4 per cent for the reasons given earlier. Undergoing some form of shock reduces the probability of diversifying into business by close to 23 per cent. Climatic and market shocks reduce family wealth, thus discouraging diversification. The reasons are as given above.

Looking at pastoral livelihoods relative to the livelihood of business, Table 5 shows that the main variables that reduce the probability of a pastoral household moving to a livelihood of business are age of the household head, marital status of the head, distance to energy source and availability of credit. Also, the older a household head is, the lower is the probability that the household will engage in business activities. It has been observed that older people tend to be static in what they know, and are less inclined to experiment with matters of life.

Marriage reduces the probability a household engaging in business for a livelihood by 0.3 per cent. As earlier mentioned, marriage automatically turns a young man into a livestock owner and a pastoralist. Also, the longer the distance to the source of electricity is, the lower is the probability of a household to pursue business activities for a living. Electricity is associated with urbanization. A household that is far away from urbanization cannot engage in business activities gainfully given the poor road infrastructure in Turkana.

As a household gets more credit, its probability to engage in business for a living reduces by 2.5 per cent. Credit sustains a household's livestock, especially after a drought, thus keeping the pastoral livelihood alive. On the other hand, religion and school attendance increase the likelihood of a household to pursue a livelihood based on business as opposed to pastoralism. A household with a religious head has a 0.3 per cent higher probability of being in business than a household whose head is not religious. But as to how religion leads to business acumen needs further investigation.

The household of a head who has attended school has a 1.7 per cent higher probability of engaging in business for a living than a pastoral household. Some of the beneficial effects of education include literacy and numeracy skills needed in

business transactions. Through literacy, the horizons and perceptions of a learner are widened. Education concomitantly demystifies age-old customs and practices allowing pastoralists to move into more lucrative business livelihoods.

From the above analysis, the common barriers that reduce the probability of a household diversifying or moving out of pastoral livelihood include household size, shocks, marital status, and distance to energy. The analysis also shows that education and religion encourage diversification.

5. Conclusions and Policy Recommendations

From KIHBS data, there is strong evidence that most households in Turkana County are food insecure. Most of the households suffer hardcore poverty, whereby even if they were to expend the entire household budget on food, they would still not be able to purchase the required food basket for minimum nutrients for a healthy and active life.

Household food poverty is likely to be correlated with the livelihood strategy chosen by a household. Turkana County exhibits four distinct livelihood categories. Any policy on food security should pay attention to these four categories. As argued in several studies, while diversification of livelihood strategies improves food and poverty situation in a household, some diversification arrangements can worsen the situation. Economic opportunities towards diversification should pay attention to the overall effect of diversification on poverty reduction and food security.

The most viable livelihood strategy in poverty reduction was found to be business. The strategy had the lowest population of the hardcore poor. The least viable strategy was diversification of agriculture into non-agricultural activities. Agricultural and non-agricultural activities may not be complementary. That the most viable option is pursued by the least number of households not only presents a problem in poverty reduction and household food security, but also indicates formidable obstacles to business. The promotion of business enterprises through the existing programs such as the Youth Development Fund, Women Development Fund, Constituency Development Fund, and NGO projects would have a lasting effect on household food security.

The study found that business activities—when pursued on their own without mixing with either pastoralism or crop farming—improve household food security status remarkably. Government policies that promote schooling and self-employment have strong bearings on household engagement in business activities. Thus, infrastructural and urban developments are crucial in encouraging households towards business activities, and in addressing food insecurity in the drought-prone region of Turkana.

Furthermore, the study showed that the common barriers that discourage livelihood diversification are household size, shocks, and distance to energy. In the pastoral areas of Turkana, households enlarge not so much because of natural

population growth but due to hosting children from relatives and friends afflicted by shocks. The practice is a common social protection strategy among the pastoralists. The average household size is 6.5, with a range of 1 to 24. Large households in Turkana County pursue pastoralism exclusively, rather than, say, business or pastoralism and farming. Policies that mitigate or reduce the effects of shocks, and those that offer social protection to affected households, have important bearings on livelihood diversification or migration to livelihood strategies that offer better food security.

In Turkana, electricity is only found in main urban areas, the hubs of business activities in the region. Distance to electricity is an indicator of development, particularly infrastructural development. Development in one direction attracts developments in other fields such as in education and self-employment. Education opportunities are particularly important because household head attendance to school has been found to increase the probability of a household pursuing business or diversified livelihood. Thus, increasing education opportunities for the pastoralists can facilitate the adoption of superior livelihood strategies, thus enabling rural households cope better with the vagaries of drought.

In conclusion, public policy should address infrastructural developments in Turkana and ASALs as a whole. Social infrastructures—such as electricity and schools—should be given priority. There is also need for public policy that favours the provision of social safety nets that cushion pastoralists against devastating effects of shocks. These policies would indirectly encourage movement into superior livelihood activities, and in the amelioration of poverty and food insecurity in the ASALs.

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