

An Empirical Analysis of Livelihood Strategies and Food Insecurity in Turkana County, Kenya

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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 and guarantee their food security. This study investigates the 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. Probit regression is used to estimate the determinants of food insecurity in Turkana, while multinomial logit regression is used to do further analysis on the determinants of livelihood strategies. The findings suggest correlation between food insecurity and livelihood strategies. Policies that target livelihood strategies may have implications on food security in Turkana. However, further analysis is required to confirm the reverse causality between livelihood strategies and food insecurity.

1. Introduction

The climate conditions in Kenya are 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 conflict between pastoralists and agro-pastoralists and among the different pastoral communities. This forces some pastoralists to concentrate herds in a few areas that are thought to be 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 the 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 (Orindi et al, 2008). An important policy question to ask at this point is whether pastoral communities in Kenya can face imminent future droughts but only suffer minimal hardships.

Over the years, the pastoralists have developed innovative livelihood strategies adapted to drought (see Orindi et al, 2008; Davies and Bennet, 2007; Humanitarian Policy Group, 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. The pastoralists also exchange livestock and animal products for grains to supplement their diets. In a 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 off 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 relatives and friends far away. They also draw from households whose animals survive the calamity and this demonstrates the value of culture and social networks (Cheng, 2006; Davies and 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 the 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 socioeconomic and climatic changes. Land alienation to create game reserves, private ranches, irrigation schemes, and encroachment into the rangelands by sedentary farmers have in particular contributed to the destruction of traditional livestock routes to dry season pastures (Elias, 2008). 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 hardest hit. They include: provision of emergency food, water, shelter, medicine, and other humanitarian interventions. The government created a ministry for the development of ASALs in 2008.

Although mitigation and relief efforts somehow cushion pastoralists from the 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 so 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 for worse. County governments may be able to focus closely on areas previously neglected by the central government. In 2011, the government announced the discovery of oil in Turkana and this might translate into non-livestock income-earning opportunity for the local people. These changes expand opportunities for the pastoralists to build pathways out of poverty.

The pastoralists need a paradigm shift. Economic realities dictate that they diversify into and embrace little known or less appreciated economic activities in order to escape from poverty and food insecurity. They have to modify their livelihood strategies in order to cope with the risks and shocks of the ASALs. This may entail diversifying livestock keeping. Since livestock are more than just economic assets, the 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 the pastoralists with beneficial effects on livestock enterprise (see for example, Adriansen, 2006; Kristjanson et al, 2007; Stifel, 2010; Cunguara et al, 2011; Ng'ang'a et al, 2011). But what measures can induce pastoralists to diversify? The inducements have to 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 the pastoralists to get through droughts with minimal hardships.

Problem statement

The pastoral communities of Turkana in 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 area, age-old livelihood strategies need some adjustments. This is necessary in order to reverse the annual pattern of hunger, starvation and destitution arising from drought.

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. The 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 in Turkana affecting a majority of the households, there is the question as to which livelihood strategy can shield households from shocks. Information on such a strategy and its determinants would be important 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 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 that the outcome of this research will be useful to policymakers and development practitioners involved in poverty alleviation and other social protection programmes for the pastoralists and communities living in the ASALs of Turkana and other parts of the country.

Objectives of the study

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

The specific objectives are threefold, namely:

1. To identify the livelihood strategies pursued by the pastoralists in Turkana and their determinants;
2. To establish whether there is any association between livelihood strategy and food insecurity in the context of Turkana; and
3. To explore whether and how diversification of pastoral activities would improve food security in Turkana.

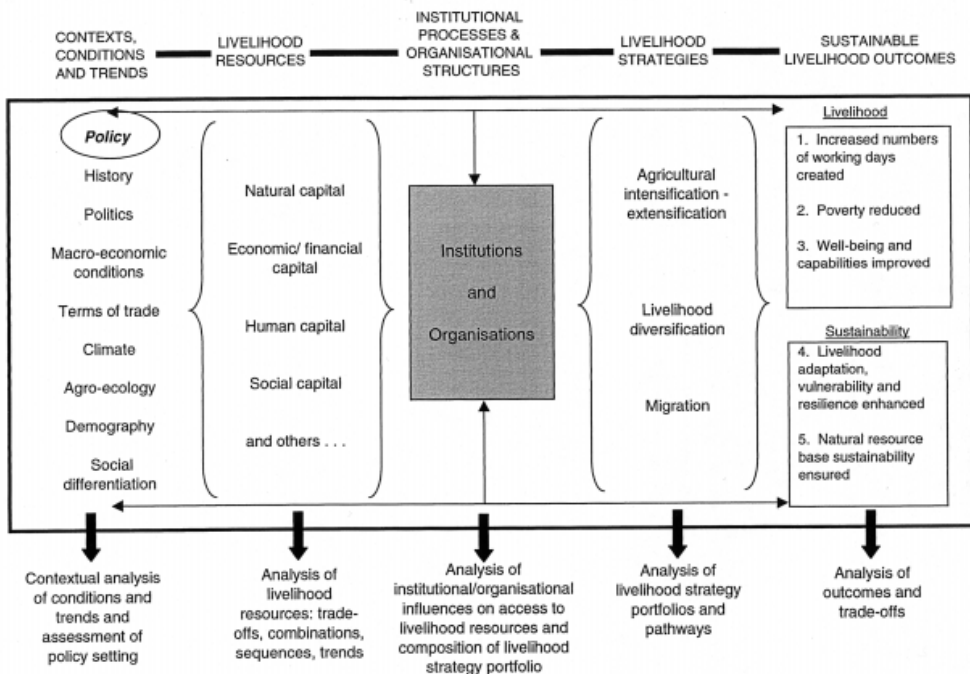
2. Literature review

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 and Conway, 1992). Livelihood itself refers to “stocks and flows of food and cash to meet basic needs” (Chambers, 1988). It is the means by which 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 (Dercon and 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 and 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 the household) which, through an institutional and organizational structure, influences the choice of livelihood strategy by the household. The strategy choice results in some flows of food and cash that determine the wellbeing of the household. Similarly, livelihood outcomes have a reverse effect on livelihood strategy choice, livelihood resources accumulated by the 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 and Conway 1992; Scoones, 1998; Adato and 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 and 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 and Meinzen-Dick, 2002).

The pursuit of multiple activities can have important implications for household income, poverty reduction, food security and ability to cope with shocks and stresses. In particular, diversification to nonfarm or non-pastoral income generating activities is important for poverty alleviation, improving household welfare and overcoming the effects of drought (Barrett et al, 2001; Lanjouw, 2001; Adriansen, 2006; Brown et al, 2006; Stifel 2010; Cuingara et al, 2011). Barrett et al (2001) argue that diversification is the norm, and more so for vulnerable agricultural households whose livelihoods are

subject to climatic and market risks and uncertainties.

The various income-generating activities that poor rural households engage in are composed of either annual or seasonal formal-sector employment, informal trade, casual labour or self-employment in home gardens and food processing activities (Adato and Meinzen-Dick, 2002). They also entail livestock production, cultivation, or exploitation of natural or common property resources. It can be seen that these activities may be agricultural or non-agricultural, within or outside a household set-up. Since households pursue different livelihood strategies, poor households require different interventions to lift them out of poverty (Alinovi et al, 2010).

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.

When people go without eating food for some time they become hungry. The whole spectrum of experience from uncertainty and anxiety about food to hunger and malnutrition is described as food insecurity.

According to the 1996 World Food Summit, food security represents "a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 1996). In the literature, food security is premised on three pillars: availability, access, and utilization. Food availability is necessary but not sufficient condition for access, while access is in turn a necessary but not sufficient condition for effective utilization (Barrett, 2010).

Thus, food insecurity is experienced when people or a section of people lack physical and economic access to "sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life". Food insecurity is a state in which individuals or households have insufficient and uncertain ability to acquire in a socially acceptable manner nutritionally adequate safe foods in sufficient quantities for an active and healthy life for all members of the household.

In the United States, the concept of food insecurity is taken beyond lack of physical and economic access and utilization of food to include perceptions of food insufficiency, inadequacy, unacceptability, uncertainty and unsustainability of food. Food intake may be currently adequate but concerns over future intake may render a person food insecure. Thus, food insecurity here has been defined as "the inability to acquire or consume an adequate quality or sufficient quantity of food in socially acceptable ways, or the uncertainty that one will be able to do so" (see, Wolfe and Frongillo, 2001).

Food insecurity is a "dynamic experience" with several consequences depending on severity. At the lowest level is uncertainty and anxiety about food availability in adequate quantity; while at the highest is hunger.

Although food insecurity is a universal experience, different locations of the world

emphasize different aspects of it. This makes food insecurity a difficult concept to measure universally at the household or individual level (Headey and Ecker, 2012).

The primary barrier to food access is financial constraint (Smith and Ali, 2007). Low or unstable incomes lead to “limited, inadequate, or insecure means of food acquisition”. Thus, economic vulnerability leads to food insecurity. Vulnerable households are likely to suffer food deprivation. This is because even if their current food consumption is adequate, they will experience a reduction in food consumption or the quality of food consumed should their income fall (Smith and Ali, 2007).

Other causes of food insecurity are unfavourable climate, economic shocks, political instability, diseases, poverty and unequal distribution of food within households (Smith and Ali, 2007). Although the most severe food insecurity is often associated with disasters (drought, flood, war, earthquake, etc.) most food insecurity is related to chronic poverty. Thus, survey-based estimates of food insecurity are strongly correlated with poverty estimates (Barrett, 2010). The causes of food insecurity are, however, population-specific, depending on the circumstances affecting the population.

A concept related to food insecurity is vulnerability. While food insecurity describes the state of a household’s livelihood at a particular point in time, vulnerability is a “forward looking” concept that describes how susceptible individuals and households are to being unable to cope with risks associated with uncertain adverse events that may happen to them such as drought (Ellis, 1998; Bogale, 2012). Adger (2006) portrays vulnerability in terms of exposure and defencelessness in the event of harm arising from environmental and social change and lack of capacity to adapt to the change. Vulnerability to food insecurity is conditional on risk factors (Scaramozzino, 2006). Thus, vulnerable households may not be food insecure currently, but they are at risk of sliding into food insecurity in the event of a calamity when they are defenceless.

Vulnerability is at varying degrees depending on the characteristics of the risk and the ability of the household to shield itself. Ability hinges on the asset base of the household. According to Scaramozzino (2006), “vulnerability can be modified by endogenous strategies implemented by households, communities or public institutions”.

A household’s total expenditure on food as a percentage of its total income is an indicator of its current economic vulnerability. Households that spend a large proportion of their income on food (greater than 75%) are vulnerable to food deprivation (Smith and Ali, 2007). In this respect, poverty may be a precursor for food insecurity.

Bogale (2012) views the vulnerability of smallholder farmers as arising from, among other factors, rainfall patterns, land degradation, population density, low levels of rural investments, and the global market. It is apparent that the causes of food insecurity and those of vulnerability to food insecurity converge at some point.

The antonym of food insecurity is food security. Given the importance of food to individuals in a household, food security is a measure of individual and household welfare. Food security has both supply and demand sides. On the supply-side are issues of production and availability. The central issue in supply is whether there is enough food for everybody’s nutrient and caloric requirements. On the demand-side is access or ability to acquire food that is adequate in quantity and nutrition over time. The main concern in demand is affordability which is viewed in terms of access or what Sen (1981) calls “entitlement”. The notion of entitlement extends to preferred food or food

that is culturally and socially acceptable or consistent with religious and ethical norms. Adverse shocks such as droughts, floods, unemployment spells, price spikes, chronic disease or the loss of livelihood-producing assets undermine access to food and render a household vulnerable to food insecurity (Barrett, 2010).

Food insecurity can be experienced at the national, regional, household or individual level. At the first two levels, supply shocks are the main reasons for the problem. At the household and individual levels, a sustained drop in own food production, food aid, employment including food-for-work opportunities can result in food insecurity. If a household cannot produce enough food of its own, its income level and food availability in the market determine its ability to procure food in sufficient quantities (FAO, 1996; Sen, 1981). Irrespective of whether household food supply is own produced or procured from the market, stability in supply is threatened by frequent catastrophes arising from either erratic climatic conditions or volatile food prices (Christoplos, 2009). Formal and informal safety net arrangements may foster stability in access to food (Barrett, 2010).

Deteriorating terms of trade between wages and other returns on the one part, and food costs on the other, limit poor people's access to food. Food access is also constrained by poor road and communication infrastructure. Roads in particular enable food to be transported from surplus to deficit areas besides reducing the cost of travel to markets and the ultimate retail price (Christoplos, 2009).

Food insecurity can be chronic, transitory or cyclical. It is chronic when people permanently lack access to sufficient food; transitory when lack of access is short-lived or seasonal; and cyclical when lack of access keeps recurring.

Household access to food does not always translate into actual food acquisition or consumption. Households may have the purchasing power but prefer other goods, services or assets. For example, households may prefer to pay school fees or construct a better house rather than acquire nutritious food. Intra-household allocation of food may also not be based on each household member's need for food. It has been noted that pregnant women, lactating mothers and children have special food needs which if not well attended can lead to under nutrition, and thus food insecurity. It has also been observed that obesity may be found in an undernourished household (Bogale, 2012). In addition, failure to utilize accessed food effectively due to poor sanitation or ill health may also prevent the attainment of dietary calories and nutrients.

According to Clay (2002), food security or insecurity is essentially a phenomenon that relates to the nutritional status of the individual. For example, nutritional outcome such as underweight, stunting or obesity is an individual outcome. The concern is with health (nutritional) and energy (calorie) needs of the individual and whether these are being met or run the risk of not being realized. The risk defines vulnerability of the 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 have to be made in order to define an appropriate notion of nutritional outcome for the household as a whole. Assuming perfect income and resource pooling within the household and no serious health problems for specific individuals, the nutritional outcomes for all household members should be very similar. If the pooling of resources within the household is less than perfect, it is likely that the nutritional outcomes for household members are different. Some members of the 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 the household is an aggregation of individuals, it is important in food security analysis to note that it is in a household that 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).

There is no universal or unanimously agreed measure of food insecurity. Indeed, there is no perfect single measure of food insecurity that captures all aspects of food insecurity - availability, access, and utilization - yet (Webb et al, 2006). Analysis of household food insecurity depends on proxies and markers that focus on: dietary intake and caloric and nutrient insufficiency (Hoddinot and Yohannes, 2002); diet diversity; food frequency scores; coping strategies indexes (Maxwell et al, 1994); appraisals of household economy, e.g., household food poverty, monetary poverty and other purchasing power indicators; and, calorie deprivation indicators, e.g., anthropometric indicators for children and weight measures for adults. Each measure on its own is inadequate in assessing one or the other aspect of food insecurity (Wolfe and Frongillo, 2001; Headey and Ecker, 2012).

Available indicators of food insecurity are either objective or subjective. Objective measures include coping strategies index (Maxwell and Smith, 1992; Maxwell et al, 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, 2010). 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 and Newman, 1994; Morduch, 1994). Empirical results show that undernourished households overlap with food vulnerable households, even though not perfectly (Christiaensen and Boisvert, 2000).

The close tie between poverty and food insecurity encourages the usage of poverty measures such as income and total food expenditure to indicate food vulnerability or insecurity. Additionally, total food expenditure is in some cases found to be correlated

with caloric sufficiency giving the measure additional credit as an indicator. It has been observed that the greatest food security gains typically come, albeit indirectly, through policies that promote poverty reduction (e.g., through employment creation) and productivity growth (e.g., by accessing technologies and markets) among the poor. Food security gains also come through safety nets that safeguard the vulnerable non-poor. Such policies generate stable livelihoods that are crucial to reducing vulnerability to food insecurity.

The main weakness of poverty measures, as indicators of food insecurity, is that they only capture indirectly the access component of food insecurity (Haddad et al, 1994). They do not capture, for example, the undernourishment aspect of food insecurity.

Objective measures of food insecurity as a whole are inadequate in assessing uncertainty, anxiety and vulnerability components of food insecurity. Some of them (e.g., stunting and growth status) are an indirect outcome of not just food insecurity but also other factors such as health, child care and sanitation. Coping or food management strategies may be early indications of future food insecurity but not food insecurity indicators (Wolfe and Frongillo, 2001).

Due to these weaknesses, perceptions-based measures are gaining ground in food insecurity research. After identifying the target population and its characteristics or behaviours, the researcher asks subjective/experiential questions to capture food inadequacy, lack of dietary diversity in food consumed, anxiety about food unavailability and socio-cultural unacceptability of food consumed. The responses are scored in a scale and a criteria set based on the scale to determine food insecure households and the extent of their insecurity. Subjective measures of the experience of food insecurity are being refined and their main weakness is lack of objectivity and measurability.

Empirical studies find close correlation between objective and subjective measures of food insecurity. Melgar-Quinonez et al (2004) using a short version of the US HFSSM questionnaire in a three-country comparison (Bolivia, Burkina Faso, and The Philippines) got a food insecurity score that was strongly associated with objective measures such as shares of food expenditure, and expenditures on diet quality and quantity. Therefore, there should be no fear in the use of either objective or subjective measures. Nevertheless, it should be remembered that either measure captures and neglects different aspects intrinsic to the concept of food insecurity. In practice, analysts choose measures or proxies that help them address the aspect of food security that they want to emphasize.

Empirical literature on livelihood strategies

Many studies have found a positive relationship between rural nonfarm 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 wellbeing in a household (Alinovi et al, 2010).

The Humanitarian Policy Group of the Overseas Development Institute (2009) identifies four dominant livelihood strategies in the 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 group, the first strategy is the most common in the 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 the poor households is a survival strategy motivated by the consequences of drought. Distress driven diversification into low return nonfarm 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, while wealth provides the “pull” to diversify into non-pastoral income-generating activities with higher returns, 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 the 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 nonfarm 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, the pastoralists are the least resilient.

Rural households pursue diversified livelihood strategies even though the extent of diversification varies from household to household and from one community to the other (Adato and 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 declining welfare as a result of diversification. The efficacy of livelihood diversification will be affected by the form of property rights, i.e., whether the natural resource is open access property, communal property, private, or state owned (Hardins, 1968; Fenny et al, 1990; Fenny et al, 1996).

By participating in market-based non-pastoral activities, pastoralists may improve their welfare and be able to sustain their pastoral activities in the face of calamities. Adriansen (2006) finds that Fulani pastoralists of Senegal in West Africa have overcome the vulnerabilities of the 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. The income from the 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 so as 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) find that income, climatic shock, education, gender, and market access are important determinants. The study also reveals that large households are more likely to diversify into nonfarm activities than small-sized households.

To examine 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 profile. Brown et al (2006), using household data from central and western Kenyan highlands, finds that geographic location, family size, farming experience, access to credit and remittances are significant determinants of livelihood choice.

Empirical literature on food insecurity

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

Coates et al (2006), in a comparative study of food insecurity experience across several cultures, find a common denominator or “core” to household food insecurity. In all but a few of the sampled cultures, concerns about insufficiency in quantity of food consumed, inadequacy of the quality of food taken, uncertainty and worry about food availability and social unacceptability of food consumed are at the bottom of food insecurity experience. The 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 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.

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 so as to satisfy household needs. In cases where the 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 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 shocks, low education, female headship in a household, poor road infrastructure, and low market access. Other factors are absence of micro-credit facilities, lack of livestock promotion programmes, and 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 utilizes data from a national household survey to analyse whether the livelihood strategy chosen by a household has any bearings on its food security status, an aspect that is not adequately addressed in the literature.

3. Methods and data

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 hard-core poor and food insecure. Thus, hard-core poverty may be a suitable 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 Ksh 988 for rural Kenya in 2005/06, 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. Households that cannot meet this basic food requirement with their total expenditure of food and non-food items are considered to be hard-core poor.

The hard-core 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.

Food purchases are quite important in the attainment of adequate nutrition for individuals and households, especially in the dry pastoral areas. According to KIHBS 2005/06, 53.9% of the food consumed in rural areas in Kenya is purchased. In the drier pastoral areas, the percentage is higher at 58.5% since there is very little own-produced food (9.5%). These areas also rely heavily on gifts and relief food (29.8%). Households whose food consumption expenditure per month falls below Ksh 988 per adult equivalent suffer food poverty and are vulnerable to food insecurity. Turkana has the highest incidence of rural food poverty in Kenya at 92.6%, as well as absolute poverty at 95% (adult-equivalent adjusted).

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 that strategy that will maximize its welfare. Income sources suggest welfare outcomes (Nielsen et al,

2012). In the vulnerable ASALs, food security is a major welfare concern (Cunguara et al, 2011; Ng'ang'a et al, 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% 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 are employment (formal, casual, and 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 the pastoral areas, livestock production is the main livelihood activity and other activities are subsidiaries or alternatives forced on pastoralists by shocks.

According to the Kenya Integrated Household Budget Survey (KIHBS) 2005/06 data, the residents of Turkana draw livelihoods from pastoralism, agro-pastoralism, farming, 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. The study uses data from the Kenya Integrated Household Budget Survey (KIHBS) to identify the barriers.

In the literature, diversified rural livelihood strategies are associated with relatively higher incomes and less vulnerability to poverty (Nielsen et al, 2012). Households that are able to overcome poverty have a high likelihood of being food secure when food security is approached from availability and access avenues. Thus, diversified rural livelihoods dominate specialized strategies in terms of food security (Dercon and Krishnan, 1996; Ellis, 1998; Brown et al, 2006; Elias, 2008; Barrett et al, 2001; Cunguara et al, 2011; Ng'ang'a et al, 2011; Nielsen et al, 2012). The study has applied multinomial probit in examining the determinants of food poverty in Turkana (Equation 1).

Available literature shows that diversified livelihood strategies have the potential to reduce food poverty. This study has applied multinomial logit regression (MNL) to identify factors constraining households' access to diversified livelihood strategies (Equation 2). Such factors have bearings on household vulnerability to food poverty (Equation 1).

Other discrete choice models such as the multinomial probit (MNP) could also be used (Equation 2). However, multinomial logit is widely used because of its relative ease in computation. Dow and Endersby (2004), show that MNP and MNL predictions are technically similar. The two methods only differ in their assumptions of the distribution of the error term. While in MNL the errors are assumed to be independently and identically distributed (IID) across alternatives, MNP assumes the errors to follow a multivariate normal distribution (Greene, 2003) and not necessarily independent. MNL also assumes independence of irrelevant alternatives (IIA) whereby

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

Equation 1 is developed from the notion that a household's food poverty status (y_i) may be associated with the livelihood strategy that the household has chosen. Accordingly, the following structural equation may capture this association

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

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 endowment. In Equation 1, it is possible to have reverse causality between household food poverty (y_i) and livelihood strategy (P_i) chosen. In this study, the equation is estimated using probit regression method. STATA 13 software proved to be most helpful in this regard.

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

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

where,

P_{ij} = the probability of household i being in livelihood strategy j where $j=1, 2, \dots$

X = individual characteristics of a household, including age, sex, household size, etc.

A = household assets, including human, financial, social, physical and natural capital

e_j = error term.

Equation 2 is a multinomial logit that is estimated using 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 Greene (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 effects measure the expected change in the probability of being in a particular livelihood strategy with respect to a unit change in an independent variable.

Data

The study utilizes data from the Kenya Integrated Household Budget Survey (KIHBS) 2005/06 of the Kenya National Bureau of Statistics (KNBS). KNBS is the official data collection and analysis arm of the Kenyan government operating under the Ministry of Planning and National Development. KIHBS survey utilized the NASSEP IV framework that mapped the country into Enumeration Areas and clusters. A cluster is the primary sampling unit with 100 households or so. KIHBS sampled 1,339 (857 rural and 482 urban) clusters out of a possible 1,800 clusters in Kenya with probability proportional to size. In each cluster, 10 households (and a further five for replacing households that could not be interviewed for various reasons) were randomly picked. A total of 13,430 households (8,610 rural and 4,820 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 were also captured. The survey also reported the prices of consumer goods and services purchased by households.

4. Empirical results and discussion

Descriptive statistics

This section analyses data on Turkana District (now called Turkana County) as contained in the Kenya Integrated Household Budget Survey (KIHBS), 2005/06. The analysis shows that over 90% of the inhabitants of Turkana County reside in the rural areas. Urban centres are few and small-sized. The towns in Turkana accommodate only a tiny fraction of the people in the county.

The area has 51 males to every 49 females, meaning that Turkana has almost achieved gender parity in population distribution. The average household size is 6.5 with a range of 1-24. The mean age of the population is 25 years. Education attainment in the county is quite low with less than 40% of the population having ever gone to school. Of those who have ever gone to school, over 50% did not proceed beyond class five. Consequently, 77% of the county's population cannot read or write in any language. Of the literate population, a majority has difficulties reading and writing a whole sentence, since only 7% of them completed secondary school education. Table 1 captures some of the realities in Turkana. Below Table 1 is a more comprehensive discussion of the realities in the County.

Table 1: Description of variables used in the regressions

Variable	Mean	Std deviation	Minimum	Maximum
hhszise	6.5	3.7	1	24
occp	0.6	1.3	0	1
gender	0.5	1.52	0	1
age	0.25	16.7	16	80
mstatus	0.55	2.7	0	1
distenergy	96.6	104.19	3	900
distwater	35.8	29.14	1	120
cashremitt	1102.1	4154.1	0	50000
credit	4413	12115	0	100000
shock	1726	7574	0	140000
attsch	0.398	.489	0	1
Number of observations= 1112				

Source: Authors' calculations from KIBHS data.

Household livelihood sources

Enterprises that constitute the main livelihood strategies for households in Turkana County include livestock keeping, livestock keeping and crop farming, livestock

keeping and business activities, and business enterprises. No household was found to combine livestock keeping with farming and business, or livestock herding alongside farming and business. While the main crops grown are sorghum, white maize and cow peas, the main animals stocked are shown in Table 2. The business activities include retail kiosks, posho/maize mills, retailing clothes, goat selling, charcoal burning and sales, fetching firewood for sale, gold mining and masonry.

Table 2 shows the income shares of the main sources of household income in Turkana. Business enterprises contribute the most income followed by remittances. Income from livestock sales is among the lowest, only surpassing labour and agricultural income, but livestock production and sale engage the highest number of the households. Due to its low returns, agriculture is practised by only a few (10%) households. Remittances are an important source of household income, even though irregular.

Table 2: Total household income shares in Turkana

Source of income	Mean income, Ksh	Income share (%)
Household enterprises	44050	52
Transfers/remittances	29700	36
Livestock income	6565	8
Labour income	1957	2
Agricultural income	1004	1

Source: Authors' calculations from KIBHS data.

Livestock farming

Livestock farming is the main income-generating as well as a cultural activity in Turkana County. Some 74% of the population rear or own livestock. The main animals stocked are as shown in Table 3.

Table 3: Main animals stocked in Turkana County

Animal	Percentage	Animal	Percentage
Meat goat	48.19	Chicken broiler	1.55
Hair sheep	29.02	Mule	1.04
Donkey	10.88	Turkey	1.04
Camel	3.63	Zebu milk cow	0.52
Indigenous chicken	2.07	Others	0.49
Exotic dairy cow	1.56		

Source: Authors' calculations from KIHBS data.

The animals graze in the open with no modern husbandry. For example, there is no artificial insemination service in the county, while veterinary services are mainly self-provided (63.21%). Government veterinary services are scarce and only 29% of the livestock farmers access them. Private veterinary services are also inadequate with only 4.66% of the population accessing them. Some 3% of the livestock farmers do not access or provide any veterinary services to their animals.

Livestock rearing in Turkana is a traditional cultural activity rather than a commercial enterprise. Rarely are cows sold for cash other than during distress sales, or slaughtered for domestic consumption. To satisfy a household's cash and food needs, a few of the small stocks such as sheep, goats or chicken are sold or slaughtered at a time.

Expenditures on livestock care and maintenance are quite low and animal deaths are quite high. Table 4 shows these situations for the year 2005/06.

Table 4: Livestock information for Turkana County, 2005/06

Livestock	Mean	Std Dev.	Min.	Max.
Ownership	27.55	30.869	0	200
Sales	.829	1.813	0	15
Consumption	1.528	2.962	0	24
Deaths	16.48	27.983	0	200
Losses	3.472	7.497	0	50
Gifts	.430	1.412	0	10
<i>Expenditures on Animal Care (Ksh)</i>				
Drugs	116.218	422.042	0	3600
Vaccines	0	-	-	-
Chemicals	0	-	-	-
Animal feeds	0	-	-	-
Fodder	0	-	-	-

Source: Authors' calculations from KIHBS data.

Crop farming

Ten per cent of the farmers in Turkana County engage in small-scale crop farming. They mainly grow sorghum (70%), white maize (26%) and cow peas (4%) in plots that measure 0.3-1 acre. The plots are communally owned and they are regarded as family or communal free lands. The farm inputs are largely sourced from the households and only in rare cases are they purchased. Thus, 78% of the seeds grown are self-grown and there is no use of fertilizer or manure to replenish lost soil nutrients. The farmers cultivate different plots over time. Crop output in Turkana mainly serves subsistence needs but in a few instances, some output is sold off for cash or given away to neighbours, friends and relatives. Giving is an entrenched social protection practice among communities in Turkana. At one time or the other, each household is either giving out or receiving a gift in form of cash, food or animal. Some crop output is also lost to weevils.

Shocks

Turkana County is prone to natural and market shocks that undermine the effectiveness of the various livelihood strategies pursued in the County. Tables 5 and 6 show, respectively, the prevalence of shocks and their responses.

Table 5: Shocks and affected residents

Shock	Affected residents (%)	Shock	Affected residents (%)
Droughts/floods	24.4	Large rise in prices of food	5.4
Livestock died/stolen	21.80	Birth in household	4.6
Severe water shortage	14.0	Death of HH member other than head	2.4

Chronic/severe illness	14.0	Death of HH head	1.20
End of regular assistance	5.4	Others	6.8

Source: Authors' calculations from KIHBS data.

The shocks are felt at household and community levels where they cause income and asset losses. Household responses to shocks are as shown in Table 6. The response is shown to vary with successive shocks.

Table 6: Household response to shocks

Response to shock	Shock 1 (%)	Shock 2 (%)	Shock 3 (%)
Worked more hours	29.58	10.89	2.68
Received help from family/friends	9.26	13.51	12.16
Received help from government	8.45	5.85	4.95
Sold animals	8.25	2.02	1.03
Spent cash savings	7.24	2.02	0.21
Reduced food consumption	6.44	18.15	22.27
Non-working HH members went to work	6.04	17.54	2.89
Consumed lower cost but less preferred food	5.43	11.09	18.35
Received help from religious institutions	4.43	3.23	2.27
Sent children to live with relatives	3.02	0.81	0.62
Received help from local NGOs	2.01	3.43	2.68
Reduced non-food expenditures	1.81	4.84	18.76
Received help from international NGOs	1.81	2.82	2.47
Went elsewhere to find wage labour	1.01	0.60	0.82
Borrowed money from shylock	1.01	0.40	0.41
Spiritual effort (prayers, sacrifices, etc.)	1.01	1.21	5.98
Removed children from school to work	0.20	-	0.41
Sold assets (tools, furniture, crops, etc.)	-	0.80	-
Started new business	-	-	0.21

Source: Authors' calculations from KIHBS data.

Table 6 shows that whenever a natural or economic disaster visits a household, assistance from friends and relatives play a very important part in assisting households to cope with the shocks. They send help to affected households or receive children from such households as other household members struggle to cope with the shock the best way they can.

The first reaction in these struggles is for working household members to work for more hours so as to generate more income to weather the shock. Should the shock persist or should another disaster strike, the household changes tack. Food consumption in the household is reduced as other members of a household who were previously not working join the labour force to boost family income. Working household members put in more hours at work. Should the shocks persist further or a new disaster strike, households further review their response to shocks. They reduce non-food expenditures and food consumption in the household.

Table 6 also shows that as shocks increase, donor fatigue sets in. Unless the third shock is of a lower magnitude, non-governmental organizations (local, international and religious) as well as the government are noted to reduce their assistance to shocked households following the third shock. Several households turn to spiritual interventions. Prayers and sacrifices become more important responses to third shocks, a sign of

desperation. At this stage, hunger and starvation become rampant.

Remittances

Environmental and market shocks reduce household incomes and assets. Remittances and transfers to households in form of cash, food and other kinds assist households to cope with shocks or to recover from the shocks. Between 2005 and 2006, 96% of the households in the area received remittances. Cash remittances come mainly from individuals and non-profit organizations. Table 7 shows the kinds and amounts that households received in remittances over the period under study.

Table 7: Remittances to households in Turkana County, 2005/06

Remittance	Mean	Std Dev.	Min.	Max.
Cash from individuals	650.139	1134.56	0	10000
Cash from non-profit institutions	489.580	4291.587	0	50000
Total cash remittances	1102.1	4154.1	0	50000
Food from individuals	301.909	476.670	0	3000
Food from non-profit institutions	1034.722	1355.935	0	12120
Food from government	63.611	131.881	0	800
Total food remittances	1400.243	1353.154	0	12120
All-kinds from individuals	179.652	311.429	0	2000
All-kinds from non-profit institutions	52.152	495.423	0	5760
Total all-kinds remittances	231.806	568.824	0	5760

Source: Authors' calculations from KIHBS data.

Household social amenities

Nomadic pastoralism is widely practised in the area. This lifestyle dictates the kind of housing demanded by the residents. Some 93% of the population lives in Manyattas or traditional dome-shaped mud houses. In towns, some 6% of the population lives in mud-walled-tin-roofed Swahili-type houses. Shanty dwellings for the very poor are also found within towns.

In view of the nomadic lifestyle, the main sources of water for domestic and livestock needs are rivers, ponds and streams. Some 39% of the population satisfies its demand for water from these sources. A further 22% draw water from unprotected dug wells and springs. In the recent past, the government and some non-governmental organizations have sunk a few boreholes in the region. Through common watering points and public taps, the boreholes serve 31% of the population. Only 8% of the population access piped water in their plots, and these are mainly located in the urban areas.

Firewood is an important source of energy in the rural areas, while electricity is important in the urban areas of the county. In rural areas, firewood is a source of lighting and cooking energy to 73% of the population. Other sources of lighting energy in the county are paraffin (20%), electricity (3%), and dry cells for torches (3%).

Determinants of food poverty in Turkana County

The structural model of food poverty shown in Equation 1 was estimated against the background that it is potentially endogenous. A chosen livelihood strategy may

contribute to food poverty, while food poverty may to a large extent influence the livelihood strategy chosen by a household. Table 8 provides probit estimates of the model with livelihood strategies 2 (non-specialized farming), 3 (non-farming) and 4 (non-farming and farming) as explanatory variables. The model ignores any likely effects of endogeneity. Livelihood strategy 1 is the base category.

Table 8: Probit estimates of the determinants of food poverty in Turkana

Variable	Coef.	Std. Err.	z	P> z
hhsize	-.153	.009	-16.07	.000
occp	-.036	.018	-1.82	.069
gender	-.078	.052	-1.51	.132
age	-.006	.007	-.80	.424
age2	.000	.000	0.62	.535
religion	-.048	.020	-2.29	.022
mstatus	-.034	.014	-2.49	.013
distenergy	-.004	.006	-5.90	.000
distwater	-.003	.008	-0.47	.636
cashremitt	.000	.000	2.13	.037
credit	.000	.000	9.04	.000
attsch	-.390	.062	-6.29	.000
shock	.001	.000	2.15	.000
constant	2.050	.227	9.03	.000
Livelihood strategies				
Non-specialized farming (strategy 2)	.175	.056	3.13	0.002
Non-farming (strategy 3)	.519	.041	12.61	0.000
Non-farming and farming (strategy 4)	.570	.048	11.98	0.000
Constant	1.623	.141	11.53	0.000

Source: Authors' estimates from KIBHS Data.

Table 8 shows that the three livelihood strategies are significant in explaining food poverty in Turkana. Other significant factors that explain food poverty in the region may be household size, distance to energy, credit availability, whether the head attended school or not, and shocks. Food poverty in Turkana may also be explained by the occupation of the household head, whether the household is religious or not, whether the head is married or not, and the amount of cash remittances received by a household.

Table 9 shows the associated marginal effects or the expected change in the probability of being food poor due to a unit change in the independent variable. From Table 9, one extra person reduces the probability of food poverty in a household by 4%. A ten shilling increase in credit availability reduces the probability of food poverty in a household by 1%. A household whose head attended school has an 11% lower probability of food poverty compared to a household whose head never attended school. These outcomes largely agree with available literature. However, the finding that an extra kilometre from a household to the nearest electricity line lowers the probability of a household being food poor by 0.1% may be erroneous.

Table 9: Estimates of marginal effects of the determinants of food poverty in Turkana

Variable	dy/dx	Std error	z	p> z
hhsiz	-.040	.002	-16.23	0.132
occp	-.009	.005	-1.82	0.068
gender	-.020	.013	-1.51	0.132
age	-.001	.002	-0.80	0.424
age2	-.000	.000	-0.62	0.535
religion	-.012	.005	-2.29	0.022
mstatus	-.009	.004	-2.50	0.013
distenergy	-.001	.000	-5.81	0.000
distwater	-.000	.000	-0.47	0.636
cashremitt	-.000	.000	2.14	0.032
credit	-.001	.000	9.13	0.000
attsch	-.111	.019	-5.75	0.000
shock	-.000	.000	2.15	0.031

Source: Authors' estimates following the probit estimates.

Though credible, and in agreement with available literature, the estimates should nonetheless be treated with caution in view of possible uncontrolled endogeneity. Equation 1 also portrays determinants of food poverty as overlapping with determinants of livelihood strategies. Thus, the variables are further discussed and in greater detail under the section on the determinants of choice of livelihood strategy in Turkana. To facilitate the discussion, the following section identifies the strategies.

Livelihood categories/strategies in Turkana County

This study identified five livelihood strategies in Turkana County, viz., 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 10 shows the percentage of people in each livelihood category who are food poor.

Table 10: Food poverty in the livelihood categories/strategies found in Turkana

Livelihood category/strategy	Hard-core poor households (%)
Specialized: agriculture (pastoralism or farming)	87
Diversified: agriculture (pastoralism and farming)	74
Diversified: agriculture and non-agriculture	100
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 gain access to 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 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 11. The F-statistic of 17.33 supports the independence of the categories.

Table 11: ANOVA results for differences in food poverty in the 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.

Bonferroni 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 12 shows the Bonferroni results on mean differences in poverty in the four livelihood categories.

Table 12: Bonferroni 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. and non-agric.	-.10872*	.00315	.000	-.1184	-.0990
	Specialized non-agriculture	-.15406*	.00353	.000	-.1649	-.1432
Diversified agriculture	Specialized agriculture	.19295*	.00333	.000	.1827	.2032
	Diversif agric. and non-agric.	.08423*	.00259	.000	.0763	.0922
	Specialized non-agriculture	.03889*	.00304	.000	.0295	.0483
Diversif agric. and non-agric	Specialized agriculture	.10872*	.00315	.000	.0990	.1184
	Diversified agriculture	-.08423*	.00259	.000	-.0922	-.0763
	Specialized non-agriculture	-.04534*	.00284	.000	-.0541	-.0366

Specialized non-agriculture	Specialized agriculture	.15406*	.00353	.000	.1432	.1649
	Diversified agriculture	-.03889*	.00304	.000	-.0483	-.0295
	Diversif agric. and non-agric.	.04534*	.00284	.000	.0366	.0541

Source: Authors' calculations from KIHBS data. * The mean difference is significant at 0.0125 level.

Insofar 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%) in Turkana pursue specialized agriculture, especially pastoralism, as the foremost livelihood strategy. Unfortunately, pastoralism is among strategies most vulnerable to hard-core poverty and, by extension, food insecurity. The strategy of diversifying pastoralism through taking on board crop farming is associated with lower hard-core poverty, but the strategy is chosen by only 35.3% of the households in the area.

Business is the least popular livelihood strategy with only 8.5% 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 a majority of 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.

Determinants of choice of livelihood strategy in Turkana County

Multinomial logit (MNL) regression is used here to get the determinants of choice for a livelihood strategy. Specialized agriculture (either pastoral or farming exclusively) is the base livelihood category in the discrete choice analysis. Table 13 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 13: 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	
	<i>Coeff.</i>	<i>Marginal effect</i>	<i>Coeff.</i>	<i>Marginal effect</i>	<i>Coeff.</i>	<i>Marginal effect</i>
Household size	-.405 (7.30)	-.064 (7.25)	-.189 (2.95)	-.1006 (1.50)	-.118 (1.38)	-.0001 (0.190)
Gender (0,1)	.133 (0.59)	.018 (0.49)	-.280 (0.89)	-.018 (0.82)	-.277 (0.53)	-.003 (0.64)
Age	-.024 (2.55)	-.003 (2.53)	.001 (0.12)	.001 (0.67)	-.076 (2.51)	-.001 (0.76)

Marital status (0,1)	-.119 (2.19)	-.021 (2.43)	.140 (1.80)	.012 (2.29)	-.393 (2.75)	-.003 (2.03)
Religion (0,1)	-.203 (2.33)	-.034 (2.49)	.0001 (0.001)	.003 (0.42)	.342 (2.15)	.003 (1.82)
Attendance to school (0, 1)	.819 (3.48)	.138 (3.26)	.104 (0.29)	.008 (0.37)	1.57 (2.97)	.017 (1.55)
Occupation (0, 1)	.249 (3.08)	.042 (3.25)	-.032 (0.32)	-.006 (0.87)	-.163 (0.97)	-.002 (1.15)
Distance to water	-.012 (2.03)	-.002 (2.21)	-.005 (0.92)	-.001 (1.37)	.005 (0.58)	-.0001 (1.25)
Distance to energy	-.004 (4.42)	-.001 (5.04)	-.005 (2.57)	-.0004 (3.50)	-.393 (2.13)	-.003 (2.03)
Cash remittances	-.001 (2.47)	-.0001 (2.61)	-.0001 (0.88)	-.67 (0.13)	-.0003 (0.69)	-2.084 (0.47)
Credit	.141 (0.57)	.026 (0.65)	.142 (0.41)	.010 (0.41)	-2.57 (3.76)	-.025 (2.43)
Shock	-.001 (2.12)	-.160 (1.59)	-.0003 (2.33)	-.229 (2.39)	.0001 (1.13)	1.67 (0.152)
Constant	2.18 (2.25)		-.993 (0.79)		4.8 (2.26)	
Log likelihood=-452 LR chi2(36) = 254 Pseudo R2 = 0.28 Prob>chi2 = 0.0000 Number of observations = 567. The base livelihood category is 1(specialized agriculture).						

Source: Authors' calculations from KIHBS data.

According to Table 13, the frequent droughts in Turkana provide shocks that discourage diversification into farming. Farming in the region is only practised 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 are the size of a household, the age of the household head and the marital status of the household head. They also include the religious status of a household, distance from the household to the water and energy source, and cash remittances.

An increase in household size reduces the probability of a pastoral household diversifying into crop farming by 4%. 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%.

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%.

A household that ascribes to some religion is unlikely to diversify into farming, but is more likely to move to business. The association between religion and business

livelihood is, however, not apparent. There is a need for further investigation to gain a clearer understanding of the association.

An increase in the distance to a water or electricity source 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 is in the rural setup where traditional values reign supreme. In rural Turkana, pastoralism is a cultural practice that is deeply entrenched.

Cash remittances cushion households against the effects of shocks. Households 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%. 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 livelihood outside pastoralism. For this reason, such a person has 25% more likelihood to engage in farming than a pastoralist.

Turning focus now to pastoral livelihoods vis-a-vis a diversified livelihood of pastoralism and business, Table 13 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%.

An increase in the distance to the nearest electricity line reduces the probability of a pastoral household diversifying into business by close to 0.4% for the reasons given earlier. Electricity in Turkana is currently found in urban places only. Livelihoods founded on business activities thrive largely in urban places explaining the outcome.

Undergoing some form of shock reduces the probability of a household diversifying into business by close to 23%. Climatic and market shocks reduce family wealth thus discouraging diversification.

Looking at pastoral livelihoods relative to the livelihood of business, Table 13 shows that the main variables that reduce the probability of a pastoral household moving out of pastoralism to a livelihood of business are age of the household head, marital status of the head, distance to energy source, and availability of credit.

The older a household head is, the lower is the probability that his or her household will engage in business activities. It had been earlier observed that older people tend to be uncomfortable with trying new things, particularly those with implications on their survival.

Marriage reduces the probability of a household engaging in business for a

livelihood by 0.3%. As earlier mentioned, marriage automatically turns a young man into a livestock owner and a pastoralist.

A longer distance to the source of electricity lowers the probability of a household to pursue business 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 receives more credit, its probability to engage in business for a living reduces by 2.5%. 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% 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% higher probability of engaging in business for a living than a pastoral household. Some of the benefits 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. Conclusion and policy recommendations

From the KIHBS data, there is strong evidence that most households in Turkana County are food insecure. A majority of the households suffer hard-core poverty. Even if they were to expend the entire of the household budget on food, they would 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 the household. Turkana County exhibits four distinct livelihood categories. Any policy on food security should pay attention to these four categories. While diversification of livelihood strategies improves food and poverty situation in a household as argued in several studies, 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 most probably business (Table 10). The strategy had the lowest population of hard-core poor households. The least viable strategy in the same regard is most probably diversification of agriculture into non-agriculture. Agricultural and non-agricultural activities may not be complementary. That the most viable option of business 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 livelihoods. Removing barriers to business enterprises probably through access to electricity, education, support to religious activities, and mitigation against shocks might 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, have a high likelihood to improve household food security status remarkably (Table 10). Government policies that promote schooling and self-employment may have strong bearings on household engagement in business activities. Thus, infrastructural and urban developments may be crucial in encouraging households towards business activities and in addressing food insecurity in the drought-prone region of Turkana.

In the pastoral areas of Turkana, households are large 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. Large households in Turkana may be more inclined to exclusive pastoralism rather than business or diversified livelihoods. 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 the main urban areas which form business hubs in the region. Electricity is an indicator of the level of development, particularly infrastructural development. Development in one direction attracts developments in other fields. Electricity has important bearings on education and self-employment.

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 increase the probability that they will adopt superior livelihood strategies that cope better with the vagaries of drought.

In conclusion, public policy that addresses infrastructural developments in Turkana and ASALs will most probably address the problem of food insecurity in these areas. Social infrastructures, such as electricity and schools, may have the most impact in this regard. There is also a need for public policy that favours provision of social safety nets that cushion pastoralists against the devastating effects of shocks. These policies would probably encourage indirectly the movement into superior livelihood strategies or amelioration poverty and move communities in the ASALs out of food insecurity.

The study findings are not conclusive because of econometric challenges. Further research is needed on appropriate econometric method to estimate a categorical choice model with a discrete endogenous regressor(s).

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Appendix 1

Definition of variables used in the 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 (occp)	Dummy variable indicating whether household head is self-employed = 0 or employed =1
Distance to water (distwater)	Distance from household to nearest water source in kilometres.
Distance to energy (distenergy)	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 (cashremitt)	Cash remittances received by a household in Kenya shillings within the year 2005/06
Credit	Credit received by a household in Kenya shillings within the year 2005/06
Household size (hhsiz)	Number of individuals in a household
Attendance to school (attsch)	Dummy variable describing whether household head has attended primary school
Shock	Proxied by the amount of money a household used to take care of a reported shock.
Marital status (mstatus)	Whether housed head is married = 1 or not married = 0

Source: Authors.