



FACTORS INFLUENCING HOUSEHOLD FOOD SECURITY IN MANDERA COUNTY, KENYA

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Abstract

Aim: *Despite the introduction of agro-pastoralism in Kenya, the country is still experiences extreme household food insecurity. This study was purposed to evaluate factors influencing household food security in Mandera County. The information and suggestions provided by this study may be useful to the Kenyan Government and other development partners interested in designing customized strategic interventions and policies to solve food insecurity in Mandera County.*

Scope of Study: *The study sought to evaluate the factors influencing household food security in Mandera County. The study considered four variables: farm inputs availability, animal breeding, crop variety, and agro-pastoralism support programs.*

Research Methodology: *The study applied the descriptive survey research design. The target population was 97, 698 households from Mandera North and Mandera East sub-counties. Stratified and simple random sampling techniques were used to select random sample of 45 households. This number was determined using the Danial sample size formula ($n=Z^2 * p * (1-p) / d^2$). Data was analyzed using descriptive statistics.*

Findings: *The findings showed that low food production was caused by limited farm inputs, lack of crop and animal variety diversification and limited agro-pastoralism support programs. The study recommended provision of subsidies farm inputs and training of competitive farming to increase food production and household food security.*

Keywords: *Household food security, agro-pastoralism, farm inputs, crop and animal diversification, agro-pastoralism support programs*

1. BACKGROUND TO THE STUDY

In the context of severe climate change and global warming, food security has become a global issue. The United Nations through the Sustainable Development Goals (SDGs) put emphasis on

ending hunger, achieving food security, improving nutrition and promoting sustainable agriculture by 2030 (United Nations Sustainable Development Goals). According to Inter-American Institute for Cooperation on Agriculture (2009) food security is defined as the existence of the necessary conditions

for human beings to have physical and economic access, in socially acceptable ways, to food that is safe, nutritious and in keeping with their cultural preferences, so as to meet their dietary needs and live productive and healthy lives. As like food security, food insecurity is the lack of access to adequate food that is safe and nutritious as a result of poor physical, social and economic factors (FAO, 2010).

In Kenya, about 3.4million people are food insecure, with 104 614 children under the age of 5 needing Severe Acute Malnutrition (SAM) treatment (UNICEF, 2017). Since early 1980s, the intensity of hunger and malnutrition has increased significantly and per capita supply of the main staples has been declining. Food insecurity in Kenya has been attributed to different factors including: drought; decline in agricultural productivity; inefficient food distribution systems; population growth; unemployment among others (Sasson, 2012). Food insecurity in Kenya has been classified as either chronic or transitory. Chronic food insecurity results from a continuous inadequate access to food and is caused by the chronic inability of households to either produce or purchase sufficient food, whereas transitory food insecurity is the inadequate access to food due to instability in food production, food supplies and income (WFP, n.d). Food problem in Kenya is mainly of transitory nature. This has been exemplified by: periodic droughts over the years, institutional failure, corruption and poor policies which cause the decline of food crop and livestock production, forcing the country to import substantial food stuffs (NDMA, 2017).

While food crisis in the ASALs has always been attributed to climatic and environmental conditions, other equally important factors have been documented. These include limited alternative sources of income, exploitative cereal marketing channels, unavailability of drought and disease resistant crop varieties, low limited crop diversification, poor storage methods, lack of credit

services, inaccessibility to agricultural services, illiteracy and poverty. The recurrent food shortages especially before grain marketing was liberalized in Kenya have been blamed on the abandonment of indigenous drought resistant crops and soil conservation methods. However, initiatives being made to assist rural communities to revert to these practices are beset with obvious inherent contradictions. Apart from changes in feeding habits and tastes over time, the market has not been overly receptive to these changes particularly with regard to indigenous crop varieties like millet, cassava, sorghum and cowpeas.

1.1.1 Agro-pastoralism in Kenya

Agro-pastoralism has been defined as farming systems that combine crop and livestock production (Lal et al., 2015; FAO, n.d). The interaction of crops and animal in agro-pastoral practices are beneficial to food security and sustainability as they provide food and sources of income for the farming households (Lal et al, 2015. In Kenya, it was introduced in the early 1990s by the Kenyan Government and the World Bank through a proposed project dubbed Emergency Drought Recovery Project (EDRP) (Mude, 2007). The project was aimed at assisting vulnerable pastoral and agro-pastoral communities living in arid and semi- arid areas to transition to livelihoods more sustainable to the climate shock. The project was launched in Marsabit, Turkana, Mandera, Tana River and Wajir, which were the most drought affected areas at the time. This project was later developed to form the Arid Lands Resource Management Project (ALRMP) (Mude, 2007), which focused on educating agro-pastoral farmers on farming practices more productive and sustainable to their environment.

Since these institutional formations, other government and non-governmental organisation projects have been established in an effort to increase land management and sustainability. They are focused on increasing food production through agro-pastoralism to ultimately improve the living

standards of the communities. Through training and farm inputs aids, most of the former pastoralists in Kenya are slowly adapting agro-pastoralism as a drought coping mechanism to sustain their household food supplies and generate income (Wairore, Mureithi, Wasonga & Nyberg, 2015). How much agro-pastoralism have contributed to the household food security in Kenya's ASAL areas, its challenges and proposed developments will be established throughout this study.

1.2 Statement of the Problem

The government of Kenya has a goal to achieve national food security by year 2030 (Kenya Agriculture Research Institute, n.d). In this regard, the Government in collaboration with Kenya County Governments and Non-Governmental Organisations has facilitated agro-pastoralism projects as a means to enhance household food security in the ASAL areas (Negatu & Musahara, 2016). These projects which offer subsidies of farm inputs, financial support, improved agricultural infrastructure and train farmers on improved farming methods have helped transition many pastoralists in Mandera County to agro-pastoralism (WFP, n.d). Using River Dawa (which passes across the Kenya, Ethiopia and Somalia borders) as a water source for irrigation, cultivation of horticultural crops is being undertaken in various locations within the county. Other farming methods and techniques such as mid farming, sustainable animal breeds, introduction of drought tolerant crops and animals are being pursued in the aim of increasing household food availability and security in Mandera County (Mandera County Government, n.d).

However, despite the presence of agro-pastoralism in Mandera County, in 2017 household food security was classified as stressed phase. According to the Food and Agriculture Organisation of the United Nations, approximately 22% of the children under five in this county risk malnutrition with 4.3% already receiving SAM treatment (Relief Web, 2016). A significant number

of individuals still depend on the government and relief organisations to attain food. For these reasons, it is important to investigate why agro-pastoralism has not been effective in enhancing food security, which is the aim of the proposed research.

1.3 Objectives of the Study

- i) To examine the influence of farm inputs availability on household food security
- ii) To determine the influence of animal breeds on household food security
- iii) To establish the influence of crop varieties on household food security
- iv) To examine the influence of agro-pastoralism support programs on household food security

1.4 Significance of the Study

The results of this study will be helpful for to the Kenya Government, Mandera County Government and concerned NGOs on investigating factors influencing household food security. Its results will provide policy makers with concrete information on how the various components of agro-pastoralism i.e. farm inputs, crop variety, animal breeding and agro-pastoralism support programs influence household food security. Accordingly, this would pave the way for more support towards agro pastoralist's interventions to be implemented by concerned bodies in order to minimize the relief dependency and strengthens households' capacity in coping with risks of food insecurity in the semi-arid areas of Kenya.

1.5 Scope of the Study

The study was focused on the influence of agro-pastoralism on household food security in Mandera County. Due to it ASAL geographical location Mandera County is constantly faced with drought

and extreme weather which has resulted to ruinous loss of animals hence, poverty and food insecurity (KNBS, 2013). As a result, the highly nomadic pastoralists' community is increasingly adopting agro-pastoralism as a coping mechanism in an effort to improve their household food security. The county is now host to small scale agriculture productions mostly in Mandera North and Mandera East that supplies horticultural products such as vegetables and fruits to the local market (Mandera County Government).

This research was carried out in two sub-counties in Mandera County; Mandera North, Mandera East. Respondents were randomly selected from the 97 698 households across the sub-counties. The data was collected through questionnaires and research observation from agro-pastoralists, pastoralists and representatives of agro-pastoralism programmes in Mandera North and Mandera East sub-counties.

2. LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Normative Movement Theory

Animal keeping has been a source of food and income for pastoral communities since its development in the 1900s (Riginos et al., 2012). According to the normative movement theory, pastoralist move in search of pasture and water (Dwyer & Istomin, 2008). Their success can be attributed to the herders ability to maintain herd cohesion and masterly of animal husbandry without need for technology (Riginos et al., 2012). The animals produce food products such as meat, milk and cheese for the herders and their families hence providing household food security. The animals are also treated as economic resources, sold for money or exchanged for crop products such as cereal though barter trade (Bollig, Schnegg, Wotzka, 2013)

However, climate change, severe famine and large animal population especially in Sub-Saharan Africa has led to environmental degradation hence, affecting the grazing lands used by herders. Due to

extended drought spells, households are frequently affected by severe hunger periods that lead to death of animals and in some cases people. The loss of the pastoralists' livelihood has resulted to high food vulnerability and insecurity at the household level. During the drought period, poor households depend on food they have not produced themselves such as wild fruits and food aid for sustenance. Sometimes, these foods are not nutritious enough to meet the household nutrition needs. As a result, a large number of the population becomes more vulnerable to nutrition deficiency diseases hence, poor productivity (Mukherjee, 2002).

As climate change continue to persist and affecting land productivity, pastoralism alone is no longer a viable livelihood. Pastoralists are now faced by the need to diversify their food production to promote food availability and stability for the community's sustenance. Coping mechanism such as agro-pastoralism has been introduced.

2.1.2 Oasis Theory

According to the oasis theory, people transitioned from hunting and gathering to animal and crop domestication around water sources. This theory can be used to explain the transition from nomadic pastoralism to agro-pastoralism by many communities in Kenya's North Eastern region, especially Mandera County. Previously, large populations of livestock existed in Mandera. However, in recent times global warming and climate change has altered environmental patterns leading to long periods of drought. Faced with this challenge, the pastoralist have moved closer to water sources for example River Dawa in Mandera County and ventured into smallholder farming to improve their household food security and sustain their livelihoods.

Agro-pastoralism in this region is practiced as small scale mixed farming (a combination of both animal breeds and crop farming). This diversification was crucial in balancing household food security as both crops and animals contribute to the production of

food and income sources. But despite most households adopting agro-pastoralism in Mandera County, many people still continue to struggle with household food insecurity and stability. The Government and Non-Governmental Organisations have introduced agro-pastoralism support programs to help farmers improve their yields.

2.1.3 Theory of Change (TOC)

The Theories of Change (TOC) was used in the analysis and application of this study. Also known as the Participatory Impact Pathways Analysis (PIPA) in the agricultural research for development domain, it is basically a process of collective thinking, reflection to articulate assumptions and integrated hypotheses on how and why a particular intervention will bring about stated or desired impacts (Nkwake, 2012). Theories of Change thinking and impact pathway analysis are now firmly becoming part of the development community’s lexicon. But is flagging the use of these techniques in planning, monitoring and evaluation of interventions just one more box to tick to secure research and development funding in an era of tightening budgets, changing priorities and an insatiable political appetite for impact results? The Food Systems Innovation Initiative thinks these techniques really could improve the performance of food security interventions. However, to master these techniques, researchers, donors and program implementers need to join forces to develop a common understanding of what these techniques mean in practice and how they can be effectively implemented (Nkwake, 2012).

Theories of Change is different from earlier techniques of design monitoring and evaluation because it forces those planning interventions to make explicit the causal chain of events and assumptions that link not only inputs to outputs, but also the link between outcomes and final impacts. One of the key differences is that ToC recognises that usually the links between outcomes and impacts are highly non-linear. This helps stakeholders of an intervention better represent the

causal mechanisms and articulate alternative pathways to navigate through uncertainty and unpredictability of progress to results (Webb, 2012). In so doing, ToC draws attention to the institutional, political, socio-economic and biophysical factors that shape pathways to impact (Webb, 2012). This provides a range of new entry points to help interventions achieve impact. It also has the advantage in that it does not give primacy to any particular development pathway, for example market, policy or ecology-led. Rather it helps users focus on desired social and environmental outcomes and work backwards from there to chart a route to impact.

2.2 Conceptual Framework

As shown in figure 1, the independent variables includes: farm inputs availability, animal breeding, crop variety and agro-pastoralism support programs. Dependent variables; household food security.

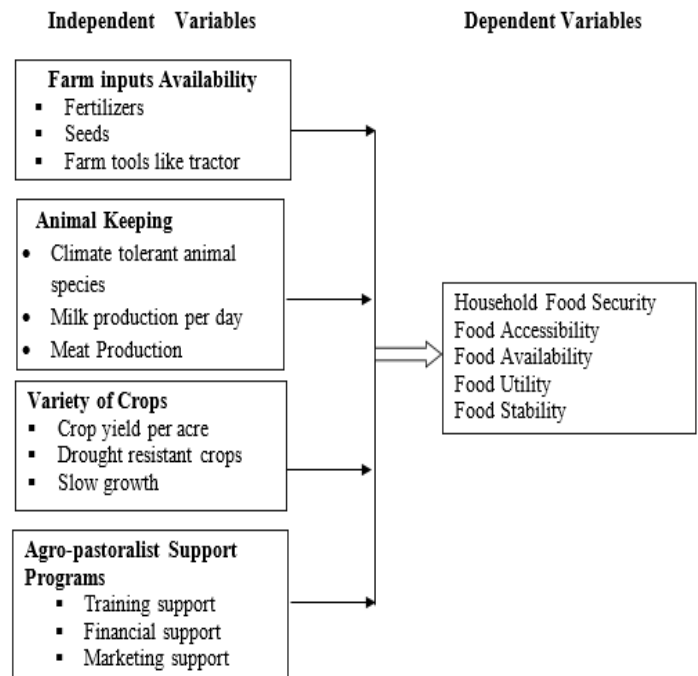


Figure 1: Conceptual Framework. Source: Researcher

3. RESEARCH METHODOLOGY

The study applied a descriptive survey research design and incorporated both qualitative and

quantitative approaches in elements of research instruments and data analysis. Descriptive survey involves the collection of data from a sample of the target population so as to determine their current status in respect to the variables under investigation. The application of descriptive survey design in this study enabled the researcher to collect facts without manipulation, sought opinions, analyzed and interpreted on effects of agro-pastoralism practice on household food security in Mandera County.

This study was carried out on pastoralists' households practicing agro-pastoralism in Mandera County specifically in Mandera North and Mandera East sub-counties. According to the Kenya 2009 Population census, the two sub-counties had a combined population of 97 698 people (Kenya National Bureau of Statistics, 2009). Simple random sampling technique was used to select as sample of 45 households. This number was determined using the Danial sample size formula described below.

Formula (Danial sample size formula)

Using the formula below, a sample size was determined as follows:

$$n = Z^2 * p * (1 - p) / d^2$$

Where: n = Sample size for large population

Z = Normal distribution Z value score, (1.96)

p = Proportion of units in the sample size possessing the variables under study, where for this study it was set at 50% (0.5)

d = precision level desired or the significance level which was 0.05 for the study.

$$n = \frac{(1.96)^2 \times 0.36 (1 - 0.36)}{(0.054)^2}$$

$$H \ 100 \% = 97 \ 698 \ \text{Households}$$

$$\frac{45}{97 \ 698} = 0.00046$$

$$\left(\frac{100 \times 45}{97 \ 698} \right) = 0.036$$

$$125497$$

$$= 0.036$$

$$n = \frac{(1.96)^2 \times 0.36 (1 - 0.36)}{(0.054)^2}$$

$$= 45 \ \text{Sample Size}$$

Data was collected through secondary and primary procedures. Questionnaires and in-depth interviews were used as instruments of primary data collection. Kombo & Tromp, (2009) noted that, the use of questionnaire as an instrument of research normally gives the respondents adequate time to provide well thought responses in the questionnaire items and enables large samples to be covered within a short time. Data collected organized, and analysed and presented using frequency distribution, tables and percentages. Descriptive qualitative analysis was adopted. The information was then filtered, interpreted and focused to meet the objectives of the study.

4. RESEARCH FINDINGS AND DISCUSSION

To determine the influence of selected variable on household food security in Mandera county, respondents were asked to mark on the variable directive statement most appropriate to the. Their level of influence was then measured using the following standard mean: 5- *Strongly Agree*, 4- *Agree*, 3- *Neutral*, 2- *Disagree*, 1- *Strongly Disagree*.

The results were as described below.

4.1. Farm Inputs Availability

Table 4.1: Farm Inputs Availability

Farm Inputs Availability	Frequency & Percentage					Total
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
Availability of Fertilizers	3 (8%)	7 (19%)	1 (3%)	19 (51%)	7 (19%)	37 (100%)
Availability of Quality Seeds	2 (5%)	9 (24%)	6 (16%)	15 (41%)	5 (14%)	37 (100%)
Availability of Farming Tools	9 (24%)	18 (49%)	2 (5%)	7 (19%)	1 (3%)	37 (100%)
Availability of Water	2 (5%)	6 (15%)	3 (7%)	8 (20%)	21 (53%)	40 (100%)

According to the Table 4.1 above, it is evident that majority of the respondents do not adequate farm inputs to bolster with productivity. Farm inputs in this study were limited to availability of quality seeds, availability of agro-chemicals such as fertilizers and availability of farm tools. A total of 70% respondents disagreed to the statement that they have available and affordable fertilizers in Mandera County. In addition, 55% of the population said they did not have quality seed availability, 73% did not have affordable farm tools, and 73% of the respondents did not have access to enough water sources for domestic and agricultural use. Cumulatively, lack of proper farm inputs have negatively influence household food security among the respondents.

4.2 Crop Variety

Table 4.2 Crop Variety

Crop Variety	Frequency & Percentage					Total
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
Yield Per Acre	4 (28%)	6 (42%)	1 (7%)	2 (14%)	5 (9%)	18 (100%)
Drought Resistant Crops	4 (15%)	7 (27%)	0 (0%)	10 (39%)	16 (19%)	37 (100%)
Fast Growing Crops	22 (61%)	9 (25%)	0 (0%)	4 (11%)	2 (3%)	37 (100%)

According to Table 4.2 above, most of the respondents who participated in this study lacked crop variety and diversification. Although 70% of the respondents strongly agreed to growing fast growing crops and 42% of the respondents agreed to growing drought resistant crops; most of the respondents (58%) did not grow any drought resistant crops. Majority of the respondents (70%) said that due to the extreme weather, they typically planted fast growing crops during the short rains. Horticultural crops such as water-melons, onions, kale, pawpaw, tomatoes, among others were observed to be most common among respondents. The only crop resistant crops highlighted by respondents were mangoes. The researcher observed that despite Mandera County being ASAL areas, most of the respondents did not grow drought resistant crops which would be more tolerant to the extreme weathers and bolster cereal productivity. Majority of the respondents had little to no information about varieties of drought resistant crops such as cassava, sorghum, millets and cowpeas.

4.3 Animal Breeding

Table 4.3: Animal breeds

Animal Breeds	Frequency & Percentages					Total
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
Drought Tolerant Animals	26 (70%)	9 (24%)	1 (3%)	1 (3%)	0 (0%)	37 (100%)
Sufficient Milk Production	1 (3%)	7 (19%)	1 (3%)	16 (43%)	12 (32%)	37 (100%)
Adequate Meat Production	5 (15%)	7 (21%)	0 (0%)	14 (41%)	8 (23%)	34 (100%)

According to the results from Table 4.3 above, 90% of the respondents kept drought tolerant livestock. 75% of the respondents said they did not have sufficient milk production per day. In addition, 64% said they did not have adequate meat production from their livestock. These results indicate that despite majority of the respondents keeping

drought tolerant livestock, they still do not have sufficient milk and meat per household.

4.4 Agro-pastoralism Support Programs

Table 4.4 Agro-pastoralism Support Programs

Agro-Pastoralism Support Programs	Frequency & Percentage					Total
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
Adequate Farming	3	7	1	21	6	38
Training	(6%)	(15%)	(2%)	(51%)	(26%)	(100%)
Access to Financial	1	4	0	4	31	40
Credit	(2%)	(10%)	(0%)	(10%)	(78%)	(100%)
Access to Timely	3	6	2	9	20	40
Market Information	(7%)	(15%)	(5%)	(23%)	(50%)	(100%)

In accordance to the data indicated in Table 4.4 above, it is evident that majority of the respondents did not have satisfactorily agro-pastoralism support systems. 78% of the respondents disagreed to the statement that they had proper access to credit facilities. In addition, 73% of the respondents disagreed to having timely market information and training on how to best package and sell their products, while 77% disagreed to having adequate training and induction on how to practice mixed farming. Only, 21% of the respondents said they had sufficient farming training and 22% said they had timely market information. This showed that the respondents lacked basic knowledge of best farming methods; they had no proper financial credit access and lacked proper training or knowledge of competitive marketing.

4.5. Household Food Security

Table 4.5 Household Food Availability

Household Food Security	Frequency & Percentage					Total
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
Household Food Availability	5	8	0	14	12	39
	(13%)	(20%)	(0%)	(36%)	(31%)	(100%)
Household Food Stability	1	8	4	15	12	40
	(2%)	(20%)	(10%)	(30%)	(38%)	(100%)
Household Food Accessibility	2	9	0	23	66	40
	(5%)	(22%)	(0%)	(58%)	(15%)	(100%)
Household Food Utility	7	10	2	16	5	40
	(17%)	(25%)	(5%)	(40%)	(13%)	(100%)

According to the data represented in the Table 5 above, 67% of the respondents disagreed to having adequate food that was available to everyone. In addition, 68% of the respondents said they did not have enough food from their own farms or the market, 58% per cent of the respondent disagreed to having access to food quantities from their farms or market and 53% of the respondents disagreed to having adequate nutritious foods.

5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

Farm Inputs Availability on Household Food Security

According to this study, Majority of the respondents (70%) did not have access to affordable fertilizer. The study also established that 55% of the respondents lacked availability of quality seeds while 29% said they have quality seed availability. In addition to farm inputs, the study found out that 73% of the respondents had access to basic farm tool. On water availability, 73% of the respondents said they did not have access to enough safe water for domestic and agricultural use.

Crop Variety on Household Food Security

The study found out that 70% of the respondents fast growing groups. 42% of the respondents agreed to growing drought resistant crops. Majority of the respondents (58%) do not grow any drought resistant crops. However, 93% of the respondents remained neutral about having adequate crop yield per acre.

Animal Breeding on Household Food Security

In reference to the findings of this study, 90% of the respondents said they kept drought tolerant livestock. 75% of the respondents said they did not have sufficient milk production per day while 22% said they had sufficient daily milk production. In addition, 64% of the respondents said they did not have adequate meat production from their livestock. However, 36% of the respondents said they had adequate meat production from their animals.

Agro-pastoralism Support Programs on Household Food Security

According to this study, 78% of the respondents disagreed to the statement that they had proper access to credit facilities. In addition, 73% (23% disagreed and 50% strongly disagreed) of the respondents disagreed to having timely market information and training on how to best package and sell their products while, 77 % disagree to having adequate training and induction on how to practice mixed farming. On the other hand, 21% of the respondents said they had sufficient farming training while, 22% said they had timely market information.

Household Food Security Level

In this study, respondents were asked to indicate their level of household food security based on food availability, food stability, food accessibility and food utility. This study found that 66% of the respondents said they lacked adequate food available to everyone in their households while, 31% said they had adequate food availability. 50%

of the respondents said they did not have enough food from their own farms or the market. Only 2% of the respondents strongly agreed that they had food stability in their households. In addition, 58% per cent of the respondent disagreed to having access to food quantities from their farms or market. On the other hand, 27 % of the respondent agreed that they have access to nutritious food quantities. As well, 53% of the respondent disagrees to having adequate nutritious foods. However, 42% of the respondents had enough food that was adequately nutritious and met their dietary needs.

5.2 Conclusions

Influence of Farm Input Availability on Household Food Security

The findings of this study revealed that essential farm inputs such as fertilizers in Mandera County are not easily accessible or affordable. Farmers also lack access to quality hybrid seeds that are genetically and physically pure and structured to withstand adverse weather conditions. As a result, farmers opt for alternative methods such as animal manure and home-saved seeds which are not as effective as chemical fertilizers and quality hybrid seeds in increasing land and yield productivity and although most agro-pastoralist in Mandera County has access to affordable basic farm tools, there is a major lack of technological farm inputs and machinery. Farmers rely on human manual labour in land preparation, planting, crop management and harvesting, which can be tedious and counterproductive.

In addition to farm inputs availability, lack of adequate water for domestic and agricultural use has negatively impacted household food productivity, distribution and consumption in Mandera County. Majority of the population do not have access to enough and safe water for both domestic and agricultural use. As a result, they depend on the seasonal River Dawa as the only water source for their household and agricultural

use. During the dry season, the river dries leading to huge losses of crop and sometimes animals.

Influence of Crop Variety on Household Food Security

On crop variety, agro-pastoralists in Mandera county lack crop variety diversification. A large number of the farmers grow fast growing horticultural crops such as onions, tomatoes, kales and watermelon rather than drought tolerant crops. This research observed that mangoes are grown as a drought tolerant crop. Farmers also have little knowledge about drought tolerant crops such as Millet, sorghum, cassava and cowpeas which would significantly improve their cereal production hence, bolstering household food security.

Influence of Animal Breeding on Household Food Security

On animal breeding, a large number of the population practising agro-pastoralism in Mandera County keep drought tolerant livestock. The commonly reared animals include zebu cattle, Galla goats, sheep and Camels. However majority of the population still do not have sufficient milk and meat production per day. Farmers, have little to no knowledge of sedentary animal breeding and husbandry techniques that can produce more hybrid animals that are drought tolerant yet productive and proper breeding systems such as zero grazing which would be beneficial in improving yield productivity hence, increased household food security

Influence of agro-pastoralism support programs on Household Food Security

On agro-pastoralism support programs, there is lack of adequate agro-pastoralism support programs in Mandera County. Most respondents lacked basic knowledge of best farming methods; they had no proper access to financial support and lacked any proper training or knowledge of competitive marketing. Lack of proper credit facilities affected the farmers' capacity to purchase essential farm inputs, hire labour and efficiently manage their farms, aspects that negatively impacted on food

productivity. The lack of timely market information and training on proper harvesting and value addition techniques affected their product quality hence; they do not attain premium market prices. In consequence, this reduced their productivity and income achieved through sales of yield further denting household food availability, accessibility and stability. Farmers also lacked adequate training and induction on how to effectively practice mixed farming. The population have little to no understanding of seasonal timings, crop and animals varieties and diversification and effective animal husbandry which would have higher yields in ASALs areas thus, improving household food availability and security.

Household Food Security in Mandera County

On household food security, a large of the population still lack adequate food supplies and are constantly worried about their household food security. Most household did not have an all year round stable source of food neither did they have access to nutritious food that met their dietary needs for a healthy and productive lifestyle. This showed that agro-pastoralism have failed to improve the household food insecurity in Mandera County. However, factors such as high levels of poverty, poor infrastructure, water scarcity among others has been attributed to the low land and crop productivity, poor food distribution and to a better percentage failure of agro-pastoralism practices to secure household food security.

5.3 Recommendations

Based on the finding of this research, the following recommendations have been proposed.

5.3.1 Farm Inputs Availability on Household Food Security

The study recommends introduction of subsidized and affordable farm inputs such as agro-chemicals and quality seeds in Mandera County. The Kenyan National and County governments, NGOs and other relevant bodies should ensure all farmers have access to affordable farm inputs by developing

price and tax policies that reduce and standardise the cost of essential farm inputs in the county. The county government should also ensure easy distribution and accessibility of these inputs by setting up government farm shops near farming locations. Moreover, farmers should be introduced to technological techniques and farm machineries such as tractors and irrigation systems which will significantly improve their yield per acre, help transition from smallholder to middle or large holder farmers hence increasing their household food security and surplus income.

5.3.2 Crop Varieties on Household Food Security

The study recommends that farmers be introduced to crop and animals varieties and diversification to improve their food yield per acre and increase household nutrient varieties. This can be done by introduction of drought tolerant crops and animals which have the capacity to withstand extreme weather conditions without compromising productivity. Farmers can grow drought tolerant cereal crops such as millet, sorghum and cowpeas alongside fast growing horticultural crops which will offer household nutrient varieties. In addition, farmers can be introduced to other farm animals such as poultry which will further increase household food security and provide potential sources of income. As a result, the population will attain food security and proper utilization hence a more healthy and productive life.

5.3.3 Agro-pastoralism Support Programmes on Household Food Security

The study recommends that the Kenya National government and Mandera County government, NGOs and other relevant bodies should improve agro-pastoralism support programmes by providing financial and credit assistance to agro-pastoralism farmers for them to improve their farming practice through procurement of farm inputs and equipment hire labour and ultimately manage their farmers hence, improve food productivity and household

food security. This can be achieved through introduction of grants and Sharia compliant credit facilities (as observed most of the population in Mandera County are influenced by the Islamic religion) to enable capital access for farmers. In addition, the programs should offer capacity building and timely market information such as farm extension services through agricultural officers and mass media.

5.3.4 Water Availability on Household Food Security

The study recommends that the Kenyan National Government, Mandera County Government, NGOs and other relevant bodies should provide other water sources by drill boreholes; construct mega dams and providing piped water for irrigation to reduce the farmers' dependency on river Dawa. This will consequently increase food yield per acre and therefore attain household food security and stability in Mandera County.

5.4 Suggestions for Further Research

As noted in this research, there is a gap in youth uptake of agro-pastoralism in Mandera County. Other researchers can investigate the underlying reasons for youths to undertaking agro-pastoralism as a source of livelihood. Other researchers can also investigate techniques and process that can be introduced or improved to make agro-pastoralism more attractive to the younger generation so as to ensure its stability and sustainability in the Mandera County and Kenya at large.

Another area identified by this study was the impact of insecurity on household security in Mandera County. This research noted that high insecurity level and tribal tensions especially along the Mandera, Ethiopia and Somalia board affect the stability of both crop farming and animal breeds. Other researchers can investigate the impact of insecurity on household food security in Mandera County and recommend security measures that can be undertaken by the national and county governments to improve the security of the county

in relation to securing household food security and sustainability.

REFERENCES

Dwyer, M.J., & Istomin, K.V. (2008). *Theories of Nomadic Movement: A New Theoretical Approach for Understanding the Movement Decisions of Nenet and Komi Reinderr Herders*. *Human Ecology* 36(521). Access, <https://doi.org/10.1007/s10745-008-9169-2>

Food and Agricultural Organisation. (n.d). retrieved from http://www.fao.org/fileadmin/user_upload/drought/docs/BLBL_3Kenya.pdf

Food and Agricultural Organisation. (n.d). *Food security: Concepts and Measurement (Corporate Document Repository). Economic and Social Development Department*. Retrieved from, <http://www.fao.org/docrep/005/y4671e/y4671e06.htm>

Food and Agriculture Organisation. (2009). *Livestock, Food Security and Poverty Reduction. The Sate of Food and Agriculture*. Retrieved on 1 Feb, 2018 from, www.fao.org/decrep/012/i0680e03.pdf

Rufino, M.C., Thornton, P.K., Ng'ang'a, S.K., Mutie, I., Jones, P.G, Van Wijk, M.T. & Harroro, M. (2013). *Transitions in Agro-Pastoralist Systems of East Africa: Impacts on Food Security and Poverty*. *Agriculture, Ecosystems & Environment* (179), 215-230. Retrieved from, <https://www.sciencedirect.com/science/article/pii/S016788091300279X>

IICA's Definition of Food Security. Retrieved from, <http://legacy.iica.int/esp/programas/seguri>

[dadalimentaria/Documents/SeguridadAlimentarias_Quees_Eng.pdf](http://www.mandera.go.ke/dadalimentaria/Documents/SeguridadAlimentarias_Quees_Eng.pdf)

Kenya National Bureau of Statistic. (2013). *Exploring Kenya's Inequalities, Pulling Apart or Pooling Together: Mandera County*. Retrieved from, <https://www.knbs.or.ke/download/mandera-county/>

Kenya Agriculture Research Institute. (n.d). *Food Security Report: Policy Response to Food Crisis in Kenya*. Retrieved from, <http://www.foodsecurityportal.org/kenya/food-security-report-prepared-kenya-agricultural-research-institute>

Kiome, r. (2009). *Food Security in Kenya. The Ministry of Agriculture*. Retrieved from, https://reliefweb.int/sites/reliefweb.int/files/resources/3C5886BE345E8FF149257644000899D2-Full_Report.pdf

Kombo, D. & Tromp, L. (2009). *Proposal and Thesis Writing; an Introduction*. Pauline Publications Africa, Nairobi.

Mandera County Government. Retrieved from, <http://www.mandera.go.ke/>

Lal, R., Singh, B.R., Mwaseba, D.L., Kraybill, D., Hansen, D.O., Eik, L.O. (Ed) (2015). *Sustainable Intensification to Advance Food Security and Enhance Climate Resilience in Africa*. Switzerland. Springer

Mude, A., Ouma, R., Van de Steeg, J., Kariuki, J., Opiyo, D. & Tipilda, A. (2007). *Kenya Adaptation to Climate Change in the Arid Lands: Anticipating Adaptation to and Coping with Climate Risks in Kenya – Operational Recommendations for KACCAL*. ILRI Research Report 18, Nairobi, Kenya. International Livestock Research Institute.

Mukherjee, A. (200). *Hunger: Theory, perspectives and Reality; Analysis through Participatory*

- Methods. England. Ashgate Publishing Limited.*
- Negatu, W., & Musahara, H. (Eds). (2016). *Innovations in Achieving Sustainable Food Security in Eastern and Southern Africa. Ethiopia. Organisation for Social Sciences Research in Eastern and Southern Africa.*
- Reliefweb. (31 Aug, 2016). *Mandera County: 2016 Long Rains Food Security Assessment Report.* Retrieved from, <https://reliefweb.int/report/kenya/mandera-county-2016-long-rains-food-security-assessment-report-august-2016>
- Riginos, C., Porensky, L.M., Veblen, K.E. et al., (2012). *Lessons on the relationship between livestock husbandry and biodiversity from the Kenya Long-term Enclosure Experiment (KLEE). Pastoralism: Research, Policy and Practice.* Retrieved from, doi.org/10.1186/2041-7136-2-10
- Sasson, A. (2012). *Food Security for Africa: An Urgent Global Challenge. Agriculture & Food Security 1 (2).* Retrieved from, doi.org/10.1186/2048-7010-1-2
- Trading Economy (2017). *Kenya GDP from Agriculture year 2009-2018.* Retrieved from <https://tradingeconomics.com/kenya/gdp-from-agriculture>
- United Nations. (n.d). *Sustainable Development Goals: 17 Goals to transform our world.* Retrieved from, <http://www.un.org/sustainabledevelopment/hunger/>
- UNICEF (18 Aug, 2017) . *UNICEF Kenya Humanitarian Situation Report.* Retrieved from, <https://reliefweb.int/sites/reliefweb.int/files/resources/UNICEF%20Kenya%20Humanitarian%20Situation%20Report%20-%202018%20August%202017.pdf>
- USAID (21 Dec, 2017). *Food Assistance Fact Sheet-Kenya.* Retrieved from, https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=9&cad=rja&uact=8&ved=0ahUKEwiM2t6v9OPYAhUBEBQKHQ4DAiIQFghZMAg&url=https%3A%2F%2Fwww.usaid.gov%2Fkenya%2Ffood-assistance&usg=AOvVaw30MiBsduAMpUZnrll_cT_w
- Wairore, J.N., Mureithi, S.M., Wasonga, O.V, & Nyberg, G. (2015). *Characterization of Enclosure Management Regimes and Factors Influencing their Choice among Agro-pastoralist in North-Western Kenya.* *Pastoralism 5 (14).* Retrieved from, <https://doi.org/10.1186/s13570-015-0036-7>
- Webb, P. (2012). *Impacts Pathways from Agricultural Research to Improved Nutrition and Health: Literature Analysis and Research Priorities: ICN2 Second International Conference on Nutrition better nutrition better lives.* Retrieved from, <http://www.fao.org/3/a-as573e.pdf>
- World Food Programme. (n.d). retrieved from, <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=8&cad=rja&uact=8&ved=0ahUKEwiM2t6v9OPYAhUBEBQKHQ4DAiIQFghTMAc&url=http%3A%2F%2Fwww1.wfp.org%2Fcountries%2Fkenya&usg=AOvVaw0eMFBCIUQbONTK525gMoA8>
- World Food Programme. (n.d). *What is food security?* Retrieved from, <https://www.wfp.org/node/359289>