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AGRICULTURE

RAMIFICATIONS OF CLIMATE CHANGE ON PASTORALISM IN KAJIADO SOUTH SUB-COUNTY

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ABSTRACT

Purpose of the Study: The main aim of this study was to investigate the ramifications of climate change on pastoralism in Kajiado South sub-county. Specifically this study investigated the influence of adaptation strategies used by local pastoral communities and climate change impact on increase on pastoralists' socio-economic vulnerabilities in Kajiado South Sub County.

Statement of the Problem: Different climate issues such as prolonged droughts have resulted to reduced precipitation which has equally led to the adaptation strategies to mitigate the impact of drought.

Research Methodology: The study adopted a descriptive survey research design. Research target population was; Staff at Agriculture, Livestock and Fisheries Department, County Assembly of Kajiado Staff and Managers working for Civil Society Organizations **(**CSOs). The sample size was of 23 Staff at Agriculture, Livestock and Fisheries Department, 42 County Assembly of Kajiado Staff and 40 Managers working for CSOs that were singled out to participate in the study. Stratified and simple random sampling techniques were applied to single out sampled subjects. Questionnaires were employed in the gathering of data from all the study's sampled subjects in the study area. Data was analyzed qualitatively and quantitatively making use of SPSS version 20.0.

Results: Based on study findings demonstrated that local pastoral communities had engaged in community financial rotating cooperatives as an adaptation strategy to address impact of climate change to their pastoral activities in Kajiado South Sub County shown by 53.4% (Mean=3.99). In addition, the study findings revealed that a substantive number of the sampled subjects as illustrated by 55.8% (Mean=3.95) disagreed that climate change impact does not increase pastoral socio-economic vulnerabilities in the form of number of pastoralists that have access to food and this does not have an impact on pastoralism in Kajiado South Sub County.

Conclusion: The study concluded that failure to engage in subsistence farming of vegetables and cereals as an adaptation strategy targeting the impact of variability in climate resulted to its continued adverse impact on pastoralism in the study area.

Recommendation: From the research findings the study recommended that county governments and CSOs should partner in improving community financial rotating cooperatives such as table banking to encourage the adaptation efforts to climate variability of pastoral communities.

Keywords: *Ramifications, Climate Change, Pastoralism, Adaptations, Strategies, Vulnerabilities*

1.1 BACKGROUND TO THE STUDY

Variability in climate has had a significant impact on the livelihoods of pastoral communities both in developed and developing countries but the later has borne the biggest brunt (Martin, Muller, Linstadter & Frank, 2014). While in developed countries adaptation strategies have successfully been implemented, in developing countries in South America, Asia and Africa pastoralists still struggle with climate change that continues to intensify their vulnerabilities (Herrero *et al* ., 2008). Additionally, studies reveal that pastoralists in Sub-Saharan Africa are hardest hit by variabilities in climate (Ericksen, *et al.*, 2013).

Scholars in South America have reported on different impact levels brought about by climate change on pastoralism. In Peru, López-i-Gelats *et al.*, (2015) reported on dissimilar negative impacts on access to forage and water resulting from variability in climate that had presented an adverse impact on pastoralism. Climate change has presented dissimilar challenges among pastoralist communities in Europe (Liechti & Biber, 2016). In Spain, Fernández-Giménez and Fillat (2012) reported that the successful implementation of adaptation strategies had effectively

aided in shielding Pyrenean pastoralists against the negative impact of climate change. In Italy, Dai et al., (2017) reported that variability of climate resulted to a significant negative impact access to forage and subsequently on pastoralism.

Additionally, it has been reported that climate change has presented an adverse impact on pastoralism subsequently intensifying pastoralists' socio-economic vulnerabilities in Sweden (Furberg, Evengård & Nilsson, 2011). In Turkey, Koluman-Darcan and Daşkıran (2016) however established successful implementation of adaptation strategies such as fodder reservoirs did limit the negative impact of climate change on pastoralism. In China, Haynes & Yang (2013) similarly established the successful implementation of adaptation strategies effectively reduced the negative impact of climate change among Tibetan yak pastoral communities. In Mongolia, Batsuuri and Wang (2017) reported that climate change had presented a significant adverse impact on pastoralists' access to forage and water subsequently intensifying their socio-economic vulnerabilities.

Different scholars in Africa have reported on the dissimilar impact of climate change on pastoralism in major rural areas of several countries. In Mali, Oyekale (2014) similarly reported climate change had adversely impacted on pastoralists' access to water and forage greatly impacting on pastoralism. Sanou *et al* (2018) reported that the adverse impact caused by climate change on access to water and forage had forced local pastoralists' communities to employ adaptation strategies such as the transformation from mobile breeding to sedentary breeding to improve pastoralism in Burkina Faso. In Nigeria, Bidoli *et al.*, (2012) reported that variability in climate had presented a significant adverse impact on access to both forage and water in major rangelands of the country.

In Kenya, Lelenguyah (2013) reported on variability of climate on the livelihoods of pastoralists in Baringo County and extended the scope of his study to the pastoralists' perception of climate change. Kajiado South Sub- County has a cool dry climate with mean annual temperatures over most of the Sub-county being around 21°C; although the northwestern corner near has higher mean annual temperatures of 23°C to 25°C. Annual average rainfall ranges from as low as 300mm, although most of the county receives an average of between 500mm and 750mm annually. It is therefore a drought prone county and this is the main hazard to agriculture as it causes crop loses, livestock emaciation and their eventual death.

1.2 STATEMENT OF THE PROBLEM

Despite its substantive contribution to food security goals in Kenya, pastoralism still faces a myriad of unaddressed challenges. Key among these challenges is variability in climate that makes it extremely difficult for pastoralists to access key resources such as water and forage that are vital for the survival of their livestock. Pastoralists in Kajiado County are not exempted from these challenges. According to a report by the Center for Minority Rights Development (CEMIRIDE), the 2017 drought led to the death of 232,400 cows in Kajiado County with an estimated 23.5% of this owned by pastoralists in Kajiado South. Further, according to a report by the Kenya Agricultural and Livestock Research Organization (KALRO), over 47% of pastoralists' livestock died in Kajiado County due to emaciation caused by the 2016/2017 drought (KALRO, 2017).

Similarly, the National Drought Management Authority (NDMA) observed within the same period an estimated 70% to 80% of livestock had been moved by pastoralists to Chyulu Hills National Park in search of water and forage emanating from shortages experienced in Kajiado South sub-county as a result of drought (National Drought Early Warning Bulletin, 2017). Specifically, according to 2017 reports by the NDMA Kajiado South sub-county was due to fluctuating precipitation during the long rains of the same year under severe vegetation. It is such failure of pasture regeneration mainly caused by climate change that necessitated pastoralists in Kajiado South sub-county to move with their livestock to longer distances which could possibly intensify their socio-economic vulnerabilities. Additionally, this affected the bodies of their cattle as they are forced to move without taking water which could have had an adverse impact on market access for their cattle thereby affecting their livelihood.

The current research therefore sought to investigate the ramifications of climate change on pastoralism in Kajiado South sub-county. The focus of the research was however to investigate impact of climate variability on; local pastoral communities adaptation strategies and pastoralists socio-economic vulnerabilities.

1.3 OBJECTIVES OF THE STUDY

i. To assess local pastoral communities adaptation strategies that address impact of climate change on pastoralism in Kajiado South Sub County;
ii. To establish the impact of climate change on pastoralists socio-economic vulnerabilities in Kajiado South Sub County.

1.4 RESEARCH QUESTIONS

i. How does adaptation strategies used by local pastoral communities address impact of climate change on pastoralism in Kajiado South Sub County?
ii. What is the impact of climate change on pastoralists' socio-economic vulnerabilities in Kajiado South Sub County?

2.1 Theoretical Literature Review

The Bohle's Model of Vulnerabilities Analysis

Formulated by Bohle (2001) the model of vulnerabilities analysis is defined as an exhaustive or all-inclusive evaluation of human wellbeing that incorporates social, environmental, economic as well as political susceptibility to a series of detrimental problems. Further, he argued vulnerabilities are formed by an intricate and interactive system of internal as well as external contributing elements. The external component is linked to susceptibilities to variations and pressures, while the internal facet constitutes the inaptitude of persons or communities to deal with burdens (Bohle, 2001). Additionally, Bohle (2007) asserts vulnerabilities are categorized as; a consequence of physical specific hazardous severe occurrences such as likelihood, intensity as well as prevalence. This predominantly underscores the disposition of hazard situations as well as the susceptibility of human networks to hazards.

The second vulnerability is social vulnerability which deems susceptibility as the congenital attribute of a network that is mostly formed by the economic, social as well as the cultural fabric of a society. It mainly encompasses; access to credit and insurance, right to food, marginalization, privation and inequality (Bohle 2007). Similarly, Füssel and Klein (2006) proponents of this model argued that there was need for any human network to take up adaptation strategies to climate change but these was highly dependent on its adaptive capacity. The degree of vulnerability of any human system's internal socio economic elements to susceptibilities of climate change is reliant on its adaptive capabilities to external stresses (Bohle, Downing & Watts, 1994; Bobadoye, 2016).

In using this model for the study, the researcher therefore attempted to examine whether there is a relationship between climate change and its impact on pastoralists' access to forage and water, also to determine whether there is a linkage between impact of climate change to pastoralists' socio-economic vulnerabilities and to determine whether local pastoral communities are taking up

dissimilar adaptation strategies to address this impact. The model is therefore pertinent to all the research questions.

2.2 Empirical Literature Review

2.2.1 Climate Change and Local Pastoral Communities Adaptation Strategies

In a study, Fyu *et al.,* (2012) had established despite the significant negative impact of climate change on pastoralism, local pastoral communities had undertaken insubstantial steps in embracing adaptation strategies to address this in Tibetan Plateau of China. Specifically, they assert these groups of pastoral communities failed to implement recommendations by the Intergovernmental Panel on Climate Change (IPCC) on adaptation strategies and local government facilitation of the same, local pastoral communities had opted for traditional coping mechanisms such as; varying of migration durations to longer periods and also varied their approaches to pasture utilization (Fyu et al., 2012).

Similarly, Maiti *et al.,* (2014) found evidence indicating in spite of the adverse impact of climate change on pastoralism, local pastoral communities were still heavily reliant on weak traditional adaptation strategies to counter its impact in India. Additionally, they assert that relying on these indigenous adaptation mechanisms such as; extension of migration durations and variations in approaches of pasture utilization had resulted to the continual exposure of these groups of pastoralists to the same negative impacts of climate change (Maiti *et al.,* 2014). However, Yi, Ismail and Zhaoli (2012) found evidence indicating local pastoral communities had embraced effective adaptation strategies that addressed the negative impact of climate change on pastoralism in Pakistan. Specifically, they note these groups of pastoralists had embraced adaptation strategies such as; the introduction of hardy cattle and goats and subsistence vegetables farming (Yi, *et al.,* 2012).

In a study, Zampaligre, Dossa and Schlecht (2013) found evidence that as a result of the adverse impact of climate change on pastoralism. Pastoral communities had embraced adaptation strategies to address this in Burkina Faso. In particular, they observed local pastoral communities had embraced adaptation strategies such as; cereal cropping, introduction of hardy goats, hardy cattle breeds and some had even opted for permanent migration (Zampaligre, *et al.,* 2013). Similarly, in his study Olaniyan (2017) had observed that the significant adverse impact of climate change on pastoralism had informed local pastoral communities to embrace adaptation strategies to counter

it in Gambia. Further, he asserted that to reduce the negative impact of climate change, local pastoral communities had opted for adaptation strategies such as; subsistence vegetable farming, water harvesting techniques and herd size composition management (Olaniyan, 2017). However, Azibo and Kimengsi (2015) established despite the significant negative impact of climate on pastoralism, local pastoral communities were slow in implementation of proposed government and Civil Society Organizations (CSOs) adaptation strategies in Cameroon. These groups of pastoral communities were still heavily dependent on indigenous adaptation strategies that were not working in countering this impact (Azibo & Kimengsi, 2015).

Further, Anim (2012) found evidence indicating climate change had presented a significant negative impact on pastoralism leading to local pastoral communities embracing adaptation strategies to address this in South Africa. Specifically, they observed local pastoral communities especially small-holder cattle and sheep farmers had resulted to; stock size management, subsistence farming of vegetables and cereals and rain water harvesting as adaptation strategies to respond to this adverse impact (Anim, 2012). Additionally, Kgosikoma, Lekota and Kgosikoma (2018) established local pastoral communities had embraced adaptation strategies to respond to the adverse impact of climate change on pastoralism in Botswana.

In particular, they assert these groups of pastoralists had embraced adaptation mechanisms such as; subsistence farming of vegetables and cereals, taking their children to schools as a long-term measure and diversification of their cattle herds composition leading to the effective countering of the negative impact of climate change (Kgosikoma, *et al.*, 2018). However, in a study Matsa and Matsa (2013) observed despite the significant negative impact presented by climate change on pastoralism, local pastoral communities mostly women pastoralists were yet to embrace reliable adaptation strategies in Zimbabwe. They also noted that these groups of women pastoralists were still heavily reliant on weak traditional adaptation strategies such as; the driving of cattle herds and goats to salty anthills and they also fed their livestock on fruit trees which did not effectively counter the negative impact of climate change (Matsa & Matsa, 2013).

In a study, Berhanu and Beyene (2014) observed that with view of responding to the negative impact of climate change on pastoralism, local pastoral communities in Ethiopia had embraced effective adaptation strategies. Further, they note these included; subsistence farming of vegetables introduced by agricultural based Non-governmental Organizations (NGOs) and diversification of

their cattle herds' portfolio which enabled them to counter emerging negative impacts (Berhanu & Beyene, 2014). However, Mushi and Makauki (2017) found evidence indicating gender inequality contributed a negative effect to local pastoral communities' capacity to fully effective embrace adaptation strategies that counter adverse impact of climate change on pastoralism in Tanzania. Additionally, they note while men were able to manage their livestock stock sizes women on the other had were allowed to keep very few animals resulting to complete loses when drought struck (Mushi & Makauki, 2017). Salamula, *et al.,* (2017) found evidence that local pastoral communities had successfully embraced adaptation strategies to counter the negative impact of climate change on pastoralism in Uganda. Specifically, they note these groups of pastoral communities had diversified their herd portfolio to hardy animals predominantly camels (Salamula, *et al.*, 2017).

2.2.2 Climate Change and Pastoralists Socio-Economic Vulnerabilities

Næss (2012) found evidence indicating that climate change had significantly contributed a negative impact that had intensified pastoralists' socio-economic vulnerabilities in the Tibetan Plateaus of China. Further, he observed that variability in climate characterized by unreliable precipitation adversely affected pasture availability which in turn influenced the number of herds stocks and subsequently intensified pastoralists' socio-economic vulnerabilities (Næss, 2012). Similarly, Namgay, Millar, Black and Samdup, (2014) established climate change had presented a negative impact on pastoralism significantly intensifying pastoralists socio-economic vulnerabilities in Bhutan. In particular, they assert fluctuations in precipitation and prolonged droughts had significantly reduced pasture and water quantities subsequently affecting number of herds and pastoralists access to food (Namgay, *et al.*, 2014).

Additionally, Younas, Ishaq and Ali (2014) observed climate change had presented a significant negative impact that intensified pastoralists' socio-economic vulnerabilities in Pakistan. They note that variability in climate which predominantly affected pasture and water availability subsequently negatively influenced numbers of pastoralists' herds and their capacity to access food (Younas, *et al.*, 2014).

In a study, Ayanda (2013) established climate change led to a significant negative impact that had intensified pastoralists' socio-economic vulnerabilities in Nigeria. Specifically, he observed reduced rainfall amounts that had adversely affected pasture and water availability resulted to a decrease in the numbers of herds and also negatively influenced accessibility to food for local

pastoral communities (Ayanda, 2013). Similarly, Kima (2014) found evidence indicating climate change significantly presented diverse negative impact which escalated pastoralists' socio-economic vulnerabilities in Burkina Faso. In particular, they contend that fluctuations in precipitation followed by prolonged droughts adversely affected access to forage and water which resulted to decreased pastoralists herds negatively impacting on pastoralism (Kima, 2014). Further, in a study Adriansen (2016) established climate change had presented diverse negative impacts significantly intensifying pastoralists' socio-economic vulnerabilities in Senegal. Specifically, they assert variability in climate characterized by fluctuations in rainfall amounts resulting to drought adversely impacted on number of pastoralists' herds and their access to food which had a significant impact on pastoralism (Adriansen, 2016).

Angula, *et al.,* (2016) found evidence on the negative impact of climate change on pastoralism in South Africa and Namibia in terms of escalated pastoralists' socio-economic vulnerabilities in both countries. Additionally, they assert fluctuations in rainfall coupled with prolonged droughts adversely affected forage quantities which in turn presented a significant negative impact on numbers of pastoralists' herds resulting to reduced incomes realized from pastoral activities (Angula, *et al.,* 2016). In a study, Sallu, Twyman and Stringer (2010) found evidence that demonstrated climate change had presented an adverse impact on pastoralism and in the process intensifying their socio-economic vulnerabilities in Botswana.

They in addition contend that reduced rainfall amounts combined with droughts led to decreased numbers of herds consequently reducing pastoralists' incomes in the rural parts of the country (Sallu, *et al.,* 2010). Further, Moyo and Dube (2014) established climate change had resulted to a significant negative impact which intensified pastoralists' socio-economic vulnerabilities in Zimbabwe. Specifically, they assert this was characterized by fluctuations in rainfall amounts which resulted to reduced forage quantities and water volumes consequently decreasing number of herds and income among nomadic herders (Moyo & Dube, 2014).

In a study, Maalla, Abakar, Hamdi and Maruod (2015) observed climate change had resulted to an adverse impact that intensified pastoralists' socio-economic vulnerabilities in the Sudan. Specifically, they assert that variability in climate characterized by prolonged droughts had negatively impacted on pastoralists' ability to access food and also led to a decrease in the numbers of their herds (Maalla, *et al.,* 2015). Further, Zelalem, Aynalem and Emmanuelle (2010) found

evidence demonstrating climate change presented negative impacts that consequently intensified socio-economic vulnerabilities among pastoral communities in Ethiopia. In particular, they contend climate change resulted to decreased forage and water which in turn affected the number of herds; pastoralists' access to food and they ability to take their children to schools (Zelalem, *et al.,* 2010). Additionally, Maleko, Mtengeti and Sangeda (2013) established climate change had presented negative impacts which exacerbated pastoralists' socio-economic vulnerabilities in Tanzania. They specifically note that variability in climate resulted to decreased numbers in pastoralists' herds, limited pastoralists' access to food and adversely affected their capacity to educate their children (Maleko, *et al.,* 2013).

2.3 CONCEPTUAL FRAMEWORK

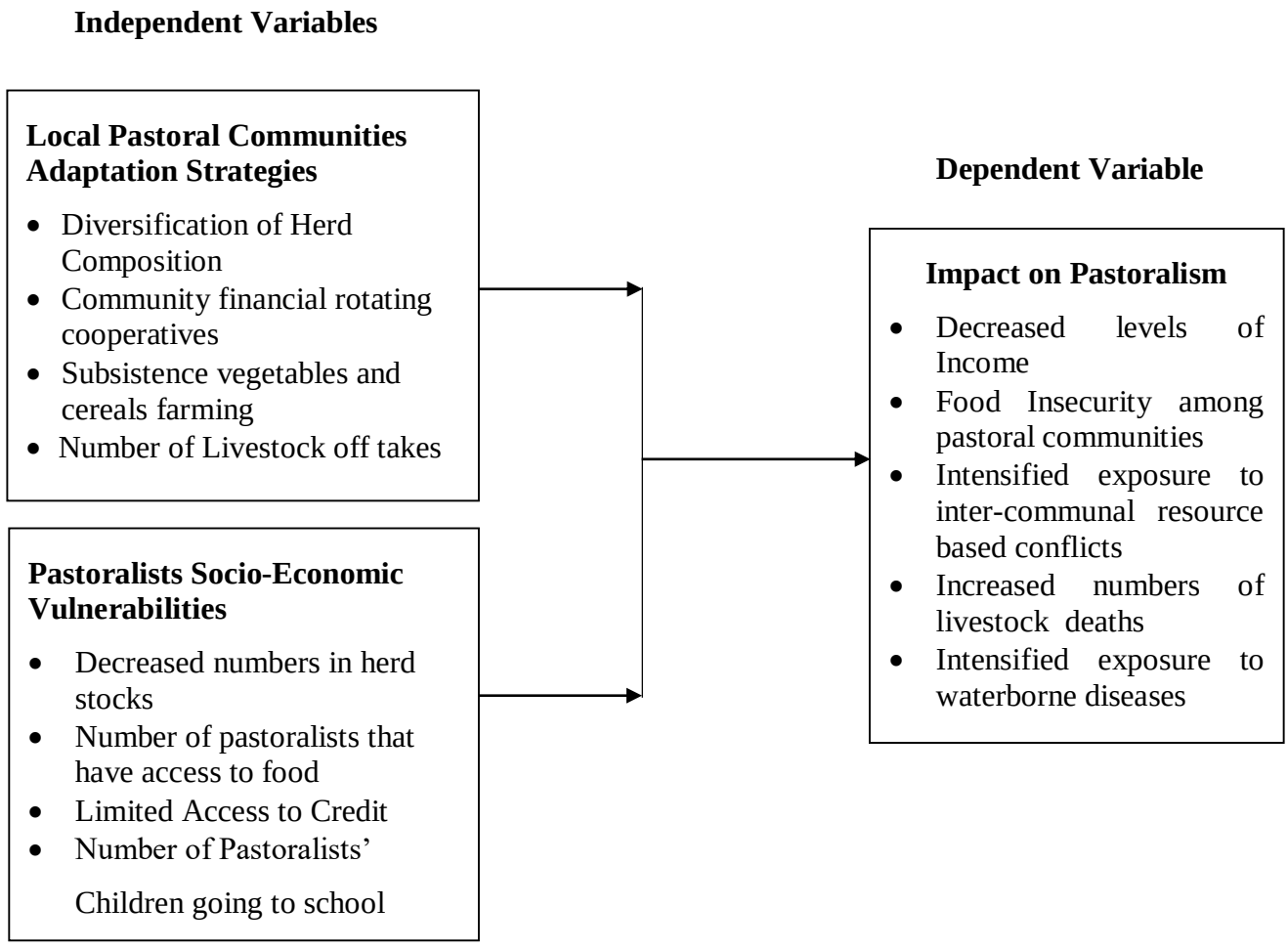

Figure 1.0: Conceptual Framework

3.0 RESEARCH METHODOLOGY

This research employed a descriptive survey research design to carry out an investigation into the impact of climate change on pastoralism in Kajiado South Sub County. Descriptive survey design was the optimal design for this study in that it facilitated the gathering of both qualitative and quantitative data establishing the link between study variables and study problem (Christensen, Johnson & Turner 2011). The target population of the study was 207 respondents and included; Staff at Agriculture, Livestock and Fisheries Department, County Assembly of Kajiado Staff and Managers working for Civil Society Organizations **(**CSOs) in the location in which research was carried out. The sample size for this study was 105 respondents. Primary data was gathered by employing the administration of questionnaires. Data obtained from open ended questions was analyzed by applying content analysis with entailed both the elucidating and presenting of data in themes guided by their respective objectives under investigation (Bernard & Ryan,2010).

4.0 RESEARCH FINDINGS AND DISCUSSIONS

Descriptive Statistics

Table 1.0: Responses to Pastoral Communities Adaptation Strategies to Climate Change

	Frequency	**Percentage**
No	51	61.4
Yes	32	38.6
Total	**83**	**100**

Hinged on the results in Table 1.0, 61.4% of the study's sampled subjects disagreed that local pastoral community had embraced adaptation strategies to address the impact of climate change indicating no while 38.6% agreed indicating yes. From this investigation's results, it was deduced that a substantive number of those working in the county government's department of agriculture, livestock and fisheries and those working in Civil Society Organizations (CSOs) as managers had knowledge of the minimal number of pastoralists that had seen the need to settle for adaptation strategies in addressing impact of climate change to their way of life.

Table 2.0: Climate Change and Local Pastoral Communities Adaptation Strategies

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std Deviation
Local pastoral communities have engaged in diversification of herd composition as an adaptation strategy to address impact of climate change to their pastoral activities.	48.7%	16.2%	1.6%	26.2%	7.3%	3.70	1.23
Local pastoral communities have not engaged in community financial rotating cooperatives as an adaptation strategy to address impact of climate change to their pastoral activities.	53.4%	21.0%	7.5%	10.1%	8.0%	3.99	1.31
Local pastoral communities have engaged in subsistence vegetables and cereals farming as an adaptation strategy to address impact of climate change to their pastoral activities.	4.2%	19.4%	4.8%	22.6%	49.3%	3.87	1.29
Local pastoral communities have not been engaged in several livestock off takes as an adaptation strategy to address impact of climate change to their pastoral activities.	25.0%	44.3%	2.7%	17.0%	11.0%	2.48	1.31
Average mean						**3.27**	**1.28**

Results obtained on climate change and local pastoral communities adaptation strategies, illustrated that a substantive number of the investigation's sampled subjects as shown by 53.4% (Mean=3.99), felt that local pastoral communities had engaged in community financial rotating cooperatives as an adaptation strategy to address impact of climate change to their pastoral activities. From this finding, it was deduced that most employees of the county government's department of agriculture, livestock and fisheries and civil society organizations (CSOs) managers had been engaged in developing interventions aimed at providing adaptation strategies for pastoral communities to respond to the adverse impact of climate change.

Results are contrary to those of the investigation by Maiti *et al.,* (2014) who found evidence that pastoralists had not been engaged in any adaptation strategies but heavily reliant on traditional adaptation strategies such as; extension of migration durations and variations in approaches of pasture utilization which had a continual exposure to the adverse impact of climate change. 49.3% (Mean= 3.87) of study respondents strongly agreed that local pastoral communities have engaged in subsistence vegetables and cereals farming as an adaptation strategy to address impact of climate change to their pastoral activities. From this finding, it was deduced that a predominant number of county government's department of agriculture, livestock and fisheries staff and CSOs' managers were working or had worked in interventions on subsistence vegetables and cereals farming whose goal is to empower pastoralists to successfully adapt to the adverse impact of climate change.

Finding comparable to those of the study by Yi, Ismail and Zhaoli (2012) who assert pastoralists had embraced adaptation strategies including subsistence vegetables farming in Pakistan. 48.7% (Mean= 3.70) were of the view that local pastoral communities had not engaged in diversification of herd composition as an adaptation strategy to address impact of climate change to their pastoral activities. This could be because most county government's department of agriculture, livestock and fisheries staff, those of the county assembly and CSOs' managers had not witnessed pastoralist buying cattle and goats that were more handy to be included in their herds.

Results are contrary to the investigation by Olaniyan (2017) who found pastoralists had engaged in the diversification of herd composition introducing hardy breeds as an adaptation strategy. 44.3% (Mean=2.48) were of the perspective that local pastoral communities have not been engaged in several livestock off takes as an adaptation strategy to address impact of climate change to their pastoral activities. From this study finding, it was deduced that a notable number of research sampled subjects placed great value on the need for the county government and CSOs need to develop interventions on livestock off-takes for pastoral communities in their area. Research results are contrary to those by Fyu *et al.,* (2012) who found though local governments had come up livestock off-takes programmes very few pastoralists were involved in it among Tibetan pastoralists.

Table 3.0: Responses to Climate Change and Pastoralists' Socio-Economic Vulnerabilities

	Frequency	**Percentage**
No	28	33.7
Yes	55	66.3
Total	**83**	**100**

Hinged on the results in Table 3.0, 66.3% of the study's respondents indicated that the impact of climate change had increased on pastoralists' socio-economic vulnerabilities while 33.7% disagreed indicating it did not. From this result, it was deduced that a substantial number of sampled subjects attributed increased socio-economic vulnerabilities among pastoralists to the impact of climate change.

Table 4.0: Climate Change and Pastoralists' Socio-Economic Vulnerabilities

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std Deviation
Climate change impact has increased pastoral socio-economic vulnerabilities in the form of decreased numbers in herd stocks which impacts on pastoralism.	7.4%	9.3%	0%	35.7%	47.6%	3.69	1.40
Climate change impact does not increase pastoral socio-economic vulnerabilities in the form of number of pastoralists that have access to food and this does not have an impact on pastoralism.	20.6%	55.8%	1.7%	13.5%	8.4%	3.95	1.26
Climate change impact has increased pastoral socio-economic vulnerabilities in the form of limited access to credit which impacts on pastoralism.	8.1%	10.0%	7.5%	44.8%	29.4%	3.74	1.35
Climate change impact does not increase pastoral socio-economic vulnerabilities in the form of number of pastoralists' children going to school and this does not have an impact on pastoralism.	41.1%	18.4%	2.3%	30.2%	8.0%	2.38	1.27
Average mean						**3.44**	**1.32**

Results obtained on climate change and increase in pastoral communities socio-economic vulnerabilities, illustrated that a substantive number of the investigation's sampled subjects as shown by 55.8% (Mean=3.95), disagreed that climate change impact does not increase pastoral socio-economic vulnerabilities in the form of number of pastoralists that have access to food and this does not have an impact on pastoralism. From this finding, it was deduced that most employees of the county government's department of agriculture, livestock and fisheries, staff at county

assembly and civil society organizations (CSOs) managers appreciated the impact of climate change on pastoral communities' food security.

Results are comparable to those of the investigation by Namgay, Millar, Black and Samdup (2014) who found evidence that the adverse impact of climate change had affected pastoralists' access to food in Bhutan. 47.6% (Mean=3.69) of study respondents strongly agreed that climate change impact has increased pastoral socio-economic vulnerabilities in the form of decreased numbers in herd stocks which impacts on pastoralism. From this finding, it was deduced that a predominant number of county government's department of agriculture, livestock and fisheries staff and CSOs' managers acknowledged that adverse effects of climate change in the form of prolonged droughts had resulted to the death of pastoralists' cattle, camels and goats. Finding comparable to those of the study by Kima (2014) who asserts prolonged droughts as a result of climate change had significantly reduced the number of pastoralists' herds in Burkina Faso. 44.8% (Mean= 3.74) were of the view that Climate change impact has increased pastoral socio-economic vulnerabilities in the form of limited access to credit which impacts on pastoralism. This could be because most CSOs' managers had witnessed a significant drop in the number of pastoralist buying cattle and goats using financial credit and also applying for it to meet their essential needs.

Results are comparable to the investigation by Sallu, Twyman and Stringer (2010) who found the adverse impact of climate change had reduced pastoralists' incomes which equally limited their access to financial credit. 41.1% (Mean=2.38) strongly disagreed with the perspective that climate change impact does not increase pastoral socio-economic vulnerabilities in the form of number of pastoralists' children going to school and this does not have an impact on pastoralism. From this study finding, it was deduced that a notable number of research sampled subjects placed great value on the capability of pastoral communities to make education more accessible for their children by paying school fees and also providing them with the necessary supplies. Research results are comparable to those by Maleko, Mtengeti and Sangeda (2013) who found the adverse impact of climate change had negatively affected the capacity of pastoralists to educate their children.

Table 5.0: Measures of Climate Change Impact on Pastoralism

Statement	Very Low Extent	Low Extent	Moderate	Great Extent	Very Great Extent	Mean	Std Deviation
Decreased levels of income among pastoralists.	4.6%	9.8%	6.8%	50.3%	28.5%	3.91	1.04
Food insecurity among pastoral communities.	5.8%	12.2%	9.2%	42.3%	30.5%	2.6	0.97
Intensified exposure to inter-communal resource based conflicts.	10.4%	4.7%	9.0%	51.6%	24.3%	3.9	1.05
Increased numbers of livestock deaths	6.2%	8.0%	11.3%	48.5%	26.0%	2.27	1.18
Intensified exposure to waterborne diseases.	13.5%	15.0%	3.4%	23.6%	44.5%	4.11	1.34

The study sought to establish the depth to which the indicators stated are measures of the impact of climate change on pastoralism in Kajiado South Sub-County. Results of the study show, a substantive number of the investigation's sampled subjects as shown by 51.6% felt intensified exposure to inter-communal resource based conflict; decreased levels of income among pastoralist as shown by a 50.3% of sampled subjects, 48.5% of the sampled subjects felt that increased numbers of livestock deaths were significant measures of the impact of climate change on pastoralism. 44.5% of the study's sampled subjects were of the view that intensified exposure to waterborne diseases while 42.3% also food insecurity among pastoral communities were not significant measures of the impact of climate change on pastoralism in Kajiado South Sub County. These results means that a substantive number of sampled subjects placed greater significance on inter-communal resource based conflict and decreased levels of income among pastoralist as measures of the impact of climate change on pastoralism. Additionally, food insecurity according

to the study's sampled subjects was the most insignificant measure of the impact of climate change on pastoralism.

5.0 CONCLUSIONS

The study concludes that local pastoral community had not embraced adaptation strategies to address the impact of climate change. In particular, failure to engage in subsistence farming of vegetables and cereals as an adaptation strategy targeting the impact of variability in climate resulted to its continued adverse impact on pastoralism in the study area.

6.0 RECOMMENDATIONS

From the research findings, the study also recommends that county governments and CSOs should partner in improving community financial rotating cooperatives such as table banking to encourage the adaptation efforts to climate variability of pastoral communities. Additionally, based on the research findings, the study recommends that county governments should work in partnership with Faith Based Organizations (FBOs) and Non-governmental Organizations (NGOs) to empower pastoral communities in addressing issues related to food security caused by climate variability. These could include but not limited to; training in subsistence farming of vegetables and cereals and also rearing of hardy livestock.

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