The study investigated contribution and role of institutions and organisations in enhancing pastoralists’ resilience and innovative adaptation strategies to the impacts of climate change in Longido District. Data were collected using several methods. The methods were the household survey, Focus Group Discussion, interviews and field visits. The results indicate that the role of each institution and organisation in enhancing pastoralist’s resilience and adaptation strategies varied from one village to another and from one institution to another. The major roles were water reservoirs construction, restocking, provision of environmental education and employment provision to pastoralists’ communities and use of by-laws.

**Keywords:** Pastoralists, institutions, organisation, resilience, innovative adaptation strategies, and climate change rangelands, Longido District.

The objective of this paper was to investigate the roles of institutions and organizations in enhancing pastoralists’ resilience and Innovative adaptation strategies to the impacts of climate change in the semi-arid Longido District in Northern Tanzania.

**MATERIALS AND METHODS**

**The study area**

Longido District (7782 km²) which is administratively in Arusha region lies at an altitude of between 600 and 2,900 m asl is located between Latitude 2°20’ and 3°10’ South of the Equator and Longitude 36°00’ and 37°30’ East of Greenwich. It is bordered by Meru and Rombo Districts to the East, Ngorongoro to the West, Monduli and Arusha Districts to the South and Siha District to the South East. The District stretches

*Corresponding author: Laurent Joseph*
Department of Management Science, Faculty of Economics and Management Science Institute of Finance Management, Box 2372; Mwanza – Tanzania
from the western slopes of Mount Kilimanjaro in the East to Lake Natron in the West. Out of the total District land area 82.14% is grazing land, 13.6% is arable land and 4.7% is forest land (LDP, 2015). Four villages namely Sinya, Engikareti, Keseria and Mairowa were involved in the study (Fig. 1). The study area is predominantly occupied by the pastoral Maasai community. Both water and natural pasture are sometimes insufficient, especially during dry periods. The District is also rich in wildlife (LDP, 2015). The vegetation in the area can be described as mixed forest, bush lands, and grass lands (LDP, 2015). Agro-ecologically the district has two distinct agro-ecological zones—highlands and low lands.

The highland zone is characterized by a number of isolated mountains with an average altitude of 2000 m above sea level. It has mainly deep, freely drained loamy soils with natural fertility status. It is occupied by forests on top of hills. Major economic activities in this zone are livestock keeping and agro–pastoralist where livestock keeping is practiced on a moderately large scale (LDP, 2015). The low zone is characterized by flat and rolling plains with altitude ranging from 600m to 1,200m above sea level. It has mainly deep, freely drained loamy soils with natural fertility status. It is occupied by forest on top of hills. The major economic activities are extensive livestock keeping and tourism. Livestock keeping in this zone is practiced on a large scale and include cattle, goats, sheep, donkeys and camels (on a small scale) (LDP, 2015). The District is one of the driest areas in Tanzania, the temperature ranges from 20⁰C – 35⁰C. Rainfall ranges from less than 500mm in low lands to 900mm in high altitude. From year 2007 the District has been experiencing prolonged dry seasons.

**Data Collection Methods**

Data were gathered through a questionnaire survey, FGD, key informant interviews, and field visits. The questionnaires consisted both closed and open-ended questions. An open-ended question gives respondents room to give their own views without being influenced by researcher. On other hand, closed-ended questions gives options to respondents and are good in collecting quantitative data, hence can simplify data analysis. The aspects included in questionnaire were: role of institutions and organizations in enhancing pastoralists’ resilience and innovative strategies to impacts of climate change in Longido District. Before using the questionnaires they were pre-tested for testing the questionnaire wording, sequencing and lay out.

The key informant’s interview was conducted using interview guides. Eight Village Extension Officers (two extension officers from each village from the four selected villages - livestock and agriculture) and four District officers (two environmental officers and two District livestock officers) were involved hence made a total number of 12 key informants. Aspects covered during interviews were major roles of institutions and organisations in enhancing pastoralists’ resilience and adaptation strategies to impacts of climate change on pastoral communities. Focus Group Discussion involved two groups in each village, males and females. Each group comprised of 10 people, making a total of 80 group members. These two groups were involved in order to capture views as they are likely to perceive issues differently even for the same problem or issue (Creswell, 2012). During the discussion the authors were mainly facilitators and this had the advantage that participants were able to discuss issues at hand freely and without fear. The main subtopics discussed included roles of institutions and organisations in enhancing pastoralists’ resilience and adaptation strategies to impacts of climate on pastoral
RESULTS AND DISCUSSION

Identifies Institutions and Organization in Longido District

Field findings reveal that there is large number of institutions and organisations operating in the area for the purpose of assisting pastoralists to cope with climate change impacts. These institutions and/or organisations can be classified into two major groups, viz: government institutions, NGOs (local and international) and Faith Based Organisations (FBOs) (See Tables 1 and 2). What is also evident is that some of the institutions and organisations are village specific (operate within) while some are generic (are both inter and intra in coverage). For example, institutions like the Longido Community Development Organisation (LCDO), Community Research Development Services (CORDS), Ujamaa Community Resource Team (UCRT) and the United Nations Development Program (UNDP) are generic while some institutions like Maasai Women Development Organization (MWEDO), Imara, and the International Union for Conservation of Nature (IUCN) operate within a specific village.

Roles Played by Institutions and organisations in the Study Area

According to the role of Institutions and organization in enhancing pastoralists’ system in resilience and innovative strategies (See Tables 1) against impacts of climate

<table>
<thead>
<tr>
<th>Major Institutions</th>
<th>Institutions and Organizations’</th>
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<tbody>
<tr>
<td></td>
<td>CORDS</td>
</tr>
<tr>
<td>Mairowa</td>
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<td>Kiserian</td>
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<td>Engikaret</td>
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<td>Sinya</td>
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Source: Author, 2015

shortages of water for livestock in Longido District were water
fact that, the Longido District Council (LDC) in collaboration with the central government, has been compensating pastoralists who unfortunately lost their livestock as a result of natural calamities such as drought or disease outbreaks. For those who lost all of their livestock, the LDC provided them with four herds of cattle and five goats per household.

**Provisional of Environmental Education**

Overall, in the four villages combined, 57.7% (N=220) felt the integrative education offered by various institutions on how to resilience against impacts of climate change as the role. The role in each village varied with Sinya and Mairowa being seriously perceived by 65.4% and 61.8% respectively. The main reason for the respondents to depict this role is because institutions such as TEMBO, TRIAS, LCDO, UCDT, UNDP, ICUN, TNRF, LDC and CORDS have and continue to provide environmental education to pastoral communities in the study villages and in Longido District as a whole. The aspects taught include impacts of deforestation and environmental conservation. The significance of education in explaining the awareness of people on the importance of natural resources conservation and development is well documented.
The Tanzania Education and Micro-Business Opportunity (TEMBO), for example, have been providing education to the pastoralists in Longido district as a strategy of enhancing pastoralists’ resilience and adaptation to climate change impacts. TEMBO, after raising start-up funds for a micro business program they are now lending money to women in Longido for projects such as raising goats for milk and meat; raising chickens and selling eggs in the village and producing and marketing handcrafted beadwork.

In addition, the organization and institutions also raises funds for informal education efforts, known as “Learning in Longido” and have now managed to establish a community library in Longido and have plans to construct a District Learning Centre which will house the library and other informal education programs. Kajembe and Luoga (1996) argue that there is no development without education. An increase in education level increases the level of awareness and thereby creating positive attitudes, values and hence motivating people to manage natural resources sustainably. Mbwambo (2000) on the other hand asserts that people tend to plant more trees for their own uses at their homesteads as opposed to less educated ones and hence contribute in resources conservation. Planting or retaining of trees around homesteads reduces pressure on micro-catchment forests thereby contributing to their resilience.

**Adoption of Drought Resistant Livestock**

Adoption of drought resistant livestock kinds is one of the roles played by the institutions and organisations in the District. The drought resistant livestock include African Zebu (cattle) selo (goat) and sak (sheep). Burrow (2006), in describing other potential characteristics of Zebu in relation to drought resistance, states that Zebu genotype has been utilized in crossbreeding systems to develop cattle for beef and dairy production systems in hot climates but success has been limited by other unfavorable genetic characteristics of these cattle such as meat quality.

** Provision of Security and Conflict Mitigation**

Provision of security among the pastoralists’ societies is one of the roles played by institutions to enhancing pastoralists’ resilience in the District. Participants in the FGDs in Mairowa and Sinya stated that “despite the calamity of climate in their areas, the district authority has been has been very vital in protecting them from thieves who mostly come from the neighboring Kenya”. It was also revealed that Longido District Council (LDC), Longido Community Development Organisation (LCDO) and Wildlife Management Areas (WMA) have been solving various land use conflicts between the pastoralists and Conservationists, particularly the Tanzania National Parks (TANAPA).

### Table 3 Perception of FGDs on Roles of Institutions

<table>
<thead>
<tr>
<th>Sex</th>
<th>Mairowa</th>
<th>Kiserian</th>
<th>Engikaret</th>
<th>Sinya</th>
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</thead>
<tbody>
<tr>
<td>Male</td>
<td>Provision of Environmental Education</td>
<td>Construction of water reservoirs</td>
<td>Provision of Environmental Education</td>
<td>Provision of Environmental Education</td>
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<tr>
<td></td>
<td>Capacity building</td>
<td>Restocking</td>
<td>Capacity building</td>
<td>Restocking</td>
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<td>Employment</td>
<td>Employment</td>
<td>Employment</td>
<td>Employment</td>
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<tr>
<td></td>
<td>Construction of water tanks</td>
<td>Advising livelihood diversification</td>
<td>Education on land Use</td>
<td>Advise on livelihood diversification</td>
</tr>
<tr>
<td></td>
<td>Restocking</td>
<td>Building of livestock</td>
<td>Building of livestock</td>
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</tr>
<tr>
<td></td>
<td>Building of Training</td>
<td>Land ownership and grazing rights</td>
<td>Constructing livestock infrastructure</td>
<td>Conflict mitigation</td>
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<tr>
<td></td>
<td>Institutions</td>
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<td></td>
<td>Dam construction</td>
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<td></td>
<td>Provision of food</td>
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<td>Female</td>
<td>Construction of dips</td>
<td>Restocking</td>
<td>Provision of Environmental Education</td>
<td>Provision of Environmental Education</td>
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<td></td>
<td>Livestock Diseases diagnosis</td>
<td>Employment</td>
<td>Capacity building</td>
<td>Restocking</td>
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<td></td>
<td>Construction of livestock</td>
<td>Environmental Education</td>
<td>Employment</td>
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<td>Education</td>
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<td></td>
<td>Land ownership</td>
<td>Dam construction</td>
<td>Dam construction</td>
<td>Conflict mitigation</td>
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<td></td>
<td>Provision of environmental officers</td>
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### Table 4 Perceived Institutional and Organization by VEO’s

<table>
<thead>
<tr>
<th>Villages</th>
<th>Mairowa</th>
<th>Kiserian</th>
<th>Engikaret</th>
<th>Sinya</th>
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<tbody>
<tr>
<td></td>
<td>Provision of environmental Education</td>
<td>Provision of education</td>
<td>Provision of education</td>
<td>Provision of education</td>
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<td></td>
<td>Capacity building on adaptive system</td>
<td>Restocking livestock</td>
<td>Restocking</td>
<td>Restocking</td>
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<td></td>
<td>Restocking</td>
<td>Adopting drought resistant livestock</td>
<td>Conflict mitigation</td>
<td>Conflict mitigation</td>
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<tr>
<td></td>
<td>Construction of livestock</td>
<td>Construction of livestock</td>
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<td></td>
<td>infrastructure</td>
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<td></td>
<td>Land ownership</td>
<td>Dam construction</td>
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<td></td>
<td>Provision of Livestock officers</td>
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</table>

Source: Field Data, 2015
Provision of Education for Livelihood Diversification

Education for livelihood diversification is one of the roles provided by institutions and organizations working in the study area. These institutions include LCDO, LD, IIED, TRIAS, UCDT and PWC (see Tables 1-2). These institutions have been creating awareness on the importance of livelihoods diversification by emphasizing pastoralists to look for other sources of income such as small-scale agriculture so as to solve the problem of food shortage; poultry production petty trading and social networking. According to FAO (2008), diversification, intensification and integration of pasture management, livestock and crop production have been identified by several experts as ways to increase adaptation in the livestock sector.

Provision of Livestock and Environmental Officers

The Longido District Council and Arusha Veterinary Investigation Centre (VIC) have made possible the posting of livestock officers and environmental officers to support the pastoralists and enhance resilience against climate change in the study area. Livestock officials have been visiting pastoralists in their villages and providing timely extension services.

As for environmental officers, during the period of data collection, they were planning to conduct workshops at village level on environmental related issues and problems and how to practice sustainable pastoralism in the rangelands. Not only that, but also the environmental officers, in collaboration with International Union for Conservation of nature (IUCN) and Tanzania Metropolitan Agency (TMA), have started to integrate traditional weather forecasting system into the scientific and modern approaches to make sure that climate variability are detected before time to allow other measures to be taken.

Provision of Land Use Education

The study revealed that, Institutions such as Community Research Development Services (CORDS), Maasai Women Development Organization (MWEDO), and Pastoral Women Council (PWC) have been instrumental in preparing land use plans at the village level, and therefore, instrumental in enhancing the awareness of pastoralists on various land issues such that even pastoralists are now aware of natural resources related policies and legislations something which was not formally not well known to them.

Establishment of Indigenous Knowledge Weather Forecasting Groups

The study revealed that the integration of Pastoralists Indigenous Environmental Technical Knowledge (IETK) has been a role of governmental and non-governmental institutions in enhancing resilience and adaptation against the impacts of climate change in the study area and in Longido District as a whole. It was revealed that, the integration of IETK is an appropriate strategy of disseminating information related to weather change in the villages and beyond. The Longido District Environmental Officer argued that indigenous information systems are dynamic, and are continually influenced by internal creativity and experimentation. It encompasses the skills, experiences and insights of people applied to improve livelihoods. In order for IETK to work effectively, there is a need to look for ways of integrating this knowledge with modern science.

Capacity Building

The study explored that, NGOs such TRIAS, LOPEHCO, VETAID and CORDS have been playing a big role in sensitizing the pastoralists on how to domesticate healthier livestock by controlling livestock diseases through appropriate use of livestock infrastructure. For instance, TRIAS in Kiserian and Sinya has been promoting and conducting training which relate with plans for income-generating activities through (micro-enterprise) training, provision of soft loans, improvement of livestock breeds, animal husbandry and marketing, establishment of community ranches and promoting strategies and approaches which could enhance better use of wildlife and natural resources.

During FGDS it was also revealed that the Government of Tanzania via Tanzania Metrological Agency (TMA), in collaboration with local leaders, has been training pastoralists on how to integrate traditional climate variability forecast with the modern or scientific systems. It was noted that some of the pastoralists have started to adopt some of the strategies on how to forecast unstable regimes in their areas and thereafter able to take appropriate techniques.

The Longido District Livestock Office has also been training pastoralists on how to domesticate dairy goats and sheep. This has resulted to some of the pastoralists now domesticate new kinds of dairy cattle which produce much milk compared to the traditional Maasai cattle. Other strategies done by the LDC is destocking campaigns aimed at reducing the number of livestock and remain with a few and healthier stock. This is important because the population continues to increase but land area is constant. Therefore, the way forward is to reduce the number of livestock. This approach seems to have started to work. One of the FG participants who preferred anonymity, managed to build a modern house as a result of this campaign.

Conclusion and Recommendations

CONCLUSION

The study identified various institutions and organisations both local and international NGOs, CBOs, FBOs, District Government and Central Government were involved in enhancing pastoralists’ resilience and innovative adaptation strategies. The revealed roles of the institutions and organisations included restocking, construction of water reservoirs, provision of land use education, education for livelihood diversification, provision of employment, and capacity building. Others were veterinary services, provision of livestock infrastructures and the establishment of integrative weather forecast groups in each village.

Recommendations

Therefore the study has the following recommendations

- Pastoralists’ capacity building on climate change resilience and adaptation should be done by NGOs, CBOs, and the District livestock officials. The initiation and the establishment of programs intended to consolidate the adaptability of climate change upon the
pastoralists will promote the techniques of how to buffer the impacts resulting from climate change.

The government and other stakeholders, as appropriate institutes, should provide support for providing technical support as well as providing capital assistance to the pastoralists. The support should be accompanied with advocating the local resilience and adaptation strategies as well as integrating the local innovative adaptation and resilience strategies with the modern technologies. The traditional strategies for predicting weather conditions employed by pastoralists such as the use of the star Ngakwa, should be enhanced.

Acknowledgments

The authors would like to thank the Institute of Finance Management (IFM) for the partial support which made this study possible.

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