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An Assessment of Existing Indigenous Knowledge for Early Warning Systems and Associated Adaptive Strategies in Turkana County, Kenya

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ABSTRACT

Indigenous knowledge in community based early warning systems is essential for drought monitoring and management. In remote areas, modern technologies for early warning are rare thus indigenous knowledge based hazard monitoring systems are commonly used. This promotes a more effective methodology of disaster management in Arid and Semi-Arid Lands (ASALs) of Northern Kenya. Communities living in the northern part of Kenya have a wealth of indigenous knowledge passed down from generations and is internalised by the communities through a process of socialisation as part of their lifestyles. Most of this knowledge is not documented and is overlooked whereas this community based practices exhibit a deep understanding and ability to cope with disasters through local actions. This creates a firm basis for assessing indigenous Knowledge (IK) for early warning for Turkana nation and adaptive strategies therein. Descriptive survey research design was used in the study. A population sample size of 902 persons was chosen using the simple random sampling technique. A study sample size was taken at 95% level of confidence. More emphasis was placed in people over the age of 60 years who were able to recall trends of drought occurrences over the study period. The data collection instruments applied included questionnaires, observation checklists and interview guides. The findings of the study showed that indigenous knowledge was invaluable if accurate and reliable drought prediction was to be achieved, hence the need for adoption of this indigenous method for early warning system. Cooperation among the local people in drought forecast improve ownership of findings hence ability to forge sustainable drought mitigation and prevention efforts. The study recommends that there is an urgent need to recognize indigenous knowledge in planning and decision making in relation to matters of drought prediction.

1.1 Introduction

Droughts and famine have become a common occurrence in the recent past and in spite of existing early warning systems, little has been done to cushion populations through diversification of livelihoods and promotion of timely, effective mitigation measures (Musimba, 2014; Rogei, 2015). The arid and semi-arid lands (ASALs) in Kenya of which Turkana County falls has had cyclic periods of hazards and disasters ranging from droughts, famines and floods leading to loss of lives, property and disruption to socio-economic activities in unprecedented scales (Nyariki & Makau 2005; Mbatha, 2013). Most inhabitants of these geographical locations are pastoralists who derive 70% of their incomes from livestock keeping and their over-reliance on livestock makes them vulnerable to external shocks (drought, famine and floods) (ILRI, 2006). Over 80% of Kenyan land mass is classified as ASALs. Pastoralism is a widespread practice as a source of livelihood in the ASAL regions. The region holds 52% of total livestock in the country and contributes 67% of the red meat supply. The population of the ASAL in northern Kenya is estimated to be at 25% of the entire population equivalent to over 10 million (Oroda, 2001).

Natural disasters are inevitable, and it is almost impossible to fully recuperate the damage caused by the disasters (Norris *et al.*, 2008). However, it is possible to conduct disaster preparedness through mitigating the potential risk by embracing indigenous knowledge (IK) for early warning of these endemic hazards and disasters in Turkana County. It is important to note that traditionally, indigenous knowledge for early warning systems has been essential for drought monitoring and management (Speraza *et al.*, 2010). Analysis of drought occurrences in given time scales and location in Turkana provides an insight on evolution of adaptations. Building of community capacities to strengthen resilience and establish safeguards is an integral component of disaster risk reduction (Ottichilo, 2003). Both levels of government should incorporate IK for warning in ASALs of Kenya (Turkana). Communities living in the northern part of Kenya have a wealth of indigenous knowledge that is passed down from generation-to-generation and is internalised by the communities through a process of socialisation as part of their lifestyles. Most of this knowledge is not documented and overlooked whereas these community-based practices exhibit a deep understanding and ability to cope with disasters through local actions (Mwaura, 2008; Handmer & Dovers, 2012). A close examination of the elderly people's experiences demonstrates a wide knowledge of local warning

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indicators based on animal behaviour and natural phenomena (Twigg,2003).

There are cultural patterns of behaviour and beliefs that aid communities to cope with hazards. These adjustment mechanisms include a community's perception of risk or the religious understanding of calamity. Both may be important determinants on how people will behave in the face of a disaster (Morren 1983). Communities also have their own ways of defining what a disaster is when conditions pass their boundaries of usual stress to become crisis. Communities pass on knowledge about hazards constitutes a mechanism for adjusting to disasters (Rugadya, 2006; Lagi, 2015). Elders passing on their experience of disasters through storytelling, which reminds the new generations on cropping patterns or other technology in use at varied times (Mawere, 2014).

The climatic conditions in ASALs are precarious leading to frequent droughts which result to the ever-recurrent famines and crop failures hence starvation and widespread suffering (Kisoza, 2007). Turkana receives low and erratic rainfall on a range of between 250 mm to 350 mm per annum (Mati *et al.*, 2006). Water resources are thus limited and poorly distributed and majority of the population have limited access to basic essential services. Incidences of poverty are quite higher than the national average. These forms of indigenous knowledge systems lead to adaptation mechanisms seen for instance through migrations in search of pasture and water. The study examined the extent of community adaptation in various locations and time periods in relation to drought occurrences and magnitude and more significantly focus on IKadoption for early warning system for drought prediction.

1.2 Problem statement

There is low degree of understanding and recognition of the indigenous knowledge based drought prediction and adaptation systems in Turkana County an area prone to drought and food insecurity. Existing community practices and adaptations exhibit a deep understanding and ability to cope with drought through local actions. While the recognition and incorporation of indigenous knowledge in disaster risk reduction efforts has been dismally insufficient, there is compelling evidence that indigenous knowledge has the potential to provide solutions to reducing disasters at many levels. This study aimed at assessing indigenous knowledge for early warning system for drought monitoring and its associated adaptive strategies. It is essential to note that over time, these traditional and cultural ways of coping with droughts have waned with time and thus there is an urgent need to explore causal phenomena and recommend ways to address or mitigate the impact. Turkana County was chosen due to the fact that the area is very prone to droughts and yet the local community depends mainly on a single means of livelihood hence higher degrees of vulnerability.

1.3 Research Objective

The objective of the study was to assess the existing indigenous knowledge for early warning systems and associated adaptive strategies in Turkana County.

1.4 Significance of the study

In Turkana County, drought is a common occurrence, often leaving the community in devastating situation due to loss of livestock which is a major source of livelihood in the area. The study forms a fundamental basis for disaster early warning system by adoption of indigenous knowledge by policy makers to mitigate the effects of droughts in the Turkana County. The study will also shed light on risks facing adaptations systems, and help inform planning and decision making as Turkana is very prone to droughts and yet the local community depends mainly on a single means of livelihood hence higher degrees of vulnerability. Types of Indigenous knowledge practices in Turkana County will be identified so that to inform planners and decision makers of the already available IK wealth that has been passed from one generation to generation for many decades.

1.5 Scope of the study

The study covered three divisions of the larger Turkana County. Kalokol, Central and Kerio with a total population of 90,063 persons (Republic of Kenya, 2009). The elderly population as per the 2009 Republic of Kenya census was 4,232. The study was therefore limited to persons of age group 60 years and above whose economic background was pastoralism. Essentially this category has a higher recall due to span of life experience with a remarkable breadth of knowledge on IK. Turkana County was chosen for the study due to its frequent droughts and existing wealth of indigenous knowledge in disaster early warning system.

2.0 Research Methodology

Research methodology is essential as it provides guidelines that govern the study.

2.1 Research Area and Population

The study was conducted in Turkana County. It occupies a total land size of 77,000 sq. km. It is an arid region whose temperatures ranging between 24-38 degree Celsius. Turkana County is an arid county thus it is very essential to appreciate the use of indigenous knowledge as the main tool for early warning against potential hazards, disasters and food insecurities. Research design used was descriptive survey where qualitative data was collected and analysed for presentation. Data collection involved oral interviews, observation checklists and desk review of literature for indigenous knowledge and its adaptive strategies. Simple random sampling was used to identify groups and locations for the administration of data collection tools. The study population was derived from three divisions of Turkana central sub county (Kalakol, Central and Kerio). The population of the three divisions are as follows from Table 2.1.

Table 2.1. Population Data on Ageing.

Name of the Division	Total Population	Study Population (age over 60 yrs-4.7%)
Kalokol	28,735	1350
Central	45,919	2158
Kerio	15,409	724
Total Population	**90,063**	**4232**

Source: Gondi Hesbon (2005)

Using the formula for small population proportions where sample size n is sample population, $n = N / (1 + Ne^2)$ (Bartlett, 2001)

Data was generated and captured from population samples shown in Table 2.2.

Table 2.2. Study Population Sample Size.

Name of Division	Study Population Sample
Kalokol	308
Central Kerio	337
Loima	257
Total	902

2.2 Sampling Strategy

The study population comprised of persons over the age of 60 years. The study population was therefore small, and thus necessitated use of the small population proportion formulae for determining population sample sizes. At 95%

confidence level, and e being the level of precision, N the study population size; then the sample size n was computed as follows:

$n = N / (1 + Ne^2)$…

The results of the computations are shown in Table 3.2. For the first case of Kalokol division with 1350 elderly persons, n=1350/1+1350(0.05)2
=1350/4.375=308

Using similar computations for Turkana central and Loima, a total of 902 sample size was derived for study.

The data collection instruments were pre- tested through short pilot study to ascertain their reliability. Improvements based on findings were initiated before final administration. The data collection was administered through research assistants who underwent training on the effective and efficient administration of the tools. Logistics arrangements were put in place and coordination mechanisms. Data was analysed using descriptive and inferential statistics. The excel sheet for CDI obtained from the department of meteorology of the University of Nairobi was used for data capture and analysis of drought trends. Tables, graphs, trend lines, pie charts, histograms and figures were used extensively to represent data and results.

3. Results and Discussions

The findings of the study were analysed and discussed based on the primary data collected from the responses and supplemented by desk analysis of available secondary data on indigenous knowledge.

3.1 Types and forms of community indigenous knowledge

There were many forms and types of indigenous early warning systems used by the Turkana community to foretell drought occurrence. Such methods involved observatory behaviour of animals, birds, insects, vegetation, trees, winds, air, temperature, clouds, earth movements and celestial bodies. Turkana people have a set of elders led by local seer with ability to predict rainfall and drought occurrence (Juma, 2016). The seer would on regular basis consult the gods in a shrine to foretell forthcoming events related to weather hence advices the community. The main common forms of indigenous knowledge in practice were: Watching the behaviour of animals and birds; reading the intestines of animals during slaughter; observing the wind and cloud pattern; observing the movement of ants, use of shoe throws - known as "*Akilamlam*" most commonly used form after the use of the intestines of animals. Case study of Maasai Mara and Serengeti migration of wildebeest a form of use of animals to predict drought and severe weather (Sinclair, 2012).

During data collection, a group of elders did intestines reading where they slaughtered a goat and analysed the contents. The elders looked at the colour of the intestines, folds patterns, and the colour of the faeces in the intestines. A situation where the intestines looked highly folded, with dry white faecal matter, indicated a period of dryness. This is attributable to the consumption of the dry vegetation and browse (Mwaura, 2008: Speraza, 2010). Mwaura explains that animals consume vegetation and browse which gets stored in the intestines, and often this is interpreted as signs to foretell drought. If there are no signs of freshness in the faecal, and lack of the greenish colour could explain the above findings. The observation of the birds' behaviour, cloud and wind patterns, was a common practice also followed the Kamba (Mwaura, 2008; Auma, 2016).

The same applied to observation of the movement of ants which was used as predictor of floods. Shoe throws is only common within Turkana community and no literature has cited this practice. It is unique though its level of accuracy could not be ascertained by this study. Turkana nation utilise indigenous knowledge in predicting and adapting to drought patterns through observation of animal behaviour in birds, reptiles, amphibians, insects and also in analysis of vegetation and trees behaviour (Macherera, Chimbari, & Mukaratirwa, 2016). It therefore forms a very important aspect of their social well-beings and enhances their adaptability against the endemic severe weather patterns and climate.

3.2 Risks facing community adaptation systems

Due to cultural gender sensitivity amongst the Turkana nation, the study had to divide the respondents based on gender. The two groups identified climate change, poverty, conflict, breakdown of social networks, lack of livelihood diversity and effects of human activities as risks to their drought adaptations. Using an interview guide further probing was done to prioritise on risks. A total of 120 persons, 60 women and 60 men were interviewed in the three divisions. The results are as shown in the tables below.

Table 3.1.Adaptation Risk Factor Analysis.

Risk Factor	Respondents	
	Male	Female
Climate change	24	12
Poverty	15	18
Conflict	3	12
Breakdown of social networks	6	3
Lack of livelihood diversity	3	6
Human Activities-Land and environmental degradation	9	9

From the tables, climate change was identified as the key risk to community adaptation for it increases vulnerability, by making the existing situation more worse. Turkana people rely on livestock keeping and drought therefore exerts stress on their livelihoods. "We entirely depend on livestock as source of livelihood, drought thus has a deleterious effect on our livelihood," alluded an elder. Men considered it more as a key factor compared to women. Respondents were so sensitive to climate change phenomena and cited changing situations.

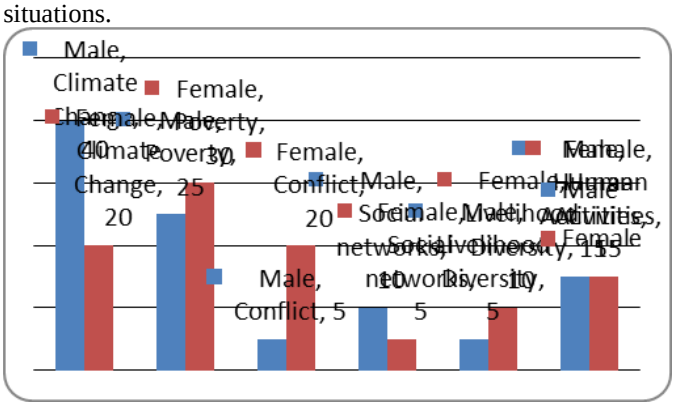

Figure 3.1. Men and Women Risk Rankings.

That in the past droughts were less frequent and the impact was not as great as compared to now. Poverty was also identified as a key risk to adaptation, but this time women felt more than men. The reason given is that women toil to provide for the family in Turkana households hence the difference. Conflict was ranked third and women again felt it more than men. This is essentially because conflicts affect women and children more than men in terms of displacements and out of their natural vulnerability as women. Human activities were ranked fourth with both men and women classifying them at 15%. Human activities cited to influence negatively their adaptations to environmental

changes were rapid urbanisation, land ownership tenures and conflict over diminishing natural resources. Figure 4.1 illustrates the adaptation risk factor of men and women in Turkana County.

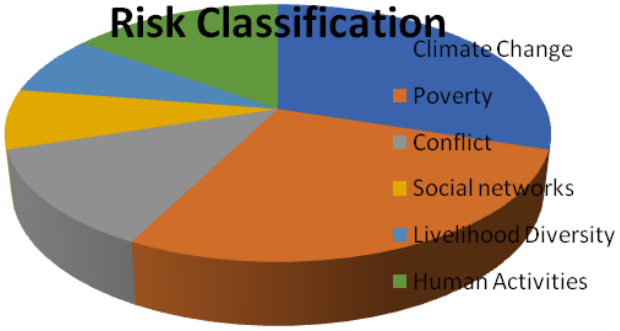

Figure3.2. Pie chart on Risk Classification.

According to Otichillo (2003) and Birkmann & von Teichman (2010), climate change is one of the biggest threats to maintenance of valuable traditions and knowledge in early warning systems. The frequency of droughts, destabilises traditional people's way of life and cultures. Slowly there is erosion of very useful practices, as people are forced to migrate to urban areas after losing their source of livelihoods. Conflicts play a major role in disrupting valuable stores of knowledge and traditions (Ruto *et al*., 2003; Santha, Fraunholz & Unnithan, 2010). The following bar graph and pie chart display these findings

3.3 Gauging Indigenous Knowledge for Early Warning System

Questionnaires were administered to gauge indigenous knowledge in drought prediction. Questions were framed in such a way to capture magnitudes of drought predictions in particular years under study. Ranking of the drought levels was considered in the range of between zero and one for low and severe respectively. The results of the data collected were analysed and presented in Table 3.3. The findings were varied based on lapses in memory recall but the frequency distribution analysis helped to smooth out variations.

Table 3.3. Drought Prediction Frequency Distribution based on indigenous knowledge.

Drought Magnitude/Year	Low	Medium	High	Severe
1993	20	48	12	10
1994	10	30	44	6
1995	12	26	52	0
1996	20	50	10	10
1997	14	34	32	10
1998	16	38	22	14
1999	10	20	50	10
2000	8	18	38	26
2001	8	20	32	30
2002	16	30	28	16
2003	16	28	32	14
2004	4	16	24	46
2005	12	26	24	28
2006	8	18	32	32
2007	12	20	40	18

From the Indigenous Knowledge findings as shown above, in 1993, majority of the respondents (53%) predicted that the severity of drought would be medium. In 1994, most respondents (49%) predicted that drought severity would be high. Further, in 1995, majority of the respondents (58%) predicted that the drought severity would be high. In 1996, majority of the respondents (56%) predicted that drought severity would be medium while most of respondents (38%) in 1997 predicted the drought to be medium although 36% also predicted that the severity would be high. From the study most of the respondents (42%) in 1998 said predicted that the drought would be medium. In 1999, majority of the respondents (56%) predicted the drought to be high while in 2000 most respondents (42%) predicted the drought to be high.

In 2001, most respondents (36%) predicted the drought to be high although 33% predicted the drought to be severe. In 2002, most respondents (33%) predicted the drought to be medium although 31% of them predicted that the drought would be high. In 2003, 36% of respondents predicted the drought to be high and 31% predicted the drought to be medium. Further, in 2004, majority of respondents (51%) predicted the drought to be severe. From the study, 31% of respondents predicted the drought to be severe in 2005 although 29% predicted it to be medium. In 2006, 36% of the respondents predicted the drought to be high while the same percentage (36%) predicted it to be severe. Finally, 44% of respondents predicted the drought to be high in 2007.

4.0 Conclusion and Recommendation

4.1 Conclusion

There are useful types and forms of IK systems for drought prediction existing in local communities. The risks that face IK adaptation systems are inherent. Recognition of the indigenous technologies in northern Kenya is essential and its proper utilisation promotes sustainability in drought monitoring at community levels.

4.2 Recommendations

There is an urgent need to recognize indigenous knowledge in planning and decision making in relation to matters of drought prediction. In addition, there should be efforts to analyze and mitigate risks that erode such an important aspect of indigenous knowledge.

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