Effectiveness of Early Warning Systems in Enhancing Food Security in Pokot Central Sub County, West Pokot County, Kenya

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ABSTRACT

Pokot Central Sub County in West Pokot County, Kenya, is the most drought-stricken and food-insecure region as of 2022. The region faces severe threats to agriculture and food accessibility, exacerbated by delayed, reactive drought response strategies and limited resources. This study evaluated the effectiveness of early warning systems in enhancing food security during drought periods. The study used vulnerability and resilience and complex adaptive systems theories to explore these interrelationships. A mixed-method approach with a convergent parallel design was adopted, targeting 22,041 households in Pokot Central. A sample of 396 households was selected through stratified random sampling and 20 key informants were chosen using purposive sampling. Descriptive analysis outlined drought preparedness and food security, while thematic and content analysis were used for qualitative data. Regression and correlation analysis determined relationships between early warning systems and food security. Key findings revealed a positive association between early warning awareness and food security ($r=0.155$, $p=0.000$). Recommendations include enhancing drought risk management and improving early warning dissemination. An integrated approach involving government agencies, NGOs and local communities is crucial for effective drought response.

Keywords: Effectiveness, Early warning system, Food Security

INTRODUCTION

The drought incidences have increasingly become intense and recurrent in nature leading to widespread food insecurity in fragile arid and semi-arid lands (ASAL) in Kenya according to 2022 Short Rains Assessment (SRA, 2022). The report further highlighted a deteriorating food security situation in the ASALs, with 4.4 million people requiring assistance while the children at risk of acute malnutrition remained high as a result of persistent droughts and food unavailability across the pastoral livelihoods. The drought events often occasion massive losses on agricultural and livestock production systems of vulnerable farmers (Bareki et al. 2017).

Droughts have wreaked havoc on food security and weakened economies resulting into billions in livelihoods losses and negatively impacting many lives. Recurrent droughts in Australia and China cost $6.0 billion and $13.7 billion in 2016 alone, leading to acute water shortages, crippled agriculture and ultimately causing hunger and famine (Mansoor et al., 2022). In developing nations like Bangladesh and India, devastating droughts have become a frequent nightmare, pushing millions into food insecurity and water crises (FAO, 2019). The intensity and frequency of these drought episodes have intensified in recent years, impacting over 2 billion people worldwide and claiming over 11 million lives (WMO, 2019). The consequences are far-reaching, threatening economies, livelihoods and the pastoral fabric of communities. The global report update of 2022 on food crises revealed that at least 20% of Africans goes to bed starving and approximately 140 million African people face acute food shortage (FAO, 2022).

In Africa, the situation is compounded by weak economies and inadequate drought management structures. For instance, food shortages in the Sub-Saharan region are periodically initiated by severe droughts and could be further aggravated by other compounding factors, such as political instability, poverty and inadequate

infrastructure. For example, in Ethiopia, the 2015-2016 drought, exacerbated by the El Niño phenomenon, led to a severe food crisis affecting over 10 million people (Relief Web, 2016).

In 2017, Kenya's drought led to a national emergency and left 2.5 million people facing food insecurity (IFRC, 2018). With effective drought preparedness and adaptation strategies, the devastating effects of droughts attributed to climate change (Naumann et al., 2018) can be mitigated and aid in pushing progress towards attaining the second United Nations Sustainable Development Goal (SDG) on zero hunger. Effective implementation of strategic drought preparedness interventions is key in achieving holistic food security among vulnerable communities.

ASALs regions of Kenya comprises of 89% of the country with estimated 38% of Kenya's population living in the ASALs. Further, the ASAL regions hosts more than 90% of the wildlife that is key for Kenya's tourism sector, contributing to 12% of Kenya's Gross Domestic Product (GDP). According to (UNICEF, 2021) West Pokot and Kitui reported high stunting rates at 46 per cent in both counties. Wasting among children under-fives ranged from one per cent in western parts of Kenya to greater than 20 percent in ASAL counties.

The National Drought Management Authority (NDMA) is a Kenya's agency established to exercise overall coordination of drought risk matters in Kenya. The institution is required to develop mechanisms together with partners to end drought emergencies and climate change adaption by operating drought early warning systems (DEWS) for evidence-based resilience building and early drought response. The partnerships among government and non-state institutions boosts synergy in drought preparedness strategies by pooling of financial and technical resources. Akwango et, al. (2017), indicate that the (DEWS) holds the potential to improve the communities' capacity in managing and reducing effects of drought through provision of early warning information on preparedness and coping strategies. Inadequate early warning systems fails to provide timely and relevant data from different areas both local and the wider hazard area for disseminated to stakeholders for early drought response and food security.

Statement of the Problem

Pokot Central Sub County is facing a complex problem of inadequate drought preparedness and food insecurity. The region relies heavily on rain-fed agriculture, coupled with prolonged and recurrent droughts, has led to rising food shortages and a surge in malnutrition cases, particularly among children and pregnant women. Ngcamu, B. S., & Chari, F. (2020) revealed that African populations living below the poverty line are experiencing increased rates of hunger, malnutrition, famine and acute food insecurity. According to the West Pokot County Short Rains Assessment report (SRA, 2022), acute malnutrition went up from 11.9 percent in 2021 to 14.5 percent, primarily due to household food insecurity. Existing drought preparedness efforts in the region are primarily short-term and focused on emergency relief measures. While these measures alleviate immediate suffering, they fail to remedy the root causes of drought unpreparedness and the recurrent droughts. A more comprehensive approach is needed, one that emphasizes the establishment of an effective drought early warning systems to enhance the community's food security.

Despite the government's operationalization of a drought early warning system in the county, it has often been criticized for its weak drought preparedness and response strategies. The NDMA is responsible for overall drought management, has had limited success in implementing timely preparedness and mitigation measures, (NDMA bulletin, 2022).

LITERATURE REVIEW

Theoretical Review

According to Holling (1973), vulnerability and resilience theory (VTR) focuses on understanding how social and ecological systems respond to shocks such as drought. He described vulnerability as the exposure of elements at risk including individuals, ecosystems and communities to possible risks, whereas resilience denotes the capacity to absorb shocks, adapt, recover and build back better to ever changing situations.

Vulnerability and resilience theory posits that vulnerability is the degree to which a system, community, or individual is likely to experience harm due to exposure to a hazard, while resilience refers to the capacity to recover from these impacts. In the context of this study, vulnerability and resilience theory is applied to analyze how various factors, such as income levels, literacy, household size and social safety nets affect the community's ability to prepare for, respond to and recover from drought-related shocks. The theory highlights that communities with higher socio-economic status, better safety nets projects and robust institutional support structures tend to be less vulnerable and more resilient to food insecurity caused by droughts.

The theory underscores the significance of strengthening community resilience through early warning systems and institutional support. For instance, effective early warning system is linked to improved food security, as indicated by a positive correlation between early warning mechanism s and food security indices.

The VRT underscores the necessity for an all-inclusive approach to drought preparedness, involving government, NGOs and local communities, to enhance food security and build resilience against drought impacts. This comprehensive approach is crucial for mitigating the adverse effects of recurrent droughts, particularly in arid and semi-arid regions like Pokot Central Sub-County. This theory emphasizes the interplay between a community's exposure to risks, their sensitivity to these risks and their adaptive capacity, which collectively determine their overall vulnerability and resilience.

In the context of drought and food security, this theory underscores the dynamic nature of vulnerability and food security resilience over time. It includes economic, environmental and social factors that determines communities' ability to cope and recover during drought events. The theory aids in exploring how governance policies and social structures can enhance food security by reducing community vulnerabilities.

Empirical Review

The effectiveness of early warning mechanisms hinges on their capacity to provide timely and actionable information to stakeholders. Systems like the Integrated Food Security Phase Classification (IPC) offer a global risk assessment and forecasting mechanism, systematically classifying food security outcomes based on existing data. It has been utilized in numerous countries to assess food security threats and guide interventions (IPC Global Support Unit, 2019)

Early warning systems play a critical role in preventing food insecurity. The Famine Early Warning Systems Network (FEWS NET) is an exemplary data collection and monitoring tool. It tracks climate, crop production and food prices using remote sensing and ground-based data. FEWS NET has successfully delivered early warnings of food insecurity in regions such as East Africa and Central America, allowing for timely responses (Brown et al., 2019). A specific example within East Africa includes the FAO's Desert Locust Early Warning System. This system monitors and alerts about desert locust outbreaks, which can devastate agricultural areas. By using data from ground surveys and satellite photography, the system enables early identification and alerts, facilitating prompt control measures to prevent agricultural loss and food insecurity (FAO, 2021).

Mubiru et al. (2019) evaluated a drought early warning system in Uganda, finding that timely dissemination of information allowed communities to take appropriate preparedness and mitigation measures, ultimately improving food security outcomes. These systems often rely on local knowledge, cell phones and radio broadcasts to disseminate weather-related risk information, helping communities adapt to changing conditions and reduce food insecurity (Ajibola et al., 2020).

While the effectiveness of early warning systems is evident on a larger scale, local areas like Pokot Central Sub County also face challenges. This region is grappling with inadequate drought preparedness and food insecurity. Implementing and tailoring successful strategies from broader contexts, such as community-based early warning systems and leveraging local knowledge, can significantly enhance local preparedness and response efforts.

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RESEARCH METHODOLOGY

The research employed a mixed-method approach using a convergent parallel design to gather, analyze and interpret both quantitative and qualitative data through semi-structured questionnaires and key informant interviews. This type of research design aimed to capture a comprehensive view of the population's characteristics while exploring potential associations between variables. The research design was applied on target sample of 396 households selected from 22,041 households in Weiwei, Lomut, Sekker and Masol wards using stratified and Krejcie Morgan table sampling techniques. The data was collected using Kobo tool to assess the effectiveness and efficiency of drought preparedness strategies and mitigation on food security in Pokot Central Sub County. For a more in-depth understanding and to triangulate the household data, 20 key informant interviews was conducted with technical sub county officers from water, agriculture, livestock and social services, as well as Sub County and ward administrators and chiefs and assistant chiefs. The research design facilitated the description, recording, analysis of drought preparedness and food security aspects in Pokot Central Sub County. It enabled the generation of numerical and descriptive data aimed at measuring correlations between variables.

Findings

The study explored the extent to which early warning mechanisms for drought preparedness contribute to food security in Pokot Central Sub County, as well as their effectiveness. According to the survey findings, 74% of respondents are aware of the drought early warning systems in place. The high level of awareness is linked to government institutions such as NDMA where they have been conducting community participatory disaster risk assessment process together with NGOs who engage the locals in developing contingency and drought preparedness plan making the community well informed about the mechanisms available for drought preparedness. The implementation of these systems is critical, given the frequent droughts that impact the Sub County and threaten food security. Drought Early Warning Systems (DEWS) are specifically crafted to offer timely information on the onset, duration and severity of drought occurrences. This information enables farmers, herders and local authorities to proactively take measures to mitigate the adverse effects of drought. The high awareness level (74%) implies that a substantial segment of the community can access and potentially benefit from these early warning systems. Effective use of DEWS allows communities to implement strategies such as water conservation, planting drought-resistant crops and adjusting grazing patterns, which are crucial for maintaining food security during drought periods.

Effectiveness of Early Warning System

The analysis of survey responses related to early warning mechanisms in Pokot Central Sub County provided important insights into community perceptions and the effectiveness of these systems. The survey evaluated four key aspects: trust in information provided through early warning systems, the timeliness of information, community preparedness to respond to food insecurity emergencies and awareness of existing early warning systems.

Regarding trust in the information provided through early warning systems has the highest mean rating (3.76) and a standard deviation of 0.92. Nearly half of the respondents (48%) agreed with this statement, indicating a general level of trust in the information disseminated through these systems.

The perceived ineffectiveness of existing early warning systems in providing timely information is reflected in a mean rating of 2.65 (SD=1.10). While a significant portion (50%) disagreed with this statement, a combined percentage of 25% (7% strongly disagreeing and 18% disagreeing) suggests that there is room for improvement in ensuring timely delivery of warnings.

A mean rating of 3.05 (SD=1.15) for the statement concerning the community's lack of preparedness for food insecurity emergencies indicates some level of concern. Around 37% of the respondents agreed with this statement, highlighting the need for improved preparedness measures. The data shows a mean rating of 2.54 (SD=1.02) for awareness of existing early warning systems. With over half of the respondents (54%) indicating they are not aware of the systems; it suggests a significant gap in communication and outreach.

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Overall, the data highlights the importance of strengthening early warning systems to ensure timely dissemination of information, fostering trust within the community and improving preparedness for food insecurity emergencies similar to Mubiru et al. (2019) which demonstrated that timely dissemination of information enabled communities to undertake appropriate preparedness and mitigation measures, ultimately enhancing food security outcomes. There is also a critical need to raise awareness about the existing early warning systems so that the community can take advantage of them. These findings were collaborated with key informants' perspectives that the community lacks an effective early warning systems in the community for food security hence the need for improvement.

Table 1. Survey Results on Early Warning Mechanisms

Statement	Mean	S.D.
I do trust the information provided through early warning systems	3.76	0.92
The existing early warning systems are not effective in providing timely information	2.65	1.1
The community does not feel well-prepared to respond to food insecurity emergencies	3.05	1.15
I am not aware of existing early warning systems in place in my community	2.54	1.02
Composite Mean and Standard Deviation	**3**	**1.05**

Regression Analysis Results of Early Warning Mechanisms on Food Security

The regression analysis results provide valuable insights into the extent to which early warning mechanisms for drought preparedness contribute to food security in Pokot Central Sub County. This analysis considered four key components of early warning systems: trust in the information provided, the timeliness of information, community preparedness and awareness of early warning systems. The dependent variable in the model was the food security index.

The analysis reveals a statistically significant negative relationship between trust in early warning information and the food security index. Specifically, the coefficient for trust in early warning information is -0.133, with a p-value of 0.004. This suggests that higher levels of trust in early warning information are associated with a decrease in the food security index by approximately 0.133 units, holding other factors constant. This unexpected negative association might indicate that while the community trusts the information provided, they may lack the resources or capacity to act effectively on it, leading to lower food security outcomes. Wang et al. (2018) stressed the need for comprehensive drought management strategies, including mainstreaming early warning systems and drought mitigation plans in food security and resilience building.

In contrast, the timeliness of early warning information did not show a statistically significant impact on the food security index. The coefficient for this variable is -0.033, with a p-value of 0.405. The 95% confidence interval for this coefficient includes zero, indicating that the effect is not distinguishable from zero. This suggests that merely providing timely information is not sufficient to improve food security unless it is coupled with actionable measures and community support.

Community preparedness also did not exhibit a statistically significant impact on the food security index. The coefficient for community preparedness is 0.048, with a p-value of 0.176. While the relationship is positive, indicating that higher preparedness could potentially enhance food security, the lack of statistical significance suggests that other factors may be more critical in determining food security outcomes in this context. Awareness of early warning systems demonstrates a noteworthy positive correlation with the food security index. The coefficient for awareness is 0.155, with a p-value of 0.000, indicating that an increased awareness of early warning systems correlates with a rise in the food security index by approximately 0.155 units. This finding underscores the critical role of enhancing awareness and ensuring communities are well-informed about existing early warning mechanisms, significantly contributing to improved food security.

The overall model is statistically significant, as evidenced by the F-statistic of 8.91 with a p-value of 0.0000. The R-squared value of 0.0847 suggests that around 8.47% of the variance in the food security index is explained by the independent variables included in the model. The adjusted R-squared value of 0.0752, accounting for the number of predictors in the model, provides a slightly more conservative measure of model fit. These statistics indicate that while awareness of early warning systems is influential, other factors not included in the model may also contribute to variations in food security outcomes.

These findings highlight the complex dynamics between early warning mechanisms and food security. While trust in information and timeliness alone do not appear to directly enhance food security, increasing community awareness of early warning systems is crucial. This suggests that efforts to improve food security should focus not only on the provision of timely and trustworthy information but also on enhancing community engagement and awareness of early warning mechanisms. Effective communication and capacity-building initiatives are essential to ensure that early warning information translates into concrete actions that improve food security. The key informant's analysis found that the primary methods for collecting data being traditional observations and surveys, with limited use of established tools or methodologies for comprehensive drought risk assessment, with the Radio and Safaricom SMS being key channels for sharing early warning information.

Table 2 Regression Analysis Results of Early Warning Mechanisms on Food Security Index

Variable	Coefficient	Std. Error	t-value	P-value	95% Confidence Interval
Trust in Early Warning Information	-0.133	0.046	-2.87	0.004	-0.224 to -0.042
Timely Information	-0.033	0.039	-0.83	0.405	-0.111 to 0.045
Community Preparedness	0.048	0.036	1.36	0.176	-0.022 to 0.118
Awareness of EW Systems	0.155	0.042	3.67	0.000	0.072 to 0.237
Constant	2.389	0.277	8.62	0.000	1.844 to 2.934

In summary, while the effectiveness of early warning mechanisms in enhancing food security in Pokot Central Sub County appears to be multifaceted, increasing awareness of these systems emerges as a key factor. Further research and targeted interventions are needed to explore the underlying reasons for the negative association with trust in early warning information and to develop strategies that can better translate early warning signals into improved food security outcomes.

CONCLUSIONS AND RECOMMENDATIONS

The research concluded that food security in Pokot Central Sub County is influenced by the effectiveness of early warning systems. While there are existing initiatives to address drought preparedness, there is a need for improvement in several areas. Enhancing educational and ensuring timely dissemination of early warnings and fostering stronger collaboration between institutions and communities are crucial steps towards achieving sustainable food security in the region.

The study recommends that government agencies should integrate food security considerations into educational program and enhance the timeliness and accessibility of drought early warning information including fostering collaboration with NGOs and local communities in developing and implementing drought preparedness plans. Communities should also actively participate in community meetings and planning sessions related to drought preparedness.

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