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The Use of African Indigenous Knowledge Systems in Climate Change adaptation in Zimbabwe

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Abstract: Climate change is a topical issue that poses threats to human development. Climate change has economic, social and ecological consequences to agriculture and food security. Therefore, incorporating Indigenous Knowledge System is an important strategy in promoting climate resilient innovations, enhancing African identity and ensuring food security in communal farming communities. This study dealt with strategies of incorporating and aligning the African indigenous knowledge systems to adapt and mitigate climate change effects. The study used a case study design, collecting data through interview and focus group discussions. Data analysis involved the thematic approach. Based on the findings, the study concludes that investing in the African Indigenous Knowledge system provides solution to mitigate environmental weather patterns. The indigenous measures are critical in empowering farmers to embrace and align their farming activities to indigenous knowledge. Therefore, the study recommends farmers to embrace their traditional farming identity through training and awareness engagements.

Keyword: Climate change; indigenous knowledge; adaptation; strategies.

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Introduction

Climate change is a topical issue that poses threats to human development (Mathabire & Dzingirayi, 2021). Measures to mitigate climate change are a top priority internationally (UNDP, 2017). Climate change has caused severe visible social, economic and physical repercussions (Hove et al., 2013). In Sub-Sahara, climate change has caused grave economic, social and ecological consequences such as drought, loss of life, cyclones, floods and heatwaves. Climate changes have caused droughts, foods, cyclones and pandemics, which have significant effects on infrastructure, ecosystem, physical and mental wellness in the community.

Indigenous Knowledge Systems (IKS) have been in use since time immemorial. Indigenous knowledge system is widely acknowledged as an important strategy to adapt and respond to challenges caused by climate change. Makate (2020) considers IKS as institutionalized local knowledge built upon and passed on orally from one generation to another. Muyambo (2018) refers to IKS as a cultural-based supported treasure. While each community has its own indigenous knowledge systems that are context specific, the type of education curriculum used in most African countries denounced the use of indigenous knowledge systems. Such kind of education is secondary in climate change adoption (Kronik & Verner, 2010; Nyong et al., 2007).

Mafongoya and Ajayi (2017) argued that incorporating IKS in agriculture is an important strategy for promoting climate resilient innovations in communal farming communities. Indigenous people by default interpret and react to the impacts of climate change in creative ways, drawing on traditional knowledge and other technologies to find solutions that may help society to cope with impending changes (UNDP, 2017).

Meanings of IKS vary across socio-ecological contexts. The depth of indigenous wisdom in agriculture has been uncovered, recovered and rediscovered through a slow process of local co-engagement and consultation with indigenous peoples. Technology has pushed away indigenous practices, as currently there are limited individuals who still have intergenerational experiences, memory traces and stories to tell regarding the use of IKS in agriculture. Examples of these indigenous people are traditional elders and leaders who are the custodians of indigenous culture. Climate change adaptation is the process of adjustment to actual or expected climate and its effects in order to moderate harm or exploit beneficial opportunities (IPCC 2018). Many communities in farming activities have negated indigenous knowledge systems (Petzold et al, 2020). Indigenous knowledge possesses a strong practical emphasis that is oriented toward agricultural planning and exhibits dynamism that allows for incorporation of new elements (Orlove et al., 2010; Kolawole et al., 2014).

Africa is particularly vulnerable to climate change due to technological underdevelopment. According to Sithole et al. (2023), Zimbabwe's average temperature has increased from 0.5 to -1 degrees Celsius over the past five years. Since 1900, the amount of rainfall has decreased by 5% and insufficient rainfall patterns create serious food insecurity (Dodman & Miltin, 2015). Deteriorating agricultural conditions in Zimbabwe is an overwhelming problem to subsistence farmers (Mafongoya & Ajayi, 2017). Gukurume (2013) reports that insufficient rainfall has serious negative affects to fauna and flora. Agriculture is the source of livelihood to most families in rural areas (UNDP, 2017). Zimbabwe appears at position nine out of sixteen Southern African Development Committee (SADC) nations that are vulnerable to climate change, leading to high levels of poverty, floods and health endemics (Sithole et al., 2023). The country experienced recurrence of droughts and floods since 1990 (Brazier, 2017). Currently, 70% of Zimbabwe's population lives in communal lands (rural areas) where they really on agricultural activities (UNDP, 2017; ZCSAF, 2018).

Bikita and surrounding areas is a semi-arid region characterized by dry spells. Agriculture is the source of livelihood to the majority in the area and climate change has caused an increase in temperatures, decline of rainfall, deterioration of soil moisture and unprecedented change of weather patterns. All these have caused a catastrophic effect to agriculture productivity, making the people vulnerable to food insecurity. The change of weather patterns has caused untold suffering to the people and animals in the area. Due to the unreliability of agriculture as a livelihood activity, most people in Bikita have adopted alternative livelihood activities, which have negative ramifications to the environment, such as vending, firewood trade and brick molding. However, little is known in Bikita district in terms of the contribution of African indigenous knowledge on climate change adaptation actions. Indigenous people in Zimbabwe use IKS in making important livelihood decisions in areas, such as weather forecast and treatment of health problems (Kaganzi, 2021). Makate (2020) reveals that indigenous knowledge systems can predict rainfall or drought seasons. Therefore, incorporating and strengthening the use of IKS in adapting farming activities in communities such as Bikita District is essential. This background triggered this study to establish the role of indigenous knowledge in adapting to climate change in Bikita communal lands of Zimbabwe.

Climate change Characteristics in Zimbabwe

The change of climate is an alteration of the climate that is determined by variety of causal factors (IPCC 2018). An increase in greenhouse gases, such as carbon dioxide, methane, and nitrogen dioxide, is the chief cause of climate change (IPCC, 2014). Climate change in Zimbabwe is characterised by increased temperatures and generally low rainfall with an erratic pattern that results in drought and health threatening disasters (IPCC, 2014). For instance, Zimbabwe experienced the deadly cyclone IDAI in 2019. Up to now, the country is failing to deduce the causes of cyclone IDAI and there is no real statistics of causalities of the cyclone IDAI.

Indigenous Knowledge Systems and Climate Change

Indigenous knowledge on climate change is the local understanding of environmental changes, including

factual knowledge about the use of the environment (Petzold, et al., 2020). Article 7.5 of the Paris Agreement stresses the importance of including local and indigenous knowledge in understanding climate change and developing relevant actions for adaptation (UNESCO, 2018). Petzold et al, (2020) argued that dealing with indigenous knowledge to adapt to climate change equips the community with survival skills under difficult conditions. Sithole et al. (2023) posit that climate change has affected indigenous peoples in various ways, such as causing life threatening natural disasters like cyclones, heatwaves and droughts. Due to the diversity of human beings and their varied cosmological relationships with nature, IKS is understood differently (Balehegn et al, 2019). Thus, IKS ended up with arbitrary labels, such as ethnoscience, conventional ecological knowledge, indigenous methods of knowing, organic knowledge, local knowledge and folk knowledge (Chang'a et al., 2010; Kolawole et al., 2014; Mapara, 2014).

Despite variations in the names given to IKS, Mafongoya et al (2021) has it that indigenous peoples share a sympathetic nature and an unbreakable bond with their surroundings. The sympathizing characteristics of nature emerge from the symbolic moral relationship that exists between nature and humans. IKS is the foundation of identity in each community and people define cultures in IKS. Social structures, including families, marriages, kinship networks and civilizations produced rich organic knowledge that is applied to improve humanity. Good moral principles bind the socially formed institutions together (Theodory, 2016). The indigenous people's well-developed implicit moral control mechanisms facilitated reciprocity among them, with other animal and plant species. Natural resources are transformed from their straightforward context to high-rich symbolic qualities on the cosmological foundation and sympathetic nature (Karki et al., 2018). Mountains, wildlife, rivers and swimming holes are turned into holy moral resources by cosmological theory (Petzold et al, 2020). Therefore, effects of climate change leading catastrophic moral discord in the community destroy these natural resources.

A study by Mafongoya et al. (2021) revealed that the mutual bond between human beings and nature has existed in the past centuries and will remain functional in the future. In Zimbabwe, credit of maintaining IKS belong to community elders who are the insurance of cultural knowledge. The elderly people, as custodians of cosmological-based local knowledge, consciously and unconsciously created a systematic way of generating acceptable livelihood strategies (Eversole & McNeish, 2005). The organic knowledge's emergence emerged from a wide range of experiences, visions and dreams. As a new ethno-science tool, the indigenous knowledge functions in agriculture, environmental management, fisheries and in political sectors (Chang'a et al., 2010). However, climate change and associated increase in weather variability, especially in the arid and semi-arid ecosystems (Balehegn *et al.*, 2019), have resulted in diminution in the reliability of many of the traditional weather forecasting knowledge systems (Roncoli et al., 2011; Kagunyu et al. 2016). As a result, many indigenous people are abandoning the use and generational transmission of such knowledge (UNESCO, 2018).

Despite the disappearance of traditional weather forecasting techniques, there has been a very little shift among many indigenous peoples in Africa toward the use of contemporary weather forecasting and climate information systems. This is mostly due to the numerous limitations placed on the use and application of contemporary weather forecasting and climate change information in pastoral societies. According to Makate (2020), indigenous people have an excellent weather information services for agricultural activities. This appears on the automatic change of the fauna and flora. The changes help the indigenous people to relate to their experiences and to predict weather forecast. For instance, in Zimbabwe, indigenous people predict weather through studying the movement of wild animals and monitoring the life cycle of the vegetation. Chanza and Mafongoya (2018) confirmed these trends with indigenous people of Muzarabani, who used Munanga tree (Acacia nigrescens) blossoms to predict the amount of rainfall expected in the season. They can also be informed by the abundance of termite colonies seen collecting biomass into their mounds, the appearance of migratory birds and large number of Christmas beetle, to be associated with normal or above normal rainfall season, with a possibility of flooding in low-lying areas (Makate, 2020). Indigenous climate knowledge is praised for offering climate services that are at a much-required information for determining the farming activities in next seasons. Therefore, embracing indigenous weather-smart innovations can complement scientific formal. Relying on the scientific methods is

not enough without embracing the indigenous knowledge approach of curbing climate change in rural areas. Each community area has its indigenous knowledge system that can helps in mitigating dangers of climate change.

Theoretical Framework

The study employed the resilience theory as the theoretical foundation. According to Sithole et al. (2023), resilience theory addresses unfavourable life circumstances that affect people negatively. It is concerned with the mediating mechanisms that allow systems to perform better than expected under adverse conditions or after such conditions have occurred (Van Breda, 2018). According to Sithole et al. (2023), resilience theory takes the position of directing researchers in uncovering a comprehensive range of resilience resources that support human flourishing. Therefore, resilience is a crucial element that is significant in debates concerning its effects on climate activities.

Methodology

Design

This study used the case study design. Case study, according to Sturman (1997), is a broad word for an examination of a person, an organisation or phenomena. A case study is a comprehensive investigation of a plan, occasion, activity, process or one or more people (Creswell, 2009).

Population and Sampling

Bikita district divides into three main parts namely Bikita-West, Bikita-South and Bikita-East. The study selected Bikita-East as the study area. Bikita-East has ten Wards, which are named in numeric form such as ward 14 up to ward 24 in nominal order. The researchers purposively selected ward 20, 21 and 24 to be the sample case area. Ward 21 lies on the far north-end of the district, Ward 20 is on the central and Ward 24 is on the far south-end of Bikita communal area. The choice of these three sparsely located wards based on the desire to ensure a full coverage of a cross section of the wards in Bikita-Wast. Ward 24 is found in agro-ecological Zone Five while the other two are found in agro-ecological Region Four of Zimbabwe (Mafongoya et al., 2021).

Instruments

In this study, the instruments used for collecting data include Focus Group Discussions (FGDs) guideline and a semi-structured interview guide. FGD is a data collection technique in which a selected group of people discusses a given topic or issue in-depth, facilitated by a professional, external moderator (Saunders, 2009). The instruments used are a good way to gather in-depth information about the community's thoughts and opinions on the topic.

Table 1: Collective Summation of the Target Population

Ward	Total Population	Number of Villages	Households
20	7473	45	1779
21	4174	25	976
24	4503	15	1047
Total	**16150**	**85**	**3802**

Source: Zimstats 2019

Treatment of Data

The analysis of data involved thematic techniques. This procedure made it possible to code the data, and themes and sub-themes from the field data.

Ethical Considerations

This study adhered to ethical principles, which are honesty objectivity, integrity, carefulness, openness and respect for intellectual property, confidentiality, do no harm, informed consent, responsible publication, legality, no harm to human subjects and social responsibility. The researchers introduced themselves through an introductory letter. They dealt with the respondents in a manner that would protect their privacy and identity.

Results and Discussion

This study presents the results of the study.

Development of IKS in Bikita

According to the findings, indigenous knowledge appeared in the socio-cultural setting of the Bikita community. This indigenous knowledge is the

community's beliefs, reflected in their moral values. The findings show that majority participants attained the knowledge through their families. Particularly, parents played a pivotal role in training their children to employ indigenous knowledge. Furthermore, people shared indigenous knowledge through community gatherings, social groups and personal experiences. Village meetings, traditional ceremonies and funeral gatherings were the commonly mentioned fauna and flora, which facilitated the indigenous knowledge development in the Bikita community. For instance, one of the respondents reported,

> As I was growing up, my parents used to teach me how to embrace local knowledge to address environmental challenges… I from my mother learnt how to preserve seeds for the next planting season. I have also applied the same approach to teach my own children to use traditional ways, which I inherited from my parents.

Another respondent had this to report:

> Most of the times, when people gather for village meetings, funerals or other traditional gatherings, people converse on issues relating to environmental changes. People then deliberate on the challenges imposed by environmental changes. I found these discussions helpful for me as I have implemented some of the practices other people have done to conform to environmentally induced changes.

The participants further revealed that indigenous practices operate with contemporary knowledge. Participants in a FGDs acknowledged that they have combined their indigenous knowledge with other external knowledge in their efforts to habituate to environmental changes to improving their farm produce. For instance, one of the respondents reported,

> I try to apply both traditional and scientific systems when dealing with crop pests or diseases in my livestock. I first use the traditional remedies and monitor the situation for a few days, when I do not notice any changes, I then resort to scientific solutions.

This implies that the local people use indigenous knowledge systems as a first option before they seek advanced knowledge systems. Thus, people have backed the indigenous knowledge with other forms of knowledge, just as reported by Petzold et al. (2020) to solve the existing problems.

Rainfall Forecasting

Through FGDs, the local people revealed that they had observed a change in the rainfall patterns, specifically in relation to the onset and amount of rainfall, which affected their agricultural produce. Corresponding to this issue, the respondents applied their knowledge of forecasting rainfall patterns to inform their farming activities. The common prediction enablers include temperatures, wind direction and wind speeds and flowering of trees.

One of the indicators of high and good rainfall seasons was wind blowing in various directions. For instance, strong winds blowing from the west was associated with dry drought. In addition, the flowering of trees was associated with limited rains. In an interview, one of the respondents had the following to say, "If you see especially *Muchakata* trees with many flowers, it is a sign that we will have limited rains that season. Those who know will start to preserve their food in preparation for a drought."

These revelations inform that IKS is useful for predicting rainfall. Enock (2013) argues that the use of indigenous knowledge to predict rainfall is confined not only to the people of the Bikita community but to other surrounding communities. Similarly, Mwaniki and Stevenson (2017) revealed that farmers in Kenya relied on IKS for weather forecasting and Muyambo et al. (2017) observed that smallholder farmers adapted to climate change with IKS.

Soil Fertilisation

Findings revealed that the local people of Bikita had a common practice of fertilising the soil, using green manure of stalks of maize, sorghum, beans and groundnuts as well as livestock manure. These practices are meant to enhance soil structure, moisture retention, hence, productivity of the soil. This finding is consistent with Rankoana (2022) and Afful and Ayisi (2020) who found that small-scale farmers in Limpopo, South Africa embraced soil mulching to preserve soil moisture while holding the soil together. Similarly, Lema and Majule (2018) observed that smallholder farmers in Burkina Faso, Niger and Senegal burnt crop residues to improve soil fertility.

Crop Planting Calendar

The other locally based practice reported among the Bikita community farmers is the timing of planting of crops and the type of crops. The farmers opined that the late onset of the rains was negatively affecting their farming calendar. As an adaptive practice, the farmers are now delaying to plant until enough rain to enable the growing of crops. One of the respondents reported,

> When growing up, we used to do dry planting… the second week of October that is when we were in the field planting. Then we certainly knew that by end of October, the first rains were coming. In recent years, I have shifted my planting dates to conform to the shift in dates we receive the first rains.

Another respondent gave similar information regarding the crop-planting calendar:

> Long ago, we used to instruct people to start herding their cattle and goats as early as the second week of November because the fields would be greening with crops. However, nowadays people are not planting until around early December. Even if we receive some rains earlier on, people just do not put seed to the ground until that time when they are sure that the crops will suffer the scotching heat by the rains.

Therefore, shifting of planting dates is a key IKS applied by the local people of the Bikita community as an adaptation strategy. The findings match with those by Makuvaro et al. (2018), who observed that farmers in Lower Gweru were planting their crops late in the year in response to the late onset of the rains. Elsewhere in South Africa, Afful and Ayisi (2020) and Rankoana (2022) reported similar trends in Limpopo.

Creating Food Reserves

The study findings show that the Bikita community has been experiencing both good seasons marked with good harvest and bad ones that had crop failure. In responding to the situation of crop failure, local people applied their indigenous approaches to ensure the availability of food in their community. The data revealed that during good seasons that produce good harvests, households stored the extra yields for future use. A respondent reported,

> Nowadays when we have any extra grains, I am never tempted to sell… you never know what the next season will bring on us… sometimes it comes with drought. Therefore, we have learnt to reserve food from the good harvest year for future use. This has become a common practice in the community. As for me, I only sell when I have assurance that the crop in the field has matured enough, promising to give me a good harvest.

The finding implies that reservation of food was a notable feature of the IKS employed in the Bikita community as the local people strived to adapt to vulnerabilities resulting climate change. This finding resonates with Egeru (2017) whose study established that adaptation initiatives employed by the local people of Eastern Uganda included reserving sufficient food stocks, among others. Similarly, Rankoana (2022) reported that the local people in Nandi and Keiyo communities in Kenya served the food stocks they had at their disposal.

Climate-Proofing Agriculture

The study found that the use of traditional farming practices, such as pfumvudza/intwasa can be the best strategy to counter climate change. The pfumvudza farming method is a reflection of shifting cultivation, commonly used in the past. This was justified by the following sentiments from one of the respondents:

> The other strategy to counter lack of rainfall is to engage into shifting and on the spot type of farming, popularly known as pfumvudza as we grow small gain crops such as rapoko, millet and sorgum. We can rear small livestock, such as goats, chicken and sheep. This small animal does not require a lot of water and care.

The rearing of small animals is a way of reclaiming and rebuilding the national livestock. Goats and sheep are inherently more resilient to drought conditions as compared to cattle, which demands remarkable investment and larger pastures. Therefore, this ensures food security as the demand for meat and dairy products remain stable, regardless of change of rainfall patterns. Engaging into small livestock farming allows farmers to harness a small piece of land. Traditional crops are highly susceptible to little rainfall patterns.

The study ascertained that the IKS on climate change is evident among the people of Bikita Community, evolving from one generation to the other. The common Indigenous Knowledge adaptation practices in are rainfall forecasting through tree phenology, animal strategies, soil fertilisation, crop planting calendar and food reservation and practicing climate proof agriculture.

Conclusions and Recommendations

The study concludes that investing in the African Indigenous Knowledge system is the solution to mitigate environmental weather patterns. The indigenous measures are critical in empowering the farmers in Bikita to embrace and align their farming activities to indigenous knowledge. The people in Bikita community relied on the African indigenous knowledge system in prediction of weather forecast. Therefore, the study recommends farmers to embrace their traditional farming identity through training and awareness engagements.

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