Indigenous knowledge systems based climate governance in water and land resource management in rural Zimbabwe
S. S. Mugambiwa and J. C. Makhubele

ABSTRACT
This paper interrogates indigenous knowledge systems (IKS) based climate governance in water and land resource management in under-resourced areas of Zimbabwe. Water and land resources are fundamental for smallholder farmers and their productivity. The concept of IKS plays a significant role in climate change adaptation in Zimbabwe’s rural communities. Climate change has a considerable influence on the success of agricultural production in the rural communities of Zimbabwe. Hence, it becomes fundamental to assess the community-based methods of climate governance. Qualitative multiple case study exploratory designs were employed with data collected through individual interviews with smallholder farmers, and thematic content analysis was used to analyse data. This study found that enhancing and embracing IKS is of paramount importance for inclusion in local-level strategies in the development process with special reference to climate governance in water and land resource management, particularly in under-resourced communities. It also established that the use of IKS enhances communities’ adaptive capacity and it should not be conducted at the expense of scientific methods but rather should be employed in order to complement the existing scientific global knowledge systems.

Key words | climate change, climate governance, indigenous knowledge systems, rural Zimbabwe

HIGHLIGHTS
• This paper interrogates the role of IKS in land and water resources sectors.
• This study makes a striking contribution by revealing the strengths and weaknesses of IKS in climate change adaptation.
• This paper recommends the incorporation of IKS into national climate change policy.

INTRODUCTION
It has been recorded that the concept of indigenous knowledge systems (IKS) plays a significant role in climate change adaptation in rural communities (McGregor 2004). In earnest, IKS is context-specific, implying that every community

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(Chanza & de Wit 2016). This knowledge cut across the spectrum from health, economy, safety, among others, and only qualifies to be IKS, for the purpose of this paper, if it has significantly helped in the solving of problems pertaining to climate change among many other socio-environmental problems. Indigenous people observe nature and its varying activities around them in many ways and in the event of shocks and threats, they apply the knowledge that they possess about the environment, mainly passed orally, and all other associated aspects around it, if possible to address and perhaps to adapt to the environmental threats that will be surrounding them. It has been documented by some scholars that indigenous people who live in the vicinity of natural resources observe the activities around them and they identify and adapt to any changes in different ways (Mugambiwa 2018). This implies that people are amenable to the environment they live in as espoused by the IKS philosophy of Ubuntu which emphasises symbiotic co-existence and taking an in protecting the environments for mutual benefits.

The symbiotic interdependence with the ecology enabled indigenous people to learn to observe how various natural artefacts from animals, birds, and plants change, interact and behave over a period of time. For instance, in support of the above assertion, Nhemachena (2007) aver that the changes that indigenous communities witness are associated with certain birds flocking to a particular direction or making a particular sound, mating of certain animals and flowering of certain plants. Through lifelong observations and knowledge passed from older generations, these are indicators that communities use to narrate and predict certain changes and that they could be expecting certain environmental shifts that in most cases are related to climatic change. To that end, preparations by IKS would be underway in response to anticipated environmental and climatic changes or disasters, such as floods or droughts. In an effort to cope with the rapidly changing environmental and climatic conditions due to excessive or low rainfall and drought, indigenous people in many parts of Africa grow different crops with different resistance to drought and floods and they often supplement these by hunting, fishing and gathering of wild plants (Nhemachena 2007). Therefore, IKS under such conditions are used to ensure continuity, preservation, restoration and sustainability of the welfare of the families and the community at large. In that regard, IKS is regarded as the fulcrum for local-level decision-making in rural communities. Continuity, preservation, restoration and sustainability of IKS have value not only for the communities in which it evolves and is practised but also for western trained scientists and planners striving to improve conditions in rural localities. This suggests that recognition of IKS and its holders is the starting point for meaningful contribution in any given form of development in any community.

Communities, both formal and informal, around the world have lived with and experienced numerous environmental and climate-related disasters throughout their existence. These disasters include droughts, floods, hails, thunderstorms, tsunamis and windstorms that are often reported to have caused the deaths of people, livestock and crops (Oluoko-Odingo 2010). These disasters should be understood and often be prepared for in order for communities to always be in a safer place in the event that they happen, hence the revisiting of IKS in mitigating such effects of environmental and climatic disasters. In Zimbabwe, numerous environmental hazards have often been reported and these include droughts and cyclones. Droughts in Zimbabwe are reported to have become more frequent and severe with the 1992–93 drought recorded to be the worst in recent memory, considering the fact that it caused the loss of 60% of the national cattle herd in the country. In the recent past, in 2019, the eastern part of Zimbabwe experienced tropical cyclone Idai which left many dead and communities ravaged. Before the emergence, unilateral and wide use of modern western scientific methods, under-resourced communities relied entirely on the application of IKS.

It is further reported that through observations over time some animals, birds, insects and plants were considered to have the capacity to detect and respond to changes in the atmospheric conditions (Mugambiwa 2017). IKS is not static, and therefore, human cultural development has progressed and taken different levels and stages over the years. Oluoko-Odingo (2010) posits aptly that the manner in which people use their IKS (cultural beliefs) to respond to the difficulties they face has also been translated to the environment in order to cater for climate-related challenges so as to help communities adapt to the numerous impacts of climate change. Another interesting angle of IKS, as postulated by
Mugambiwa (2017), is that communities have made numerous strides, which include mastering the positions of stars, the sun and the moon in relation to impacts on their daily lives. IKS holders are able to predict climatic conditions, the emergence of health conditions, among others, based on the position of the half-moon or full-moon. All these experiences are of paramount importance in predicting future climatic changes and shifts and being able to explain them within their cultural contexts. In support of that, Ajibade & Shokemi (2003) confirm that the knowledge of past disasters and climate in Africa constitutes part of the IKS based experiences that have been handed down from generation to generation in the form of oral tradition. IKS is constituted by varying knowledge systems that have been developed over a very long period of time by communities prior to the emergence of western scientific knowledge.

METHODS

This paper employed a qualitative, multiple case study exploratory research design in order to investigate IKS based climate governance in water and land resource management in rural Zimbabwe. The population of the study constituted all smallholder farmers in Mutoko District and criterion purposive sampling was employed to select research participants. Thirteen participants were selected for in-depth interviews. The 13 participants who took part in in-depth interviews constituted smallholder farmers who are adult residents of the community whose daily work activities are directly affected by the effects of climate change. Inclusion criteria for data collection were informed by factors such as age of the respondents, period of stay in the area and general understanding of climate change, climate change adaptation programmes and indigenous practices used to adapt to the effects of climate change. Household in-depth interviews were conducted at the participants’ homesteads. Data were analysed through Thematic Content Analysis (TCA).

Theoretical framework

Grounded theory was adopted as the theoretical basis of the study. The theory was propounded by sociologists Barney Glaser and Anselm Strauss. The creation of the theory was informed by the high levels of displeasure Glaser and Strauss had with the existing theories that dominated sociological research (Glaser 1992). The fundamental argument was that there is a need for researchers to be in a position to formulate theories from the findings of social research rather than rely entirely on the existing theoretical perspectives. This was considered instrumental because it gives rise to the formation of new social theories that are social bound and context-specific. Glaser & Strauss (1967) asserted that such theories are essential in understanding the specific detailed features of any area or aspect of social research. This is because the theory would be grounded in the data from which they had emerged rather than relying on analytical constructs and variables from pre-existing theories. As a result, grounded theory was established to open space for the development of new contextualised theories.

Furthermore, Glaser (1992) asserted that grounded theory should be employed as a general methodology of analysis that is closely associated with data collection that makes use of the data to formulate a theory using systematically applied set of methods. Glaser & Strauss (1967) opined that the other importance of grounded theory is to help forestall the opportunistic use of theories that hold a dubious fit. Their argument was that there is a tendency among researchers to produce highly empirical research whose conclusion has a tacked-on explanation borrowed from a logically deduced theory. In so doing, the author will be trying to furnish the data with a more general sociological meaning and to account for and interpret the findings. Glaser & Strauss (1967) present what is termed logico-deductive theorising, whereby the sociologist makes use of selective examples systematically and allows them to have theoretical control over his formulations. This is large because the adequacy of theory in sociology comes from the premise that it cannot be divorced from the process through which it is generated (Babbie & Mouton 2011). As such, one of the ways of judging the usefulness of a theory is by assessing how it was generated. It is also argued that in order for a theory to gain prominence it should possess the following facets; logical consistency, clarity, parsimony, scope and integration (Babbie & Mouton 2011).
Furthermore, the generation of theory from data is not entirely a result of the data that is collated for the study. Rather, it is a product of a combination of systematically worked out data and other ideas that emerged from the research (Babbie & Mouton 2011). The source of certain ideas can also come from sources other than the data. Grounded theory guidelines provide steps through which the researcher should follow in order to reach the conclusions of a theoretical perspective. The reason for the adoption of grounded theory is to do away with the dominance of hypothetico-deductive theory-testing approaches. Against this background, Glaser & Strauss suggested the adoption of grounded theory as a way of systematically building a theory making use of data obtained from social research. As such, the steps and guidelines followed in analysing the data in this study through grounded theory are as follows:

- Identifying Categories

Identifying categories is where the researcher intends to group together instances such as events, processes or occurrences that possess the central commonalities and features.

- Coding

After identifying the categories, the step that follows is coding which is largely descriptive as it gives the researcher a chance to identify higher-level categories that systematically integrate low-level categories into meaningful units as proposed by Glaser (1992).

RESULTS AND DISCUSSION

Hereunder are the findings and subsequent discussions pertaining to the IKS in climate governance in relation to water and land resource management.

IKS dimension

The concept of integrating IKS in climate change governance is not a new phenomenon in Africa. Natural disasters such as droughts and floods have been on the face of the continent for many years. Africans have employed various ways to adapt to the effects of such disasters (Brooks & Adger 2005). Communities in many African countries have as a result managed to cope with the changing environment and also along the way acquired the skills readily needed for them to cope in the face of climate change and other non-climate change related disasters (Oluoko-Odingo 2010). Many African countries have survived numerous weather catastrophes because they have identified ways of coping with the changing environment within their cultures and it has worked well for them. Mugambiwa (2018) avow that such ways are consistently applied by many African countries in order to adapt to the effects of climate change and Africans in Mutoko District in Zimbabwe are not excluded.

This study found that IKS governance in the water and land use sector has a fundamental cultural dimension that draws the attention of the local farmer. In essence, the concept of IKS brings about the cultural dimension of the debate on the general perception of climate change and the presumed and actual adaptation strategies. As a result, the cultural dimension is of paramount importance to the development of options on matters of national importance because they are closely related to the indigenous people. The findings of the study revealed that climate change as one of the pressing environmental challenges should be dealt with within the context of IKS (culture) and should have numerous culture-based adaptation strategies in place. Some of the culture-based strategies revealed by participants are the practice of rainmaking ceremonies. This study revealed that the practice is now hardly conducted due to the emergence of foreign western religions and other societal transformations. Therefore, in this case, one of the participants indicated:

‘... cultural activities might not have changed but there is lack of seriousness and consistence among community members on the practice of cultural activities such as Mafuwe (rain making ceremony) which has always been one of the major cultural activities in this area. I think some of the reasons for this is the forms of religion that our people are now subscribing to which are not considerate of our African cultural beliefs’

[Participant 12: In-depth interview].
In corroboration of the above sentiments, another participant echoed that:

‘... in our culture it has always been the norm that in the event that we have little rains we would conduct ceremonies such as Mafuwe (rain making ceremony) where the spirit mediums were consulted. So from there the spirit mediums would positively respond to the request of the communities through provision of rains’

[Participant 6: In-depth interview].

In correspondence with the finding, Patt & Gwata (2003) opined that many communities are in a position to demonstrate their richness in IKS by the practices that they take part in such as rainmaking ceremonies. The authors further suggest that the richness of IKS is demonstrated by the fact that many of these processes and practices are not uniform, implying that they are diverse but they produce results that are effective and can be used successfully for climate change adaptation. The processes and practices vary significantly in different parts of the continent, that is, the western, eastern, southern or northern. Moreover, IKS on its own provides a wide range of opportunities for in-depth studies that reveal how the different processes are executed and how they inform or impact the process of adaptation and national climate change policy.

It can be argued that ideas can be easily adopted if they are proven to have been tried and tested. As such, the adoption of practices that are said to have been passed from generation to generation in the realm of IKS is likely to provide better opportunities in the quest to address the challenge of climate change (Patt & Gwata 2003). This implies that practices that are quick to be adopted by people, in general, are those that are already in existence, with a proven record of success. Patt & Gwata (2003) conducted a study in Zimbabwe and observed that the use of seasonal forecast in conjunction with IKS made local farmers more willing to take part in the process. That was largely because the process presented the farmers with practices in which they are well versed. Some of the IKS processes and practices that the farmers took part in were related to natural mulching, suppression of diseases and harmful pests, and conservation of soil moisture. There was also the widespread use of IKS based plant materials that included agrochemicals to combat pests that are normally known to attack food crops by small-scale farmers. Lastly, the use of controlled bush clearance as a way of minimising the washing of soil surface by the runoff and the use of green manure and protection of riverbanks are some of the most important IKS methods that the communities employed.

**IKS water resources management**

Germaine with previous studies (Chanza & de Wit 2016; Mafongoya & Ajayi 2017), this paper established that processes and practices by IKS Holders/Practitioners that are already in place are easily adopted. The other indigenous knowledge practice that was outstanding in this study is indigenous methods of irrigation. Lack of sufficient rains, which has become a common phenomenon over the years in Mutoko and many other places, has seen indigenous methods of irrigation become an effective adaptation strategy. There are many forms of irrigation that are practised in the area. One of the common ways is river water harvesting where irrigation water is drawn from river waterholes. This is a common practice that has been passed from generation to generation in many villages. To better comprehend this, one of the participants had this to say:

‘... the rivers have dried prematurely and it is very worrying because we depend heavily on them. It is part of our indigenous agricultural system that when the rains go we use water from riverside wells to irrigate our plants. That has always been the system and it sustained our forefathers and it has been passed from one generation to the other. Today we use the same system but merging it with scientific ways that comprise the use of solar panel induced irrigation’

[Participant 4: In-depth interview]

Communities in general and smallholder farmers in African communities have always experienced and coped with environmental disasters. Through these experiences, farmers possess the knowledge that is relevant to cope with adverse environmental shocks and stresses caused by climate change (Oluoko-Odingo 2010). This knowledge is described by scholars as what is needed and essential in the mapping out of a comprehensive national response for
climate change. IKS forms that foundation and basis of climate change adaptation because they are responses with which indigenous people are well versed. Enhancing and embracing IKS is of paramount importance for inclusion in local-level strategies in the development process. IKS is believed to develop in an area where people have a long history of residence and are integrated with their biophysical environment.

Another important aspect that will be seriously impacted by climate change is water resources (Moellets et al. 2013). The availability and quality of water are highly affected largely because climate change can either result in less precipitation or cyclones, both of which result in drought. In the event that there is less precipitation, there will be less water for agricultural activities and in instances where there are floods, the quality of water available is likely to be largely contaminated and crops are destroyed which results in hunger and food insecurity. Both effects can be argued to have serious impacts on agricultural activities since rural communities rely heavily on agriculture as the basis of their subsistence economy (Joshua et al. 2011). It has also been revealed that water is considered to be critical for agriculture across the semi-arid tropics despite the fact that rainfall predictions are said to be uncertain. In that regard, scientists concur that climate change will reduce the availability and storage of water and warmer temperatures will decrease water quantity and quality that is needed to water crops (Mogotsi et al. 2011; Moellets et al. 2013). The improvement of crop production is largely reliant on crop production, which suggests that water availability is of paramount importance insofar as crop production and sustainable development is concerned. Consequently, Jiri et al. (2015) purport that valuable local knowledge relating to climate change assessment and adaptation is held by rural societies. These knowledge systems are transmitted and observed by each succeeding generation and in the process, they ensure the wellbeing of communities by providing food security, environmental conservation as well as valuable skills for disaster risk management.

Nkoana et al. (2018) opine that numerous adaptation strategies that are related to agriculture have positive impacts on water resources and management. At that same wavelength, more than half a decade ago, it was also reported that most importantly, there is no form of agriculture that takes place without water resources and farmers make various efforts to supplement water resources in the event that they are faced with the effects of climate change that strain water resources (Anguelovski et al. 2014). In that regard, one needs to make mention of the fact that most of the water-related adaptation strategies include the different types of irrigation that many people take part in. These include syphoning water from the rivers or wells or boreholes. However, despite the different types of irrigation that people are involved in, they all serve the same purpose which is to provide supplementary sources of water (Cooper et al. 2008). It has also been argued that improved cropland and grazing management play an important role in water storage and infiltration in an effort to reduce loss through runoff and resulting in greater water availability in the soil and enhancing ecosystem water balance. This also plays an important role in manure application and generally for other approaches that are responsible for maintaining or increasing soil organic matter.

Furthermore, conservation agriculture is said to be important in the reduction of evaporation from the soil in drier environments (Nkomwaa et al. 2014). This comes as a result of the combined water loss that takes place through runoff and evaporation which often leaves less than half of the rainfall available for crops. It has also been established that terraces and contour ridge farming have huge impacts on water, providing for storage of rainfall and discharging excess runoff through a drainage system (Nkoana et al. 2018). Nonetheless, in places where water management is aimed at drainage to lower water tables for crop production, there will be the risk of exposing soil organic matter and promotion of substantial losses of soil carbon. The arguments provided by scholars reveal that much of the concern over water resources in agriculture stems from a lack of moisture needed to maintain crop or forage production at optimal levels.

Moreover, it has been argued that this issue is particularly critical in dryland agricultural systems (Abbas et al. 2016). As a result, irrigation is considered to be the most common and direct way for producers to reduce water stress to crops and forage grasses through improved cropland and grazing management are also some viable alternative strategies that can be used to improve soil water regimes. Nkomwaa et al. (2014) established that in semi-arid areas of sub-Saharan Africa, small-scale farmers
make use of digging pits to harvest rainwater as well as rehabilitate degraded land for cultivation of millet and sorghum. This form of technology is known to improve infiltration and increases nutrients that are found or are available on sandy and loamy soils which leads to significant increases in yields and improved soil cover. In the same places, farmers are also involved in water harvesting from rooftops and they also divert water from natural springs into tanks (Anguelovski et al. 2014). This helps to ensure that they have a substantial amount of water stored up for future use. This suggests that when they experience drought, the stored water will sustain them for a much longer period of time which will make it possible for them to continue with their agricultural activities.

Furthermore, it has also been found that water is important for supplementary irrigation of vegetables and crops (Cooper et al. 2008). In some locations, it was argued that the weather becomes dry, as in the case of a short period of rains then, as a result, the water infiltrates underground and is used by the plants such that farmers continue with their agricultural activities (Abbas et al. 2016). Also, crops are said to likely grow to maturity making use of the conserved moisture. The experiences of farmers demonstrate that no matter the fewer numbers of days that are available for farmers in a season, they will be in a position to harvest water in the pits (Nkoana et al. 2018). Of utmost importance is the fact that these processes are made possible by the combined use of IKS and scientific techniques, both of which have the potential to contribute to productivity while also sustaining the farming system.

**IKS weather forecasting**

Regarding IKS weather forecasting, this study found that the elderly farmers are responsible for the formulating hypotheses relating to seasonal rainfall and this is done through the observations made on the natural phenomena. These methods of observation were referred to in this study as IKS weather forecasting.

‘… There are certain wild fruit trees that usually show us that there would be more rains if they produce in abundance. The wild fruit trees include Mitohwe (Thespesia garckeana) tree which produces Matohwe (Snot apple/African chewing gum) and Muhute (Syzygium cordatum) tree which produces fruits known as Hute (oval berries) among others. The tree is found usually near streams or swampy spots. So whenever the tree produces fruits abundantly, it means that there would be more rains.’

IKS based knowledge which people usually use is related to tree species and animals, among other things. The knowledge of tree and animal species gives community members the ability to understand the environment they live in to the extent that they are able to relate their behaviour to physical changes. Furthermore, there is also the involvement of cultural and ritual specialists to draw predictions from divination, visions or dreams. This translates to the fact that IKS has another side that does not only dwell on the lived experiences but rather it focuses on the supernatural world that translates to the role of the gods or ancestors and spirit mediums.

Ajibade & Shokemi (2003) allude to the fact that local communities in Africa have developed complex systems used in the gathering, interpreting and decision-making that is weather-related. Ajibade and Shokemi also found that in Nigeria, farmers are able to use knowledge of weather systems such as rainfall, thunderstorms, windstorms and sunshine to prepare for future weather. This is done through the use of IKS and they have adopted what is known as IKS weather forecasting that is now an important part of farmers’ planning and response system to disasters. In that regard, the difference between traditional and Western systems is that meteorologists use global models and satellite imagery, while IKS draws its knowledge from perspectives base on lived experiences related to the aforementioned animal and plant species among many other aspects.

The main reason for employing IKS adaptation in rural communities is reported to be a way of helping to ensure the achievement of sustainable development in rural communities. Scholars confirm that little has been done to incorporate IKS into the formal climate change adaptation strategies vis-à-vis climate governance (Mugambiwa & Rukema 2019). The phenomenon of climate change cannot be dealt with outside the concept of sustainable development. This is so considering the fact that many rural communities rely largely on the natural environment; hence, strategies to deal with the effects of the natural environment are needed in order for them to achieve
sustainable development. As such, incorporating IKS into climate change policies can lead to the development of effective adaptation methods that are not only cost-effective but also participatory and sustainable. This is because they will not require more money to implement and the people around villages will be willing to take part because the programmes will be within their cultural context.

Furthermore, Ajani et al. (2013) argue that the significance of IKS has been noticed and acknowledged in its design and implementation that is aimed at sustainable development projects. In the same spirit, it has been established that the challenge at hand is that very little has been done to incorporate IKS into formal climate change adaptation strategies. That, therefore, calls upon policymakers and academics to find ways in which they can work towards ensuring that IKS is incorporated in the broader academic spectrum (Williams & Hardison 2013). Despite the fact that IKS has been passed from one generation to the other by word of mouth, its significance should not be overemphasised. This is because IKS is considered to form the basis of local-level decision-making in many rural communities on the continent, as such it will be difficult for communities to do without it (Adger et al. 2012). It has also been established that IKS is transferable to the extent that it provides relationships that connect people directly to the environments in order to assist them to find ways of adapting to the effects of climate change.

The arguments that have been made thus far demonstrate that it is difficult to deal with climate change outside the context of sustainable development. Climate change cannot be separated from sustainable development since sustainable development is the most effective way through which communities can frame the adaptation and mitigation question. The process of integrating IKS into climate change policies requires the development of competitively effective adaptation strategies that are cost-effective and sustainable (Leonard et al. 2013). In that regard, it can be argued that IKS brings about simple and user-friendly strategies that communities can easily employ to cope with or adjust to the impacts of the climate in rural communities.

Furthermore, it has been documented that local farmers in sub-Saharan Africa have over the years developed a number of adaptation strategies that have constantly enabled them to reduce vulnerability to climate change (Adger et al. 2012). Some ways that are constantly employed in many African countries include the development of early warning systems for the prediction of events. Predicting weather and climate is one aspect many rural communities are credited with because IKS gives them the capacity to understand the current weather conditions and to predict future weather conditions and disasters (Mugambiwa 2018). That suggests that predicting weather conditions is the strength of farmers in most parts of sub-Saharan Africa rural communities. It is reported that these farmers have developed complex systems that they use in gathering, prediction and interpretation of weather-related aspects and information using IKS (Adger et al. 2012). The systems they employ with the use of IKS have been immensely significant to the farmers as a way of managing their vulnerability to the effects of climate change.

CONCLUSIONS

Embracing IKS has been found to be essential in local-level strategies in the development process, particularly in water and land resource management. The integration of IKS and climate governance was found to be sufficient because it provides communities with options for adaptation that are within their means. As such, despite the high probability of natural disasters such as droughts and floods IKS gives communities confidence in the capacity they have to achieve their expected outcome because it presents adaptive options that were designed within their contexts to suit their needs. Employing such methods has necessitated the community in this study to cope with the changing environment and also along the way acquired the skills readily needed for them to cope in the face of climate change and other non-climate change related disasters. The community has also survived certain weather catastrophes due to the fact that it identified ways of coping with the changing environment within its cultures and it has worked well for them.

This study has also established that climate change has had overwhelming impacts on agriculture, specifically on land use and water resources among other sectors. It is important to note that in the Shona culture land and water resources are strongly associated with supernatural powers wherein the ancestors are considered to have control over them. Hence, the connection ancestors contribute to
informative channels of adaptation because the ancestors are considered to be overseers of the living who see what will happen in future and provide solutions. Due to the aforementioned ancestors’ link, the use of IKS enhances communities’ adaptive capacity since it presents adaptation methods that are context-specific and social bound.

This paper established that processes and practices that IKS Practitioners practices that are already in place are easily adopted. This shows that IKS is not limited to indigenous knowledge since it also takes into consideration existing methods to alternate them or to merge them for the sake of improved adaptive capacity. The other dimension through which IKS enhances adaptive capacity is through the provision of community-based weather forecasting. In this study, the elderly farmers are responsible for formulating hypotheses relating to seasonal rainfall and this is done through the observation made on the natural phenomena.

The use of IKS weather forecasting methods significantly enhances adaptive capacity in the area since a plethora of community members do not have access to meteorological service reports and they also do not have to capacity to interpret them. Given the significance of the IKS as an adaptive strategy, there is a need for support from the national authorities through policy. Zimbabwe has a National climate change policy framework that says little about the role of IKS in climate change adaptation. This is against a background of many rural communities that depend on IKS. This suggests the need for the government to consider revising the policy document in order to incorporate the use of IKS in the National Climate Change Policy Framework. There are also challenges associated with IKS to the effect that to some extent it is maladaptive. This is because many communities are adapting to the use of scientific methods in all areas of life such that it becomes difficult to consider the use of IKS in certain instances. Hence, that requires a consideration of selective systems of IKS wherein it is applied where it best works and in certain instances, it is not considered.

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DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.
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