THE USE OF INDIGENOUS KNOWLEDGE FOR SUSTAINABLE LIVELIHOODS IN THE COMMUNITIES OF STANHOPE IN ZIMBABWE AND MSINGA IN SOUTH AFRICA

Inesisa Ncube
University of South Africa, South Africa
inesisancube@gmail.com
https://orcid.org/0009-0009-2461-6807

Josiline Chigwada
University of South Africa, South Africa
chigwaj@unisa.ac.za
https://orcid.org/0000-0003-0964-3582

Patrick Ngulube
University of South Africa, South Africa
ngulup@unisa.ac.za
https://orcid.org/0000-0002-7676-3931

Jan R Maluleka
University of South Africa, South Africa
maluljr@unisa.ac.za
https://orcid.org/0000-0002-3760-8162

ABSTRACT

Indigenous knowledge (IK) plays a crucial role in maintaining and enhancing sustainable livelihoods in communities. Considering that many communities have struggled to maintain a peaceful relationship with the environment, IK is invaluable to the creation of sustainable communities. The study aimed to assess the use of IK in sustaining livelihoods in selected communities in South Africa and Zimbabwe. A qualitative, multi-case study was conducted among two purposefully selected communities in Msinga, South Africa, and Stanhope North, Zimbabwe. The target population included men and women aged 18 and above who resided in Msinga and Stanhope North. Data was gathered through face-to-face interviews and focus group discussions (FGDs) with community leaders and community members, respectively. Data was analysed thematically. The findings revealed that rural communities still use IK to sustain their livelihoods. However, this knowledge is continually being lost as the younger generations prefer Western knowledge. The study recommends that further studies be undertaken to engage younger generations in the use of IK and to explore ways in which technology can be utilised to share this knowledge in informal settings. Further recommendations include encouraging IK holders to share their knowledge, documenting this knowledge for future use, and obtaining support from the government and other stakeholders to promote the documentation of this knowledge and prevent its loss.

Keywords: Documenting indigenous knowledge, Indigenous knowledge management, sustainable communities, sustainable development goals, sustainable livelihoods

INTRODUCTION AND BACKGROUND

Indigenous communities use IK as a basis for communication and decision-making (Baporikar, 2022; Maluleka and Ngoepe, 2019; Maluleka and Ngulube, 2018; Morgan, Reid, McMillan, Kingi, White, Young, Snow and Laurenson, 2021). IK is used to make decisions on food security, human and animal health, education, environmental and natural resource management, weather forecasting, and many other economic and social activities at a local level. However, the marginalisation of IK in modern development programmes has raised concerns about the sustainability of the livelihoods of the billions of people who rely on it, particularly in rural communities (Mhlongo, 2020; Nyiraruhimbi, 2012). This study assessed how the rural communities of Msinga and Stanhope North use IK to sustain their livelihoods. Although IK can be used to solve problems, the reluctance to acknowledge and use this knowledge has constrained the development of viable and sustainable strategies (Haambiya, Kaunda, Likongwe, Kambewa, Chama and Musuka, 2016). Furthermore, Hansen and Antsanen (2018) highlight that Indigenous communities are facing the effects of globalisation and modernity, which have led to a breakdown in the communication system. This has impacted the fundamental teachings and culture of indigenous people, which fosters the ability to communicate with oneself, others, and the environment (Magni, 2017). IK represents a community's cherished heritage and values, and is deeply embedded in its culture (Tirivangasi and Tayengwa, 2017).

IK plays an integral role in maintaining and strengthening livelihoods in communities and has been applied in areas such as agriculture, medicine, food security, biodiversity, environmental sustainability, and education (Kusumastuti, Silalahi, Asmara, Hardiyati, and Juwono, 2022; Masoga and Shokane, 2019). IK has enabled indigenous communities to sustain their lives by adapting to unfavourable conditions, while protecting the environment and enhancing their resilience to adverse conditions (Rukema and Umubyeyi, 2019; Aluko, 2018). However, globalisation, modernisation and Western knowledge have overshadowed IK, leading to local communities failing to solve life problems as they adopt imported solutions. While IK faces extinction, rural communities such as Msinga and Stanhope North still utilise this knowledge to sustain their livelihoods; yet, little effort has been made to examine how these communities are using this knowledge to sustain their livelihoods. This study aimed to help local communities, such as Msinga and Stanhope North, utilise the knowledge they already possess. Raising awareness of the importance of IK will contribute to its survival and support sustainable development. The study sought to establish the use of IK for sustaining livelihoods in Msinga and Stanhope North through the following objectives: to establish the use of IK in decision-making in these indigenous communities; to determine how IK is used for solving some global problems; to ascertain the use of IK for survival strategies by these indigenous communities; and to assess how IK assists in the sustainable use of these resources in indigenous communities. The next section provides the contextual setting of the study areas and a review of how IK can be used to sustain livelihoods. This is followed by the methodology, findings, discussions, conclusion and recommendations.

LITERATURE REVIEW

This study aimed to investigate how the communities of Msinga in KwaZulu-Natal (KZN), South Africa, and Stanhope North in Matabeleland North, Zimbabwe, utilise IK to sustain their livelihoods. The selection of these communities was based on their rural nature, remoteness from western influence and their harbouring of IK. Msinga is in the midlands of KZN, approximately 50 kilometres north of Greytown and 90 kilometers south of Dundee (Msinga Local Municipality, 2021). It is comprised of six traditional authorities, including Bomvu, Mabaso, Mchunu, Mthembu, Ngome and Qamu, spanning 2500 square kilometers (Msinga Local Municipality, 2021). The area is predominantly rural, with the Ingonyama Trust serving as the traditional authority, owning 69 per cent of it. The traditional culture, which provides a support system for the community and its custodians, is an asset that should be preserved and valued (Msinga Local Municipality, 2021). Stanhope North is in ward sixteen of Matabeleland North Province's Umguza district in Zimbabwe. It is located 54 kilometres northwest of Bulawayo, in the Bulawayo Metropolitan Province, along the old Tsholotsho Road (R53) (Ndhlovu and Mpofu, 2016; Zimbabwe Statistics Agency, ZimStats, 2012).

Located on the banks of the Gwayi River, Stanhope North is divided into six traditional villages, with plots forming the seventh village. Due to the sandy and dry nature of the area, Stanhope North is primarily suitable for cattle ranching; however, villagers practice subsistence farming of drought-resistant crops, including sorghum, various maize varieties, watermelons, and groundnuts (ZimStats, 2012). The abundance of Mopani trees in the area allows villagers to harvest Mopani worms (*amacimbi*) for consumption and retail purposes. The underdeveloped and rural nature of Stanhope North has led to a lack of infrastructure, including access to portable water, roads, and electricity. Consequently, many villagers must walk long distances to fetch water from the Gwayi River (World Food Programme, 2022). Rural communities like Msinga and Stanhope North's reliance on natural resources has largely helped them to use their IK to sustain their livelihoods without overburdening these natural resources. These communities have used locally available resources to generate income and sustain their livelihoods. People in Msinga and Stanhope North have led simple lives due to the limited access to modern technology (Baiyegunhi, 2015; Mbatha and Masuku, 2021). Considering this, Goduka (2012) posits that with most of the IK in communities being undocumented, it is at risk of disappearing due to globalisation and modernisation. These have led to younger generations adopting different values and lifestyles through exposure to international and global influences. Moreover, the modern world has overlooked the potential of such knowledge to contribute to sustainable livelihoods.

Use of IK in decision-making

IK plays a crucial role in decision-making processes across various fields, including environmental conservation, natural resource management, education, food security, public policy, and healthcare, among others (Morgan et al., 2021; Ojeda-Zavala, 2022; Robinson, Mairi, Bangalang, Nayinggul et al., 2022). Integrating IK into decision-making can enhance the effectiveness and sustainability of these decisions. IK about local ecosystems, plants, and animals can inform conservation efforts, helping to protect and

restore natural habitats. Indigenous communities often possess extensive knowledge about sustainable hunting, fishing, and farming practices, which can guide resource management strategies (Persoon and Minter, 2020). There are also traditional methods for predicting weather patterns and extreme events, which can be valuable for climate change adaptation planning (Filho, Wolf, Totin, Zvobgo, Simpson, Musiyiwa, Kalangu, Sanni, Adelekan, Efitre, Donkor, Balogun, Mucova and Ayal, 2023). IK has helped rural subsistence farming communities adapt to climate change and make agricultural decisions for decades (Basdew, Jiri and Mafongoya, 2017; Filho, Barbir, Gwenzi, Ayal et al., 2022; Rankoanna, 2022; Naazie, Dakyaga and Derbile, 2023; Ubisi, Kolanisi and Jiri, 2020; Zvobgo, Johnston, Olagbegi, Simpson and Trisos, 2023). Therefore, the exclusion of local people and their knowledge from planning, management, and decision-making processes on issues that directly affect them has been found to cause conflicts between local people, agencies, and government in development strategies. This study aims to unpack how indigenous communities in Msinga and Stanhope North have been utilising IK for decision-making. The next section outlines how IK can be utilised to address community issues.

Solving problems using IK

The world faces several complex issues, such as global warming, terrorism, weapons of mass destruction, nuclear proliferation, failed states, ideological struggles, resource scarcities, wealth and health disparities, pandemics, globalising trends, human rights violations, and the continued use of force to advance individual, group, and national interests, which have led to global campaigns to promote positive environment behavioural change (Ige, Jita and Jita, 2019; Tapfuma, 2017). Farmers employed indigenous practices such as crop diversification, crop rotation, multiple cropping, intercropping, mulching, natural soil fertilisation, agroforestry, planting pits, using calabashes to store water, and ashes for pest control (Rankoana, 2022). Furthermore, in traditional African medical knowledge, the use of plants and herbs has been endemic to the continent's healthcare system, particularly in rural communities (Maluleka and Ngoepe, 2019). This wisdom has protected the health of indigenous communities by combining the collective knowledge, abilities, and experiences of healers (Maluleka and Ngoepe, 2019). The indigenous healing system combines knowledge of botany, toxicology, chemical physics, biochemistry, and psychology in a holistic approach (Ufearoh, 2020). Indigenous medical practitioners handle prevention and therapy, perceiving illness, and healing holistically. These therapies often improve healing by addressing the whole person rather than just the symptoms, and they also trace the disease back to its root cause. The IK systems that are being used by communities in Msinga and Stanhope North to solve problems will be documented in this study. The use of IK for survival strategies is explained in the next section.

Use of IK for survival strategies

Indigenous people have thrived for generations, adapting to adversities while maintaining their livelihoods. In rural communities, women play a pivotal role, applying their knowledge to enhance the livelihoods of their families and communities. Huambachano (2018) posits that indigenous communities have a fundamental culture-to-land relationship that is essential to their food and livelihood systems. Huambachano (2018)

and Rastogi and Dutta (2015) emphasise the importance of culture-to-land connections, arguing that disruption of this relationship due to modernisation and globalisation poses a threat to indigenous people's access to food and wellbeing. Food security is a major issue in Africa, with the continent remaining the least food secure globally (Huambachano, 2018). Indigenous food preservation techniques such as drying, fermenting, germination, boiling, and soaking have been employed by indigenous communities to preserve their produce after harvest. Asogwa, Okoye and Oni (2017) indicate that the influence of Western culture, globalisation, changes in women's socio-cultural standing, and a lack of documentation are all factors that have contributed to the loss of such techniques. Therefore, indigenous ways of food processing, preservation, and storage must be preserved and promoted as a survival strategy. This study aims to showcase how the Msinga and Stanhope North communities utilise IK as a survival strategy. The following section notes how they use IK in sustaining resources.

Sustainable use of resources

Indigenous peoples have employed sustainable methods, including farming, hunting, gathering, fishing, animal husbandry, and forestry, to enhance biodiversity and maintain healthy ecosystems (Keane, Khupe and Muza (2016). According to Chege, Semenye and Lemba (2018), these practices contribute to land and water management, forest and marine protection, and anti-desertification activities. Hence, cultural and religious values-based conservation strategies are often more sustainable than those based on legislation or regulation. D'Acqui (2016) used South Africa, Tanzania, and Zimbabwe as examples to highlight a technique for fostering sustainable improvement in soil fertility of marginal areas in semi-arid environments in East and Southern Africa. The study found that using indigenous, chosen strains of nitrogen-fixing cyanobacteria and releasing organic substances, such as exopolysaccharides (EPS), can improve soil fertility and crop productivity. Maroyi (2017) also found that indigenous peoples in the Eastern Cape province of South Africa have knowledge of local vegetation that provides them with food, fuel, and medicine, and that they have managed these resources sustainably for generations. Whether the Msinga and Stanhope communities are also utilising IK to sustain resources will be demonstrated in this study. The United Nations Sustainable Development Goals serve as the conceptual framework for this study, which assesses how the Msinga and Stanhope North communities utilise IK for sustainable livelihoods. These indigenous ecological practices align closely with the United Nations' Sustainable Development Goals (SDGs), particularly SDG 15, which aims to protect, restore, and promote the sustainable use of terrestrial ecosystems. Lushombo (2025) emphasises that IK systems provide a vital epistemological foundation for ecological sustainability, with embedded spiritual, cultural, and communal dimensions that reinforce long-term stewardship of land and biodiversity. By integrating indigenous ecological wisdom into mainstream sustainability frameworks, societies can enhance efforts toward biodiversity conservation, climate resilience, and the equitable use of natural resources, thereby contributing not only to SDG 15 but also to SDG 2 (Zero Hunger), 13 (Climate Action), and 6 (Clean Water and Sanitation).

METHODOLOGY

This study aimed to assess how the communities of Msinga and Stanhope North utilise IK to support sustainable livelihoods. A qualitative research design was adopted, underpinned by the interpretivist paradigm, which views reality as socially constructed and seeks to understand human experiences within their cultural and contextual settings (Creswell and Poth, 2018). The paradigm was deemed suitable as the study sought to explore community-specific knowledge systems and lived experiences that are best understood through subjective interpretations rather than quantifiable metrics. The rationale for using qualitative case studies lies in their ability to provide rich, contextual, and in-depth insights into complex social phenomena, particularly where cultural and community-specific knowledge systems are involved (Creswell and Poth, 2018). The multi-case design allowed for comparative analysis between the two communities, highlighting both commonalities and differences in how IK is applied. Both communities are predominantly rural, with rich traditions of IK used in farming, healthcare, environmental stewardship, and communal governance. These sites were purposively selected based on their geographical diversity, socio-cultural distinctions and known reliance on IK for sustaining livelihoods. Purposive sampling was employed to identify individuals with in-depth knowledge of community systems.

Data was collected through face-to-face semi-structured interviews and FGDs. Six semi-structured interviews were conducted with community leaders, three from Msinga and three from Stanhope North, who were selected due to their roles as traditional authorities, elders, and IK custodians within their communities. The decision to interview three leaders per site was guided by the need to ensure triangulation of perspectives while maintaining depth and manageability in data collection. These participants were identified through community entry processes facilitated by local gatekeepers, who helped ensure the cultural appropriateness and credibility of the research. These qualitative methods were selected for their effectiveness in capturing lived experiences, narratives, and culturally embedded knowledge that cannot easily be quantified. Semi-structured interviews offer flexibility while ensuring key themes are addressed, and are especially valuable when working with community leaders who hold deep insights into traditional practices (Priya, 2021). These leaders provided a foundational understanding of how IK is perceived and operationalised at the community level.

To broaden participation and capture a range of voices, five FGDs were conducted, three in Msinga and two in Stanhope North. FGDs were chosen because they facilitate dynamic interaction among participants, often uncovering shared beliefs, contested ideas, and group norms that individual interviews might not reveal (Yin, 2018). The number of FGDs was determined based on the principle of data saturation and logistical feasibility. Each group consisted of eight participants selected through stratified purposive sampling to ensure representation across gender and age categories. The discussions lasted approximately two hours per group. This group size was chosen to balance inclusivity with manageability, ensuring that every participant had an opportunity to contribute meaningfully (Khan and Abedin, 2022). Of the five FGDs, three were homogenous (e.g., women-only, men-only, or youth-only) and two were heterogeneous (mixed-gender and mixed-age). This deliberate structuring allowed participants to discuss sensitive or

culturally specific topics more openly in homogenous settings, while heterogenous groups provided opportunities to explore interactions and validate findings across demographic lines (Hennink and Kaiser, 2022). This combination helped mitigate potential biases and provided a more holistic understanding of community knowledge systems.

Data was collected using two primary instruments, that is, a semi-structured interview guide and an FGD guide, which were developed based on the study's objectives and informed by the literature review on IKS. The instrument included open-ended questions designed to elicit narratives about how IK is used in agriculture, health, conflict resolution, and environmental management. Follow-up prompts were used to encourage deeper reflection. Interviews and FGDs were conducted face-to-face in participants' languages with the assistance of trained research assistants and interpreters. Each session was audio-recorded with consent, and lasted approximately 60-120 minutes. The interview data provided foundational insights that informed the design and flow of the FGDs. This sequential and iterative approach enabled the research team to adapt questions for relevance and depth as the study progressed.

To ensure credibility, prolonged engagement with the communities and triangulation of data sources through interviews and FGDs were employed. Member-checking was conducted by summarising key points during the interviews and FGDs to confirm accuracy and intent. Transferability was supported by providing descriptions of the context, participants and findings. Dependability was enhanced through the use of an audit trail that documented research decisions and reflective memos. Documenting all the steps and decisions fostered accuracy and accountability, giving the researchers the opportunity to report and deal with inappropriate data. Confirmability was ensured by maintaining neutrality and using verbatim transcripts to support theme development and the triangulation of data collection instruments. Ethical clearance was obtained from the ethics review board, and informed consent was obtained from all participants prior to data collection. The participants were assured of confidentiality, anonymity, and the voluntary nature of their participation. Community leaders granted permission for research activities in their respective areas, and local customs were observed throughout the research process to ensure cultural sensitivity and respect.

The data gathered from interviews and FGDs were analysed using inductive thematic analysis using the six-step framework developed by Braun and Clarke (2021), as well as insights from Ngulube (2015). The reflective six-phase approach included familiarisation with data through repeated reading of transcripts, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report. The process was inductive and iterative, allowing themes to emerge organically from the data while remaining aligned with the study objectives. An integrated approach was adopted across the methods and participants during analysis. Themes were identified by comparing insights from both interviews and FGDs, ensuring cross-validation and convergence of findings. Data from homogeneous and heterogeneous FGDs were analysed separately and then merged to identify shared patterns and contradictions, strengthening the robustness of the thematic structure. The findings are presented thematically, with each theme supported by direct quotations from participants to preserve

voice and authenticity. This approach enabled a holistic interpretation of how IK contributes to sustainable livelihoods in both Msinga and Stanhope North. Thematic analysis was selected because it provides a flexible yet rigorous approach to identifying, analysing, and reporting patterns or themes within qualitative data. It allowed the researchers to distil complex narratives into meaningful categories that reflect the ways IK supports sustainable livelihoods in the two communities.

FINDINGS

The study aimed to determine the capacity of IK to sustain livelihoods. Using Braun and Clarke's six-step thematic analysis approach, themes such as decision-making, problem-solving, sustainable resource use, and survival strategies were inductively derived from the community leaders' interview responses, demonstrating the practical application of IK in both Msinga and Stanhope North communities. The community elders were anonymised as M1 to M3 and S1 to S3, while the FGDs were named FG1 to FG5.

Use of IK for decision-making

The Msinga community leaders agreed that indigenous people should be included in the decision-making process at all levels. They added that the adoption of modern policies should be scrutinised to check if they do not conflict with the cultural values and beliefs, and M1 indicated that *"now we are forced to adopt a culture that we do not know and are in danger of losing our cultural identity, values, and heritage".* M2 indicated that the problem is with the national ruling system, since at the community level, they are still utilising indigenous knowledge in the decision-making process. He said "*I think the problem we have is our national ruling system because at the rural community level, we still uphold our cultural values, beliefs, and knowledge when making decisions. The government should adopt effective policies that respect our indigenous knowledge and culture instead of bringing these European policies that are not meant for us".* M3 pointed out that they rely on ancestors' revelations to make decisions by saying, *"We also rely on ancestors' revelations to guide us in taking decisions. Our ancestors communicate with izinyanga or elders to inform the community of certain events, their implications on our lives and the measures to be taken to avoid them".*

The findings from Stanhope North demonstrated the importance of considering views from indigenous communities when making decisions. S1 was of the view that *"Making decisions should pay attention to our context and IK especially at a national level because adopting European policies will conflict with our African values and culture therefore causing the problems that we are seeing today in our county".* S2 stated the role of elders within the community by saying *"We have a council of elders who provide wisdom and insight to issues that affect our community. They help keep the community grounded and aware of issues around us".* The final elder, S3, indicated the way decisions are made by saying *"The counsel which consists of village headmen and community elders meet to ponder on the points raised in the community meeting and come to an agreement which is then passed into law".*

Use of IK to solve problems

The findings from Msinga demonstrated that IK can be utilised to address global problems. The first community elder, M1, indicated that social cohesion was fostered by teaching children their cultural values, which emphasised respect for themselves, others, elders, and the environment. He said: *"In our culture, children respect each other and although they used to fight while herding cattle, it was respectful. If we go back to raising children with respect and humility, then we will avoid having to deal with adults that are unruly the way we have seen them do with those lootings".* The second community elder, M2, talked about the use of traditional medicine by saying *"We have always believed in the power of traditional medicine, especially in this difficult time of Coronavirus. We drank and steamed a mixture of herbs to help us fight the virus and it helped".* The third elder, M3, emphasised the use of IK to predict drought by saying: *"We have acquired knowledge on the prediction of drought and famine by reading signs on goat intestines, social conflicts, diseases, childbirth, and peace or war in the chiefdom among others. More dung in the small intestines meant there would be plenty of rain, peace, and no famine".*

The community elders from Stanhope North agreed that IK was used to solve local problems. The first elder, S1, said: *"As you know here the nearest hospital is about 40 to 50kms and even if you go there feeling sick, they will give you a painkiller and send you back home. So, we have relied on traditional medicine to treat sicknesses. We have also relied on indigenous weather forecasting to prepare and plan for the forthcoming planting season".* The second community elder, S2, showed the use of taboos and totemic beliefs to present over usage of some resources and abuse of the environment by saying: *"Taboos and totemic beliefs have greatly contributed to biodiversity conservation, environmental restoration and protected use of plant and animal species".* The third elder, S3, emphasized the use of indigenous plants and herbs to cure diseases by saying: *"The use of indigenous plants and herbs to cure diseases has helped us to holistically cure underlying symptoms and diseases rather than targeting specific symptoms. Many plants and herbs cure various diseases".*

Use of IK for sustainable use of resources

The community elders in Msinga emphasised the use of IK through the sustainable use of these resources and the medicinal value of most of the herbs. One elder, M1, pointed out: *"We use the resources that the land has to offer sparingly to ensure that future generations can also get to enjoy the benefits of having these resources".* The second elder, M2, indicated how ancestors' revelations help to use the resources sparingly by saying: *"When our ancestors are angry about something that we did, they send a message to elders to forewarn us that something bad will happen and we should be prepared".* He added that this helps them ensure an adequate supply of resources and put in place coping mechanisms, such as barter trade and relocating livestock to neighbouring communities. The third elder, M3, pointed out the use of the same plant to cure various diseases by saying: *"The use of a certain plant or herb to cure various diseases implies that underlying diseases and symptoms can be cured in one dose without having to harvest various herbs or plants for each symptom or disease, thereby ensuring that herbs and plants have time to regenerate".*

The Stanhope North people utilised taboos to preserve biodiversity and maintain a balanced food chain. One community elder, S1, pointed out that *"people who bear the surname of Manzini must not eat fish as it is believed that all their teeth will rot, or they will grow scales".* They also have various uses for cow dung, including treating migraine headaches, as a fertiliser, and as a floor polish. The use of the same herb to cure multiple illnesses, as stated by Msinga elders, was also noted. This included the use of various parts of aloe to treat stomachaches and toothaches, clear black spots, remove pimples, and heal wounds. Additionally, the roots were used to treat chickens. The second community elder, S2, pointed out the use of bio-friendly ways to ensure that there is no harm to the environment by saying: *"We have used methods such as intercropping and multi-cropping to preserve soil structure, and manure as fertiliser to preserve soil composition without degrading it".* The third community elder, S3, explained how indigenous communities consider the implications of their activities on the environment and future generations. He stated, *"We do not have professional planners, but we have knowledge on how to plan our settlements concerning water sources, grazing lands, roads, and other infrastructure, attractions or cultural sites, among others".*

Use of IK for survival strategies

The findings from Msinga community showed that the indigenous communities were using IK for survival strategies. One community elder, M1, pointed out: *"We dry, steam, boil or use coarse salt to preserve food so that it can last longer since we do not have refrigerators. We also have storage methods that ensure that our harvests are properly stored so that it is not wasted or destroyed. We have a granary where we store our maize after drying and removing cobs. We consume indigenous fruits and vegetables for a healthy diet. These survival tactics have helped us to live within our means".* The second community elder, M2, indicated that they source their food locally to ensure food security and use various preservation methods to have an adequate food supply. He stated that, *"Msinga is known for having endemic droughts, hence we grow drought-resistant crops such as sweet potatoes and sorghum to ensure that we have a food supply".* The third community elder, M3, indicated how they used IK to mitigate drought by saying: *"In times of drought, we pray to our ancestors, grow drought-resistant crops, migrate young men and women to urban areas in search for work, and make grazing arrangements with distant communities".* He added that if there were any signs of a severe drought, the indigenous people of Msinga would go to the mountains and pray to their ancestors for protection, and then return home when the rain came.

Stanhope North community elders concurred with the views expressed by those from Msinga. They indicated that they preserve food after the harvest through boiling and sun drying where S1 stated that: *"The harvest is dried, steamed or salted, crops such as maize, peanuts, round nuts, soya beans, sorghum, melons are sun-dried while vegetables such as okra, soyabean leaves, and pigweed among others are boiled and sun-dried. Mopani worms are salted and either boiled or roasted then sun-dried. Indigenous fruits are also dried".* Community elder M2 also stated that they survived by consuming indigenous fruits and vegetables and said, *"We survive by consuming indigenous fruits and vegetables that grow naturally in our forests, and this adds variety to our diet".* Community elder M3 pointed out that they have sacred days when they do

not work: *“On Thursdays here, we do not work in the fields or any hired jobs except for domestic work such as fetching water, cleaning the yard, applying cow dung or watermelon leaves to the floors, plastering walls to do artistic drawings over them”.* He added that this process allowed them to balance their social lives, where elders attend social gatherings and discuss community issues, while the youth meet others at the stream while doing laundry or herding cattle.

FGDs findings

IK use in decision making

FGDs with community members revealed that decision-making in Msinga is based on cultural values and includes the people in the decision-making process, as stated by FG1, who said, *“People should be included in the decision-making process, especially at the national level. The adoption of these modern policies should also be scrutinised to check if they do not conflict with our cultural values and beliefs because now, we are forced to adopt a culture that we do not know and are in danger of losing our cultural identity, values, and heritage”*. This inclusion of the people seeks to ensure that the heritage and identity of the community are perpetuated, and it allows the people to scrutinise policies. It also allows people to be aware of the procedures and processes undertaken in the community. Furthermore, including people in the decision-making process ensures the effectiveness of policies, as they are more likely to understand and uphold them. In Stanhope North, the discussions revealed that including community members in the decision-making process keeps the community grounded, and united as people are aware of the laws that bind them and are governed by these boundaries as stated by FG3: “*Making decisions should pay attention to our context and IK especially at national level because adopting European policies will conflict with our African values and culture therefore causing the problems that we are seeing today in our country.”* It also builds wisdom within the community as people seek to do the right thing rather than impress others. It also helps to hold people accountable for upholding the values and beliefs that bind the community. FGDs with community members corroborated the findings from interviews with community leaders and further elaborated on these findings. Using IK to sustain their livelihoods has taught the people of Msinga the value of knowledge and how culture is important for the preservation of the environment and sustainable living. It has taught them “*self-respect, self-reliance, team-playing, sustainable living, economic use of resources and respect for the environment. The indigenous culture in Msinga ensures that people preserve land, people are peacemakers and respectful, and build meaningful interactions based on trust and ubuntu*. *The use of this knowledge has also taught people how to rely on intuition to solve problems and learn from their interactions with others.*” As stated by FG2.

Use of IK to solve problems

In Stanhope North, the discussions further revealed that people have learnt many skills, such as weather forecasting, planning, and balancing diets from available resources as stated by FG4: “*We have acquired knowledge on the prediction of drought and famine such as reading signs on goat intestines, social conflicts, diseases, childbirth, and peace or war in the chiefdom among others. If the small intestine was found to be empty, drought or famine or hostility and war were to be expected in the chiefdom, but if it had a lot of*

dung, this meant that there would be plenty of rain, peace and no famine. Instead of relying on textbooks, they analyse, use intuition, reasoning, observation, and interaction to solve problems. Using IK that they learnt from their elders, the people of Stanhope North have developed respect, humility, harmony, teamwork, dedication, and peacemaking skills. This has helped the community survive the harsh economic conditions while also coping with severe climatic conditions. This knowledge has also taught them to ensure a nutritious and balanced diet using indigenous vegetables, meat, and fruits. They have maintained biodiversity using taboos and totemic beliefs, as stated by FG5, who said, *"The use of totems and taboos have helped us in preserving biodiversity, restoring the environment, and ensuring the responsible use of plant and animal species. They have helped limit the excessive exploitation of certain resources and discouraged harmful practices toward the environment".* These are values that are continuously taught by the elders, and such interactions enhance dedication towards maintaining the environment and using the resources sustainably.

Use of IK for sustainable use of resources

The discussions revealed that in Msinga, *"traditional medicine is used to treat diseases such as diabetes, arthritis, warts, high blood pressure, cancer, corns, rheumatism, earache, period pain, toothache, and many others",* as stated by FG2. Indigenous herbs used to treat diseases include aloe, *ipewula*, *umphaluli*, impepho and others. Traditional healers not only treat diseases but also perform spiritual cleansing and offer consulting services. In Stanhope North, FG3 indicated that *"We use indigenous plants and herbs such as ucucuza, intakubomvu, blackjack, umvagazi, umlawuzi, umganu, umnungwane and many others to cure diseases such as ringworms, toothache, tissue swelling, blood pressure, skin disorders, wounds, headaches, flu, and many others".* They also indicated that they do skin incisions (*ukucaba*) to heal blood and bone diseases. Grandparents, uncles, and aunts are tasked with educating the younger generation about responsibility, *ubuntu*, discipline, upholding cultural values, resolving disputes, anger management, and other important life skills. In Msinga, FG1 indicated that *"girls go emhlangeni when they become of age, and boys go entabeni. These are age-based teaching regimens where they are taught grooming, hygiene, and other social constructs that young people experience when they become of age*". In Stanhope North, boys go on hunting escapades, while girls go *ukuya sik utshani* (cutting thatching grass). FGDs with community members of Msinga and Stanhope North unveiled that indigenous people's governance systems are based on respect for the land and environment. In Msinga, FG2 stated that *"We do transhumance of livestock in drought-prone seasons to offset the effects of droughts on livestock, use taboos and totemic beliefs to prevent abuse of natural resources and the environment, and use indigenous indicators to predict weather and make informed decisions."*

Discussions with community members on the contributions of IK to sustainable livelihoods further revealed that their IK has provided medicine to cure ailments such as cancer, sexually transmitted diseases and other diseases using modern medicine. FG3 indicated that *"We use mechanisms such as ilima, ukusisa, and barter trade to alleviate poverty in their respective communities. Indigenous vegetables, fruits and meat have provided nutrition. This knowledge has also been used to educate the younger generations on the*

importance of humility, respect, and responsibility. There are social gatherings such as ukuy' emhlangeni, ukuy' entabeni, which are aimed at educating the younger generations about these values. Taboos and totemic beliefs are also mechanisms used to balance consumption, and biodiversity".

Use of IK for survival strategies

Discussions with the community members concurred with the interview responses. In Stanhope North, data from FGDs revealed that community members are adopting Western methods, especially marriage ceremonies and belief systems. FG5 noted that *"The community considers church weddings as the respectable marriage ceremony and traditional marriage ceremony as outdated and obsolete. Ukuthethela, which is a cultural belief system of communicating with ancestors to report any events happening in the family, has been deemed unholy, demonic, and backward and has been fading away. Ukucel' izulu has become Christianised. People now gather and have an all-night prayer meeting, unlike the traditional ceremony in which the type of animal that was caught during the clearing of the forest of dead trees and animal carcasses determined the success or failure of the quest*". This has meant that most community members have adopted modern Christian doctrines, which forbid them from practising these. FG4 indicated that *"Traditional methods of preparing meat and vegetables, such as using peanut butter in place of cooking oil, and consumption of indigenous food such as umxhanxa, isjeza, and indigenous fruits and vegetables, are still in practice."* Traditional medicine is also being used in Stanhope North. FG3 pointed out that *"Ilima is also still in use as a support mechanism within the community to ensure food security."* Although one might argue that these are still used due to the prevailing economic crisis in Zimbabwe, which is marred by ill-equipped hospitals, unemployment, and food shortages. In Msinga, people still value their heritage. FG1 said that *"Traditional wedding ceremonies are still regarded with respect over white weddings, although some people choose to have a modern white wedding after the traditional one."* They are proud of their heritage and knowledge and are still actively practising in various fields, including food, medicine, education, social, and spiritual activities.

DISCUSSIONS

There was convergence in the data from the communities and the leaders, as different data collection strategies were employed to verify consistency and divergence. The findings of this study highlighted that indigenous people from Msinga and Stanhope North were in support of including them in decisions that affect them. Participants in Msinga and Stanhope North agreed that alienating indigenous communities from decision-making distorts the knowledge they have relied on for centuries, thereby setting it up for failure, buttressing what was stated by Latulippe and Klenk (2020), Morgan et al. (2021), Ojeda-Zavala (2022), and Robinson et al. (2022). The growing recognition of the value of indigenous knowledge systems in decision-making, particularly in areas such as environmental and natural resource management, underscores the necessity of reevaluating knowledge brought to indigenous communities by industrialised nations. Frequently, externally imposed knowledge systems are unsustainable and can ultimately cause more harm to local communities, as noted by Persoon and Minter (2020).

The participants of Msinga and Stanhope North highlighted ways in which IK could contribute to solving global problems. This suggests that IK is essential in addressing local issues, enhancing food production, promoting healthy lifestyles, distributing wealth, preventing conflict, and managing local affairs, thereby contributing to global solutions, as noted by Tapfuma (2017). Discussions with community members of Msinga and Stanhope North revealed that problem-solving is one of the indigenous people's strong traits, as they have had to rely on intuition and knowledge gained through trial and error, reinforcing what Rankoana (2022) and Maluleka and Ngoepe (2019) stated. The indigenous communities of Msinga and Stanhope North have employed various survival strategies, such as using cow dung as a fertiliser to increase yields, treating headaches, and using it as a floor polish, among other uses. Due to inaccessible health facilities, indigenous communities often rely on traditional medicine. They have employed indigenous measures to protect biodiversity, sustainably utilise natural resources, and manage the environment, which has ensured that resources last longer, as noted by Huambachano (2018). The use of taboos and totemic beliefs in Msinga and Stanhope North has proven to increase biodiversity, as indicated by Maroyi (2017). Their farming, hunting, gathering, fishing, animal husbandry, and forestry methods involve the sustainable use of land and water resources, as well as economic, social, and cultural elements.

Limitations of the study

Due to the nature of this study, a larger population could have been used to yield varied results. However, this was not possible due to resource and time constraints since the study had to be completed within the stipulated timeframe. Therefore, the results of this study should be accepted as a basis upon which other studies can be carried out. The COVID-19 pandemic also posed threats to the completion of the study as it imposed travel bans and gathering restrictions. These altered methods of data collection required the researcher to rely on technology and employ the services of others to access their phones, allowing interviews with community leaders and focus group discussions to be conducted via WhatsApp video calls.

Conclusions and recommendations

The study concludes that IK is a vital resource for sustaining livelihoods, particularly in rural and marginalised communities such as Msinga in South Africa and Stanhope North in Zimbabwe. The findings demonstrated that IK is deeply embedded in the cultural fabric of these communities and is actively used to make decisions, address local challenges, manage natural resources sustainably, and develop survival strategies in the face of socio-economic and environmental hardships. For instance, traditional decision-making systems, such as councils of elders and ancestral guidance, help maintain community cohesion and ensure culturally aligned governance. In both communities, IK has been applied to predict weather patterns, prevent the overexploitation of natural resources through taboos and totemic beliefs, and treat illnesses with indigenous herbs and medicinal practices. Moreover, IK has facilitated the use of locally available resources to promote food security, economic sustainability, and environmental preservation. Techniques such as drying and fermenting food, intercropping, and soil conservation

methods reflect a sustainable interaction with the environment. In the face of challenges such as droughts, unemployment, and food shortages, these communities continue to rely on indigenous food systems, medicinal practices, communal labour systems like *ilima*, and cultural ceremonies to maintain their livelihoods and identity.

Despite its evident value, IK is under threat from modernisation, globalisation, and declining intergenerational knowledge transfer. The study, therefore, recommends the urgent documentation and archiving of this knowledge for future generations. IK holders must be empowered and encouraged to share their knowledge, especially with the youth, to foster continuity. Furthermore, governments, academic institutions, and development partners should recognise and support the integration of IK into policy frameworks, rural development strategies, and educational systems. This support should include funding for community-driven documentation projects, platforms for intergenerational knowledge exchange, and the incorporation of IK in national sustainable development agendas. Protecting IK not only safeguards cultural heritage but also contributes directly to achieving the SDGs, particularly those related to food security, environmental sustainability, health, and climate resilience. In conclusion, the experiences of Msinga and Stanhope North highlight the transformative potential of IK when recognised, preserved, and integrated into development efforts. It is imperative that local and global stakeholders act collaboratively to protect this invaluable asset for present and future generations.

REFERENCES

Aluko, Y. (2018). Women's Use of Indigenous Knowledge for Environmental Security and Sustainable Development in Southwest Nigeria. *The International Indigenous Policy Journal,* 9(3): 1-23. https://doi.org/10.18584/iipj.2018.9.3.2

Asogwa, I.S., Okoye, J.S.I. and Oni, K. (2017). Promotion of Indigenous Food Preservation and Processing Knowledge and the Challenge of Food Security in Africa. *Journal of Food Security,* 5(3): 75-87.

Baiyegunhi, L.J.S. (2015). Determinants of Rainwater Harvesting Technology (RWHT) Adoption for Home Gardening in Msinga, KwaZulu-Natal, South Africa. *Water SA*, 41(1): 33-40. https://doi.org/10.4314/wsa.v4lil.6

Baporikar, N. (2022). Strategies to Manage and Preserve Indigenous Knowledge. In Tshifhumulo, R. and Makhanikhe, T. (Eds.). *Handbook of Research on Protecting and Managing Global Indigenous Knowledge Systems,* pp. 207-222. IGI Global. https://doi.org/10.4018/978-1-7998-7492-8.ch012

Basdew, M., Jiri, O. and Mafongoya, P.L. (2017). Integration of Indigenous and Scientific Knowledge in Climate Adaptation in KwaZulu-Natal, South Africa. *Change and Adaptation in Socio-Ecological Systems,* 3(1): 56-67. https://doi.org/10.1515/cass-2017-0006.

Braun, V.V. and Clarke, V. (2021). *Thematic analysis: A practical guide*. Sage.

Chege, J.M., Semenye, P.P. and Lemba, J.K. (2018). Influence of Indigenous Knowledge on Household Food Security Status Among Smallholder Farmers in Kilifi Sub-County, Kenya. *Advances in Research,* 14(6): 1-8. https://doi.org/10.9734/AIR/2018/41338.

Creswell, J.W. and Poth, C.N. (2018). *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*. 4th Edition. Sage.

D'acqui, L.P. (2016). Use of Indigenous Cyanobacteria for Sustainable Improvement of Biogeochemical and Physical Fertility of Marginal Soils in Semiarid Tropics. In Arora, N., Mehnaz, S., Balestrini, R. (Eds). *Bioformulations: For Sustainable Agriculture*, pp. 213-232. https://doi.org/10.1007/978-81-322-2779-3_12.

Filho, W.L., Wolf, F., Totin, E., Zvobgo, L., Simpson, N.P., Musiyiwa, K., Kalangu, J.W., Sanni, M., Adelekan, I., Efitre, J., Donkor, F.K., Balogun, A.L., Mucova, S.A.R., and Ayal, D.Y. (2023). Is Indigenous Knowledge Serving Climate Adaptation? Evidence from Various African Regions. *Development Policy Review*, 41: e12664. https://doi.org/10.1111/dpr.12664

Filho, W.L., Barbir, J., Gwenzi, J., Ayal, D., Simpson, N.P., Adeleke, L., Tilahun, B., Chirisa, I., Gbedemah, S.F., Nzengya, D.M., Sharifi, A., Theodory, T. and Yaffa, S. (2022). The Role of Indigenous Knowledge in Climate Change Adaptation in Africa. *Environmental Science & Policy*, 36: 250-260. https://doi.org/10.1016/j.envsci.2022.06.004.

Goduka, N. (2012). Re-Discovering Indigenous Knowledge- Ulwazi Lwemvelo for Strengthening Sustainable Livelihood Opportunities within Rural Contexts in the Eastern Cape Province. *Indilinga: African Journal of Indigenous Knowledge Systems,* 11(1): 1-19.

Haambiya, L., Kaunda, E., Likongwe, J., Kambewa, D., Chama, L. and Musuka, C. (2016). *Community Perceptions on the Role of Indigenous Knowledge in Policy Recommendations for Co-Management Modelling.* http://ruforum.org/sites/default/files/Haambiya.pdf.

Hansen, J.G. and Antsanen, R. (2018). What Can Traditional Indigenous Knowledge Teach Us About Changing Our Approach to Human Activity and Environmental Stewardship in Order to Reduce the Severity of Climate Change? *The International Indigenous Policy Journal,* 9(3): 1-14. https://doi.org/10.18584/iipj.2018.9.3.6.

Hennink, M. and Kaiser, B.N. (2022). Sample Sizes for Saturation in Qualitative Research: A Systematic Review of Empirical Tests. *Social Science & Medicine*, 292(114523): 1-10. https://doi.org/10.1016/j.socscimed.2021.114523

Huambachano, M. (2018). Enacting Food Sovereignty in Aotearoa New Zealand and Peru: Revitalizing Indigenous Knowledge, Food Practices and Ecological Philosophies. *Agroecology and Sustainable Food Systems,* 42(9): 1003-1028. https://doi.org/10.1080/21683565.2018.1468380.

Ige, O.A., Jita, L.C. and Jita, T. (2019). Major Personality Traits Influencing Environmental Knowledge: A Case of Urban Learning Ecologies. *Problems of Education in the 21st Century,* 77(1): 39-54. https://doi.org/10.33225/pec/19.77.39.

Keane, M., Khupe, C. and Muza, B. (2016). It Matters Who You Are: Indigenous Knowledge Research and Researchers. *Education as Change*, *20*(2): 163-183. https://doi.org/10.17159/1947-9417/2016/913.

Khan, N.A. and Abedin, S. (2022). Focus Group Discussion. In Islam, M. R., Khan, N. A. and Baikady, R. (Eds). *Principles of Social Research Methodology*. Springer. https://doi.org/10.1007/978-981-19-5441-2_26.

Kusumastuti, R., Silalahi, M., Asmara, A.Y., Hardiyati, R. and Juwono, V. (2022). Finding the Context of Indigenous Innovation in Village Enterprise Knowledge Structure: A

Topic Modelling. *Journal of Innovation and Entrepreneurship* 11(19): 1-15. https://doi.org/10.1186/s13731-022-00220-9.

Latulippe, N. and Klenk, N. (2020). Making Room and Moving Over: Knowledge Co-Production, Indigenous Knowledge Sovereignty and The Politics of Global Environmental Change Decision-Making. *Current Opinion in Environmental Sustainability,* 43(2020): 7-14. https://doi.org/10.1016/j.cosust.2019.10.010.

Lushombo, L.W. (2025). Ecological Sustainability for "Life on Land": Wellspring of Indigenous Knowledge. *Religions,* 16(3): 1-21. https://doi.org/10.3390/rel16030311.

Magni, G. (2017). Indigenous Knowledge and Implications for the Sustainable Development Agenda. *European Journal of Education*, 52(4): 437-447. https://doi.org/10.1111/ejed.12238.

Maluleka, J.R. and Ngoepe, M. (2019). Integrating Traditional Medical Knowledge into Mainstream Healthcare in Limpopo Province. *Information Development,* 35(5): 714-723. https://doi.org/10.1177/0266666918785940

Maluleka, J.R. and Ngulube, P. (2018). A Framework for Acquisition, Transfer and Preservation of Knowledge of Traditional Healing in South Africa: A Case of Limpopo Province. *ESARBICA Journal: Journal of the Eastern and Southern Africa Regional Branch of the International Council on Archives,* 37: 111-137.

Maroyi, A. (2017). Diversity of Use and Local Knowledge of Wild and Cultivated Plants in The Eastern Cape Province, South Africa. *Journal of Ethnobiology and Ethnomedicine,* 13(1): 1-16. https://doi.org/10.1186/s13002-017-0173-8.

Masoga, M.A. and Shokane, A.L. (2019). Viewpoint: Indigenous Knowledge Systems and Environmental Social Work Education: Towards Environmental Sustainability. *Southern African Journal of Environmental Education,* 35: 1-11. https://doi.org/10.4314/sajee.v35i1.14.

Mbatha, M.M. and Masuku, M.M. (2021). Subsistence Agriculture as the Basis of Rural Livelihoods in Msinga Local Municipality, KwaZulu-Natal, South Africa. *Journal of Human Ecology,* 76(1-3): 53-60.

Mhlongo, M. (2020). Harnessing Indigenous Knowledge Through Community Involvement in Public Libraries in South Africa. *Libri*, 70(4): 291-303. https://doi.org/10.1515/libri-2019-0194.

Morgan, T.K., Reid, J., McMillan, O.W. T., Kingi, T., White, T.T., Young, B., Snow, V. and Laurenson, S. (2021). Towards Best-Practice Inclusion of Cultural Indicators in Decision-Making by Indigenous Peoples. *AlterNative: An International Journal of Indigenous Peoples*, 17(2): 202-214. https://0-doi-org.oasis.unisa.ac.za/10.1177/11771801211015686.

Msinga Local Municipality. (2021). *Msinga Integrated Development Plan (IDP).* https://www.umsinga.gov.za/

Naazie, G.K., Dakyaga, F. and Derbile, E.K. (2023). Agro-Ecological Intensification for Climate Change Adaptation: Tales on Soil and Water Management Practices of Smallholder Farmers in Rural Ghana. *Discov Sustain* 4(27). https://doi.org/10.1007/s43621-023-00142-w.

Ndhlovu, M.P. and Mpofu, T. (2016). Communal Farming, Climate Change Adaptation and the Media in Zimbabwe. *Jàmbá: Journal of Disaster Risk Studies,* 8(3): 1-10. https://doi.org/10.4102/jamba.v8i3.239.

Ngulube, P. (2015). Qualitative Data Analysis and Interpretation: Systematic Search for Meaning. In Mathipa, E. R. and Gumbo, M.T. (Eds). *Addressing Research Challenges: Making Headway for Developing Researchers,* pp. 131-156. Mosala-MASEDI Publishers & Booksellers.

Nyiraruhimbi, A. (2012). *Indigenous Approaches to Maize Production and Soil Management in Msinga, KwaZulu-Natal Province, Pietermaritzburg*. University of KwaZulu-Natal. https://researchspace.ukzn.ac.za/bitstream/handle/10413/9906/Nyiraruhimbi_Agnes_2012.pdf?sequence=1.

Ojeda-Zavala, N. (2022). Erring on the Side of Indigenous Peoples: Traditional Knowledge, Scientific Uncertainty, and Indigenous Participation in Decision-Making. *Nordic Journal of International Law*, 91(3): 453-508. https://doi.org/10.1163/15718107-91030008

Persoon, G.A. and Minter, T. (2020). Knowledge and Practices of Indigenous Peoples in the Context of Resource Management in Relation to Climate Change in Southeast Asia. *Sustainability*, 12(19): 1-23. http://dx.doi.org/10.3390/su12197983.

Priya, A. (2021). Case Study Methodology of Qualitative Research: Key Attributes and Navigating the Conundrums in Its Application. *Sociological Bulletin*, 70(1): 94-110. https://doi.org/10.1177/0038022920970318.

Rankoana, S.A. (2022). Indigenous Knowledge and Innovative Practices to Cope with Impacts of Climate Change on Small-Scale Farming in Limpopo Province, South Africa. *International Journal of Climate Change Strategies and Management*, 14(2): 180-190. https://doi.org/10.1108/IJCCSM-04-2021-0040.

Rastogi, R. and Dutta, M.J. (2015). Neoliberalism, Agriculture and Farmer Stories: Voices of Farmers from the Margins of India. *Journal of Creative Communications,* 10(2): 128-140. https://doi.org/10.1177/0973258615597380.

Robinson, C.J., Macdonald, J.M., Perry, J., Bangalang, N., Nayinggul, A., Nadji, J., Nayinggul, A., Dempsey, S., Nadji, S., McCartney, S., Taylor, A., Hunter, F., May, K., Cooper, D., Moyle, F., Drummond, A., Borovac, C., van Bodegraven, S., Gilfedder, M., Setterfield, S. and Douglas, M.M. (2022). Coproduction Mechanisms to Weave Indigenous Knowledge, Artificial Intelligence and Technical Data to Enable Indigenous-Led Adaptive Decision-Making: Lessons from Australia's Joint-Managed Kakadu National Park. *Ecology and Society*, 27(4): 36. https://doi.org/10.5751/ES-13747-270436.

Rukema, J.R. and Umubyeyi, B.S. (2019). Indigenous Knowledge Approach in Maintaining a Livelihood in the Face of Disastrous Climate Change: Case of Drought in Msinga Villages, KwaZulu-Natal. *Jàmbá: Journal of Disaster Risk Studies,* 11(1): 1-10. https://doi.org/10.4102/jamba.v11i1.758.

Tapfuma, M. (2017). Preservation of Indigenous Knowledge Systems in Zimbabwe: Some Ethical Considerations. In Ngulube, P. (Ed.). *Handbook of Research on Social, Cultural, and Educational Considerations of Indigenous Knowledge in Developing Countries,* pp. 244-258. IGI Global. https://doi.org/10.4018/978-1-5225-0838-0.ch013

Tirivangasi, H.M. and Tayengwa, D. (2017). Indigenous Knowledge Systems (IKS) and Food Security in South Africa: Is Land Reform a Prerequisite? *Journal of Human Ecology,* 57(3): 118-124. https://doi.org/10.1080/09709274.2017.1305637.

Ubisi, N.R., Kolanisi, U. and Jiri, O. (2020). The Role of Indigenous Knowledge Systems in Rural Smallholder Farmers' Response to Climate Change: Case Study of Nkomazi Local Municipality, Mpumalanga, South Africa. *Journal of Asian and African Studies*, 55(2): 273-284. https://doi.org/10.1177/0021909619874824/

Ufearoh, A.U. (2020). Covid-19 Pandemic as an Existential Problem: An African Perspective. *Filosofia Theoretica: Journal of African Philosophy, Culture and Religions,* 9(1): 97-112. https://doi.org/10.4314/ft.v9i1.7.

World Food Programme. (2022). *Gweru District: Food and Nutrition Security Profile*. https://www.fnc.org.zw/wp-content/uploads/2023/04/Gweru-District-Profile.pdf

Yin, R. (2018). *Case Study Research and Applications: Design and Methods.* 6th ed. Sage.

Zimbabwe Statistics Agency (ZimStats). (2012). *Provincial Report: Matabeleland North.* Population Census Office.

Zvobgo, L., Johnston, P., Olagbegi, O.M., Simpson, N.P. and Trisos, C.H. (2023). Role of Indigenous and Local Knowledge in Seasonal Forecasts and Climate Adaptation: A Case Study of Smallholder Farmers in Chiredzi, Zimbabwe. *Environmental Science and Policy,* 145(2023): 13-28. https://doi.org/10.1016/j.envsci.2023.03.017.