Indigenous Knowledge Systems in Crop Management and Grain Storage in Chimanimani District of Zimbabwe

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Abstract

This study explored the indigenous knowledge systems (IKS) in the Chimanimani District of Zimbabwe and how they are used in crop management and grain storage. Also examined were the effects of IKS use on community food security and integrity of the environment. A qualitative interpretative research design was employed through the use of detailed in-depth interviews and focus group discussions with traditional leaders and community elders. The choice for these groups of people was informed by the general belief that they are often regarded in the community as a reservoir of indigenous knowledge systems. Phenomenological underpinnings anchored the study because it was vital to bring to the fore the various related IKS phenomena and links to food security and environmental management in the community. A socio-ecological lens was used to establish links and interrelations of factors that contribute to food security and environmental management. Major findings include that ashes and leaves from some indigenous trees are used to enrich soil quality, preserve food, and treat livestock. In addition, ashes and leaves are applied as organic pesticides for a variety of crops grown in the district. The study established that these local knowledge systems and practices contribute to low farming costs, high crop yields and good environmental management. The indigenous trees used for this purpose are held in high regard and conserved through the practice and enforcement of socio-spiritual prohibitions like taboos. The study concluded that the body of local knowledge firmly rooted in the Chimanimani people's culture and traditions is relevant to and consistent with the national and global agenda towards strengthening and sustaining community food security and environmental management. Furthermore, the local knowledge systems found in this study have policy implications for environmental management and climate change strategies as well as knowledge management from a socio-ecological perspective.

Keywords: *indigenous knowledge management systems, environmental management, food security*

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Introduction

This paper builds on the current wave of realisation that indigenous knowledge systems can play a crucial role in sustainable livelihoods as extensively discussed in Hammersmith (2007), Mapara (2009), Chiwanza et al. (2013), Muyambo and Maposa (2014) and Sithole (2014), as well as the 2019 Special Issue of the Southern African Journal of Environmental Education. It has been noted that there is a direct link between community socio-cultural erosion and depletion of natural resources or environmental destruction (Makamure & Chimininge, 2013; Rim-Rukeh, Irerhievwie & AgbozuI, 2013; Risiro, Tshuma & Basikiti, 2013). This link is explained through socio-ecological perspectives which illustrate the intimate interconnection between livelihoods of human beings and their surrounding environment which has endured over many generations.

In Africa, IKS suffered a great deal from colonisation and its twin cousin, racism. From a socio-ecological perspective, when the natives were removed from their indigenous communities, this resulted in a detachment from their familiar ecology and a loss of environment-linked indigenous knowledge for sustainable livelihoods. Thus people had to build knowledge of their new environments. During the transitional period, some IKS were lost and environmental livelihoods were disrupted to some extent. Studies elsewhere have also shown that indigenous knowledge systems play a positive role in Africa's development but there is not much traction to mainstream them in sustainable food security and environmental management (Emery, 1996; Mohamedbhai, 2013). Despite the long history of relegation and marginalisation of African indigenous knowledge systems in terms of the mainstream national and community livelihoods development discourse, IKS can be relatively resilient to externally induced socio-political vulnerabilities because of cultural and spiritual rootedness in communities (Mararike, 2003; Mutema, 2003; Hoppers, 2005;). Thus, Muyambo and Maposa (2014, p. 24) concluded that IKS in Africa "failed to die despite the racial and colonial suffering Africa went through in the past" which confirms an earlier assertion by Ramose (2002) that a people's IKS anywhere in the world is 'immortal' and inseparable from their socio-cultural compass. Unfortunately, the socio-ecological approaches to livelihoods development in the post-colonial era in Africa is more Eurocentric than Afrocentric (Mulwa, 2004; Matunhu, 2011). At this point, it is crucial to discuss briefly the phenomenon of indigenous knowledge from an epistemological perspective.

Cosmology and attributes of indigenous knowledge systems

Roots for the word 'indigenous' can be traced back to French (*indigène*) and Latin (*indigena*) (Amaro & Watson, 2016). In both languages and culture, it means 'sprung from the land', a native or literally 'in-born'. Thus, it can be deduced that indigenous knowledge refers to the way of knowing and application of the resultant knowledge associated with a particular group of people in their native socio-geographical location. While Denison and Wotshela (2009) argued that IKS is not technically the same as 'local knowledge', there is no doubt that it is localised knowledge ingrained in people's culture, beliefs and practices with an inter-generational connectedness and endurance.

To date, the term 'indigenous knowledge systems' or IKS has been defined in various ways, depending on the social context and/or disposition of the author. Some have broadly described it as both a concept and practice of a specific body of knowledge of the indigenous or local people (Shutle, 1990; Mapara, 2009; Muyambo & Maposa, 2014). Chiwanza and others (2013, p. 2) viewed it as durable local knowledge which is the "adhesive that binds society" while Mararike (1999) and Sithole (2014) posited that IKS are community-based livelihood survival strategies especially in the rural areas. What is common in these descriptions is that indigenous knowledge systems are unique to a given culture or society and they are a vital part of the community's social identity and heritage. On this aspect of IKS being part of the social identity of a community, Chiwanza and others (2013, p. 2) observed that "indigenous knowledge is indeed the cornerstone for building of our [community] identity and ensuring coherence of social structures within communities". Thus, from a socio-anthropological perspective, IKS forms part of the socio-economic wealth of a community and it is generally understood that it has be passed down from one generation to another.

Furthermore, it is clear that for knowledge to qualify as indigenous knowledge, those using it should have survived on it for a considerable length of time. It is further apparent from the literature that IKS forms part of the bed-rock of a community's socio-cultural framework (values, beliefs, norms and practices). It should also be noted that there are generally agreed factors which seem to threaten survival of IKS in communities. These include urban-rural migration, globalisation, and changes to population structure due to factors such as famine, epidemics, displacement and war, among others (Mugabe, 1998; Chiwanza et al., 2013). However IKS is defined or described, it is a constantly evolving knowledge discourse (Denison & Wotshela, 2009).

Concept of food security

The United Nations Food and Agricultural Organization (FAO, 2010) states that food security is when a household or community has reliable availability and access to sufficient, affordable and nutritious food. It is estimated that the world requires 70% increase in food production by 2050, especially in developing countries in view of exponential population growth (Bruinsma (2009). This increased demand for food is compounded by the current undernourishment challenges in most developing countries. As discussed in the preceding sections, there is value in understanding local knowledge systems, and this includes how they are potentially used in enhancing food security and environmental management. There is a strong relationship between how the environment is managed and the ability of a community to be 'food secure' (UNEP, 2009). Macro dynamics at policy level, meso processes in the form of human-environment connections and micro process at individual and household sub-levels are interwoven contributing factors to food security. These sociological dynamics and intertwined relationships require socio-ecological explanations in an iterative process. In the context of Chimanimani district, availability, access and utilisation of environmental resources, farmed crops including indigenous ones make up a large proportion of what constitutes a food secure household between ecological seasons.

Study objective

The objective was twofold in that the study sought to establish what IKS are found in the Chimanimani District and how the people use that knowledge for their livelihoods and environmental management.

Methods

A qualitative interpretative research design was applied to explore IKS in the Chimanimani District, including its application to food security and co-existence with the environment. Phenomenological underpinnings anchored the study in order to bring to the fore the various IKS-related phenomena and links to food security and environmental management. For this reason, detailed in-depth interviews and focus group discussions were conducted with traditional leaders and community elders. The choice behind these two groups of people was informed by the fact that they are strongly associated with the reservoir of indigenous knowledge systems, beliefs, socio-cultural history, socio-ecological history and practices in a community.

The other group of study participants were agricultural extension officers and leaders of development organisations who had been working in the district with a focus on food security and environment. A combination of purposive and snowball sampling techniques were used for the selection of the study participants.

A total of 39 people from the three municipal wards participated in the study and their ages ranged between 30 and 90 years. Of the 39, 29 (74.3%) were aged between 60 and 90 and 10 (25.6%) were between 30 and 60. In terms of gender, 22 (56.4%) were male and 17 (43.6%) were female. The three wards studied were relatively representative of the socio-ecological make-up of the district. Wards 18 and 21 are at the edges of the district thereby providing localised insights on IKS and food security, while Ward 15 is in the middle where the town is located thereby providing somewhat cosmopolitan views on IKS. As is often the case, a diversity of socio-cultural beliefs, norms and practices converge in urban centres. Therefore, although the other 20 wards in the district were not studied, Ward 15 represented differentiating factors that could be found in any ward, particularly given the close proximity of the wards in the district. It is worth mentioning that even though the study participants were selected from different sub-municipalities with unique ecological patterns, they all shared a common socio-cultural history, language and environment.

Findings

The findings are presented in two broad categories, namely food security and environmental management. Within the food security dimension, seven themes emerged: (a) the local crops and livestock; (b) IKS used in land preparation; (c) IKS used in crop management; (d) IKS used in crop harvesting; (e) IKS used in the storage of grain; (f) IKS used in the preservation of grain and meat; and (g) IKS used in livestock health. The findings have demonstrated that people in

Chimanimani have a rich body of indigenous knowledge which they use for food security and unique environmental management.

The local crops and livestock

The study found that the most common crops grown in Chimanimani are maize, sorghum, millet, *rapoko*/finger millet and bananas. Others not as widely grown include groundnuts, roundnuts, sunflowers, beans, cowpeas and sesame seeds (known as *uninga* in the local Ndau language). In Ward 18, which is a dry section of the district with low levels of rainfall, drought-resistant crops such as groundnuts and *rapoko* are grown and livestock production includes goats, cattle, traditional chickens and donkeys. In contrast, due to their relatively high rainfall and rich soils, Wards 15 and 21 grow maize, bananas, oranges, sugarcane, sweet potatoes and indigenous yams *madhumbe*), among other crops. It was noted that the growing of small grains is increasing in the area as a response to climate change conditions, particularly droughts. Goats, cattle and traditional chickens are the main forms of livestock found in almost every household in the district. Other types of less common livestock in these two wards include sheep, pigs, quails, donkeys and rabbits. The crops and livestock mentioned are both for subsistence and to generate household income, especially bananas, small grains, cattle, goats and traditional chickens at local and national markets.

IKS used in land preparation and planting

The study found five traditional methods used in Chimanimani to prepare land for agricultural activities, namely digging of basins, slash and burn, spreading of manure, spreading of ashes and farrowing. The study participants claimed these traditional methods contribute to improved crop health as is evident in this point made by one of the elders (aged 82): "*Zvinobatsira kuti shakura rinoita shoma* [weeds are greatly suppressed] and crops will not be affected by diseases… *Zvirimwa zvedu zvinokura zviine utano wakanaka, sometimes kurega kushandisa nzira dzechirungu kunobatsira zvakanyanya* [Our crops grow healthy and not using the contemporary farming methods helps greatly in improving food security]." It was reported that digging of basins keeps moisture for longer periods while spreading of ashes and manure adds nutrients and quality to the soil for farming. Also, ashes are believed to have a pesticidal effect on crops and have some type of chemical that supresses some weeds. This was corroborated by the agricultural extension officers interviewed.

The IKS used in planting crops include broadcasting, planting seeds/seedlings in lines and *kuparira*. Broadcasting is mainly used for small grains like sorghum, millet, *rapoko*, *uninga* and cowpeas, while maize is planted in lines. *Kuparira* involves planting seeds when rains are imminent so that seeds germinate quickly. The land preparation and planting is combined with the local people's use of their indigenous knowledge to interpret weather conditions and predict rainfall patterns.

Use of IKS in crop management

The study found that the indigenous knowledge systems for crop management in Chimanimani largely involve organic pesticides processed from indigenous trees and shrubs found in the local

environment. Juice from the *Munyambanje* tree (*tagetes minuta*) or *Mukonde* (candelabra tree) leaves/ashes are sprayed onto crops to prevent pests like *zvipumbununu*. To prevent and control stalk borers (*mbunga*) and aphids, the study discovered that people spread *Zumbani* (lemon bush/*lippie javanica*) leaves or *mutoronga* (hot pepper) solution or animal urine (especially from cattle and goats) in the affected fields. As is the common practice elsewhere in the world regarding application of ecological indigenous knowledge systems (Berkes, 2008), the use of the trees and shrubs discussed here are sanctioned by traditional leaders in accordance with environmental protection practices like taboos.

It was found that indigenous methods are fundamental in the area studied in the prevention and control of weeds, pests and aphids and they have been proven to enhance crop health and yield. Respondents stated that traditional methods such as crop rotation and minimum tillage help to improve and maintain soil quality. Generally, these methods can be labour intensive. The study noted that communities sometimes use collective actions like the *nhimbe/humwe* practice to voluntarily assist each other at the household level with a range of farming activities. Sithole (2014) described *nhimbe* as a collective community-based work practice used historically by most Zimbabweans in rural areas particularly for farming related activities. It should be noted that the *nhimbe* practice is now rare and has taken various forms over the centuries. For instance, a *nhimbe* targets mostly beer drinkers in the community for labour for a development initiative and then beer is served after the work is finished as a form of appreciation. The practice of *nhimbe* is one of the manifestations of the African worldview linked to the respect of humanity, commonly known as *ubuntu*, and it is based on mutual trust, enthusiasm to help each other and nurturing reciprocal relationships in a community. On the aspect of early planting, one community elder (aged 77) emphatically stated its advantage: "For *Rutiti* (a devastating weed) we plant early so that it doesn't affect the maize". *Rutiti runonyanya* [worsens] in January so if you plant early in December, the crops won't be affected". It was also revealed that the use of organic pesticides helps to maintain and balance water concentrations in crops.

Local knowledge and traditional practices in crop harvesting and storage

Maize is commonly harvested in stacks. Stalks of grain are cut and heaped usually in the middle of the field. The grains are harvested after stacking. The rationale behind stacking is to ensure that no crops are left in the field; a complete harvest is achieved through this method.

For storage of crops, a *tsapi* (traditional granary) is used in Chimanimani like in many other rural communities in the country. One of the advantages of a *tsapi* is that it maintains the right temperature for the grain throughout the year as it is constructed with natural materials including poles, thatch grass and mud, materials with temperature regulatory mechanisms. Construction expertise is passed on through generations in the communities and materials are locally found, making the *tsapi* storage method generally inexpensive.

Traditional methods in preservation of grain

The study discovered that the indigenous trees and shrubs found in the area also play a crucial role in the preservation of grain. The scent from leaves of certain indigenous trees

and shrubs applied to grain repels insects. The poles obtained from *changa*, *mukute* (*Syzygium cordatum*), *mutsungunu* (*Bridelia micrantha*) and *mungunraurwe* (tonic root) trees used for the *tsapi* construction have a repellent effect on termites. In addition, a mixture of mud, cow dung and ash are used to clean the tsapi in preparation for grain storage and this prevents weevils, aphids and rodents. Some of the leaves which are crushed and placed in the packaged grain or in a *tsapi* include those from *mushani/zumbani* and *munyambanje* bushes. It was also reported that goat droppings are mixed with the mud used for the construction of the *tsapi* floor and this prevents weevils too as well as snakes from getting into the granary. This finding is similar to that of Stathars and others (2000) in the district of Chikomba in Zimbabwe. The other method mentioned involves the application of ashes (dry or in liquid form) to the grain. Ashes can come from maize cobs, any wood or leaves. It was learnt that small grains are usually not affected by weevils. On this aspect, the study findings revealed that people in dry areas of Chimanimani (especially in Ward 18; Biriri) are encouraged by government, traditional leaders and civil society organisations to grow small grains like *rapoko* and sorghum. In doing so, the communities in this part of the district are likely to benefit from the twin advantage of drought-resistant crops which are not prone to weevils and aphids.

The study found that the crop preservation methods, if properly applied, are effective for six to 12 months and in some instances, even up to 24 months. A 56-year-old woman interviewed stated that "it normally lasts for about 6 or even 12 months but you can add some more leaves or ashes when you see that they are about to expire". It was noted that these methods are not hazardous to people or livestock. In fact, they play a dual role of preserving grain and providing medicinal benefits to people who consume the grain. *Mushani/zumbani* and *munyambanje* are further used as herbs for various ailments.

Discussion

The indigenous knowledge systems used for food security and environmental management in the communities studied in Chimanimani are based on the local indigenous trees and shrubs. The materials are locally and naturally available and thus inexpensive. A close examination of this socio-ecological dimension reveals inseparability of indigenous knowledge systems from the natural environment. The colonial period in Africa and other parts of the world led to distortion, dilution or loss of indigenous knowledge systems. Chiwanza and others (2013), Mapara (2009), as well as Muyambo and Maposa (2014) have noted a resurgence of indigenous knowledge systems in developing countries. The resilience of indigenous knowledge systems can be explained by their cultural and spiritual rootedness (Mbiti, 1990; Mararike, 1999; Mbigi, 2005). Another explanation for the distortion or peripheral view of Zimbabwe's IKS is the type of education system which is still largely biased towards Eurocentric pedagogical approaches and worldviews (Matunhu, 2011).

It is clear from the findings presented here that the Chimanimani communities value and work with indigenous knowledge systems. This is evident in the active use of IKS in crop management and grain storage. These practices are part of a social ecology trajectory as seen in how communities weave their livelihoods into the natural environment. As is characteristic

of indigenous knowledge around the world, IKS in this study are passed down via an oral tradition. The absence of formal documentation frameworks increase the risk of IKS loss over generations, an aspect which has been extensively discussed by Chiwanza and others (2013). One aim of this study thus was to document these indigenous knowledge systems; perhaps future studies could go beyond what has been covered here.

While the local people in Chimanimani appreciate and apply their indigenous knowledge systems in agricultural practices, there is still an element of inferiority or social stigma attached to IKS from the Ministry of Agriculture, the Department of Meteorology as well as community development partners in the district. This is evidenced by the fact that very little of what has been shared in this study has been incorporated or integrated in mainstream strategic information or in the knowledge base for sustainable food security and environmental management. This finding confirms earlier observations that Africa's vast indigenous knowledge systems have been suppressed or diluted by the triple effects of colonisation, racism and a Eurocentric education system (Ramose, 2002; Hammersmith, 2007; Matunhu (2011); Chiwanza et al., 2013). These three effects have undeniably left indigenous Africans with little confidence or motivation to document their own knowledge systems even decades after independence from colonisation. Notwithstanding this, there is now a recognition of the vital role African indigenous knowledge systems can play in sustainable development as recently noted: "Africa may be an ideal continent to learn about and begin seriously integrating indigenous knowledge with development planning techniques" (Lalonde, 1991). Asia has made tremendous progress on this dimension of development (Savage, 2012).

Dense and durable social networks in a community facilitate IKS sharing through generations (Sithole, 2014; Mararike, 2016). As noted in this study, the practice of *nhimbe* in its various forms is in itself a community social network which enables sharing and application of IKS within and between generations. If this was not so, the study would have found only a few people with the knowledge within the sample and limited application in crop management. As the study discovered, the *nhimbe* practice, though reportedly not as popular as it was in the past, is evidence of strong inter-household bonds that exist in the communities and this is why one of the key informants said that "*nhimbe* is a family fibre". Figure 1 below attempts to demonstrate the centrality of social bonds in the community in terms of IKS sharing, its application for livelihoods and ultimately, its durability or resilience across generations.

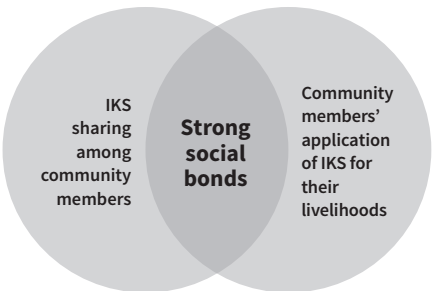

Figure 1 *Fertilisation and durability of IKS in communities*

The use of the indigenous knowledge is consistently in harmony with the natural and the spiritual world. This confirms Muyambo and Maposa's (2014, p. 22) assertion that "indigenous communities in Africa were quite conscious of the significance of environmental protection and management even before the advent of colonisation". Thus, community socio-spiritual sanctions (taboos and sacredness) exist to deter people from destroying water sources, trees and bushes, especially those used for human and animal medicine as well as for fruits, crop production and environmental conservation/management. Such trees or bushes are highly respected in the communities studied with sanctions enforced by community leadership, thus the environment is protected. The use of cow dung and animal urine, among other aspects discussed in this study, demonstrates community innovation for livelihoods using locally available natural resources.

Although the indigenous trees and bushes used for crop management for livelihoods are fairly abundant in the communities studied, the use of leaves and bark threatens their existence and resilience of the practice. In addition, the slash and burn method used for land preparation obviously diminishes the integrity and quality of soil for farming and environmental conservation. The use of manure from livestock droppings and urine helps to restore soil integrity and fertility.

Conclusions

The indigenous knowledge systems found in this study evidently contribute to crop and livestock production and management. While the study did not undertake a comparative analysis of farmers using IKS techniques and those not using them in terms of food security, the study attempted to outline IKS in the studied communities of Chimanimani District and how they are used in crop management, grain storage and to a certain extent, environmental management. Also apparent from the findings is that the use of IKS techniques in crop management and grain storage is economically cheaper than the use of contemporary/conventional pesticides and grain preservation chemicals. Furthermore, the study highlighted the human-nature relationship within the social ecology discourse for sustainable community livelihoods.

The study established that social bonds and social reproduction (quality of relationships) are key enablers for sharing and learning about indigenous knowledge systems among community members. It remains an issue that IKS still suffers from marginalisation in the mainstream community and national development.

Recommendations

The following three recommendations are made to the government of Zimbabwe:

1. IKS in education curricula

It is strongly recommended that the education system be reviewed with the view to deliberately incorporate indigenous knowledge systems in education and development curricula. This

can be designed to fit all levels of the education structure in the country, that is, from early childhood development level to tertiary institutions.

2. National IKS research and development institute
The study has illustrated an endowment of indigenous knowledge systems in the communities studied but there is little evidence of scrutiny and documentation of that body of knowledge elsewhere in the country. For this reason, it is highly recommended that the government of Zimbabwe establishes and supports a dedicated national institute whose mandate is to conduct interdisciplinary research and develop indigenous knowledge systems across the country. The key aim will be to integrate IKS in the mainstream national development trajectory and concurrently build and sustain national identity and pride.

3. IKS national fund
In order to motivate and increase appreciation of IKS among both students, academics and industry, it would be important to create a national scholarship for IKS and sustainable development studies. This would encourage IKS-related research in academic institutions and industry. This fund can also be used to sponsor IKS-related workshops and conferences to increase intellectual debate, sharing and learning on the subject.

Notes on the contributor

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