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INDIGENOUS KNOWLEDGE SYSTEMS: A SYNTHESIS OF BATONGA PEOPLE'S TRADITIONAL KNOWLEDGE ON WEATHER DYNAMISM

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ABSTRACT

The introduction of technology and modernization has undermined and neglected local or indigenous knowledge for communities in predicting climatic and weather changes although indigenous knowledge has shown to be of great importance in agriculture and development practices for rural communities. Indigenous knowledge is facing a risk of being side-lined despite holding the key to dealing with the risks posed by climate change. This study assessed the utilisation of indigenous knowledge in predicting seasons by the BaTonga people in Binga District, Zimbabwe. BaTonga people in the past used indigenous knowledge to predict the seasonal phenomenon in each year. Rural communities face hazards that disturb food security, social development, and attainment of the Sustainable Development Goals (SDGs). The indigenous knowledge helped the BaTonga people to come up with means to cope with the effects of disasters such as starvation by farming in valleys and flood plains, storing excess food and praying to their gods to bring more rain and to control pests. In the face of widespread of innovation and technological advancements, traditional knowledge system is on the downward trajectory despite its value in community development discourse. Therefore it is imperative to revive such knowledge systems and harness it with scientific knowledge in an attempt to answering climatic challenges in rural Zimbabwe and beyond.

KEY TERMS: *traditional knowledge systems, BaTonga people, Binga, Zimbabwe, weather, agriculture, food security, disaster management*

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INTRODUCTION

The absence of scientific knowledge in rural communities created value in the use of indigenous knowledge to manage changes in seasons, disaster situations and food security. In Zimbabwe the use of taboos, totems and sacred places have been used to protect and preserve the environment as part of the indigenous knowledge (Risiro et al, 2013: 22). The main objective of the study was to investigate the utilisation of BaTonga people's indigenous knowledge on their activities and environmental sustainability. In Africa, Indigenous Knowledge Systems (IKS) are holistic and produces a deep understanding of the inter-relationships among the different elements of a habitat (Eyong, 2007: 124). With the current dynamics in the information communication technology, utilisation of the scientific approaches in predicting weather conditions across seasons has taken momentum. BaTonga people relied on IKS in predicting the changes in the seasons in their stay in the Zambezi valley. There is need to rethink development with traditional knowledge so as to build the local indigenous knowledge (Odero, 2011: iv). The importance of indigenous knowledge lies in that it has for a long time been used for survival, including forecasting of local hazards by local communities (United Nations, 2015: 1). This shows the extent to which IKS contributes to the sustainability of the environment and community development.

Access to weather information, such as seasonal forecasts, has been limited among the rural populace in Zimbabwe. The current challenges include rapid decline in biological diversity, species, ecosystems, and genetic diversity (Fonjong, 2008 et al., 2010) cited by Ngara and Mangizvo (2013: 21). This calls the need to value the role of IKS in addressing problems experienced in Africa (Gaotlhobogwe, 2017: 192). Odero (2011: iii-iv) categorises the indigenous Knowledge into characteristics of astrology; vegetation like baobab and acacia; birds; and the wind. In Binga, radios were not a reliable resource of weather forcast information because they rarely matched the situation on the ground (Christian Aid, 2011). The timing and amount of rainfall received in Zimbabwe are becoming increasingly uncertain Manjengwa et al, (2014). Uncertainty therefore affected the rural farmers who lack access to irrigation. However, as an answer to sustainable agriculture IKS presents an enormous wealth of knowledge to be tapped (Eyong, 2007: 127). This indicates the value that compelled the researchers to undertake this study to investigate the IKS among the BaTonga people.

The use of local indicators has become important because where they agree with the climate forecast there is greater confidence (Christian Aid, 2011). Christian aid (2011) shared some IKS indicators in Binga. Heavy setting of the baobab and tamarind trees indicated a drought. Production of many flowers by the *mukololo* tree indicated the forthcoming of heavy rains, but lack of flowers meant drought. When the ground hornbill calls rains were expected. The increase in swallows' activity indicated that rain was imminent. If rains came from Zambia, to the north, the season was more likely to bring adequate moisture than if it came from the south. Mist on hilltops signified the approach of a good rainy season. There are indigenous cultivation practices which help to conserve soil and water and also increasing soil fertility leading to increased crop production (Eyong, 2007: 127 Thus, IKS remains key and calls for the necessity to document as much information as possible in the academic circles.

Evidence suggests that the frequency and length of dry spells during the rainy season increased while the frequency of rain days reduced (Manjengwa et al, 2014). BaTonga communities do not show an isolated case in the application of IKS in agriculture. For example, diverse local communities in Kenya relied on traditional local indigenous knowledge systems for adaptation to and management of climatic risks (Odero, 2011: 3). IKS has been an important resource in the sub-Saharan African region in terms of agricultura practices and predicting hazard events. This helped people to prepare for the hazards thereby increasing their resilience. The investigation of the IKS practices of BaTonga people of Binga therefore was key in this study.

The IKS created early warning systems in times of hazardous and disastrous events . In Central Africa, Eyong (2007: 131) confirmed that poor harvest, famine and other epidemics have been detected and reported through the IKS before they occurred. With such a phenomenon IKS have shown validity in day to day environmental issues affecting the rural communities. On a study in Mberengwa, Zimbabwe Shoko (2012: 112) opined that indigenous knowledge such as the use of biotic weather indicators to predict weather played an important role in decision making in rural livelihoods. This provided a recipe to creating a sustainable environment. From such a background, it was noted that most of the BaTonga people IKS practices were not documented. Therefore, this study sought to investigate the IKS' influence among the BaTonga people in terms of their agricultural practices, relations with environment, prediction of hazards and their livelihoods.

CONCEPTUAL FRAMEWORK

Indigenous knowledge

The term indigenous knowledge has diverse interpretations and meanings. It is also called local and/ or traditional knowledge (Odero, 2011). IKS refers to what indigenous people know and do, and what they have known and done for generations, practices that evolved through trial and error and proved flexible enough to cope with change (Melchias, 2001 cited by Eyong, 2007: 122). This definition appears to be broad in interpreting the meaning ofindigenous knowledge. Mawere (2015: 59) defined indigenous knowledge as a set of ideas, beliefs, and practices

of a specific locale that has been used by its people to interact with their environment and other people over a long period of time. Therefore IKS translates to the thoughts and beliefs existing among the local people to which value is attached and transcended along the lines of descent as being meaningful and correct in a particular locality.

In this instance, IKS based practices include knowledge of indigenous plants, food preservation techniques, seed selection to avoid drought, and disease control in livestock (Odero, 2011: 2).Indigenous knowledge incorporates culture- and society specific knowledge on practices such as agriculture, traditional medicine on the use and ethno-botanical knowledge of medicinal plants for human and animal usage; and celestial knowledge which influences human living, weather forecasting and disaster prediction (Nakashima et al., 2012). According to Sarkhel (2011) cited by Sarkhel (2016: 430), manifestation of indigenous knowledge include information, practices and technologies, beliefs, nutrition, health, veterinary care, human resources, education, communication like storytelling, agriculture and fisheries, food and technology, tools, hand crafts, performing arts ,religion and astrology. This study pays particular attention to the IKS practices among the BaTonga people on how in it has been a tool for sustaining agriculture, livelihoods, hazard prediction and the environment. Thus, across Southern Africa, the different circumstances experienced by the local communities and institutions are informed by specific social and institutional contexts and histories of engagement with reliance on their environment (Midgley, 2011).

Adaptation strategies

The local people resort to strategies that work best to make them survive in predicting the seasons. Ngenwi, (2011) gives account of strategies that were employed to signal the significance of the indigenous knowledge in West Africa. Such strategies included alteration of planting dates; mixed farming and storage of extra harvest for food supply separately from that destined for the market. On the same note, planting materials for the coming planting season were separated from food reserves; they adopted the use of local plant materials in protecting grains against weevils in storage; and also made crop diversification: a lot of crop species on the same piece of land guarded against crop failure in times of adverse climatic conditions. In West Africa, the women were trading their labour for (by barter) for food.

This study sought to close the information gap available on the link between the use of IKS and sustainability of the environment and community. In Nepal communities have dealt with natural climatic variability and other changes by innovating and institutionalising indigenous and local knowledge practices in managing local natural resources and infrastructure development (Ministry of Science, Technology and Environment (2015: iv). Related to this is the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) programme which aimed at ensuring that the communities, using their own knowledge manage their natural resources.

Mapara (2009: 140) opines that indigenous ways of knowing have brought forth useful knowledge on medicine and health. Jaya (n.d) iterated that indigenous knowledge is generally an under-utilised resource and a lot of IKS are at risk of getting extinct. The International Federation of Library Associations and Institutions (2008) cited by Olaide and Omolere, (2013: 90), ascertained that libraries publicise the value, contribution, and importance of indigenous and local traditional knowledge to both non-indigenous and indigenous peoples. To avoid extinction of IKS practices for the BaTonga people, this inquiry was carried out to document such practices..

The Ministry of Science, Technology and Environment (2015: iv) of Nepal encouraged on the need to marry the scientific knowledge to the indigenous knowledge to attain effective climate change adaptation. The rural community of Ilocos Norte Province of the Philippines heavily relied on indigenous weather forecasts to plan and prepare agro forestry activities as well as in disaster prevention (Shoko, 2012: 95). For communities to engage in effective adaptations and climate resilient development, there is need to integrate IKS into local and regional knowledge systems and management plans (Midgley, 2011). Thus biblical citations reveal that for everything there is season, and a time for every matter under heaven (Ecclesiastes 3:1), and that you observe days, and months, and seasons, and years (Galatians 4: 10). Communities therefore develop and make use of IKS through observing their environment. This can create sustainability of environment and community development.

METHODOLOGY

A sample of twenty participants was purposively selected in Kalungwizi and Luunga wards for the study. Purposive sampling was done basing on the assumption that the participants had the traditional knowledge pertaining to their environment. These research participants involved a mixture of old and young men and women. The researchers only went to those people who in their opinion were likely to have the required information and be willing to share it as encouraged by Kumar (2011). To assess on how the traditional knowledge transcended along the lines of descent, young people aged between eighteen and thirty-five years were involved in the study. The Ministry of Agriculture extension workers were the key informants to inform how they appreciated and utilised the traditional indigenous knowledge of BaTonga people. Thus, Midgley (2011) argues that it is necessary to work with a wide range of informants, across age, gender and educational lines. This helped to triangulate and validate the responses from the study.

Data collection methods included open ended interviews which allowed interviewees to express their views concerning seasonal changes basing on traditional climatic and weather knowledge. This study was confined to

the two wards of Binga district which are Kalungwizi and Luunga in Zimbabwe. Data was collected based on the indicators together with their meaning and reliability with the lens of BaTonga people's IKS. Data presentation and analysis was based on the qualitative techniques. Data was grouped, summarised, put into themes and synthesised to suit the purpose of the study.

Informed consent was sought from all the research participants who were engaged by the researchers. Participants freely decided to participate in the study. All the secondary data sources were well acknowledged to avoid plagiarism.

FINDINGS AND DISCUSSIONS

Before embracing technological communication methods, the BaTonga people used some traditional signals to predict seasonal and weather changes which helped them in their day to day livelihoods including agriculture. This section discusses the findings from the study elaborating how some natural features, signs, animals, pests and plants were used in seasonal change predictions by people to sustainably prepare themselves against the risks of climate change, effect on livelihoods and impact of natural hazards such as famine or drought. The behaviour exhibited by the indicators then passed a certain message to the communities who, in their own understanding attached a particular meaning.

Termites

The elderly women interviewed during the study in Luunga and Kalungwizi wards indicated that termites offered a significant indicator to predict the coming of the rain season. Termites have been since the old age an indispensable indicator to determine the change of seasons for the BaTonga people in the Zambezi valley. This did not only raise alarms of the seasonal changes, but was also a saving reminder for the farmers to begin planting. In the fall of winter and rise of summer, termites were and can still be seen even today packing and gathering food for underground storage to signal the coming of rain. Such actions by termites sent a loud haranguing sound to the potential subsistence farmers to begin preparing for planting as the disappearance of termites from the eyes of man signals the coming of rains. The actions displayed by termites are very reliable in predicting weather changes for subsistence farmers in the communal areas who lack access to technological and scientific information on weather. This was indicated by one elderly man in Kalungwizi who noted that "*kuti munchenje wabulika yanuunga yawa alayo mvula* (it rained after the disappearance of the termites). This is upon the argument that farmers in Southern Africa face a challenge of receiving inaccurate forecasts for use of seasonal forecasts by farmers (Jiri et al, 2016: 159). There is greater potential for communal subsistence farmers to abate the danger brought by climatic changes if they resort to using IKS and coin it to technological scientific knowledge in the process of farming.

Animals

Fauna and flora have shown that there is life in an ecosystem if there is no specie superior and calculating the extinction of each other. Participants in Luunga ward shared experience by highlighting that the natural death of some wild animals which usually occurred between August and October signified a forthcoming drought. However, this was not a much reliable indicator in predicting a spell and defining the disaster associated with climatic changes for the farmers. Similarly, among the Batswana community in South Africa, the behaviour of plants, domestic and wild animals, birds, insects, atmospheric, astronomic and wind were used as indicators of various forms of natural disaster in their arid and semi-arid environments (Kaya and Koitsiwe, 2016: 103). Such traditional information can be relevant planning ahead of a forthcoming and expected misfortune like drought which are highly associated with climate changes.

Sacred animals like lions played a very defined and significant role in predicting climatic, weather and seasonal variations for the BaTonga people in the Zambezi valley in the dead centuries before they mingled with other tribes and races, which are gradually diluting their religious, traditional and cultural practices. A lion is one of the precious animals for the BaTonga people. When a lion visited the shrines, the coming of rain was foretold by its roared at shrines (*malende*) an incident which rarely occurred except to warn people about the coming of rains. This was a reliable source of weather information as one participant acknowledged that usually it used to rain a day after the lion visited the shrines and this used to transpire between October and November with October well known as *mweezi wakutoba kwamvula* (a month of first rains). Due to the abandonment of cultural and traditional practices for Christianity, this indicator has been malnourished is gradually decaying. Shrines are no longer being honoured making such traditional information to miss subjecting the communal population to risk of the effects of natural disasters.

In addition to the above weather prediction, frogs and fish play an important role in the dissemination of weather message to the BaTonga people up to date. The croaking of frogs in the fall of winter gave a reliable message that it was about to rain and time for planting had come. This message sent by frogs to the people was cemented with the play of fish in the months of October and November in each and every farming season. It is

very important to observe importance of these species in the lives of communal farmers and this help them to prepare for the impact of climate disasters and the anomalies associated with each season.

The coming of the rain season was also indicated by certain birds which produced unique sounds as said by one elderly woman. Birds known as *basikampembeza* or *ndiyo-liyo* would fly across the sky to celebrate the change of the season and this is very reliable weather information source for the BaTonga people as they significantly indicate a seasonal transition. As projected by one of the research participants, at most two weeks or some few hours before it rains and this indicator is even relentlessly accepted as a source of weather information and used in rainfall prediction by the BaTonga people.

A chirruping bird known as *kayiwa* has according to the observations of the researchers proven the love and empathy of BaTonga people to live in harmony with nature, as this is considered an important bird which alerts the farmers of the coming of rainfall and usually this used to happen at the end of October in each and every year. In South Africa among the Batswana community, the behaviour of certain bird species were used to predict the disasters (Kaya and Koitsiwe, 2016: 103). To them, nests being found to the top of the trees on river banks were an indicator of flooding and vice versa.

It has been learnt among the BaTonga people that when *Mwaaba* (painted dog) produce a sound near a homestead, it signal a misfortune that is likely to happen to anyone in the neighborhood, especially the relatives. The sound is translated as expressing *kulwezwa*, meaning the coming of a misfortune. On the same note, *mayuwa* was a sound produced by small animals of the cat family, believed to having been coming from *basangu*, (the spirits of the dead) to signal that someone was about to die. Sounding of *machinchiizya* also expressed misfortune to the family related to those who head them sounding. Such kind of indigenous knowledge help the communal people to traditional avoid and prevent natural disasters

Pests

Fire flies (*mwini-mwini*) shining during the night in huge numbers during the rainy season has been said to be an indication of a higher amount of rainfall in that season. However, sometimes the fire flies were unreliable in depicting weather information to the farmers. Seemingly, the amount of mosquitoes translates the amount of rainfall to be expected in a given season. A lot of mosquito bite was an indication of high rainfall. This is a measuring tool in other words used to compare seasons by the BaTonga people in the Zambezi valley.

Some pests like (*kampekete*) were reliable in weather predictions by the BaTonga people. Too much of *kampekete* was a sign shown at the end of November after germination was an indication of the coming of too much rains although these pests on the other hand vandalised the crops living them vulnerable to the risk of drought disaster. This encouraged farmers to cultivate and work hard since they believed that they were facing a good season and experience a bumper harvest. They even prepared themselves with bigger storage bans (*matala)* to keep their harvests as a means of fighting hunger and starvation. In Uganda, in terms of growing the traditional vegetables, farmers used home-made solutions such ash, urine, water, acacia leaves and chilli peppers to control pests and diseases (Hart and Mouton, 2005).

There are some traditional practice which the BaTonga people avoided to prevent some misfortunes in their livelihoods and mitigating the effects of the climatic changes in the region. Such traditional practice included among other sitting down when eating during cultivation and eating whilst standing or moving around the field was believed to attract more pests. Such traditional practices were initiated by traditional leaders particularly the spirit mediums and enforced through the local leadership like the *sibbukus* (village heads) and *basimwaami* (chiefs) and failure to oblige to the orders was punishable. In addition to this, Thursday has been spared as a traditional resting day. A study carried out by Singh (2007) in India indicate that farmers managed crop pests by a cultural worship called *Hareli* which was celebrated at the onset of monsoon. Such indigenous practices of pest control occur differently from among regions of the world and have enabled the BaTonga people to survive the risks associated with climatic and seasonal dimensions in the region.

Telestereographic indicators

This category of indicators is usually comprised of the moon and the stars. The changing direction and angles of a moon varies the interpretations which the BaTonga people use to predetermine the climatic and weather for a particular farming season. The changing of direction and angles is usually observed during the period between October and November when the rain season is expected. The direction of the moon does not only indicate the amount of rainfall to be expected by the farmers, but also show the change of a season. Therefore, there is need for human beings to find the harmony with mother-nature and agricultural practices, based on specific calendars linked to the indigenous cosmovision (Magni, 2016:15)

Encirclement around the moon (*dambwa kumweezi*) is a significant indicator to determine whether there can be enough rains or dry spells. A bigger encirclement indicates that there will be sufficient rains and a meager figure is believed to be a sign of starvation and little rainfall in a particular season. According to one spirit medium interviewed during the study, the bigger the encirclement the more the rain to be received. This is a very reliable signal in the walk of agriculture which when adopted by the traditional communal farmers today, fighting food

insecurities will be easier. Risky effects of climatic variances such as floods were predicted through such weather forecast strategies. Hence, farmers prepared mechanisms of copying with the effects of the affore mentioned disasters and increased the levels community development.

Rains received before the rain season at the onset of a new moon have a clear message to the farmers which means little rain can be received in that season. This indicator is very reliable in weather forecasting and if merged with scientific knowledge today, fighting the effects of drought would be easier for the whole mass of the different societies in Zimbabwe and world over. Indigenous people develop prevention strategies based on forecasting weather and modification of agricultural practices to reduce damage to crops from harm (Magni, 2016: 24). Globally, people have a conception that lightning flashes before rains is a signal of the coming of rains. This is an appreciated reliable source of weather information for the farmers and in as much as the people are concerned with fighting hunger and starvation and absorbing the shocks of climate change.

A cluster cloud of stars locally known as *kkondo lyamuchimba/ mangwangwa* show stars moving slowly in the sky during the dry season and when itreaches a certain point, a rainy season is experienced. This celestial vision marks the seasonal changes as shown by red clouds which are said to described the end of rain (*mvula yalamba munsila)* Such visual indicators help BaTonga to prepare for the coming of winter and preservation of food thereby avoiding harvest loses through poor storages as well as to mitigate the effects of malnutrition in the winter season.

The end of a season is marked by the traditional counting of months through the physical counting of the new moon. The wind is regharded as a very significant weather prediction tool for people since the ancient times before civilization introduced man to machines and man introduced machines. At the beginning of a rainy season, the blow of wind which is locally known as *muswii (trade winds)* was experienced at dawn and this signaled the coming of a rainy season. Trade winds are usually observed in October and November and serve the alarm purpose to alert farmers to prepare for the new season.

IKS in the Zambezi valley has enabled farmers to prepare themselves against the impact of disasters like drought, floods and famine. Usually the preparedness is alarmed by the wild fruits such as the tamarind (busiikka), baobab and *mateme* which if they are produced in large quantities are said to indicate famine. Because of such indicators people gathererd as much food as they can and store in order to consume during the winter season there of which issues centered on malnutrition are minimized. This indicates the extent to which IKS provided assistance to BaTonga people. In Africa, farmers developed coping strategies that include growing of drought tolerant crops and plants to secure food during drought (Magni, 2016:8; and Singh, 2007: 103)

Plants

IKS in Binga district is at most ascertained by vegetation. Sacred plants such as baobab trees, tamarind and mungiyi/munyi areused as places for performing weather rituals such as rain making (*malende)*. Plants like *mululwe* are not permitted for use as firewood. Such kinds of practices do not only save the traditional purposes but also the conservation of vegetation which in turn help people to preserve the environment and minimize the dangers of deforestation. Although deforestation happens, Binga proved to be one of the districts with a lot of vegetation in Zimbabwe apart from the forest reserves because of such traditional practices. Studies conducted in southern Africa highlight that if certain trees bear fruit at certain periods of time then either good or poor rainfall can be experienced in that zone (Jiri et al., 2016:160). Magni (2016:25) found that dropping or drying of flowers before maturity indicates the approach of a dry season. In other words, the use of plant behavior as a predictor of rain season is critical among the BaTonga people in Binga. This contributes to preservation of certain plant species which then creates a positive effect on climate.

RECOMMENDATIONS

IKS use agrees with the climate forecast and has a significant room to putting a greater confidence to farmers and they are seen as more accurate with or without the confirmation of a seasonal scientific forecast. Farmers need to make use of indigenous knowledge in order to stay alert and prepared for any climatic changes and its effects on society.

Local technical advisors such as the agricultural extension (AGRITEX) workers need to take heed of the relevance of the IKS in promoting agriculture and fighting the effects of drought and other disasters in order to have a hunger free world. The AGRITEX officers need to educate farmers on how they can synchronize IKS to benefit their farming to enhance food security.

Humanity should focus on fighting deforestation and contest to ensure some animal species are preserved as noted from the role which they play in communicating the upcoming weather and the risks associated with climatic changes. The commission of National Parks and Wild life management need to conduct sensitization meetings in the rural communities together with Forestry commission and the Agritex department to ensure nature is conserved at all cost for the best interest of the future generation by embracing the IKS.

There is need for coordinated multi-faceted efforts among all development practitioners, social workers, governors, academics, institutions, farmers and individuals to embrace and institutionalize indigenous knowledge as key in ensuring environmental justice and sustainable development of rural communities.

CONCLUSION

This research has analyzed the indigenous knowledge systems as a synthesis of BaTonga people's traditional knowledge on weather dynamism, disaster preparedness and environmental sustainability. The access to scientific information on weather changes and climate change is missing in the lives of these people making it difficult for them to coup and fight the impact of climate change. It has been established through this research that indigenous information can help the peasants globally to mitigate the levels of the impact of climate change and strive towards achieving the sustainable development. Sustainable development is possible if people observe the above indicators against climate change, drought disasters and the precedents of unfavorable field results for the communal farmers.

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