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Promoting Indigenous Knowledge Systems for Sustainable Environmental Resources Management

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Abstract

Though population changes have been noted to have effects on the state of the environment; the initiatives adopted to mitigate these eco-imbalances are still not in tandem with sustainable environmental development. This is reflected in the lack of significant eco-behaviour change by the populace, which at the same time has revealed strong attachment to their environment reflected in different cultural practices that were pro-environmental. This suggests that the ills of climate change are not foreign to different inhabitants, but rather they are historical phenomena that communities constantly struggled to mitigate. The paper argues for the employment of indigenous environment protection methods as the only sustainable solution to the ever complicated eco-challenges. Also, it advocates for the need of specific environmental projects/programmes to be organised in such a way as to suit specific geographical locations so as to accommodate the necessary indigenous environmental knowledge of all people concerned.

Keywords: *indigenous environmental knowledge; resources management; eco-challenges; population*

1. Introduction

The world over, and Africa in particular, there are on-going concerns on environmental destructions and their relationship to people's livelihoods. Among these are the widespread contentions by scholars and environmental activists about an increasing disregard of indigenous knowledge (IK) in a society, a tendency that accelerates the mismanagement of the environment (Warren, 1992; Lumley, 1976). Also, some claim that modernization and new ways of understanding nature are leading to a disregard of the sensitivity people had over natural resource use. This is because people no longer desire to extract resources and use them in a raw form, but in a more refined and processed form (Sulle & Nelson, 2009; Haugen, 1987; Östberg, 1986) that removes people's natural attachment to things in nature (UNPFA, 2006: 22).

The development of science and technology, for example, is seen as possessing new cultures and new ways of people-nature relations (Dickens, 2004); modern science is seen as availing new solutions to the needs of human kind. It seems, therefore, that it is no longer an obligation for people to feel that they are destroying life in nature; instead they are simply capitalising on its utility value. Other contentions also associate rapid

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population dynamism—as expressed by increased migration, education, and economic processes: all of which create a community with high degree of heterogeneity in many aspects (Mnzava, 1983: 24)—with subsequently varying sensitivity to the environment, sometimes with negative social, economic and ecological effects. In that respect 'the mystical'[1] paradigm that controlled the relationship between humans and nature has been overpowered by new positivistic thinking and behaviours on environmental resource management and use.

Thus, as Rÿser (2012) notes, as indigenous peoples actively engage in efforts to solve complex problems created by human action or natural phenomena, academics, national decision-makers, non-profit organizations, and business planners recognize the significance and relevance of indigenous knowledge and traditional knowledge to the development of new strategies for meeting the challenges of the twenty-first century. In that regard, there has been consistent reckoning on indigenous knowledge to provide solutions to development (Briggs, 2005), eco-challenges, and sustainable environment management (Magni, 2016; Casimiri, 2003). That is to say, interpreting and understanding indigenous knowledge systems has become a top priority in the search for answers to the human survival questions of sustainability and the effective responses to adverse effects of climate change (Rÿser, 2012).

Before getting into the details of the matter, it is pertinent to unpack the meaning of some key phrases, especially IK and indigenous environmental knowledge (IEK). For example, although scholars (both indigenous and non-indigenous), organizational doctrines, and institutions contribute to a substantial body of literature that offers various definitions of *indigenous knowledge*, no common understanding or a widely accepted definition has materialized (Rÿser, 2012). In that respect there have been various definitions of the concept of IK. For example, the United Nations Environmental Programme (UNEP) argues that IK can be broadly defined as the knowledge that an indigenous (local) community accumulates over generations of living in a particular environment. This definition encompasses all forms of knowledge—technologies, know-how skills, practices and beliefs—that enable a community to achieve stable livelihoods in their environment (UNEP, 2017). On other hand, Magni (2016: 5; quoting Agrawal, 1995: 418) defines IK as "… the knowledge and know-how unique to a given society or culture, which encompasses the cultural traditions, values, beliefs, and worldviews of local people, including specific beliefs, rules and taboos that are part of the customary law of a specific group." In this regard, according to the UNEP (2017) IK is unique to every culture and society, and it is embedded in community practices, institutions, relationships, and rituals.

IK is also used to refer to the way people in a certain community apply or make decisions about the use and control of resources, such as the timing of planting and

[1]Narratives of 'sacred nature' are often connected with some rituals. Myths are often foundational or key narratives associated with religions. These narratives are believed to be true from within the associated faith system (though sometimes that truth is understood to be metaphorical rather than literal). Within any given culture there may be sacred and secular myths coexisting

harvesting, and protection of crops from pests and diseases. It is specific in both time and space, and it is often associated with original inhabitants of a particular geographical location who have a distinct culture and belief system (Rajasekaran et al., 1991). As such IK encompasses a number of terms used interchangeably to refer to its concept, including traditional knowledge (TK), indigenous technical knowledge (ITK), local knowledge (LK), and indigenous knowledge system (IKS) (UNEP, 2017).

Emanating from the above explanations, the term IEK is therefore used to refer to the cumulative vibrant body of knowledge, beliefs and skills; which is inclusive of practical and traditional knowledge typical or applied within a particular area (environment) mainly for the purpose of attaining a suitable livelihood (Östberg, 1986: 37). On the other hand, the phrase 'indigenous environmental knowledge' is used to express how IK manifests itself in the ability of people to use and manage available environmental resources like forests, animals, soils and water. Their knowledge involves not only using the environmental resources available within a particular locality, but also how to manage these resources sustainably. According to Ntamigamba (2013), IEK has existed and developed outside the formal education system; around specific conditions of men and women within a geographical area with intimate contact to environmental resources management and use in that area. IEK has enabled communities to survive over an extended period of time while at the same time maintaining environmental ecology.

This paper examines how resilient is IEK for sustainable environmental resources management (ERM) in the context of population changes. Following this part that introduced the concepts of IK and IEK, the second part covers some theoretical conceptualizations, while the third part hints on how IK gained global attention for development and environmental researches. The fourth part analyses the relevance of indigenous knowledge in sustaining the environment, especially in the context of population changes. The fifth part explains challenges facing the application of indigenous environmental knowledge, while the sixth and last part concludes the paper and gives some recommendations.

In accomplishing such tasks, this paper relies on the reflections of primary data from fieldwork conducted in Muhange, Kibondo district, Tanzania, which was intended to examine the role of indigenous knowledge in the management of environmental resources. In addition, it also makes use of secondary data or documentary analysis. Primary data were collected by means of interviews, focus group discussions, observation, and transect walks. In the cause of collecting primary data, key variables,—which reflect social-cultural norms and values of the population—acted as indicators of the level of eco-challenges and their relation to the perceptions of the people of their environmental management: types of crops grown, environmental management activities, water resources, migration processes, sex differences, and age differences.

On other hand, the collection of secondary data involved purposive review of studies that have examined the utilization of indigenous knowledge system in environmental management programs, as well as those that advocate for the use indigenous/traditional environmental management mechanisms. The selected documents contained first-hand

information from respondents, which were gathered by several researchers and published through various outlets. This review was undertaken with a view to establishing their recognition of IK and IEK in enhancing sustainable environmental resources management (ERM), and citizens' participation. Against this backdrop, the selected studies are thematically examined to establish the aspects they covered during the exploration.

2. The Impact of Population Changes on the Environment: Theoretical Conceptualization

Different scholars have tried to explain the relationships between increase in population and environmental degradation. Ntamigamba (2013: 10; quoting Msufe, 1999: 43) argues that the capacity of human beings to modify the environment is clearly dynamic and varying in both time and space. Changes through time, for example, are associated to changing sizes and densities of populations, changing cultural characteristics, changes in livelihoods and associated changes in the demand for environmental resources, coupled with changing environmental stability. As such, these processes have resulted in environmental degradation as they tend to increase people's demand on the environment, which unfortunately cannot support them.

However, although there are currently many debates on the direct relationship between the environment and population in Tanzania, there is yet an adequate and coherent explanation on how this relationship manifests itself in real life. Also, there has been no enough theorization on the latent and subtle ways in which this relationship actually works either negatively or positively to environmental resource management and use. As results, there has been a disregard of some key population aspects like generational differences or natural increase. This is an indication that the on-going environmental campaign in Tanzania may not be able to suit the actual context (Butalaine, 2003). It is also the case that, often, awareness on natural increase may help to know what people need from their environment, but not in terms of capturing the varying needs and interests of the people. If in a given society, for example, the number of young people between 16-39 years is as twice as much as other groups, and if there is no direct means of achieving a livelihood like employment opportunities in industry or other establishments, it is obvious that the environment and its natural resource will be an immediate option for survival, and/or a means to satisfy the often powerful ambitions to get a good life and becoming wealthy.

Therefore, understanding this phenomenon will help to know, for instance, the nature and type of environmental education to be given to this category of population, or what are the eco-friendly alternatives that can help them solve life problems. More often, however, such interventions have not been supported with the application of indigenous ways of sustainable environmental resources management and use to allow some of its relevant aspects to be continuously adopted. In that respect, it is possible to concur with scholars who argue that a population may be having either positive or negative effects on the environment depending on a combination of factors, apart from the population itself (Joseph, 2002; Black, 1998; Gichuki, 1991; Mamdani, 1972). We are of the view that changes in the size of population, in combination with other factors, may also have an impact on people's appreciation of the environment.

Social scientists have come out with a variety of theories to explain the relationship between IK, population, and environmental resources management and use. Theoretically, the overarching analytical lens that the paper is built on is constructivism. However, for a better understanding of the chosen of theory, we first survey and present a synoptic and critical analysis of two theories that have over time attempted to explain the relationship between population expansion and environmental destruction: the Malthusian and Boserupian theories. In the next part we shall attempt a modest brief survey of some of these theories and their theoretical postulations on how population increase leads to environmental destructions; and also comment on their strengths and weaknesses.

2.1 Malthusian Theoretical Conceptualization

The thrust of the Malthusian theory is based on the premise that any population increase will be forced to compete for the scarce resources found in the environment, which in the final analysis automatically leads to environmental destruction. Further to that, it argues that while population increases exponentially, food supply depends on fixed resources that can only be expanded by developing new land for cultivation. Therefore, according to this theory, population increase tends to outstrip the means of support available, and the inevitable outcome is famine.

The Malthusian theory owes its strength to the fact that when a population increases above the environmental carrying capacity, it will most likely cause environmental destruction. For example, an abrupt increase of population—like the one caused by refugee influx [in Kigoma and Kagera regions—has proved to be environmentally hazardous (Rutinwa & Kamanga, 2003; Musoke, 1997). Nevertheless, the Malthusian theory has its weakness. One of its major weaknesses lies on its main argument that views population as the only danger to the environment. To the contrary, other studies have concluded that the environment can still be conserved despite an increase in population. For instance, the study conducted in Machakos (a semi-arid area in Kenya) from 1930 to 1990 by Gichuki and his colleagues challenges the Malthusian central idea and has provided evidence or proof that population increase does not necessarily lead to environmental destruction; and that despite of solid increase in numbers, communities in the area have continued to preserve and conserve their environment even more than it was before the increase in population.

2.2 Boserupian Theoretical Conceptualization

The second theory that attempts to explain the population increase and environmental destruction nexus is the Boserupian theory (1965). Contrary to the Malthusian approach, the Boserupian theory attests that small and stagnant population is unlikely to go beyond the stage of primitive agriculture to higher level of techniques and profits in agriculture, while a growing population will be faced with the need to improve the land. One of the key arguments raised by Boserup is that populations will automatically bring about the conservation of the environment when it has access to improved technology.

However, the applicability of the Boserupian theory has revealed some weaknesses especially in Tanzania where the long-term application of fertilizers has resulted in infertility of the land in different areas of the country. Apart from the use of fertilizers,

pesticides too have been found to be environmental pollutants, especially to water and land. Furthermore, the use of tractors is leading to environmental damage in some parts of the country. This is so because tractors do cultivate large pieces of land after clearing down a substantive number of trees. The end result is the destruction of land and the environment in general since the land becomes bare, and hence exposed to soil erosion.

Apart from the weakness of the Boserupian theory, especially in the application of technology, the other major weakness of this theory is that it lacks any analysis that includes indigenous knowledge in environmental resource use and management. For instance, the theory is silent on what could be the alternative measures or means to solve environmental problems when the technology used is incompatible with the IK of the people concerned. Thus, it is in this context that we consider and opt for the social constructionist theory as the best theoretical lens to substantiate the fact that the increase and persistence of environmental degradation has a proximate relationship to the disintegration of traditional knowledge concerning environmental management among the growing population.

2.3 Social Constructionist Theoretical Conceptualization

The weaknesses of the previous two theories in explaining the relevance of IK calls for the use of other theories, in our case the social constructionist theory, which strives to understand cultural groups' definition and relationship with nature and the environment. The social constructionist theory can be said to be a reflection of the self-definitions of the people within a particular cultural context. Some contemporary examples around the world illustrate how landscapes are a reflection of social-cultural symbols and meanings that define what it means to be a human being in a particular culture.

The social constructionist theory of nature stresses the fact that people's behaviours are a response to their interaction with institutions they encounter in life, and that behaviours are determined through those institutions (Berger & Luckmann, 1966). Social constructionists trace how seemingly natural occurrences are constructed through the history of human actions and interactions. For example, during the implementation of the *ujamaa* villagization programme in Tanzania in the 1960s, people's interaction with their environment changed due to the alteration of settlements. People were detached from their ancestral land and confined to the new and small land. This lowered effectiveness in environmental management as the meaning too changed.

In understanding human relationships with the natural environment, subjective symbols and the meanings through which groups of people socially construct the environment scene must be described. The meaning of things are handed in, and modified through an interpretive process used by a person in dealing with things s/he encounters (Wallace, 1999: 225). This implies that, whatever a human being does has a purpose that corresponds to the meaning attached to that action. For instance, why does a person plant trees? It may be because s/he has attached life to trees, trees provide firewood, shade, building material and many more new economic values. 'Trees' to people may thus have a simple utilitarian value, but at the same time they have a cultural and spiritual value such as attachment to property throughout generations.

The social constructionist theory maintains that natural phenomena are social-cultural phenomena in the sense that they are constructed through social interactions among members of a culture as they negotiate the meaning of nature and the environment. As Burch (1971: 9) underscores, "… the origins of natural resource are to be found in the society, not in the earth." Furthermore, it is argued that the web of human society is an interwoven web of myth and rhetoric of faith and personating that filters and sorts the meanings of man and nature (Burch et al., 1972). The natural environment is transformed into culturally meaningful phenomena, and then viewed from the perspective of these cultural definitions (Geertz, 1963: 37).

Human beings are seen as living in a world of meaningful objects. These meanings are, however, socially constructed and formulated through the process of social interaction. Thus, when different groups come into interaction, they bring together a combination of different ideas and constructions about the world. This is the case when different population groups interact. In identifying the meaning and understanding the life of a group, it is necessary to understand the life of a group in its world of objects in terms of the meanings the objects have for the members of the group.

The utility of fire, for example, varies across groups in society. For instance, in some communities in south-eastern Tanzania where the slash-and-burn practice is dominant, fire is a tool for beginning production: signifying the commencement of a new production of life. But among the Aborigines and park rangers in Australia, fire has distinct meanings and very different management practices based on these meanings (Lewis, 1963). Among the Aborigines, the meaning of fire derives from traditional ecological knowledge of hunting and gathering. To them, setting fire is the most important management tool used to influence the distribution and relative abundance of plants and animals that form the economic bases of their society and culture. Fire setting is not done haphazardly, but is based on a myriad of environmental signs that have been taught orally across generations of Aboriginal people for 35,000 to 40,000 years (ibid.). On the other hand, as opposed to the Aborigines, park rangers are mostly trained to engage in fire-fighting, and thus consider fire to be environmentally destructive.

As opposed to Malthusian and Boserupian supporters, anthropologists are not just concerned with technical or ecological questions but also with the construction of knowledge, the power and pressures behind choices and decisions regarding people's cultural and physical environment, and with the ways in which these environments speak back. Birdsell (1958) maintains that before drawing conclusions about the origins of environmental problems, we need historical accounts of the concrete interactions between society and nature that have produced them. It is from those histories and by the use of social constructionist theory that we can infer the modes of thought and behaviour that are more likely to be influencing the use of the environmental resources management and use in Tanzania.

3. Resilience of Indigenous Knowledge

The importance of IK and practices for sustainable natural resource use and management first received considerable attention in the 1980s. The International Union

for the Conservation of Nature (IUCN) also paved the way for the recognition of the role played by indigenous knowledge in biodiversity and human development. Henceforth, the value of indigenous knowledge systems in facilitating sustainable natural resource management and development gradually began to be recognized by development planners, several agencies and governments.

According to Warren (1992: 6), indigenous (environmental) knowledge—particularly agricultural and environmental—gained international recognition after the United Nations Conference on Environment and Development (UNICED) held in Rio de Janeiro, Brazil, from 3rd–14th June 1992 (ibid.). Agenda 21, drawn at this UNICED, emphasizes the requirements for governments and intergovernmental organizations to respect, record and work towards incorporating indigenous knowledge systems into research and development programs for the conservation of biodiversity and sustainability of agricultural and natural resource management. Principle 22 of the same agenda emphasizes sustainable resource use and development that is people-centred, environmentally sound, and participatory in nature. This is because it touches on people's realities and addresses people's needs in life.

In Tanzania, the Ministry of Natural Resource and Tourism recognizes the fact that rural people have a long history of protecting and managing their environment. For instance, the Sukuma of Mwanza, Shinyanga and Tabora regions have maintained a traditional system of reserving dry season grazing in areas called *ngitili* (URT, 2014: 13). *Ngitili* is a natural resource management system that involves the conservation of grazing and fodder lands by encouraging natural vegetation regeneration and tree planting. The reasons for maintaining the *ngitili* system—and how it signifies the practice of traditional knowledge—have been widely discussed; and so have been its social and economic benefits (Monela et al., 2005: 57). For instance, Shechambo (2008: 57) explained how *ngitili* is a conservation practice that was constructed through years of experiencing weather changes in the Shinyanga area, and the recognition that strictness in rules of resource use over certain spaces can assure enough fodder for livestock in dry seasons. Through such understanding people came to see how *ngitili* not only proved helpful to protect the environment, but also improve the livelihoods of livestock-dependent communities in the region. Again, this example of *ngitili* provides evidence that forest restoration is not only a technical issue but also one of community involvement, and adaptation of local traditional knowledge.

4. Relevance of IK on ERM in the Context of Population Changes

The 1997 Canadian International Development Research Center (IDRC) *1997 Annual Report* attests that the poorest people are generally the most seriously affected by environmental destruction since their way of meeting basic needs—such as food and shelter—may be hard to find, causing them to face daily constraints. This reflects what local people in their setting would need from the environment, but environmental conservation projects do not always recognize the application of indigenous knowledge in environmental conservation and management. Forest conservation plans, for instance, may conflict with community needs for fuel collection, for example by introducing a new species of a tree that is believed to be good but which the

community itself is not ready to use. It is because of this that Batulaine (2003) urges for the need to revisit the role of local settings, traditional knowledge, and institutions in controlling the conduct of individuals and organizations in exploiting natural resources. Indigenous people rarely have the power or final say on how environmental programs should be planned (Magni, 2016). This creates problems during implementation processes and sustainable maintenance because the program may differ from what indigenous people perceive to be a good environmental management system. This is mainly because people will possess no sense of ownership of the program and the resource itself since there will not be any cultural attachment to it.

As such, when planning for any development or environmental program, we need to be mindful of the existing patterns of ERM among communities where the projects or programs are to be implemented, so as to ease implementation processes. As Kerario (1996) noted, any changes in natural resource use and land ownership patterns can seriously undermine the access of indigenous community to necessary resources. Observant of these realities, as earlier said, the Tanzanian Ministry of Natural Resource and Tourism, Forestry and Bee Keeping Division has been one of the forerunners of mainstreaming some IEK practices into its programs or acknowledging them. Although there are several documented examples of the practices of indigenous knowledge to sustain the environment, those that have attracted more attention are the *ngitiri* practiced by the Sukuma of Mwanza and Tabora regions, the '*mshitu*' in North and South Pare Mountains, where local people have managed forests called *mshitu* for sacred purposes (URT, 2014), the '*ngolo'* of the Matengo in southern Tanzania, and the '*ndagashida*' practiced in some parts of Shinyanga (the present-day Simiyu region). This paper however, uses the '*ngitiri*', '*ngolo*' and '*dagashida*' practices in Tabora and Mwanza, Songea, and Simiyu respectively to illustrate how relevant are IK and IEK systems on ERM in the contexts of population changes.

First, let us begin with the practice of '*ngitiri*'. In this traditional environmental conservation strategy, grazing reserves ('*ngitiri*') are closed to livestock at the beginning of the wet season and opened up, section by section, during the dry season. The idea here is to retain an area of standing hay until the rains come. The strict control is maintained over the *ngitiri* and anyone who violates this rule is heavily fined, which ensures that people abide with the agreed rules. In this way the society is assured of constant grazing for their animals throughout the year.

One of the most elaborate traditional environmental conservation systems is the '*ngolo*' Matengo pit-farming system. Before the Ngoni invaded the Matengo over 250 years ago, the Matengo had adopted a system of cultivation known as slash and burn with minimum cultivation (Allan, 1965: 132). As a result of the invasion by the Ngoni, the Matengo people were pushed into restricted mountains, natural caves, and steep slopes. In view of the terrain of the area, the Matengo had to invent a method of survival on the steep hillsides, and probably a strategy to ensure that fertile soils were not exported to their arch enemy, the Ngoni, who cultivated the foothills. Under such circumstances, survival was possible only by fundamental innovation in land use system. So, every available inch of the valley bottom had to be cultivated and kept in cultivation almost indefinitely. In the wake of

increasing land shortage, with no option but to cultivate the steepest slopes, and with no cattle to provide manure, the Matengo evolved an admirable system of agriculture commonly referred to as '*ingolo*' in Matengo dialect (or pit-farming system), or '*ngolo*' in Kiswahili. The sustainability and future prospects of the '*ngolo* 'system rely heavily on its multifunction, i.e., controlling soil erosion, maintenance of soil fertility through composting, and moisture conservation by trapping rain water into pits where it stays for long periods of time. The sustainability of *ngolo* is vested upon the local people's perception of the importance of the system (JICA, 1998). Owing to the immense merits of the *ngolo* system, a majority of farmers in the Matengo highlands have continued to use pit-cultivation as a means of survival for many years.

According to Brandstrom (1996), the '*dagashida*' institution in Bariadi, Tanzania, is a local and traditional institution established in the area to regulate the management and maintenance of environmental resources, including trees. It operates through resolutions or sanctions set to control individuals' demands over family or community land; to use land in such way that its use abides with the family or community norms of ERM. Some of these sanction regulated rights to graze animals on harvested fields and on felling indigenous tree species that were particularly deemed valuable either because of their fruits or for being perceived as sacred according to Sukuma traditions.

Similarly, Leach and Mearns (1988: 124) found that, on their own initiatives, villagers in Isagala village in Kahama made a large stretch of *mbuga* land into a village reserve. *Mbuga* lands are moist depressions where rain-fed paddy rice is commonly cultivated. The Isagala's reserve is divided into two sections whereby one is closed to all forms of use, while the other is opened to licensed cutting of firewood. Permission to cut is granted to those who have an approved letter from a ten-cell leader that is signed by a village secretary. They found out that it was possible to implement such a scheme effectively because the decisions were taken by the villagers themselves, fully confident that the reserve is *mali yetu* ('our property'). It was also found that the reserve is patrolled without payment by the *wasalama* (traditional guards) of the village (ibid.).

On the other hand, a study conducted in Muhange by Ntamigamba (2013) illustrates another shining example of the power of IK and IEK in ERM. The study found out that people have their traditional ways of conserving the environment in their daily activities. In crop production, for instance, they use manure to improve the fertility of the soil. Also, the types of crops grown and methods of cultivation reflect the topographical location. Peasants in Muhange ward were found to use ashes to protect their crops from pests and diseases. Again, the same people used traditional methods to preserve their crops, which included the use of red mud soils to plaster beans crops to protect them from pests and diseases. In that regard methods of farm preparations, type and the way of planting, harvesting and storage systems are based on traditional/indigenous knowledge that are environmental friendly (ibid.).

Our study also found out that social-cultural practices such as rituals were very important in environmental management. For example, the way rites of passage are organized and conducted—i.e., who participates and at what location ritual are

conducted, and the subject-matter of the rites—in consonance with environment protection. For instance, Ntamigamba (2013: 76) points out that the *Erythrina abyssinica* trees—locally known as *mlinzi and mrama* trees—were very significant in conducting cultural practices like rites of passage in Muhange, Kibondo. These trees were found to be most valuable in water conservation. Also, in North and South Pare mountains, local people have managed forests called '*mshitu*' for sacred reasons (URT, 2014).

Furthermore, the study found portrayals of some norms and values that were practiced for the purposes of conserving the environment. These included norms and values related to water resources and sacred forests. Norms and values were exercised through restrictions, particularly restrictions that are linked to evil spirits and other cultural beliefs. For instance, people were not allowed to fetch water around sources that are mainly located in thick forests, which were believed to be the home of *amashinga* (evil spirit) (Ntamigamba, 2013: 98). The study also found out traditional method of keeping animals in collective and organized manner known as *'ikinaama'*. This practice gave chances for people to organize on how to graze their animals sustainably (ibid: 67-70).

Another proof that indigenous knowledge and practices of environmental conservation are of vital importance, and that indigenous people have a lot to offer in terms of contextual environmental resource management, is reported on a project by the United States Agency for International Development (USAID) on a forest in Niger (Soumaré, 1984). The project was designed to manage 5,000ha of the Guessselbodi forest reserve using what is termed as 'participatory management' that involved the local residents. The important features of the project were that the local people were involved from the early planning stages, their interests were taken into consideration (e.g., by allowing access to forest products during restricted grazing periods), and their participation was sought for the management of the forest areas. In this way, the local residents were given the responsibility of managing their local forest resources. Interestingly enough, at the start the USAID experts knew little about the ecology of the forest area, but relied heavily on the knowledge of the local foresters and people.

5. Challenges Facing the Application of Indigenous Knowledge

The practical application of indigenous knowledge has, however, faced many challenges leading to negative implications on environmental management. Firstly, the adherence to traditional practices that served to protect the environment in many communities is slowly eroding due to several socio-economic changes (Schonmeier (1987). For example, currently there are considerable differences between individual people's ability and willingness to apply different elements of what was understood as aspects of indigenous knowledge. For example, traditional sanctions known as *mchenya* (lit: a fine) were applied and supervised by village security committees in the communities that practised *ngitili* (Shechambo, 2008: 58). But with changing societal composition and economic hardships, practices contravening the required use of the *ngitili* multiplied because of people's different perceptions of the *ngitili*, which made some people to start complaining about the *mchenya*. According to the nature of the changing livelihood pursuits, *ngitili* had nothing to do with the lifestyles of those who were not agro-

pastoralists living within the same community. This proves that despite the usefulness of the project to people's livelihoods, some members of the same group may not necessarily accept it. This is often due to a clash in perception and practices over environmental management; but also due to the adoption of other life styles that change the values attached to some eco-friendly practices.

Secondly, Schonmeier (ibid.) argues that an increasingly dense population and the resultant use of land have led to the decline in the efficiency of a system applying indigenous knowledge practices if applied unaltered. Generational difference or natural increase of population, for example, may result into alteration of human environmental relations in several ways (Batulaine, 2003). For instance, the uses of big trees may change from those of cultural practices like rituals to commercial uses. Consequently, people's attitudes toward the use and management of environmental resources may also change from positive to negative, as they will try to understand the utility of environmental resources to their lives rather than for sustainable management. In the absence of realistic management initiatives, the end result is usually environmental destruction.

Taşar (2009: 9) has observed that today there is a grave risk that much indigenous knowledge is being lost and, along with it, valuable information about ways of living sustainably both ecologically and socially. Concretizing such argument, Haller et al., (2007: 39) underscored that poor integration between modern approaches of environmental conservation and traditional environmental knowledge and practices act as impediments for indigenous knowledge to grow. For example, the introduction of new species of crops by national/international environmentalists may not necessarily suit local environments. The introduced crops may need industrial fertilizers and pesticides which, in turn, may be harmful to the environment. The result, therefore, has often been the failure of different programs and negative impact on the environment.

Another challenge to IK is the low value given to indigenous knowledge as an effective approach in natural resource management in many places. Ntamigamba (2013: 8-9; quoting Simon, 1997: 56) advanced that traditional practices on the environment informed by indigenous knowledge have been overlooked in water furrow management along the southern slopes of Mount Kilimanjaro, a situation that is leading to the gradual disappearance of numerous traditional environmental systems related to natural resource management and use. As such, excluding traditional environmental knowledge systems also means excluding the indigenous people from participating in managing their natural resource on the argument that indigenous people are conservative, speculative, and inaccurate. One of the shining examples of program that failed due to disregard of indigenous environmental knowledge and practices is that of the British groundnuts scheme in Tanganyika in the 1950s, which failed because it underplayed the traditional agricultural knowledge and practices of the area (Kikula, 1997: 211).

A study by the FAO (1983) and Timberlake (1985: 122) also found that most development officials and researchers believed that people such as peasants have nothing to teach but everything to learn. This still prevails to a large extent in many circles, and it hinders the success of many environmental conservation programs. It is a fact that many governments

and agencies still consider peasants as ignorant; and that once they are told of the negative effects of practices damaging the environment, they will stop them. On the contrary, studies have found out that peasants are aware of environmental destruction, only that they often fail to get the right support to enable them stop practices that result in environmental degradation, which in turn affects their lives (FAO, 1983).

Apart from the factors mentioned above that have facilitated the gradual loss of indigenous knowledge and practices in environmental resource management and use, the population issue has also emerged to be one of the most important factors. Different scholars have tried to explain the relationships between increases in population and environmental degradation. For instance, Ntamigamba (2013: 10 quoting Msufe, 1999: 43) argues that human's capacity to modify the environment is clearly dynamic, varying in both time and space. The changes through time are related to changing sizes and densities of populations, changing cultural characteristics and associated changes in the demand for environmental resources: all of which result into environmental instability to sustain human and other animals' lives.

Another challenge is the perceived dichotomy between IK and Western knowledge, often referred to as scientific knowledge; particularly the seeming incompatibility of IK and Western (scientific) frameworks of monitoring and managing natural resources. To scholars such as Casimiri (2003: 5):

> … even while research struggles to understand indigenous knowledge as a whole, there are key differences between an indigenous way of knowing and the Western paradigm which do not mesh. For example, Bielawski (1992) points to the underlying contrast between scientific and Inuit knowledge bases - that the Inuit do not separate people from nature, while Arctic scientists do.

Agrawal (1995: 422) cements this thus:

> … substantive difference between indigenous and western knowledge lie their subject matter and their characteristics—the latter is said to be more analytical and abstract while the former is intimately connected to livelihoods and of the people rather than being abstract ideas and philosophy attributed to.

This perceived dichotomy arises from several reasons. One is the concept 'indigenous'. Ellen and Harris (2000) argue that, "the term 'indigenous' almost invites an oppositional 'us and them' scenario between the two knowledge systems" (in Briggs, 2005: 103). On the other end Magni (2016: 29) attributes it to decade's practices, in which "traditional knowledge has been compared and contrasted with scientific knowledge." As a result the common trends has been what Mazzocchi (2006) have termed as comparisons of 'opposing views.'

> Western science favours analytical and reductionist methods as opposed to the more intuitive and holistic view often found in traditional knowledge… [it] is positivist and materialist in contrast to traditional knowledge, which is spiritual and does not make distinctions between empirical and sacred …. [it] is objective and quantitative as opposed to traditional knowledge, which is mainly subjective and qualitative … [and it]….is based on an academic and literate transmission, while traditional knowledge is often passed on orally from one generation to the next by the elders (Mazzocchi, 2006: 464).

As such, for some scholars there is a fundamental problem of attempting to integrate IK into an unchanged Western resource management system (Casimiri, 2003). Because of this fundamental difference, management models that seek to combine the expertise of both Western science and IK remain,

> … primarily western, scientific and bureaucratic .... Examples of these programs are such as the one to Reduce Emissions from Deforestation and Degradation (REDD), which has categorically excluded indigenous peoples from the decision-making process of the program" (Magni, 2016: 26).

6. Conclusion and Recommendation

Despite increased initiatives in addressing the importance of indigenous knowledge in environmental resource management and use, little has been done to analyse the impact of population changes on the applicability of indigenous knowledge and practices in relation to natural resource use and management. A number of studies and therefore initiatives to manage environmental resources conceptualize environmental destruction to be a result of population increase in absolute numbers. However, conceptualizing environmental damage using such a predictable approach lacks some analytical explanation on the relationships between environmental devastation and different aspects of population variables such as traditions, religious beliefs, etc. These approaches fail to spot key questions such as asking about the relationship between belief systems and the environment in the context of rapid population growth.

This study has illustrated that traditional/indigenous practices are effective as implied in traditional practices related to conservation of environmental resources. It has also revealed that it is not simply population increase in absolute numbers that has affected traditional environmental management systems, and that the uses of environmental resources are the only responsible factors for environmental problems like degradation. Population increase in absolute numbers cannot be the only factor responsible for environmental degradation, but the most important factors are located in the manner in which such a population strives to earn a daily living, i.e., how far their livelihoods depend on the environment.

The paper has also argued that the disregard of traditional environmental knowledge on the use and management of resources has equally contributed to environmental degradation. This revelation was made possible by the use of the social constructionist theory that made it possible to examine how people's behaviours are a response to their interaction with institutions they encounter in life. According to the theory, whatever human beings do have a purpose that corresponds to the meaning they attach to that action.

It is evident from the study findings that the significance of indigenous knowledge in the management and use of natural resource has to be recognized. This is because if indigenous environmental knowledge is well organized and practiced among the people it can help to halt the problem of environmental destruction. As such, if there is

indigenous knowledge (indigenous environmental knowledge and management of natural resource), indigenous environmental knowledge reflects people's culture; and if culture differs from one society to the other, then it is very important and logical to argue that any initiative concerning environmental programmes should avoid hasty generalizations. This is to say, approaches and techniques used to manage the environment in one locality might not necessarily work in another due to differences in people's traditional knowledge. The same may be the case even in the same local area with regard to the time and other emerging factors such as age differences.

Thus, we recommend that specific environmental projects/programs should be organized in such a way to suit a specific people in a specific geographical location so as to accommodate all necessary traditional knowledge and practices that are relevant and have been used to protect the environment in the past. In other words, there is no single approach to rescue the environment that can cover the whole country, region, or district with people having cultural differences. Therefore, any programme aiming to conserve the environment has to target specific people in the specific place, while taking into account the IK and IEK of the people concerned.

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