A Critical Analysis of The Impact of Digitizing Indigenous Knowledge

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Abstract. A review of recent literature on the subject reveals that indigenous knowledge (IK) is one of the most popular subjects that have been studied, written about, discussed in conferences, in websites and favourably funded in terms of study projects, discussions and project implementation. At the international level, UN organisations such as the World Intellectual Property Organization, UNESCO, FAO and others have in recent years woken up to the fact that there is need to acknowledge, recognize and appreciate that traditional knowledge from all parts of the world has contributed and continues to contribute tremendously to many spheres of and strategies in world development. Specific policies, including national policies, have even referred to indigenous knowledge in the context of information communication and technology, copyrights and intellectual property rights. It however seems that the concern is focused on dissemination and sharing of this knowledge for the common good, to the extent that one wonders to whose interest this focus is geared and whether the 'common good' as justified by the concept of information commons, is truly common. In recognition of the fast technological developments and globalization trends, the author studied plans and processes of digitizing indigenous knowledge in Kenya and argues that under the present socio-economic and socio-political circumstances, it may not, in most cases, be advisable to indiscriminately subject it to the undergoing processes of digitization.

The study was carried out in Kenya where the research assessed and critically analyzed the impact and challenges of digitizing indigenous knowledge.

The study establishes that to date Kenyan IK largely remains unrecorded and shrouded in secrecy since it is not fully protected by patents or copyright laws, and where it is written and thus communicated, it is not fully interpreted, understood and appreciated. Traditionally, it is passed on verbally and thus classified as mere folktales. Nonetheless, while digitization of IK is a new and unavoidable development, it can also enhance piracy and loss of intellectual property rights unless Kenya establishes adequate and effective infrastructure and information system to capture, store and preserve its IK for utilization of this valuable resource in solving current and future socio psycho-political and economic problems for the betterment of Kenyans and the world at large.

Keywords*:* Biopiracy *;* Copyright; Digitizing*;* Folklore; Indigenous; Indigenous people; Indigenous knowledge *(IK);* IntellectualProperty Ownership*(IPO);* Information Commons; Patent; Traditional Knowledge.

Introduction

1.1 Indigenous Knowledge (IK)

Indigenous knowledge has been variously defined, with each definition focusing on different aspects of this knowledge. Referring to it also as traditional or local knowledge, indigenous knowledge has been defined as "the large body of knowledge and skills that has been developed outside the formal educational system. IK is embedded in culture and is unique to a given location or society. It is the basis for decision-making of communities in food security, human and animal health, education and natural resource management". World Bank website, www.worldbank.org/afr/ik/index.htm) as reported in http://www.unesco.org/most/bpindi.htm. IK is part and parcel of peoples' culture as it is closely interwoven with people's cultural values. Culture is the fabric that holds human communities together for the purposes of community survival. The culture, the identity and the confidence at the individual, family, clan, group, community, national and even racial level is to a very large extent dependent on the knowledge of origin, history, achievement and failures of that entity. It is not a transient fad but a present and dynamic reality which is actively created and molded. It provides a stable sense of identity and cohesion of the particular people.

Therefore, a people without their IK are a 'lost' and 'an entity without a clear identity'. IK captures traditional knowledge and wisdom of people who have survived for hundreds of years in complicated and risky environments. It has been accumulated over generations and handed down in a systematic manner, as governed by what each community has found to be the most effective method. IK has been handed down by word of mouth through such forms and formats as stories and tales, songs, sayings, proverbs and symbols, a wide variety of forms and formats which include ways and methods of remaining in harmony with nature. IK encompasses languages, folklore, wise sayings, music and technology. Therefore, IK is not easily coded and much of it has not yet been recorded. It is not readily accessible to researchers, policy and decision makers. For a variety of reasons, it is also poorly understood by scholars, particularly the 'westernized' Africans.

1.2 The Importance of Indigenous Knowledge

African communities hold indigenous knowledge on food crops with respect to nutritional values and processing techniques for durability and storage. They have specialized IK on food crops in relation to suitability for specific climatic conditions and seasonal weather variations. From generation to generation, indigenous knowledge regarding production and consumption was used for curbing famine and for ensuring and strategizing for food security and constant food supply. The communities also have knowledge on a variety of herbal remedies, treatment procedures for various ailments and knowledge on some surgical procedures. Similarly in the indigenous traditional society, it was known that the three co-existing entities, i.e. people, animals and vegetation were one with the environment both physically and spiritually, and that they all had to share natural resources in a balanced manner. For example, communities in mountain regions in Africa had for generations

collected, used and preserved a wealth of tradition on environmental conservation and agroforestry. This tradition had provided a mechanism for strengthening the alliance between environmental conservation and local cultures. Loss of this knowledge through 'modernity' has led to unbalanced removal of either one or more of these entities coupled with attempts to protect the others. This unnatural and impractical solution to current environmental problems has led to ecological disasters such as deforestation and global warming which the world is facing today.

Within the last 15 to 20 years, scholars have come to realize that human communities have generated, refined and systematically passed on their traditional knowledge from one generation to another. But traditional society has always recognized the importance of that knowledge in their community's life and survival. Mwangi (2002) notes that indigenous knowledge systems and information base are founded and are deeply entrenched within experience, collective (community) wisdom, resourcefulness and historical reality.

1.3 Threats to Indigenous Knowledge

Nowadays, IK is being threatened by rapid changes in the natural environment as well as the continued socio-political, economic and cultural changes being experienced all over the world. Many scholars have observed that Africans in particular have for nearly two centuries, suffered from the loss of their history, their cultures, languages, and from the loss of their identities and the pride that naturally goes with these.

Today, these same Africans are beginning to question their true identity especially when they find that however much they deny themselves and struggle to belong elsewhere, those elsewhere do not and cannot accept them as belonging to the same culture, community or even nationhood. For example, Ethiopian Jews (Falashas) have experienced racial discrimination in Israel at the Israeli community and person to person levels. (Concluding observations of the Committee on the Elimination of Racial Discrimination: Israel.30/03/98.http://www.unhchr.ch/tbs/doc.nsf/(Symbol)/CERD.C.304.Add.45.En?Opendocument).

The African continent, has gone through some experiences which have interfered with the pattern and effectiveness of the preservation and handing down of African indigenous knowledge. For example, slave trade to the north, east and west, wars and emigration, and colonialism in the 19th and 20th centuries have for generations, affected the process. Under colonialism, the occupied communities and nations were forced not only to hate themselves but also to dislike their cultures, religion, languages, identities and systems of existence and survival. This process interfered with people's systems not only of generating and creating new indigenous knowledge but also the system of passing on this knowledge to the next generation, for example, in crafts and technology, writing, language and music. It should be noted that the very same non-Africans who have been forcing or persuading Africans to lose their identity have on the whole continued to discriminate against people of African origin in the postcolonial era. On the other hand,

in their own motherland, Africans continue to reap the negative benefits of losing their indigenous knowledge. (Researcher's observation of Kenyan families living in UK, 1990s).

Like all other forms of knowledge, African IK should be part of the African knowledge economy in the African development process because the knowledge economy in many countries involves economics, institutional infrastructure, political and social regimes, education systems, processes of innovations and inventions and information technology and communication. If African IK is fully utilized, it would also be an integral part of African knowledge economy.

In the 21st Century, the wealth of the African indigenous knowledge is being held by a few people, an insignificant number, largely those advanced in age. Many of these people have not acquired significant foreign-based education. They are normally isolated from the modern educated or semi-educated African community, thus the transfer of the knowledge they have is virtually non-existent. Yet this transfer is a pre-requisite to proper IK utilization. This transfer is made even more difficult by the scattering of many members of the community in terms of time and space as they pursue modern means of survival far away from their ancestral homes. Communication among members of the same indigenous origin is progressively becoming complicated and ineffective. Thus since it has never been written down properly, the indigenous knowledge of the elderly is slipping away day-by-day. For example, knowledge on the traditionally highly valued and rare indigenous species and local varieties of plants and animals, is on its way to extinction. Since information on the importance of these resources to human beings and the environment is only held by the older disappearing generation, the current generation of Africans is yet to fully commit itself to acquire, understand, preserve, protect and appropriately apply this knowledge for its survival and the survival of its children and that of its children's children. The majority of the modern Africans are not aware of the fact that African IK should be regarded as an invaluable ancestral legacy and a valuable national resource.

Furthermore on issues of biodiversity, and because of lack of knowledge, many Africans, especially the younger generation, who take pride in their 'modern' patterns of consumption, are known to despise their traditional foods in favour of exotic foods, a most common phenomenon among usually unhealthy "junk food". Poverty, famine, and malnutrition are common in parts of Kenya despite the fact that local indigenous foods could be readily grown. Many modern Africans lack traditional knowledge on the nutritional values and cultivation techniques for local edible plants. Most people no longer know, for example, when and where to collect seeds or how to preserve them (MOST/ CIRAN BP.08).

Indigenous knowledge on a variety of valuable African plants has over the years been tapped by outsiders and used to manufacture drugs without adequate acknowledgement of the intellectual property rights. Yet recognition and identification, validation, dissemination, transfer and exchange concepts on IK have been written about. Moreover, the concept of digitization for the benefit of preservation, and recognition and rights of

the owners is not often stressed. This is a major concern of the researcher. Indeed African indigenous knowledge is extensive and valuable not only for the African survival but also for the survival humanity. It is a valuable resource which is threatened by lack of appreciation by the owners and by subsequent lack of protection, particularly in the globalised environment (Wikipedia 2006).

Part of the problem regarding the protection of IK is its diversity. The suggested solution to solving the wide ranging problems threatening IK is digitization. But how safe is it to digitize, in the pretext of protection and sharing of this knowledge, at the stage in which the IK owners may not fully appreciate the implications of digitization?

1.4 Efforts to Protect Indigenous Knowledge

There are significant global efforts for addressing this issue. For example, the setting up of World Intellectual Property Organization (WIPO*)* in 1967; in 1974 became part of the UN system, to protect traditional knowledge (that is IK), signifying international recognition of the value of this knowledge. (http://www.iprcommision.org; http://72.14.209.104:www.commons-sense.org). WIPO is concerned with copyrights, patents and trademarks. It was mandated with the promotion of creative intellectual activity in order to accelerate economic, social and cultural development in the world. In this context, it is noteworthy that most scholars fail to regard IK as an intellectual activity (http://www.cptech.org).

The position of IK as an intellectual property right remains vague. Regarding protection, and as guided by *Berne Convention based on the Berne Union for Protection of Literary and Artistic Property*, copyright notably protects digitized work in the 'public domain' until the right has expired after at least 50 years, or after as many years as specified by the individual countries. The US Copyright was extended to 95 years in 1998 (http://72.14.209.104:www.commons-sense.org). The 1967 Stockholm Amendment of Berne introduced copyright exceptions where copyright could be waived without the author's permission if the reproduction of the work was for special cases, and not in conflict with normal exploitation of the work and not intended to prejudice the interests of the author. Kenya Copyright Act 2002 recognizes the Berne Convention.

Convention on Biological Diversity (CBD) was passed in 1992 (http://www.iprcommision.org) in appreciation of the need to promote, preserve, access and share benefits of traditional knowledge and genetic resources. The concern here is the access and sharing of benefits without clearly specifying whose benefits are to be shared and in what proportions they will be shared. Related international instruments include such declarations, covenants and conventions as the ILO Convention (169) Concerning Indigenous and Tribal People's in Independent Countries, UN Declaration of Human Rights, The International Covenant on Economic, Social and Cultural Rights, International Covenant on Civil and Political Rights which revised the 1957 Indigenous and Tribal Populations Covenant (107) (UNESCO, 2005).

1.5 Research Problem

The research assesses and critically analyzes the impact and challenges of the digitization of indigenous knowledge. The geographical study area is Kenya. However, it is also recognized that the indigenous knowledge problems facing Kenya are similar to those experienced in many other African countries, particularly sub-Sahara Africa.

Available literature indicate that efforts directed at African indigenous knowledge do not seem to lay enough emphasis on the preservation and utilization of this valuable resource for the benefit of its owners. The owners of the resources are not empowered enough to appreciate its uniqueness and its value in diversity because communication of valuable and relevant information in this context is grossly inadequate. The study has focused on the extent and value of ongoing digitization activities of the indigenous knowledge in Kenya.

The research aims to provoke scholars and experts to seek to give something back to their communities, to take responsibility to use all means necessary including modern technology to identify, record, preserve and safeguard their communities' knowledge and to use the same to solve today's technological, socio-economic, cultural and political development problems.

The study was limited by the fact that indigenous knowledge is yet to be fully appreciated by most of its de facto owners. This complicates attempts to gather information from them.

2 Literature Review

2.1 Challenges Facing Indigenous Knowledge

Otsile (2005) and Kawooya (2006) have confirmed the danger of outsiders misappropriating indigenous knowledge from Africa, indicating that some African scholars are now researching their indigenous knowledge and appreciating that the Africa's knowledge indeed plays pivotal role in scientific and technological advancement even in western countries where this process is facilitated and protected by the Intellectual Property (IP) laws.

2.2 Protocols for the Preservation of Indigenous Knowledge

The main written sources of indigenous knowledge were found to include books written by foreigners who arrived before and at the beginning of colonization, writing as explorers, settlers, colonial administrators or as missionaries. Most of these were found in the British Museum, Public Records Office and The Church Missionary Society Library (Thairu 1990). There were also a few books written by Kenyan nationals which provided the African interpretation of much of what the foreigner had recorded, for example, Kabetu, Matthew (*Kirira kia ugikuyu*. Nairobi, 1947) and Kiama, Stanley. (*Miikarire ya Agikuyu*. Nairobi, 1934).

Much of what has been written on indigenous knowledge in the international context and to some extent in the Kenyan context has focused on the identification, recording, storage, transfer, dissemination and exchange of indigenous knowledge in the context of

development. These activities have been spearheaded by international partnerships, giving the impression that the idea has not originated from the indigenous people themselves. The organizations related to United Nations have played a very influential role, particularly in regard to designing frameworks of action and providing financial and human resources.

In the Common-sense Project (CSP), Armstrong and Ford (2005:13) define digitization as 'the process by which any kind of information, be it text, audio or video is converted into binary digital codes to enable the digital information to be stored, compressed, copied or transferred over networks without loss of quality. They explain that digitization 'provides levels of quality, predictability, storage and transportability' unlike the analogue information systems. For example digitization has enabled information and data to be carried through such infrastructures as 'traditional copper phone lines, wireless terrestrial and satellite broadcast systems, WiFi, fibre optic cabling and cable TV lines.' (ibid. p.13). Different communication media are being brought together and harmonized through technological convergence. This convergence has been defined as bringing together broadcast, telecommunications and information technology platforms and channels which were traditionally separated. Noting that cell-phone services are enabled to transmit digital information by the General Packet Relay Service to use internet protocols and similar packet–switched systems, Armstrong argues that while digitization and technological convergence have greatly extended the reach of information commons, it has also facilitated the infringement of copyright laws (African Commons Encyclopaedia 2005).

Armstrong and Ford (2005:14) have also discussed organizations that have influenced laws and conventions at the national, regional and international levels, such as World Intellectual Property Organization (WIPO) and several other UN bodies. In 2004 the Geneva Declaration on the Future of WIPO acknowledged that humanity was facing a global crisis in the governance of knowledge, technology and culture (Consumer Project on Technology. http://www.cptech.org).

In his paper entitled "Indigenous Knowledge for Development; a framework for action", Woytek (1998) has largely been guided by the IK Initiative Team in the World Bank African Region and Information Solutions Group. He argues that the 'vision of a truly global knowledge partnership will be realized only when the people of the developing countries participate as both contributors and users of knowledge.' (p. iv). The paper defines IK and shows why the same is important in the development process. It advocates the need for dissemination and exchange of IK and the need to raise awareness of the importance of IK and the integration of IK in development activities directed, guided and financed by 'development partners'.

The Common – sense Project cited above, (Armstrong and Ford 2005:3) also maps how far Africa has moved towards the goal of achieving a "digital information commons", charting international, regional and national policies on IK. The idea of 'commons' signifies free access to information that has been built and is maintained by the community acting together for the benefit of all... (and) should allow reuse and adaptation in order to progress the flow of knowledge and information' (ibid. p.9). The project aims at conducting

research to equip 'African activists and decision makers' with the information they require to develop a cutting edge and relevant intellectual property policies and practices. Indeed CSP used a 'Wiki" online mode in which anyone anywhere in the world could edit, input, amend, build on and improve the growth of African Digital Commons. The document is a quick source of information on the global and African players, processes, issues and projects on digital information. It highlights the need to extend copyright protection to include software, academic journals and electronic databases particularly for commercial gains vis a vis facilitation of greater public access to knowledge particularly for educational purposes. African Digital Commons advocates 'more application of digitisation and of international digital networks that balance the rights of publishers with those of users, rather than prioritizing one at the expense of the other.'

The author also noted the new concept of open access which is countering copyrights. Open communication is comparatively inexpensive particularly for education purposes. This too poses the risk of indigenous knowledge being accessed and used without due recognition of the originator. *Open Document* is an MS XML based format developed under the Organization for Advancement of Structured Information Standards (OASIS) to use Open XML Translator project on SourceForge.net site. The Berlin Declaration and the World Summit of the Company of Information (WISIS) allows and provides for use of Open Standards e.g. Open Document Format and use of Free Software to freely disseminate information by public agencies and local communities according to their requirements and to meet their own needs. All this is in the general spirit of 'opening up'. Initiatives to digitize IK can take the advantage of open access to use these inexpensive facilities (African Commons Encyclopaedia 2005).

The indigenous knowledge subject has recently been reviewed and discussed in several workshops, conferences and websites focusing on issues of oral transmission and subsequent misappropriation of African indigenous knowledge as a traditional resource, its commercialization and dissemination of related research 'particularly in the digital environment' (www.ifla72/papers/116 p. 2).

In an article entitled 'Copyright, indigenous knowledge and Africa's university libraries; the case of Uganda', Dick Kawooya (2006) shows that indigenous knowledge among other resources of 'indigenous communities' are misappropriated by outsiders, many of whom are aided by their own countries' intellectual property (IP) laws while the knowledge is portrayed as 'inferior and of no value' to the extent that even the owners have grown to believe the same.

3 Methodology

Data was collected through a questionnaire designed to guide interviews and discussions with respondents selected through biased sampling.

a) Interviews and discussions were held with Kenyan nationals who hold some of the indigenous knowledge, people of the older generation who in their lives have witnessed and even participated in some of the activities that have utilised indigenous knowledge and skills. Some gave their views on digitization of African indigenous knowledge. Others were researchers in this field.

b) Interviews were held with herbalists who gave some information on how they learnt their skills and what their expectations are in regard to giving that information to be recorded.
c) Visits were made to markets where observations, interviews and discussions were held with men and women at work in the production of some of the items they marketed.
d) The researcher read and examined critically official documents, books, journals, magazines and newspapers and carried out extensive search on the internet.

The respondents and other sources provided useful information on such important topics as nature and environmental conservation, textile technology, herbal medicine, traditional surgery, architecture, cookery, indigenous religions, beliefs and practices, and many others, besides their general concerns about recording, preservation and transfer of indigenous knowledge.

4 Findings

4.1 Existing frameworks and initiatives for the digitization and preservation of indigenous knowledge

The researcher found that many manuals and frameworks have been written on how to record and use IK, for example, by the International Institute of Rural Reconstruction, a non-governmental organization based in Philippines. Other international endeavours, have to a large extent been spearheaded by the World Bank, notably through Indigenous Knowledge for Development Initiative under Partnership for Information Communication Technology for Africa (PICTA) to focus on indigenous knowledge, some targeting the digitization of the same. The Global Knowledge Partnership (GNP) aims to facilitate equality or openness in the contribution, access and utilization of global knowledge including indigenous knowledge. The African Digital Commons based in the LINK Centre, Graduate School of Public and Development Management, Wits University, Johannesburg, South Africa, aims to support African innovation, education and creativity (Armstrong and Ford 2005).

Undoubtedly the new fields of Informatics and telecommunication have had and continue to pose challenges that countries, regions and continents need to deal with. Kenya, like many other African countries, has ineffective information structures, information policies and legislative framework, and lacks harmonization of elaborate or advanced infrastructure and policies even where these exist. But all is not lost. The Attorney General's office is currently in the process of developing an IK policy (Personal communication with NMK staff, 2006). It is expected that the policy will seek to protect the national IK, recognize and respect each community source and protect copyright and intellectual property rights. The Ministry of Information and Communication and The Communications Commission of Kenya are active in facilitating the development of information and communication technology (ICT) in many parts of the country, developments that will undoubtedly influence digitization of indigenous knowledge.

The format in which IK is available is varied. It includes papers, books, articles in the newspapers, audio tapes, videos, photographs and websites. As has been noted, most indigenous knowledge experts only communicate the same orally. Many African nationals of the older generation carry some of the unrecorded indigenous knowledge. Some have made significant efforts to record the knowledge they have which they are willing to pass on, particularly when they are assured of its preservation and security. Many of those interviewed stated that they would like to be assisted to digitize the same but they needed to acquire digitization skills or be assisted to digitize their knowledge by those already skilled. They stated that they wished to be recognized as the sources of the indigenous knowledge they now have.

It was found that some organizations in Kenya having recognised that this indigenous knowledge might be lost, have began to appreciate the need for its recording. The knowledge is being lost because a large part of the population has not acquired it due to negative attitude it has towards this knowledge. The African Initiative for Alternative Peace and Development (Muhando et al. 2004) is one such organization involved in identification and description of the Kenyan sacred sites. Their reports describe the indigenous knowledge associated with these sites. However the initiative needs moral support to continue in this endeavour. The National Museum of Kenya (NMK) also initiated its Indigenous Food Plants Programme in 1989. This programme has subsequently been implemented with the help of local communities in ten districts of Kenya. NMK has to-date focused on bio-diversity, a very crucial area regarding food supply, health and commercialization or economic concerns, besides preservation. Broadly, NMK aims to compile agronomic, nutritional, cultural and market data on priority species. Working under the Indigenous Food Plant Programme, NMK acknowledges the need to promote cultivation, consumption and marketing of "indigenous foods among Kenyans, particularly the young who despise their traditional foods … in their modern patterns of consumption." (MOST/CIRAN BP.08). These should be done through field demonstrations, educational materials and the media. It also aims to compile a database of the indigenous food plants of Kenya, through research in the field and at the East African Herbarium. Through its commitment in research, building of a resource centre and creation of a database among other activities, NMK will make essential contribution in the capturing, storage and preservation of Kenyan indigenous knowledge (Interviews with NMK staff, 2006).

Indigenous knowledge in creative arts such as music, dance forms and styles was also found to lack Intellectual Property Rights (IPR) protection. For example, the original composer and singer of the internationally acclaimed 'Malaika' song, Fadhili Williams, gave up his rights for a fee of 200 shillings since his intellectual property rights were not appreciated or protected. The current digitization services were found to include iTunes, iPod, EMusic and YahooMusic, many of which have internet radio option. Some digital music services are engines for music. Digitization and ownership call for recording, patenting and blogging, requiring discussions to determine sharing of benefits and compensating the artists where necessary.

The frameworks and initiatives appeared to focus on digitization to capture, preserve and disseminate, impart or share IK. The processes lacked emphasis on the rights of the 'owners' of this knowledge, be it individuals or community, in the context of intellectual property rights, patents and copyrights.

4.2 Language and indigenous knowledge

Due to the processes and demands of slavery and colonization, new languages, Kiswahili and English, respectively, were introduced. Thus in the school curriculum these languages are mandatory and are examined, at the expense of African languages. Consequently many African children no longer learn the indigenous languages and have even developed negative attitudes towards them.

According to Shiyong Lu, etal (2004):

> When a language disappears there are two major effects. First, there is the loss of the valuable data of the cultural system that produced the language. The death of a language usually entails the loss of a community's traditional poetry, songs, images, stories, proverbs, laments, and religious rites. Secondly, any language loss represents a serious scientific loss: studies of linguistic diversity and cross-linguistic comparisons drive much of the linguistic theory. In addition, linguistic material provides valuable information about population movements, contacts, and genetic relationships.

That some African languages are not yet recorded and have no written dictionariesmeans that they are at the risk of dying. They are an endangered species which will disappear with all the data on such formats as poetry, songs, images, stories, proverbs, sayings, and religious rites. It is imperative that this data is captured through digitization using most modern technologies such as the semantic web technologies, namely, the XML and OLAC and ontology, among others.

In his attempts to preserve languages, one medical expert, Felix Konotey Ahulu invented a method of writing African tonal languages so as to enable the reader to pronounce the words correctly like a native speaker of the language and thus communicate verbally in the language accurately and effectively. This will enable any reader of the written tonal language to read it as accurately as the native speaker does and facilitate learning and speaking in these languages. Konotey Ahulu is aware of the value of speaking tonal languages, that is, most African mother tongues (where mothers can speak them), since they exercise human brain in a more extensive manner than non-tonal languages e.g. English. These brain parts when exercised may also make the learning of complicated mathematical concepts and music much easier (BBC tonal language information on Mandarin Chinese and Vietnamese, US English. The indigenous tonal languages therefore need to be preserved, learnt and spoken to enhance learning of a variety of subjects by the speakers besides preserving and communicating indigenous knowledge (Personal communication 2006).

4.3 Indigenous knowledge, genealogy and traditional communities

The researcher found that in their quest for indigenous knowledge, some families are actively searching for their indigenous identity, ancestry and origin; researching and constructing their family trees and digitizing the same to facilitate storage, preservation, dissemination and continued development as the families expand. The two families of 'Mbari ya Ithanga' and 'Mbari ya Miri' reported that these exercises have been very interesting and educative, particularly to the younger generation. The family history, the talents and specialities of the individual members of these families have been revealed and described in the process of constructing the family trees. (Waithanji, Wanja and Thairu, Njeri Kagumba, Mwangi and Wamuyu; Personal communication 2006).

The researcher also found that to a large extent, pastoral communities such as Maasai and the Barbaig have been able to preserve and successfully implement their indigenous knowledge systems in new environments but lack of appreciation of this knowledge by others is threatening their environment in the present times. Traditional systems are used to predict the weather; improve pastoral lands by techniques such as rotating grazing, burning pasture to regenerate new growth and killing undesirable plant species besides caring for livestock. Women in some pastoral communities play a vital role in livestock management, but because of lack of modern education, they have little power in decision-making and limited opportunities to broaden their knowledge through exchanging experiences with other people including men. From these findings, it was clear that if and when recognized, indigenous knowledge can contribute to conventional pastoral management and animal husbandry. The combination of indigenous and conventional knowledge would benefit most Maasai and Barbaig pastoralists, among others, (Kilongozi 2005). Digitization would enhance recording, preservation and controlled transfer of this knowledge in the 21st Century for local and national development.

The researcher was informed about the *mirema kiriti* agroforestry system of environmental conservation (Justus Ndungu, Personal communication, 2006; Leakey, L.S.B, 1977). The term refers to trees left standing when clearing forest and bushes for cultivation by the Agikuyu. The practice was to ensure conservation of forests in central Kenya in the traditional belief in spiritual ownership of land by indigenous plants. It was required that ceremonies be performed if and when any of the indigenous plants, which were the spiritual owners of the land they covered, were 'killed', that is, cleared for cultivation. The people believed religiously that if all the bushes and trees were killed by humans so as to make room for cultivation without leaving some of their representatives to occupy and co-own the land with humans, the angered disinherited spirits would wreak disaster and vengeance on the new human owners and occupiers. In spite of this indigenous knowledge on conservation, the colonial government gave logging concessions to European traders who cleared these 'sacred' 'mirema kiriti' in central Kenya for profit. This was unlike many other widely practised international land laws that governed buying and selling of land. War rules, treaties and protection of land ownership were then governed largely by military occupation or rules of combat, all without any regard to the plants which according to the 'mirema kiriti' system, are the real (spiritual) owners of the land.

The researcher was also informed how indigenous knowledge has been handed down by word of mouth through stories and tales, songs, sayings, proverbs and symbols with interesting illustrations. The use of the Wakamba clan symbols and stock breeder family symbols are handed down through artwork, artistic features, drawings and picture writings. Similarly, the Gikuyu Gicandi consists of drawings and 'picture writing' on a gourd and is interpreted through poetry and songs. Many other methods vary from one community to the other, depending on and influenced by the environmental and time determinants (Pick 1973).

There was unique IK on manufacturing processes of metallurgy, containers (*ciondo*), pottery, wicker work trays (itarururu), jewellery designs, clothes, and fashions. The author also noted that unfortunately IK and many African arts and crafts such as stone sculpture, makonde carvings and rock paintings are not effectively protected under the intellectual property rights laws.

4.4 Summary of Findings

On the whole, the author found that to date, Kenyan indigenous knowledge remains unwritten. Where it is written, the recorder in most cases does not wholly appreciate it due to prejudices introduced by western education. While the descriptions of IK were found to be closer to being factual, the interpretation was largely found to be biased due to misconceptions and racial prejudice. The elderly who are knowledgeable are few and their numbers are decreasing with time. They are unable to pass on the knowledge because the young who should learn and even inherit the technical skills have not been prepared to do so, in some cases due to the fact that many young people cannot speak their own mother tongues. In this state, they cannot access their communities' IK which is held by the elders. Besides, the young generation looks down upon the indigenous knowledge and regarded it as 'backward', that is, not 'westernized'. Due to the absence of IK in the younger generation, information on varieties of plant species and their value is soon becoming extinct, and so is "information about population movements, contacts and genetic relationships" (Shiyong Lu, et al. 2004), to mention only a few. Notwithstanding, in many African communities, most specialized indigenous knowledge is shrouded in secrecy. This secrecy was found to be mainly driven by economic threats.

The research established that deliberate efforts to record indigenous knowledge in Kenya so far cover a very narrow spectrum of its totality and recording to preserve for the benefit of the intellectual owner is not a major issue. If greater effort is not exerted, the stated danger of losing a large portion of this knowledge might occur, either through neglect or through piracy.

5. Discussion

Under the colonial laws and regulations that governed the lives and activities of Kenyans before independence, the nearly fifty discrete nations, so-called tribes or communities, were governed without any concern for their indigenous systems and knowledge as a means of uniting them into a new nation in which all citizens and their needs would be

catered for. Instead, the invaders used the Roman system of 'divide *et impera*' or 'divide and rule' and developed and promoted negative stereotypes of each group so as to make sure that indigenous Kenyans remained divided. However when it came to their own security the British for example used the Maasai blood brotherhood system *muumai* to secure a lasting peace and co-existence with the Maasai for ever (Hollis 1902). These are the same laws and regulations that the independent governments have continued to depend on. Where changes have been made, consultations and reviews have not gone back to the original African practices to make remedies for colonial deficits. People do not own or even inhabit their traditional homes any more nor are they governed by their indigenous rules and regulations. However, the traditional rules and regulations which ensured security of life and property within communities have not been replaced by new laws which would guarantee such security for Kenyans who have been displaced from their original motherlands. These rules and regulations were an important component of indigenous knowledge which was passed from one generation to the next. Modernization ignored this knowledge. The indigenous Maasai system of blood brotherhood cited above, ended all wars between the Maasai and the British and is still in operation. Knowledge of this should have been used by independent Kenya to foster everlasting peace and unity among all its communities. In this connection, it is interesting that the human genome project has recently confirmed that of all the races of the world, the sub-Saharan African shows the widest inter-community variation. Thus African indigenous systems had for hundreds of years established effective systems of co-existence despite wide sociological, physical and linguistic differences. The 'Miji Kenda' are but a phenomenon of indigenous maintenance of cultural identity and inter-communal tolerance. They have maintained the individuality and the unity of their nine small groups despite hundreds of invasions and interactions with virtually all the major external colonisers and traders.

It is not surprising that to date, having abandoned indigenous systems, building Kenyan nationhood has been problematic. Many new Acts of Parliament have been and continue to be developed without due consultation with regard to Kenyans' own vision and mission. For example, Mwangi (2002) has competently reviewed policies and Acts that govern mountain ecosystems, such as the Forest Act (1957, revised 1964), the Wildlife (Conservation and Management) Act (1977, revised 1985), The Land Act (1970, revised 1986) and The Crop Production and Livestock Act, among others, and established their inadequacy in this regard.

Copyright Law in Africa has been controversial (Githaiga 1998) where distinction is made between traditional knowledge, indigenous knowledge and traditional cultural expressions. Indigenous expressions of knowledge have been misappropriated in the pretext that this knowledge was in 'public domain'. This knowledge is described to include the oral and unwritten or the knowledge under collective community ownership. The community is presumed not to be a legal entity. Relevant laws governing Kenyan indigenous knowledge are both international and national. The treaties, declarations and conventions at the international level have guided national policies and laws where these have been

developed. Kenya, like many other African countries, has enacted some laws however, the indigenous knowledge policy is in the process of being developed.

Protection of IK has been a topic of discussion at the World Trade Organization (WTO) fora, but the issue has not been solved. The Western countries have their Intellectual Property Rules (IPR) which appear to distinguish between 'knowledge' and 'traditional knowledge'. IPR dictates that knowledge is the property of an individual or company, but that traditional knowledge is collectively handed down through generations and is therefore not an individual's but the community's intellectual property. In 1999, the Organization for African Unity (OAU), now African Unity (AU), approved an African Model Law that comprehensively covers IPR issues for diversity and indigenous knowledge, making it necessary for all member countries to pass laws that comply with IPR. The Council for Scientific and Industrial Research, a South Africa parastatal, has indeed focused on Hoodia plant of the San people (BBC website; http://www.iprcommission.org). In 1999 and following the Western IPR, and aiming to reinforce bio-prospecting as opposed to bio-piracy, South Africa patented the Hoodia for the San for 15 to 20 years only and allowed foreign pharmaceutical companies to commercialize the product and pay the San of South Africa, Angola, Zambia, Zimbabwe and Namibia only a percentage of the benefits earned.

If one's source of income and livelihood in general is threatened by competition, the specialist will not reveal his or her industrial secrets. If however, the holders of IK are assured of intellectual property rights and copyrights over a logically determined period, they will allow the indigenous knowledge to be recorded. One way would be to assure them of a good pension and affordable and accessible health service, good education for their children and affordable housing i.e. 'civilized living' in exchange for sharing their IK with the broader humankind.

There is persistent denial of the fact that this traditional knowledge was accumulated through experimentation, therefore scientifically developed, not necessarily using today's laboratories and equipment. In Kenya, the 'Jua Kali sector' is very active and fast growing. Players in this sector often innovate and invent processes and invest in resources. They have developed a considerable body of knowledge, some of which can now be regarded as IK. Such knowledge needs legal protection. The challenge to the country is that of recognizing the knowledge and innovations developed by this sector and its contribution to national development, and controlling and harmonizing these innovations through standardization.

The disclosure of invention in order to obtain protection, to record the invention and to avoid potential ownership disputes should be guided. The challenge is that digitization may interfere with the disclosure where the description of the invention needs to be confidentially made while fulfilling the national desire to record, process, protect and commercialize the invention for development. The country needs to guide the inventors so that they can avoid premature disclosures which may jeopardize and disqualify the invention from protection.

The digitization process of the various formats of indigenous knowledge is in progress at different rates and in different parts of the world. But as already noted, coding indigenous knowledge is not easy. The digitization objectives vary from one initiator to the next as do the outcomes of the process with respect to different formats and places of origin. Digitizing may also cause some of its properties to be lost. Digitizing is expected to facilitate validation of IK with modern technology. Computer simulation using IK would serve digitization strategically, for example, in the utilization of indigenous knowledge in designs in modern architecture.

The problem facing African indigenous knowledge may be summarized by the following questions: Is the 'public domain' concept threatening African cultural heritage? Does the African traditional knowledge fall under public domain for anyone to exploit at will, and to be commercialized with no benefits reaching the original owners? Is the concept of 'information commons' governing knowledge sharing, science and new technologies to the detrimental to the Africans? Is it safe to digitize the African indigenous knowledge under the present circumstances? In the important field of governance, peace, conflict resolution and nation building, why have indigenous systems that have worked between the British and the Maasai for over a hundred years not being recorded, developed and utilized by Kenyans and other Africans? The researcher has attempted to discuss many aspects of these questions. Clearly more work needs to be done and African communities and researchers need to address this issue so as to ensure that they use indigenous knowledge for their welfare and survival.

With regards to strengths and weaknesses, it was noted that in NMK, three important efforts are effectively combined: research, extension, and the dissemination of information for consciousness-raising purposes. Indigenous food plants that had never been studied are now known to the scientific communities, and in the process contributing to the conservation of biological and cultural diversity. NMK's efforts to bring indigenous knowledge to the people of Kenya was supposed to restore Kenyan national and individual pride in the origins and identity, and to give them the confidence to influence the scientific, technological and socio-economic and cultural developments of the 21st Century. By raising the status of indigenous knowledge in the eyes of local communities, the practice will increase people's respect for their own culture. Most of the Kenyan indigenous knowledge is unique to specific Kenyan communities who are the inventors and innovators and therefore own its intellectual property rights (Personal communication with NMK staff, 2006).

When the Kenya indigenous knowledge is recorded and disseminated, it will be easily pirated and the owners' intellectual property and copy rights claimed by others where the existing laws may be weak. When Kenyan indigenous knowledge is shared, it may be difficult to trace all the benefits generated to ensure that its inventors and innovators and rightful owners get all the benefits due to them. Efforts to date are concerned with recording, analyzing, disseminating and sharing. When indigenous knowledge is shared without intellectual property protection, it is lost by the rightful owners. The foreign

input may elicit questions such as: what are the interests of the foreigners? Partnership is good, but the national research priorities need to take lead in the cooperation in order to determine the aims and objectives, finding solutions to specific local problems, especially in cases where such problems also have global dimension. Notwithstanding, and operating under a Memorandum of Understanding, the International Plants Genetic Resources Institute in Rome has had invaluable input into the bio-diversity project at the NMK.

There is general fear of digitizing the African Indigenous Knowledge (AIK) as this may lead to misappropriation even at a faster and more extensive level than it is happening today, yet intellectual property rights should obviate this. Digitizing Kenyan indigenous knowledge would be expected to ensure that both this IK and its rights are preserved for generations to come but there is no legal framework yet for ensuring that this happens. One major weakness of the ongoing digitization process is that research for publication and/or collaborative research with non-indigenous partners is exposing local knowledge to piracy. In addition to this, commercial interests are likely to result in a selection of species and varieties for economic exploitation and promotion, and thus reduce the present rich resource diversity.

The researcher has confirmed that IK in Kenya is virtually an untouched knowledge resource. There is a very urgent need to capture and preserve African Indigenous Knowledge in Kenya and other African countries, in particular, music, medicine, artwork and languages, noting the significance of tonal languages in human brain language function. All means of preservation, including digitization, and communicating the indigenous knowledge of the African peoples and of protecting the owners' rights should be used.

6 Conclusions

This study has highlighted the presence of invaluable local IK. In the traditional societies, this knowledge formed the basis for local decision-making on food security, natural resource management, animal health and many other activities vital to these communities, including recreation.

African indigenous knowledge is seriously threatened by misappropriation. It is also even more grievously threatened by its loss and lack of transmission or transfer from generation to generation. Separation of the youth from their grandparents as a result of urbanization coupled with the youth's negative attitude towards indigenous concepts and practices makes this transfer extremely difficult. Once the older generations go with that knowledge without recording it or transferring it as was the practice in traditional societies, the knowledge will be lost for ever. Every elderly knowledgeable individual in the traditional society was a veritable library resource of indigenous knowledge and experience. Many elderly Kenyans still are. The holders of that knowledge (who are its experts or 'professors' as Routledge, the anthropologist, called them in 1904) are largely governed by secrecy and traditional rules and regulations that determine when, how and to whom that knowledge should be transferred. When such people die today, a whole irreplaceable library of human knowledge and experience is lost for ever. It becomes extinct. Kenya

has the means to ensure that this does not happen. These experts need to be persuaded and facilitated to transfer the IK they hold. Otherwise they will die with this knowledge as many in some communities have done already. If this situation is not arrested before it is too late, there will be disastrous results that will indeed affect the future of the African and his/her role and status in the globalized world.

Digitization of IK is not intended, in any way, to remove this knowledge from the collective and original ethnic or community ownership. Rather, it should enable the communities not only to preserve their indigenous knowledge, but to do so in a controlled and beneficial way. Thus the example of the Hoodia cactus and the San people should be emulated and even improved upon.

Bearing in mind that not all IK is beneficial to sustainable development today and that not all IK have solutions to world problems, and even that IK is not static, it is high time the indigenous knowledge was recognized, identified, validated and documented to facilitate sharing of that knowledge with humanity. In doing so, attention should be focused on the following three key areas: (i) infrastructural development to facilitate digitization, (ii), financial and human resources, and (iii), willingness and acceptance by the owners and guardians of indigenous knowledge of the need to digitize this knowledge.

Besides these key areas, it has been noted that digitizing indigenous knowledge is besought with wide ranging problems in Kenya and indeed the whole of sub-Saharan Africa. The problems include (i), inadequate levels of recognition, valuing and protection of African indigenous knowledge and insufficient intellectual property controls, (ii), loss of language and efficient and effective ways of expressing indigenous knowledge, (iii), dependence and reliance on foreign records for sources of authoritative accounts on IK, (iv), lack of comprehensive and clearly 'Afrocentric' digitization and ICT initiatives, (v), lack of comprehensive national policies and initiatives regarding digitization of IK that ensure that benefits accrue primarily to the owners and secondarily to humanity at large; and (vi), on-going activities and projects aim to facilitate access to IK (that is exploitation) rather than to recording and preserving it for the present and the future survival.

With regards to digitization, Kenya needs to address the policy at the community, national and international levels to define community role in protecting IK as a valuable input in exploratory research, to safeguard related moral reflections and philosophy, to involve parents and children in digitization, where appropriate using multimedia technological processes to communicate the knowledge. Kenya needs to digitize in order to preserve IK, to provide national funding in IK digitization and preservation of the national strategic resource, adopting a subject specialization approach, to facilitate acquisition of the necessary skills, and to ensure that reference is made to IK aspects of indigenous ethics, treaties, laws and constitutions when addressing these issues at both the national and international levels.

New information technology is spreading globally at a very fast rate, a factor not to ignore or take for granted. It is a technology that will affect African indigenous knowledge. Failure to embrace it will be disastrous.

7. Recommendations

Kenya should take the lead in applying this new information technology, not only using the Kenyan indigenous knowledge in solving modern problems but also in the preservation, protection and development of the same as a valuable national resource. It is time the African citizen and particularly the African scholar, appreciated the value of the national IK and made a commitment to protect his/her indigenous knowledge as a cultural heritage. It is time to appreciate that African indigenous knowledge is virtually an unexplored territory containing invaluable knowledge untouched knowledge resource, and that it remains a rich field for African scholars to capture and preserve, using possible technologies, including digitization, and safeguarding the intellectual property rights for the benefit of its owners.

Targeting the Kenyan citizenry, policymakers, development workers and researchers, the author recommends that:

i. Kenyan people and the government appreciate and value IK of all indigenous communities as integral part of their cultural heritage and diversity by recognizing, identifying, validating and documenting indigenous techniques of all communities in Kenya, encouraging all communities to learn and share their knowledge, providing resources for knowledge management and developing ICT at all levels and in all geographical areas.
ii. Kenya should formulate and issue an IK policy to facilitate recording, storing, protecting and preserving IK for future generations with ethical, moral and legal respect to ownership, access rights and economic benefits.
iii. Kenya should ensure that the Copyright and Intellectual Property (IP) laws are applied to serve the individual indigenous 'nations' to protect their intellectual properties and to facilitate understanding and conceptualization of the value and role of the indigenous knowledge in the emancipation and development of the country as it claims ownership and takes charge and control of its indigenous knowledge.
iv. Besides NBK, Kenya should set up an IK Statutory body to establish and develop a national IK Resource Centre charged with IK management in all fields. Kenya should also establish national indigenous knowledge committees and commissions with very clear mandates and facilitation to digitize African indigenous knowledge with the ultimate aim of collecting, storing and preserving IK as an invaluable national resource.
v. Considering that the new technological developments can facilitate recording of IK for posterity, use and application of the technology is imperative to systematically record and digitize all IK while developing and testing digitization model systems which can be supported nationally and regionally.

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