Exploring the use of ICT tools for capturing, preserving, and disseminating Indigenous Knowledge amongst IK owners and users. A preliminary study of IK users in the KwaZulu Natal Province, South Africa[1]

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Abstract
Information and Communication Technologies can be used effectively for facilitating access to and the use of Indigenous Knowledge. The paper explores the role played by information and communication technologies (ICT) in capturing, preserving and disseminating indigenous knowledge in KwaZulu-Natal, which is one of the strongholds of traditional knowledge in South Africa. The study employed both qualitative and quantitative research measures for data collection. This preliminary report focuses on the sampled 78 Indigenous knowledge (IK) ICT users sampled within KwaZulu Natal. The sample consisted of researchers, academics, information specialists/librarians, and trainees or students. A short background information is supplemented by a quantitative data analysis achieved using a computer aided data analysis software program (Statistical Package for Social Sciences-SPSS). Tentative results indicate that there is significant interaction between the ICT users and the IK owners or custodians. IK users lack the required ICT facilities, mainly due to problems associated with infrastructure and cost. We argue that access to ICTs, and the ethical and legal issues regarding access ad use of IK captured by using ICTs that border on Intellectual property rights, are predominant impediments to ICT use in the sector. We suggest further exploration of this burgeoning sector through research in capacity building, resource support, and further policies for ICT exploitation. Similarly the recognition that the recording of IK using ICTs is unavoidable is fundamental.

INTRODUCTION

Present day's literature proffers several definitions of Indigenous Knowledge. The broadest of these (e.g. NRF, n.d.), which we intend to use, defines IK as a "*complex set of knowledge and technologies existing and*

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developed around specific conditions of populations and communities indigenous to a particular geographic area" with an emphasis on how *"these forms of knowledge have hitherto been suppressed… therefore, IKS should be brought into the mainstream of knowledge in order to establish its place within the larger body of knowledge"*. Essentially, Indigenous Knowledge (i.e. local/traditional/folk knowledge, ethno science etc.) is a dynamic archive of the sum total of knowledge, skills and attitudes belonging to and practiced by a community over generations, and is expressed in the form of action, objects, and sign language for sharing. Numerous examples[4] (e.g Kaniki and Mphahlele, 2002:4-6) exist indicating how IK thrives in beliefs, medicine (traditional African medicine using herbs), community development (e.g. communality or the ubuntu support system), sealing, energy production (through charcoal burning), education (knowledge transfer from generation to generation), communication and entertainment (e.g. festivals, drama, songs, dance, story telling or "reading clubs"),farming practices (e.g. soil conservation, intercropping, farm rotation), food technology (e.g. fermentation techniques, preservation), and arts and crafts (e.g. pottery, painting, curving, weaving, decoration). These skills, knowledge and attitudes, when shared, adapted and refined, sustain communities, and bring development in areas such as healing (e.g. alternative/traditional/herbal medicine; physical and mental fitness - acupuncture, yoga, tai-chi; Maasai's treatment of foot and mouth disease; or the Fulani treatment of cattle ticks with euphoria plants), nutrition (e.g. vegetarian cuisine, or the hoodia stem/cactus used by San people/clan to starve off hunger and control thirst/ 'slimming drug' on hunting trips), wealth/income/business (e.g. intellectual property, tourism, informal sector or SMEs), education (e.g. customs, traditions, culture, language), entertainment (e.g. traditional music and dance), politics (conflict resolution through indaba, imbizo, kgotla, baraza etc.), architecture and design; clothes/attire), industry and countless more.

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[4] http://www.worldbank.org/afr/ik/basic.htm

One of the focus areas in Knowledge Management (KM) is the conversion of intangible knowledge (i.e. Indigenous Knowledge – IK) to tangible knowledge. Nonaka and Takeuchi (1995:62) define intangible knowledge as personal knowledge that is created through individual experiences. This knowledge is largely embedded within the culture and traditions of individuals or communities. Tangible knowledge, on the other hand, is recorded, documented or codified knowledge, widely conveyed through formal language, i.e. textual, electronic or digital. The manner in which this kind of knowledge is presented has made its storage, conveyance and sharing extremely easy, and its popularization overwhelming. However, Nonaka and Takeuchi (1996:833) caution that tangible and intangible knowledge are not entirely two separate entities - they supplement each other. This is an area in which the integration of IK in mainstream knowledge, and more particularly in Knowledge Management, is inadequate. Knowledge, according to the two authors, is created and extended through the social interaction between tangible and intangible knowledge, and may follow four basic patterns:

- Intangible to intangible (socializing) – where individuals share intangible knowledge through personal contact.
- Intangible to tangible (externalization) – where the knowledge base is extended by the codification of experience, insight and judgment so that it may be utilized by others.
- Tangible to tangible (combination) – where individuals combine the tangible knowledge of others to create a new whole.
- Tangible to intangible (internalization) – where individuals use the codified knowledge of others to broaden their own intangible knowledge.

2. Challenges of integrating IK with other forms of knowledge

Some of the challenges of integrating IK with other forms of knowledge have been discussed recently by Ocholla (2007) among others at the African Information Ethics Conference in Pretoria. Fundamentally, integrating IK with other forms of knowledge begins, first, with knowledge creation and development processes that may be viewed in six steps, all of which are recognized by the World Bank (See Indigenous Knowledge for Development; a Framework for Action (1998[5])). The first step or process in the World Bank document consists of recognition and identification, in that IK has to be recognized, identified and selected from a multitude of other forms of knowledge. Step two involves IK's validation/affirmation, i.e. identifying its significance, relevance, reliability, functionality, effectiveness and transferability. This signifies an ability to support problem solving. For example the HIV/Aids scourge, particularly in Africa, has invited a number of IK experimentations, most of which have not been validated (i.e. tested over time and used for problem solving), some of them culminating in a number of disasters. Step three involves codification/recording/ documentation. Explicit knowledge thrives because of its tangibility, transferability and storability, all of which originate from a knowledge recordal system. Although there are some contestations regarding the recording of IK - the argument being that IK owners easily loose moral and material ownership of their intellectual property or capital, which is renegade to third parties - explicit knowledge thrives because of its visibility, access, and use. Step four consists of the storage of IK for retrieval. This requires the creation and development of IK repositories that require taxonomies, databases, recording, indexing, and preservation for easy access and use. The IK database developed by the World Bank[6] and those listed by Le Roux (2003), as well as the IK publication pattern revealed by Ocholla and Onyancha (2006), are essential examples. However, although IK databases are a brilliant idea, reliable content within

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[5] http://www.worldbank.org/afr/ik/ikrept.pdf
[6] 6http://www.worldbannk.org/afrik/databases.htm

the databases is still a major problem. For example, the World Bank database reflects only 17 records on Kenya (see Table 1).

Table 1. Indigenous Knowledge records search results in the World Bank database on Kenya

IK Database Search Results

To view details click on practice title.

Your search returned 17 record(s).

No.	Country	Domain	Technology	Title
10	Kenya	Agriculture	Agriculture	Botanical knowledge of the Maasai
41	Kenya	Health Nutrition & Population	Traditional Medicine	Medicinal use of plants to alleviate health problems of both human and livestock.
42	Kenya	Environment	Biodiversity, Conservation	Taboos restrict felling of trees in the Maasai steppe.
43	Kenya	Agriculture, Environment	Agricultural Meteorology	Weather forecasting on the basis of astronomy and ecology.
44	Kenya	Agriculture, Environment	Biodiversity, Taxonomy	Use of plants and animals determines their taxonomy.
46	Kenya	Agriculture	Taxonomy	Classification of livestock disease names assists the Maasai in sharing knowledge, diagnosing diseases and preventing their impact.
47	Kenya	Health Nutrition & Population	Knowledge Management	Sharing of medicinal knowledge among the Maasai.
51	Eastern Africa Region,	Agriculture, Health Nutrition &	Biodiversity	Traditional societies in East Africa use wild plants for different purposes and means

	Kenya	Population		to survive.
58	Eastern Africa Region, Kenya, Tanzania	Education	Informal Education	Storytelling is the traditional means to bridge past and present and to transfer ethical values through the generations.
63	Kenya	Health Nutrition & Population	Traditional Medicine	Use of plants for their antibiotic effects.

See[7]:

Evidently, creating meta-data capturing capabilities and multiple storage approaches is becoming increasingly essential. Step five borders on IK transfer, and following this, step 6 would be the dissemination and use of IK. For example, use of knowledge put it to testing, acceptance and further validation for development. Therefore in essence, the six steps or processes are essential if the gap between IK and other forms of knowledge is to be closed. In addition, the use of ICTs would feature strongly in most of the highlighted steps/processes.

The second consideration for integration borders on pragmatism, i.e. what can we reap from IK. Other forms of knowledge have thrived because of their functions, importance or benefits. The recognition and development of IK is picking up momentum, largely due to the benefits being derived from it. For example, as already mentioned, IK is increasingly being used for health services, particularly herbal/ traditional/alternative medicine, and in agriculture, among many others. Reported activities and practices of IK by the World Bank in "*IK notes on Indigenous Knowledge*" (2006[8]) - which covers 93 documents from 1998 that focus on Africa and Eastern and

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[7] http://www4.worldbank.org/afr/ikdb/ik_results.cfm
[8] http://www.worldbank.org/afr/ik/iknotes.htm

Southern Asia shows ongoing activities and practices of tremendous achievement in the field of traditional medicine and health practices, agriculture, biodiversity, education, natural resource management, conflict management, energy generation and preservation etc; that are of great benefit to the communities in question. Additionally business and trade, through tourism, has created significant interest in indigenous food, arts and craft (weaving, painting, sculpture and pottery). Significant growth has also been driven by pharmaceuticals. Unfortunately, most IK practices are currently being held in the informal sector/unregulated economy, and are therefore subject to abuse. It is acknowledged[9] that IK provides skills, experiences and insights into individuals and communities which may, in turn, be used to improve the livelihoods of those mostly situated in the informal sector of the economy. Furthermore, according to the World Bank document cited:

- IK provides local communities - especially the poor - with problem solving strategies
- IK is an important contribution to global development knowledge
- IK systems risk extinction
- IK is relevant for the development process
- IK is an under-utilized resource in the development process

Thus, learning from IK by first investigating what local communities know and have, can assist with understanding local conditions and provide a productive context for activities designed to help the communities in question[10].

However, this document strongly views IK as a survivalist instrument of development, meaning that its use is likely to occur less in areas where the lives of communities are better, or beyond the norm of survival. Will this be the case with pharmaceuticals, IK practitioners or even IK users, some of whom are not poor, and do not belong to the rural community. Put another

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[9] http://www.worldbank.org/afr/ik/basic.htm)
[10] http://www.worldbank.org/afr/ik/why.htm

way, how many people employed in the IK industry are not poor, or come from poor communities? Despite the rather sad denigration of IK, the World Bank recognizes that IK is relevant in at least three levels of development, the first being that it is important in the local community in which the IK knowledge owners live and practice. Secondly, development agents such as NGOs, civil society, and governments, need to recognize, value, and appreciate IK during their interactions with local communities. Essentially, before incorporating IK into their approaches, they need to understand and critically validate it against the usefulness of their intended objectives. There are unique examples, such as South Africa's recent policy document on "Indigenous Knowledge Systems"[11] produced by the Department of Science and Technology, where government has integrated IK health workers, such as traditional healers, into mainstream national health care services by passing a "*Traditional Health Practitioners Legislation*". This, according to the Government policy document, mandates the establishment of a "*Traditional Health Practitioners Council to preside over the activities of approximately 200 000 South African Traditional Healers*". According to the above document, the "*Traditional Medicine Strategy of World Health has noted that the use of traditional medicine is widely growing within Africa alone, as up to 80% of its population uses traditional medicine for their health needs, largely due to accessibility and affordability*". The aforesaid views are shared by Ngulube (2002:61), in pointing out that approximately 80% of the world's population depends on IK in meeting their medicinal needs, and at least half rely on IK and crops for food supplies.

Thirdly, Indigenous Knowledge forms part of the Global Knowledge System. In this context, it has a value and relevance in and of itself. Thus, IK can be preserved, transferred, or adopted and adapted anywhere in the world. Some of the World Bank's achievements as at 2005, in areas such as integrating IK in bank projects [18 cases], mainstreaming IK in development [14 cases],

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[11] http://www.dst.gov.za/publications/reports/IKS_Policy%20PDF.pdf

building capacity to facilitate IK exchanges [22 cases], collecting and disseminating IK [12 cases], and building partnerships [10 cases][12]; are of great significance.

The fourth consideration is epistemological. The nature, origin, foundation, limitations and validity of IK requires further exploration and interrogation. For example Agrawal (2004) identifies key issues in a manner that poses the following questions: How does IK differ from scientific/modern/western knowledge? How do the two differ in dealing with immediate /concrete necessities as opposed to distant and abstract issues? What are the methodological and epistemological differences? And what are the contextual differences? It is therefore necessary to provide more epistemological content, concept and context to IK in order to broaden its understanding and application to research and education in Africa, and wherever else there's such a need.

Essentially, IK's use and exploitation is increasing, in areas such as alternative medicine, agriculture, sports, culture and business. The rapid increase in globalization, which could be harmful to IK, is also influential.

3. Information and communication technologies (ICTs)

Among others, Chisenga (1999:3) is of the view that ICTs are tools that enable Africa to contribute to global information resources by translating indigenous knowledge into web content. Joanne (2004:1) believes that Information and Communication Technologies (ICTs) have a central role in the emerging knowledge-based economy, in which the generation and exploitation of knowledge are seen to play a crucial role in the creation of wealth. Joanne notes that ICTs facilitate the rapid collection, collation, storage, and dissemination of data, thereby assisting the knowledge creation and diffusion process.

It is worth mentioning that almost all audiovisual resources play an increasingly pervasive role in preserving and protecting IK. For instance, using multimedia technologies, indigenous groups, to some extent, have been

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[12] http://www.worldbank.org/afr/ik/achieve.htm

able to record and preserve significant aspects of their cultures, including language, ceremonies, dance, songs, stories, symbols, design, artwork, tools, costumes and many more(Hunter, Koopman and Sledge 2002:3). Multimedia is viewed by Hunter, Koopman and Sledge as audiovisual resources that emanate from Graphics, 3D models, Microfiche and Microfilm, Television and Radio (e.g. still pictures using video and radio cassettes) and computers. The three authors note that the documentation of Indigenous Knowledge and history has become an extremely important tool for ensuring the survival and self-sustainability of indigenous communities and cultures, providing evidence of past injustices, and supporting claims of original ownership.

The purpose of this paper is to determine the role played by information and communication technologies for management, preservation, and dissemination of Indigenous Knowledge in general and in the KwaZulu Natal Province. The objectives of the study constitute establishing the types of ICTs currently in use for capturing, storing, processing, retrieving and disseminating indigenous knowledge, and determining problems encountered in the availability and use of ICTs.

3. METHODOLOGY

The preliminary study was conducted using a survey method. The target population consisted of researchers, academic staff, information specialists/librarians, community members and students covering IK. One hundred questionnaires were distributed of which 78(78%) were completed and returned. Twenty (20) questionnaires were distributed per category, i.e. 20 were administered to researchers, 20 to community members, 20 to information specialists/librarians, 20 to trainees/students on IK, 20 to academic staff. The study used multistage sampling techniques that included cluster, snowball and purposive sampling. Cluster sampling was incorporated because we lacked a reliable sampling frame due to a dispersed population.

Besides cluster sampling, purposive and/or judgmental sampling was used to select IK ICT users that fit the study. We took advantage of non-probability sampling because we were not aware of the size of the target population. Neuman (2003:211) notes that non-probability is designed for researchers who cannot, or do not seek to, determine the sample size in advance and have a limited knowledge of the larger group or population from which the sample is taken. Thus snowball and purposive sampling techniques were used in this study

The respondents were expected to respond to the following: Are you aware of owners of indigenous knowledge (IK)? Do you consult them for their experiences? Are you aware of ICT tools for capturing, storing, processing, retrieving and disseminating IK? Which ICT tools do you use for capturing and storing IK? Which ICT tools do you use for disseminating IK? Do you encounter problems with the availability of ICT tools? Do you encounter problems in the use of ICT tools? And what mechanism would you propose to eradicate the problems encountered in the availability and use of ICT tools? In addition to the literature review, descriptive statistical methods were used for data analysis. These were facilitated using the Statistical Package for Social Sciences (SPSS) and Microsoft Excel. The outcome of the analysis is reflected in the results section below.

4. The Results

The results focus on general information as provided by the respondents and information related to the research questions outlined.

4.1 Personal Information

A cross-section of the respondents participated in this survey. 51% of the 78 respondents were females, and 38 (49%) were males. The respondents were required to indicate their status by choosing from 6 options: researcher, academic staff, community member, information specialist and/or librarian,

student and trainee on indigenous knowledge (IK). The distribution of the respondents by status is shown in Table 1 below. Although the respondents were 78, most of them selected more than one status, thus creating multiple responses.

Table 1: Status of the Respondents

Status of Respondents	Number of Respondents
Researcher	54
Academic Staff	24
Information Specialists/Librarian	22
Students/Trainees on IK	21
Community members	14

The age of the respondents was also established, as we expected much older people to use the services of IK owners. Fig 2 provides the summary of this category.
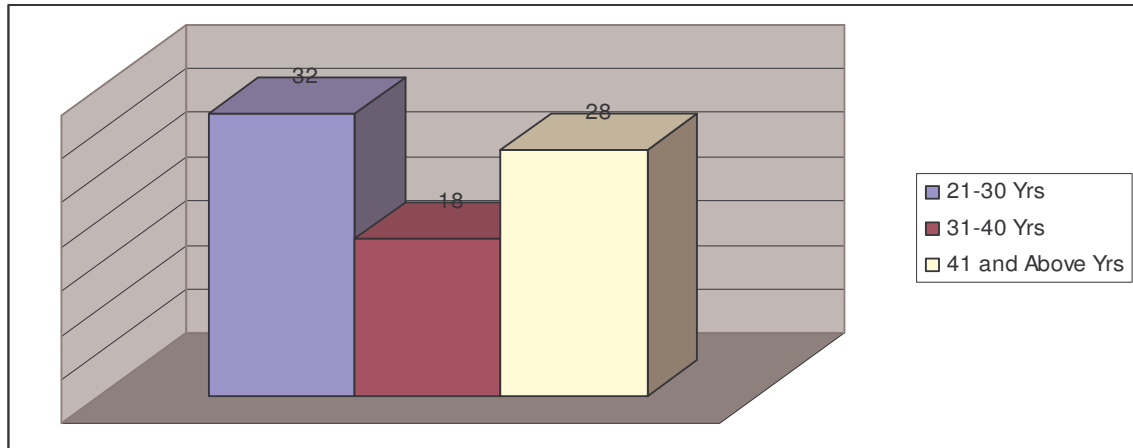
Figure 1: Age of the respondents

Figure 1 above reveals that 32 (41%) of the 78 respondents are between the ages of 21 and 30 years, 29 (36%) respondents are 41 and above years, and 18 (35%) are between 31 and 40 years.

4.2. Awareness of owners and/or sources of Indigenous Knowledge (IK)

Awareness of the owners and/or sources of Indigenous Knowledge is a significant variable in the assessment of Indigenous Knowledge access and use. The variable was further used to explore if the respondents were in touch or are concerned with consulting owners and/or sources of IK. The results show that most (63; 81%) of the 78 respondents were aware of owners and/or sources of IK, and only 15 (19%) respondents are sometimes aware of the owners and/or sources of IK. Notably, the awareness of owners and/or sources of IK is significantly higher amongst the IK ICT users.

4.3 Consulting owners and/or sources of IK

This section explores whether IK users consult with IK owners. 33 (43%) of the 78 respondents ascribed consulting with the owners of Indigenous Knowledge. Respondents who said they sometimes consult with owners of IK were 26 (33%), while 19 (24%) respondents stated that they do not consult owners of IK. The results reveal that over half (76%) of the respondents

consult owners of IK. Assumingly, those who do consult and recognize the significance and uses of the local knowledge do so for different purposes from which it is sought.

4.4. Frequency at which owners of IK are consulted

Only those respondents who indicated that they consult with owners of IK responded to this question. There were 59 respondents who attended to this question. The results show that 32 (54%) of the 59 respondents consulted with owners of IK once a month, while 27 (46%) consult whenever necessary. Overall, there is significant consultation with owners of IK.

4.5 Purpose of consulting with owners IK

The aim of this item was to identify the reasons that inspired respondents to consult with owners of IK. The results are summarized as follows:

1. Historical purpose;
2. Research;
3. Have interest in preserving IK and
4. Help community in realizing the importance of IK.

Responses to all the categories were below 50%.

4.6. Documenting Indigenous Knowledge (IK) for future generations

The aim behind this question was to establish whether ICT tools can be used to capture, store, process, retrieve and disseminate Indigenous Knowledge for future generations. The results show that most (63; 81%) of the respondents prefer the documentation of Indigenous Knowledge, and 15 (19%) revealed that they sometimes prefer, as they argue that through documentation IK would definitely be preserved for future generations. The same number and distribution showed an awareness of the availability of ICT tools for capturing, storing, processing, retrieving and disseminating IK.

4.7. ICT tools for preserving and protecting IK

This question required respondents to indicate the type of ICT tools they use to preserve and protect IK. The results are summarized in Table 2 below.

Table 2: ICT tools for preserving and protecting IK

ICT Tools for Preserving and Protecting IK	Number of Respondents Citing N
Computers	77
Databases	63
Internet	57
Video Cassettes	57
Radio Cassettes	47
CDs	27

More than one item was scored in this category. Notably, a small range of technology was identified, and how the use of the selected equipment was achieved requires further clarification.

4.8. ICT tools used for disseminating IK

The ICT tools used and preferred for disseminating IK are summarized in Table 3.

Table 3: ICT tools used for disseminating IK

ICT Tools for Preserving and Protecting IK	Number and Respondents Citing N
Computers	63
Telephone	46
Radio	46
Television	37

4.9. Rating the effectiveness of ICT tools in preserving and protecting IK

Respondents were required to indicate their perceived level of the effectiveness of ICT tools in preserving and protecting IK. Table 4 below illustrates the findings.

Table 4: ICT tools effective for preserving and protecting IK

ICT tools	Very Effective	Effective	Less Effective	Not Effective
Computer	43	35	0	0
Internet	34	34	5	5
Database	34	39	0	5
Microfiche	1	7	21	49
CDs	40	28	5	5
Video Cassette	45	23	10	0
Radio Cassette	45	23	10	0
Digital Watermarking	1	0	7	70
Cryptography	1	1	6	70

There is a strong preference for video cassettes, radio cassettes and CDs for preserving and protecting Indigenous Knowledge. Computers, the Internet and Databases are also strongly recognized. However cryptography, digital watermarking and microfiche projects witnessed less effectiveness or popularity. The findings suggest that the effectiveness of ICT tools in preserving, protecting, and disseminating IK to a wider audience may be determined by the type of ICT tool used.

4.10 Views on whether passing IK by word of mouth is a waste of time

Respondents were asked to indicate whether passing IK by word of mouth is a waste of time. The purpose of this question was to determine whether ICT tools play a role in preserving, protecting and disseminating IK. The results are presented as follows:

Table 5: Views on whether passing IK by word mouth is a waste of time

(N=78)

Variables	Number of Respondents Citing	
	N	%
Strongly Agree	10 (12 %)	
Agree	22 (28%)	
Strongly Disagree	11 (14 %)	
Disagree	34 (46 %)	
Unsure	1 (0.1%)	

Table 5 above reveals that 45 (57.6%) of the respondents strongly disagree and/or disagree that passing IK by word of mouth is a waste of time when compared to using ICT tools. This is in contrast to 32 (41%) of the respondents who strongly agree and/or agree with the same. The findings suggest that a major challenge facing ICT tools is the tacit nature of IK (it is typically exchanged through personal communication from master to apprentice, from parent to child, etc.). In some cases, modern tools can be used, while in other circumstances, it may be more appropriate to rely on traditional methods i.e. the oral transmission of information.

Reasons for strongly agree and/or agree variables were based on concerns about brain-drain, where the community knowledge or library held by the knower mostly dies with that person's death. Memory lapses were also recognized as common amongst knowledge holders. This evidently makes oral transmission very limiting in terms of Indigenous Knowledge management. Reasons for strongly disagree and/or disagree variables were based on the opinion that documented information is sometimes out of context, and oral information is always original.

4. 11. Problems encountered with the availability of ICT tools

Slightly more than half (40; 51%) of the respondents encounter problems with

the availability of ICT tools, 33 (42%) of the respondents sometimes encounter problems with availability, and only 5 (6%) do not encounter problems with the availability of ICT tools. With regard to problems encountered, the results show that most (56; 72%) of the respondents state financial constraints as a hindrance to ICT access, while 41 (53%) ascribed lack of infrastructure as the main obstacle. Less than half (36; 46%) of the respondents indicated that the cost, sustainability and maintenance of ICT tools are the constraints that make it difficult to access ICTs, and a paltry 15 (19%) respondents reported that the absence of an ICT policy and its implementation hinders the availability of ICTs.

4.12. Problems encountered in the use of ICT tools

Respondents were asked whether they faced challenges in the use of ICT tools. The results indicate that 45 (58%) of the 78 respondents encounter problems with regard to the use of ICTs, 21 (27%) sometimes encounter problems, and 12 (15%) do not encounter problems. These findings suggest that some respondents are not fully equipped with ICT skills, and that vigorous training might be necessary.

The types of problems encountered in the use of ICT tools are summarized in figure 3 below.

Figure 3: Problems encountered in the use of ICT tools to capture, store, and process, retrieve and disseminate IK
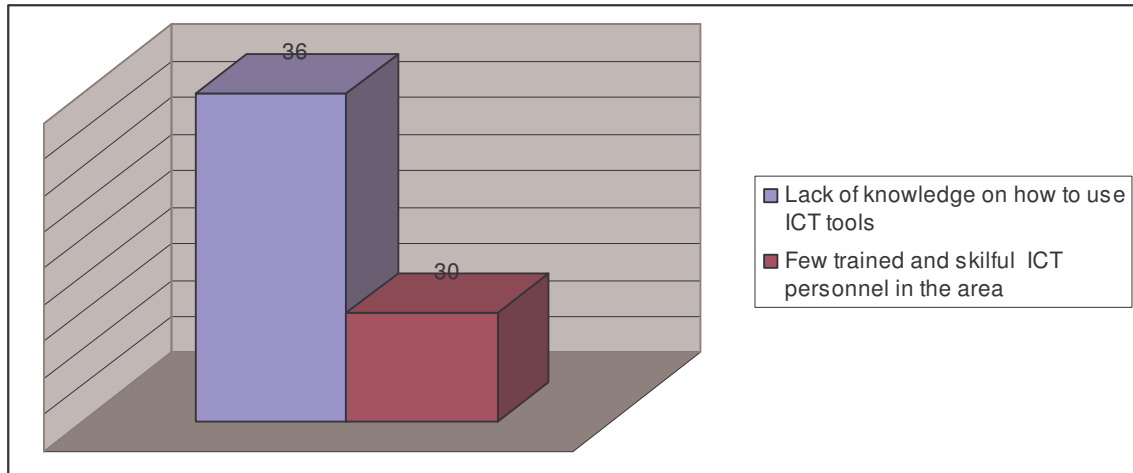**(N=66)**

Figure 3 above shows that above half 36 (55%) of the 66 respondents lack knowledge on how to use ICT tools and 30 (45%) of the 66 respondents complained that there are few trained and skilful ICT personnel in their area. These findings reveal that respondents need to be equipped with ICT tools skills in order to effectively use them for capturing, storing, processing, retrieving and disseminating IK for future generations.   In other words, IK ICT users need to be trained in/with newly designed ICT tools in order to easily cope with constant change within the information society.

5. Conclusions
Information and communication technologies (ICTs) are likely to play a crucial role in the integration of indigenous knowledge in mainstream knowledge management. They are expected to play a major role in the six steps of integration, i.e. recognition and identification, validation or affirmation, codification/documentation, storage and retrieval, transfer, and the dissemination of IK. The importance and benefits of IK should play a role in promoting IK transformation from tacit knowledge into explicit knowledge, and further recognition of ICTs as a major recording system. Noted that the use of IK by researchers is dominant. There is also a high level of awareness of IK and consultation with owners/custodians of IK and that such consultation is fairly frequent. Notably, the owners of IK are highly consulted

for research purposes. We have observed that the ICT tools identified for capturing, storing, processing, retrieving and disseminating IK are not unusual, as they include: computers, databases, internet, videocassettes, radio cassettes and CDs. It is likely that a multiple and a variety of technologies could be identified and used in the future as new technologies emerge. Assumingly, the effective use of ICT tools to preserve, protect and disseminate IK would assist in curbing the danger of losing this knowledge whenever individuals forget or die from natural or other causes, and thus ensure that the knowledge is adequately captured and stored and that brain drain emerging from loss of community memory is avoided. This is despite the problems cited with ICT tools, such as financial constraints, lack of infrastructure, cost, sustainability, maintenance, and the absence of an ICT policy and its implementation. Although IK users were expected to be ICT literate as they use them to capture IK for several reasons, it was surprising (85%) that they require skills on what ICT to use and how to use them. We expect that ICT skills would be much lower among IK owners and therefore consider educating and training of both the users and owners on the use of ICTs for IK management to be critical. We recommend that government support be intensified in areas of policy and legislation, management, funding, capacity building, research, mapping and auditing of IK and ethics.

8. References

Agrawal, A. 2004. Indigenous and Scientific Knowledge: some critical comment. Indigenous Knowledge Monitor (3). [Online] : http://www.nuffic.nl/ciran/ikdm/3-3/articles/agrawal/html_.Accessed 15 May 2007 from IK notes. Accessed 10 February 2007

Chisenga, J. 1999. Global of information infrastructure and the question of Africa continent. *A paper presented at 65th IFLA council and general conference,* Bangkok Thailand, 20-28 August 1999. [Available on-line]. www.ifla.org./IV/ilfa65/papers/118-116e.htm. Accessed 30 June 2004

Hunter, J., Koopman, B. and Sledge, J. 2002. *Software tools for indigenous knowledge management.* [Available on-line].

Indigenous Knowledge for Development. A Framework for Action .1998. [Online] http://www.worldbank.org/afr/ik/ikrept.pdf. Accessed 20 May 2007

Joanne, R. 2002. From-know-how to show-how? Questioning the role of information and communication technologies in knowledge transfer. *Technology Analysis & Strategic Management,* Vol. 12, Issue 4. [Available on-line]

Kaniki, Andrew M. and Mphahlele, Kutu M.E. 2002. Indigenous knowledge for the benefit of all: can knowledge management principles be used effectively? *South African Journal of Libraries and Information Science,* 68(1), 1-14

Le Roux, C.J.B. (2003), tapping indigenous knowledge on the world-wide web *Indilinga African Journal of Indigenous Knowledge Systems,* Vol 2, Issue 1 , 107-113

Mutula, S.M. .2002. The digital divide in Sub-Saharan Africa; implications for the revitalisation and preservation of indigenous knowledge system: Proceedings of the 15th Standing Conference of Eastern, Central and Southern African Library and Information Associations. *SCECSAL 2002 From Africa to the world-the globalisation of indigenous knowledge systems.* Pretoria:

National Research Foundation (NRF). 2003. Indigenous knowledge systems. [Online]. Available WWW: http://www.nrf.ac.za/focusareas/iks/ Accessed 10 November 2005

Ngulube, P. 2002. Strategies for managing and preserving indigenous knowledge in the knowledge management era. . Proceedings of the 15th Standing Conference of Eastern, Central and Southern African Library and Information Associations. *SCECSAL 2002 From Africa to the world-the globalisation of indigenous knowledge systems.* Pretoria

Nonaka, Ikujiro; Takeuchi, Hirotaka.1996. A theory of organizational knowledge creation, *International Journal of Technology Management*, Vol. 11 Issue 7/8, p833-845

Nonaka, I. & Takeuchi, H. 1995. The knowledge-creating company: how Japanese companies create the dynamics of innovation. New York: Oxford University Press.

Ocholla(2007) Marginalized Knowledge: An Agenda for Indigenous Knowledge Development and Integration with Other Forms of Knowledge(pre-print to be published in the IRIE) [Online] http://www.lis.uzulu.ac.za

Ocholla, D.N and Onyancha O. Bosire .2006. The marginalized knowledge. An informetric analysis of indigenous knowledge publications 1990-2004.*South African Journal of Libraries and Information Science*.Vol.71.No.3, 247-248.

The World Bank Group. 2004. What is indigenous knowledge. [On-line]. www.worldbank.org/afr/ik/basic.htm. Accessed 30 May 2007