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Information and Communication Technology Tools for Managing Indigenous Knowledge in KwaZulu-Natal Province, South Africa

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Abstract

This article addresses the use and the types of information and communication technology (ICT) tools that are currently used in the management of indigenous knowledge (IK) in the province of KwaZulu-Natal, South Africa. The theoretical basis of the study was informed by the Knowledge Creation theory (KC) proposed by Ikujiro Nonaka. The study adopted a post-positivist research paradigm to enable multiple perspectives by using both quantitative and qualitative research approaches. A total of 96 copies of the questionnaire designed for this study were administered to ICT users/ beneficiaries; 57 (59%) were returned. Additionally, interviews were conducted with the owners or custodians of IK. Fully, 224 owners or custodians of IK were sampled, while 196 (88%) were interviewed. The study acknowledged the wealth, access to and use of indigenous knowledge in the province. The study found that the advent of ICT tools provides a good platform for managing indigenous knowledge. It was found that a number of tools are currently used to manage indigenous knowledge. However, the number of challenges facing the use of ICTs is not uniform between ICT users/beneficiaries and owners or custodians of IK. Most crucial among ICT users/beneficiaries and owners or custodians of IK was the aspect of access to relevant ICT infrastructure and resources and a lack of digital skills. This study contributes to the current literature and discourse on IKS; it interrogates the applicability and models of knowledge creation theory to IK research; it adds fresh data, information and knowledge on IK research, particularly in South Africa; it and proposes practical solutions to problems of ICT application for IK development.

Keywords: Information and Communication Technology, ICT Tools, Indigenous Knowledge, KwaZulu Natal

Introduction

The present-day society relies on information and communication technology (ICT) tools to manage intangible and tangible knowledge. ICT has the capacity to support knowledge management through its multiple technologies which combine microelectronics, computer hardware and software, telecommunications, and optoelectronics, such as microprocessors, semiconductors and fibre optics, which enable the processing and the storage of large amounts of information, as well as its rapid dissemination through computer networks (Ngenge, 2003).

It is argued that tacit indigenous knowledge (TIK) needs to be managed because it is at risk of becoming extinct if appropriate measures are not taken to preserve and manage it. For example, indigenous knowledge (IK) is predominantly tacit or embedded in the experiences and/or local knowledge of the community. The literature on indigenous knowledge provides multiple definitions of the concept. For example, the World Bank Group (2004) defines IK as knowledge appropriate to for local

decision-making in agriculture, health, natural resource management, and other activities. It comprises experimental locality-specific knowledge and medicinal practices, as well as healing, hunting, fishing, gathering, agriculture, combat, education and environmental conservation developed by indigenous people over many years (Chisenga, 2002; Ngulube, 2002). Notably, much of indigenous knowledge (IK) is preserved in oral traditions, such as human memories which are gradually disappearing due to loss of memory and death (Dlamini, 2016; Lwoga and Ngulube, 2009) or other forms of brain drain. It is commonly exchanged through personal communication and demonstration and gets transmitted from master to apprentice, from parents to children, and from one neighbour to the other, and so on (Dlamini, 2016; Ngulube, 2002). Based on the views and experiences above, it can be said that, IK is gradually disappearing in most African countries because there are no tangible efforts to recognise or manage it through technology (Lwoga, Ngulube and Stilwell, and 2010). Ngulube (2002) argues that the reason IK is diminishing is because there are no proper mechanisms for capturing, storing, processing, retrieving and disseminating the valuable asset for future generations. It would seem, therefore, that with the advent and the use of ICT tools in the management of IK, the possibility of IK becoming extinct can be minimised or even eliminated

Many studies (e.g. Agrawal, 2002; Ilo 2012) acknowledge that there is a need to access and use information and communication technologies in the management of indigenous knowledge. Much earlier, Nonaka (1994), too, emphasised a need to manage tacit knowledge through technology. The question that arises is: What types of ICT tools are used in the management of IK for the future generations?

Africa uses 80% of its IK for medical purposes (Mahomoodally, 2013; World Health Organisation (WHO), 2003) and yet IK is marginalised (Ocholla, 2007). Marginalisation is a very broad term. Ocholla (2007) defines marginalisation as exclusion, and argues that IK has often been referred to in a negative or derisive manner, with phrases such as "primitive", "backward", "archaic", "out-dated", "pagan" and "barbaric". For example, the World Bank Group (2004) remarks that in the past the scientific community despised traditional knowledge and doubted its credibility or reliability. Thus, scientists tended to dismiss traditional knowledge as subjective, anecdotal and unscientific. However, Mutula (2002) submits that the fact that indigenous knowledge is believed to be knowledge possessed by a person and shared orally does not mean that it is non-essential and can therefore be ignored. He observes that indigenous knowledge continues to suffer from a lack of recognition because of the limited economic self-sufficiency of many traditional communities. To him, the rapid globalisation has awakened many countries and development organisations to the threat of losing IK, and they are putting in place initiatives aimed at preserving and revitalising this valuable resource. Furthermore, it is apparent that globalisation threatens the existence of IK due to a lack of adequate protection for it. A study by Ngulube (2002) acknowledges that indigenous knowledge is diminishing, and argues that there are no proper mechanisms for capturing, storing, processing, retrieving and disseminating indigenous knowledge for future generations. However, the increased exploitation of indigenous knowledge (IK) in alternative medicine, agriculture, sports, culture and business has awakened societies, countries and corporate sectors to the threats of losing IK.

IK, being largely a tacit or an intangible form of knowledge, is easily lost if no proper mechanism is developed for transforming it into explicit/tangible knowledge through capturing, storing, processing, retrieving and disseminating it (Dlamini, 2016). Ngulube and Lwoga (2009) believe that information and communication technologies offer a window of opportunity for emerging nations to harness and utilise IK. They suggest that a need exists for intervention to revive the processes of managing IK for future projects in agriculture, a sector in which IK is very rich. They further recommend that IK be documented and preserved so that it can be available for poverty reduction initiatives before much of it is completely lost. The major challenge is how this can be achieved and what types of ICT tools can be adopted for managing IK for future generations. Would documentation and management of IK be achieved at the source level (e.g. IK holders/owners) or proxy level (IK beneficiaries)? Notably, the rapid development and the utilisation of ICTs in South Africa provide an avenue for technology to improve access to IK. This raises questions concerning the methods and the types of ICT tools that are currently in use for the management (capture, storage,

dissemination and use) of indigenous knowledge in the Province of KwaZulu-Natal and their benefits to society.

Contextualization

Related studies indicate that most societies, countries and corporate organisations are introducing initiatives aimed at preserving, revitalising and disseminating this valuable resource. For instance, the adoption of an IK policy for the protection of indigenous knowledge has become a top priority in South Africa. As argued by Mosimege (2005), South Africa initiated its IK policy in September, 1996. The adoption of this IK policy was effected by the national cabinet in 2004 (NRF: Framework Document, 2016). According to the Department of Trade and Industry (2008), inter-governmental institutions, such as the United Nations Educational, Scientific and Cultural Organisation (UNESCO), World Intellectual Property Organisation, World Trade Organisation, United Nations Environment Programme and United Nations Conference on Trade and Development, also unlocked discussions on the possibility of safeguarding IK, referred to in the policy as local knowledge (LK). It is widely acknowledged that the protection of IK is necessary because traditional knowledge holders are frequently disadvantaged economically and socially without protection. Furthermore, the country as a whole is also disadvantaged economically if no immediate protection is afforded. Thus, the IK policy is directed against the poaching of local knowledge which is the largest threat (Department of Trade and Industry, 2008).

South Africa has several indigenous knowledge (IK) policy frameworks and institutions that guide the development of indigenous knowledge (IK). These include the Department of Trade and Industry's publications 'The Protection of Indigenous Knowledge through the Intellectual Property System: A Policy Framework (2008)', and 'Innovation Towards a Knowledge-Based Economy: Ten-Year Plan for South Africa (2008-2018)', the Leshiba Arts and Culture Trust's 'Proposed Establishment of a Centre for Indigenous Knowledge and Appropriate Technology (2003)', the National Research Foundation's (NRF) document 'Indigenous Knowledge Systems Knowledge Fields Development (KFD) Framework Document (2014)' National Research Foundation's (NRF) 'Indigenous Knowledge Systems Knowledge Fields Development (KFD) Framework Document (2016)' and the Department of Science and Technology's 'The Bio-Economy Strategy (2013)'.

The IK policy document (2008) has nine main objectives or goals which are summarised as follows: to develop new epistemologies and research methodologies on IKS; to develop, promote and protect IK and IKS; to contribute towards a knowledge economy; to develop new technologies in line with national priorities; to record and document IK and IKS; to document and activate traditional knowledge in a modern development paradigm; to contribute towards a strategy for sustainable living that harnesses, showcases and educates local people in indigenous knowledge and appropriate technology; to identify viable business opportunities that could establish a sustainable economic base for job creation and community upliftment through the application of IK; and to develop and enhance the role IKS plays in eco-tourism as a blend of natural and cultural attractions. It is evident that transformation of IK from tacit knowledge to explicit knowledge through proper documentation and recording systems is emphasised in the policy document, and that ICT is to play a major role to enable such documentation to occur and be more effective.

The protection of IK faces several challenges. For example, not all countries accept the idea that indigenous knowledge should be protected. Developed countries are not in favour of protecting IK because they are the greatest poachers of traditional knowledge (Department of Trade and Industry, 2008). For instance, the Department of Trade and Industry (2008) reports that the United States is not a member of the Convention on Biological Biodiversity (CBD), which promotes the protection of IK through an Intellectual Property (IP) system. In other words, there is international resistance to the protection of IK by some very developed countries.

Purpose of the Study

The purpose of the study was to examine the use and the types of ICT tools for managing indigenous knowledge in the province of KwaZulu-Natal. The study is a response to the following research questions: What ICT tools are currently used for

recording or capturing IK? What ICT tools are used for storing IK? What ICT tools are used for disseminating IK?

Conceptualization/Theoretical Model

This study was largely informed by Nonaka's (1994) SECI model/theory known as Knowledge Creation Theory. In this theory, knowledge is generated in a four-way mode, and is transferred and converted based on socialisation, externalisation, combination and internalisation (Nonaka and Takeuchi, 1995). In this context, Knowledge Creation model is highly interactive in generating, sharing, documenting, and transferring knowledge through knowledge management approaches (Lwoga, Ngulube and Stilwell, 2010; Ngulube, 2003). The study adopted knowledge creation model because of the four distinctive interactions between tacit and explicit and vice versa, which could be used to manage tacit knowledge (Nonaka and Takeuchi, 1995). The four key elements show the process of knowledge creation as follows:

1. Socialisation is where tacit-to-tacit knowledge is shared and converted through shared experiences.
2. Externalisation is the process of conversion of tacit knowledge into explicit knowledge.
3. Combination is the process of converting explicit knowledge into more systematic sets of explicit knowledge.
4. Internalisation involves the conversion of explicit knowledge into tacit knowledge, for example, learning by doing (Monika and Takeuchi, 1995).

It is widely acknowledged that knowledge management theories can provide scientific lens and framework for the management of indigenous knowledge (Lwoga, Ngulube and Stilwell, and 2010). In that light, this article uses knowledge creation model because of its notion of promoting the management of tacit knowledge such as indigenous knowledge. It is argued that knowledge creation as a model for knowledge management highlights the likelihood of managing indigenous knowledge using ICT tools (Dlamini, 2016). Research reports by Mosoti and Masheka (2010), for example, sum up the drive to manage knowledge in African culture with an old African proverb that states, "In Africa, when an old man dies, the entire library is burnt." With that notion in mind, knowledge creation has promoted the management of IK by converting it from tacit to explicit knowledge. Notably, knowledge creation demonstrates that socialisation can be used as a tool which commands custodians of IK to share their experiences, skills, intuition, local knowledge and beliefs with people who do not have access to that knowledge, but who may view it to be valuable through conversation and close interaction (Dlamini, 2016). Socialisation in this study is important because it allows and promotes knowledge sharing among communities and organisations for the benefit of all. Ngulube (2003) narrates that in the past, when rural communities wished to remember or celebrate the values of their society, they composed or performed songs, proverbs, myths, poetic forms and oral prose, including folktales and riddles. In this regard, indigenous knowledge was shared and created through cultural roles, such as apprenticeships, initiation rites during adolescence and age set systems. (Lwoga, Ngulube and Stilwell, 2010). The study also took advantage of externalisation as it an important element in the management of IK. For example, externalisation takes place when a person holding tacit knowledge converts it into any secondary form (for example, document or image, or rock painting) where another can retrieve it, even in the absence of a person holding it (Ngulube, 2003; Lwoga, Ngulube and Stilwell, 2010). The study noted that the process of externalisation enables people with different backgrounds to share their tacit knowledge. Interestingly, the process of externalisation minimises lack of trusts and promotes understanding among rural-based and urban- based people, particularly ICT beneficiaries (Dlamini, 2016). It can be said that externalisation was used because it allows the interaction between owners of IK and users of ICTs. For instance, ICT beneficiaries visit owners of IK to observe methods they use in IK, for example, in drying food such as pumpkins, meat, and green vegetables, just to mention a few, for the purpose of capturing, storing and disseminating for future generations (Dlamini, 2016). Interestingly, a study by Ngulube and Lwoga (2007) approves that technological tools can be used to capture, store and make IK accessible. It is argued that one of the advantages of using technology to manage IK is that

it facilitates the presentation of knowledge in databases and documents (Ngulube and Lwoga, 2007).

The third key element in the management of IK is combination. It is used to exchange from explicit knowledge to explicit knowledge (Ngulube, 2003; Nonaka, 1997). It is argued that a secondary form of knowledge is used to make another secondary form of knowledge (Ngulube, 2003). Lwoga, Ngulube and Stilwell (2010) provide the example of traditional farmers sharing their explicit knowledge with others through village meetings, group interactions, documents, and ICTs, such as cell phones and emails. In that regard, ICT tools are innovations that can work interchangeably with owners or custodians of IK in storing and transmitting valuable information which is IK. In addition, individuals' perceptions of ICT tools have been found to play a pivotal role in how IK is managed (Dlamini, 2016). For instance, Chisenga (1999) is of the view that ICT tools enable Africa to contribute to global information resources by translating indigenous knowledge into web content. A study by Le Roux (2003) concludes that the Internet is considered pivotal for communicating and preserving of indigenous knowledge. Lastly, internalisation is widely accepted as one of the important elements in knowledge creation theory. For example, Ngulube (2003) posits that internalisation occurs when external knowledge from documents, databases and artifacts is used to create new knowledge inside a person that can also be transferred to others. In that regard, internalisation is crucial for learning by doing, where shared bodies of knowledge are internalised (Nonaka, 1994). Dlamini (2016) adds that internalisation allows any person interested in the use of IK to learn by doing. This means that if users acquire certain knowledge from the beneficiaries of IK, they are unwittingly drawn to take part in any activity. For instance, local people perform their traditional dance, while others observe and join them once they master their style. One of the advantages of internalisation, as indicated by Ngulube (2003), is that it ensures that explicit knowledge does not become obsolete and irrelevant.

Methodology

The study adopted a post-positivist research paradigm to enable multiple perspectives. Both quantitative and qualitative research approaches were used during a single phase of data collection. Quantitative data was gathered by the survey method involving self-administered questionnaires among ICT users/beneficiaries. The qualitative data was gathered by both survey and qualitative content analysis, largely through open-ended questions, which were embedded in the semi-structured interviews held with owners or custodians of IK. In-depth literature review and document analysis formed part of the qualitative content analysis. Because the province of KwaZulu-Natal is too large, the study used cluster sampling which is appropriate for such a province. Notably, the province of KwaZulu-Natal is divided into districts. The districts with high infrastructure are considered urban while those with low infrastructure are considered rural. The districts with high infrastructure are Metropolitan Municipality in Durban and Umgungundlovu District Municipality in Pietermaritzburg. Districts municipalities which were considered rural included: Zululand District Municipality (Lundi), Umkhanyakude District Municipality (Mkhuze), Ugu District Municipality (Port Shapstone), Sisonke District Municipality (Ixopo/ Kokstad), iLembe District Municipality (Kwa Dukuza/ Stanger), Umzinyathi District Municipality (Dundee), Uthukela (Ladysmith), and Amajuba District Municipality (Newcastle).

The study also took advantage of purposive and snowball sampling which are effective when the exact type of participants to be involved in the study is not known. The sample for the study was drawn from ICT users/beneficiaries and owners or custodians of indigenous knowledge (IK) in the province of KwaZulu-Natal. Notably, the ICT users/ beneficiaries consisted of researchers, information specialists and/or librarians, academic staff, students and/or trainees in the field of IK; cultural officers, IK recorders, IK documentation centre managers, journalists, and artisans. Respondents who are owners or custodians of IK consisted of traditional healers, diviners and herbalists, traditional farmers, traditional musicians, rural artisans, community elders, traditional midwives, rainmakers, chiefs, traditional food specialists, and storytellers as profiled in Table 1.

Table 1: Demographic Profile of the Respondents

Demographic data of ICT users/beneficiaries and owners/custodians of IK				
Variables	**ICT users/beneficiaries**		**Owners/custodians of IK**	
	F	**%**	**F**	**%**
Gender				
Female	30	52.6	100	51
Male	27	47.4	96	48.9
Total	**57**	**100%**	**196**	**100%**
Age				
31-40yrs	31	54	54	27.5
21-30yrs	15	26	11	5.6
41yrs and above	11	19	121	61.6
18-20yrs	0	0	10	5
Total	**57**	**100%**	**196**	**100%**
Status				
Researcher	14	24.5	0	0
Information librarian	10	17.5	0	0
Field worker	8	14	0	0
IK recorder	8	14	0	0
IK consultant	6	10.5	0	0
IK documentation centre manager	4	7	0	0
IK coordinator	3	5	0	0
Cultural officer	2	3.5	0	0
Government employee	1	1.7	0	0
Collections officer	1	1.7	0	0
Owner of IK	0	0	196	100
Total	**57**	**100**	**196**	**100**

The study employed largely non-probability sampling where cluster, snowball and purposive sampling techniques were used at different stages to select the respondents. A total of 96 copies of the questionnaire were administered to ICT users/ beneficiaries; 57 (59%) were returned. Additionally, interviews were conducted with the owners or the custodians of IK. A total of 224 owners or the custodians of IK were sampled; however, 196 (88%) were interviewed. The quantitative data aspect from the ICT users/beneficiaries of the study was analysed using the Statistical Package for the Social Science (SPSS). This paper reports part of the study based on quantitative data analysis.

Results and Discussions

The findings of the study are reported by themes derived from the research objectives below.

ICT Tool(s) Currently Available for Recording, Storing and Disseminating IK

It was important for the study to identify the types ICT of tools used for managing IK. ICT users/ beneficiaries (the two concepts will be used interchangeably) largely use ICT tools for managing indigenous knowledge, whereas a large number of owners and/or custodians of IK do not. Notably, only 62 (32%) of owners of IK used ICT tools to manage IK (Table 2) in this sample.

Table 2: ICT Tools Used for Recording and Capturing Indigenous Knowledge

Variables	ICT users/beneficiaries 57		Owners and/or custodians of IK 62	
	Frequency	%	Frequency	Percentage %
Video/camera	52	91	13	20
Video/recording/filming	39	68	0	0
Tape/sound recording	37	64.9	0	0
Cell phone recording	34	59.6	49	79

The study found that most ICT users and some owners or custodians (the two concepts are used interchangeably) of IK use ICT tools for recording or capturing purposes. Additionally, even though a large number of owners of IK do not use ICT tools to manage IK, 62 (32%) still use them. It was noted that a lack of awareness, culture, skills and financial constraints may also have contributed to ICT tools not being used in managing IK. These findings were corroborated by Nonaka (1994) who was of the view that KM models such as Knowledge Creation should be applied in managing tacit knowledge through technology. Thus, Nonaka and Takeuchi's (1995) observation was that externalisation and combination is very effective in this process. The importance of using ICTs to manage indigenous knowledge is also seen as a remedy in the present-day society (Oppenneer 2010:3; Molawa 2009; Adam 2007; Akinde 2007).

The findings showed that some ICT tools are used by owners of IK and some by ICT beneficiaries for recording or capturing IK. Cell phones and digital cameras are largely used by owners of IK, while ICT beneficiaries use multiple tools for recording or capturing IK. A study by Lwoga (2009) concurs that cell phones and digital photographs have been used to capture IK. Other related studies (Adetoun, 2007: and Fogwill, *et al.* 2011; Christie, 2005; Ilo, 2012; and Okore, Ekere and Eke, 2009) have reported that the use of digital film/video cameras to record and/or capture IK is one of the most effective ways to ensure the availability of indigenous knowledge on ICT tools. Similarly, Ilo (2012) noted that video cameras have become vital tools used to capture different forms of art and other physical objects. Chista (2011) and Kargbo (2005) observed that tape recorders are also used in capturing traditional knowledge in agricultural environments. The recording system has recently improved with the use of modern mobile phones for both photo and video recordings. The views of these authors reinforce the possibility of managing IK using new technologies.

Studies by Ilo (2012), Flor (2013), Owiny, Mehta and Maretzki (2014) acknowledge that mobile phones are a vital tool for capturing knowledge. We have established that these devices are used in multifarious ways, such as: to record music, stories, tales and idioms, all of which constitute an integral part of tacit indigenous knowledge. Contrary to this enthusiasm, Oppenneer (2010) argues that ICT tools are in fact ill-equipped to manage IK successfully, because not all IK is "capturable". This sentiment is shared by other authors, such as Semali and Kincheloe (1999), whose viewpoint is that the design of ICTs does not accommodate IK. The literature suggests that there are challenges faced in the management of IK through ICTs. For example, a looming challenge involved in using ICTs for cultural preservation and revitalisation is the reality of obsolescence (Oppenneer, 2010).

Table 3: ICT Tool(s) Used for Storing or Preserving IK

Variables	ICT users/beneficiaries 57		Owners and/or custodians of IK 62	
	Frequency	%	Frequency	%
Computer	57	100	0	0
Internet (e.g. Facebook, YouTube, Google Docs, Twitter, etc.)	42	73.6	0	0
USB	40	70	0	0
DVDs	38	66.6	42	67.7
E-mail	31	54	0	0
CD	0	0	31	50
Cell phone	16	28	14	22.5
Tape/voice recorder	12	21	0	0
Video/digital camera	6	10.5	0	0

Table 4: ICT Tool(s) Used for Disseminating IK

Variables	ICT users/beneficiaries 57		Owners and/or custodians of IK 62	
	Frequency	%	Frequency	%
Internet (e.g. YouTube, Facebook, Twitter, databases, etc.)	57	100	0	0
Cell phone	37	65	49	79
DVDs	0	0	41	66
CD	0	0	21	34
Telephone	19	33	12	19
Laptop	0	0	9	14.5
Radio	3	5	0	0
Television	3	5	0	0
E-mails	1	1.7	0	0

The findings of the study indicate that ICT tools are used by ICT beneficiaries and owners of IK to store or preserve (Table 3) and disseminate tacit indigenous knowledge (Table 4). It is evident that some ICT tools can perform multipurpose tasks. These ICT tools include the Internet, e-mails, CDs and cell phones. The findings indicate that the Internet (social media, search engines, etc.) is predominant multipurpose tool for storing and disseminating IK among ICT users, while DVD a is the most predominant multipurpose tool for storing and disseminating IK among IK owners. The effectiveness of the Internet for enabling access to and the use of documented knowledge is indisputable.

It has been used for storage, retrieval, dissemination, sharing and access of knowledge quite successfully. The findings of the study are in line with the findings of Nonaka (1994) who reported that it is possible to store and disseminate tacit knowledge through technology. Websites like YouTube allow users to upload, share, and view videos anywhere in the world. Facebook is another tool that most individuals use to post video messages, share their interests, make connections, and join groups with similar interests (Essoungou, 2011). Twitter is also used by businesses and farming communities to broadcast their merchandise or commodities for sale, check prices and interact with customers and suppliers (Owiny, Mehta and Maretzki, 2014). A study by Owiny, Mehta and Maretzki (2014) highlighted that information on growing and marketing local indigenous vegetables is normally featured on local radio programmes, using the language of the area.

The study also showed that there are some ICT tools in managing IK, which include computers, USBs, tape/voice recorders, and video/digital cameras. Computers were the predominant tools used by ICT beneficiaries to store or preserve IK, as was also confirmed in related studies (Ilo, 2012).

Table 5: Effectiveness of ICT Tools Used in Recording or Capturing IK

Types of ICT tools	Very effective		Effective		Less effective		Not effective	
	F	***%***	***F***	***%***	***F***	***%***	***F***	***%***
Video/camera	39	68	19	33	nil	nil	Nil	Nil
Video/recording/filming	34	59.6	19	33	4	7	Nil	Nil
Cell phone recording	9	15.7	28	49	18	31.5	2	3.5
Tape/voice recording	24	42	28	49	5	8.7	Nil	Nil

It was established that ICT tools are ranked as effective tools in recording or capturing IK. ICT users revealed that videos/cameras were the predominant tools used to record IK (Table 5). Lwoga (2009) also found that multiple ICT tools are either effective or very effective in disseminating indigenous knowledge. Evidently, these tools are used significantly for recording and filming IK from the custodians of IK in this study, a testament to their effectiveness. Fogwill *et al*, (2011) also reported that using digital film/video cameras to record or capture IK was one of the most effective ways to ensure the availability of IK. Similar studies by Christie (2005) and Okore, Ekere and Eke (2009) show that digital/video cameras are used to record indigenous ceremonies while owners of IK are performing. The literature also illustrated the advantage of using digital cameras, which cannot be quantified. They can be used to record data, later copied onto CD-ROMs, and subsequently viewed using either a computer or via a computer on the Internet (Okore, Ekere and Eke, 2009; Adetoun, 2007). A study by Kargbo (2005) and Chisita (2011) also reported that tape/voice recorders are useful in capturing traditional knowledge in agriculture. The literature showed that tacit indigenous knowledge practices can also be converted to explicit knowledge through the use of ICT tools such as video/camera, video recording/ filming, tape voice recording, and cell phones (Ilo, 2012).

Table 6: Effectiveness of ICT Tools in Storing or Preserving IK

Types of ICT tools	Very effective		Effective		Less effective		Not effective	
	F	*%*	*F*	*%*	*F*	*%*	*F*	*%*
Computer	36	63	21	36.8	nil	nil	nil	Nil
Internet (e.g. You Tube, Facebook, Twitter and Google Docs, Wikis)	37	65	20	40	nil	nil	nil	Nil
Tape/voice recorder	30	53	24	42	3	5	nil	Nil
Video	19	33	38	66.6	nil	nil	nil	Nil
USB	19	33	29	50.8	7	12	2	3.5
Intranet	36	63	21	37	nil	nil	nil	Nil
DVDs	27	47	30	52.6	nil	nil	nil	Nil
Cell phone	12	21	24	42	nil	nil	nil	Nil
CDs	22	38.5	35	61	nil	nil	nil	Nil
Film reels	4	7	12	21	25	43.8	16	28

It was established that ICT tools are very effective in storing or preserving IK. ICT users pointed out that computers, the Internet (YouTube, Facebook, Twitter and Google Docs, Wikis), video, television, and radio are highly effective tools in storing or preserving IK. Notably, other ICT tools, such as intranets and mobile phones are also effective.

Table 7: Effectiveness of ICT Tools in Disseminating IK

Types of ICT tools	Very effective		Effective		Less effective		Not effective	
	F	*%*	*F*	*%*	*F*	*%*	*F*	*%*
Internet (i.e. You Tube, Facebook, Twitter, etc.)	40	70	17	29.8	nil	Nil	nil	nil
Computer	37	64.9	20	35	nil	Nil	nil	nil
Video	28	49	29	50.8	nil	Nil	nil	nil
Intranet	17	29.8	30	52.6	10	17.5	nil	nil
Television	32	56	25	43.8	nil	Nil	nil	nil
Radio	36	63	21	37	nil	Nil	nil	nil
Cell phones	13	22.8	32	56	12	21	nil	nil
Film reels	4	7	8	14	44	77	1	1.7

We consider effectiveness as the extent to which ICT tools used to disseminate IK and reach a targeted or intended audience. It was established that ICT tools are generally effective in disseminating indigenous knowledge. The most highly cited ICT tools in disseminating indigenous knowledge were the Internet (i.e. YouTube, Twitter, Facebook, Google Docs, etc.), computers, video, television and radio (Tables 6 and 7). Other very effective ICT tools for disseminating IK were intranets and mobile phones. Le Roux (2003) and Tihapi (2004) also mention that the use of the Internet in disseminating IK is crucial and that it does not only disseminate but also communicates and preserves IK. Internet connectivity is used to promote awareness and appreciation of IK nationwide (Lor, 2004).

Table 8: Passing Indigenous Knowledge (IK) by Word of Mouth or Storing it on ICT Tools

Variables	Frequency	Percentage %
Strongly agree	18	31.5
Agree	2	3.5
Strongly disagree	21	36.8
Disagree	16	28
Undecided	Nil	Nil
Total	**57**	**100**

The study has established that the use of ICT tools is preferred for use in passing and storing by word of mouth in the transmission of IK. ICT users attested to storing and transmitting tacit indigenous knowledge through ICT tools, while a minority preferred word of mouth (Table 8).

The study identified various reasons why indigenous knowledge should be managed through ICT tools. ICT tools transmit IK globally, while word of mouth is limited to regions where custodians of IK live; young people no longer have an interest in IK as they consider it old-fashioned; and the numbers of holders of the knowledge are diminishing, due to old age and incurable diseases, threatening the continued existence of the knowledge; it would die with them. Various literature sources support the findings of the study. For example, Nonaka and Takeuchi (1995:31) approves and encourages the use of ICT tools to manage IK. Mosoti and Masheka (2010:111) support this by citing an old African proverb alluded to at the beginning of this article." We did not underestimate the suggestions from a minority of ICT beneficiaries supporting the use of word of mouth to transmit IK.

Problems Encountered in the Availability and Use of ICTs in Preserving and Disseminating Indigenous Knowledge

In this section, we discuss problems encountered by ICT users and owners of IK in the use and availability of ICT tools (Table 9).

Table 9: Challenges Encountered in the Use and Availability of ICT Tools in Managing IK

	ICT Users/beneficiaries 57		Owners and/or custodians of IK 62	
	F	%	F	%
Low battery (lack of electricity to charge cell phones and digital cameras)	29	56	32	51.6
Lack of digital skills to capture and store quality data	22	42	47	75.8
Recorded data sometimes gets lost	14	27		
Memory of ICT tools too small to contain recorded data	8	15	38	61
ICT tools like digital cameras are sensitive to being carried and are affected by dust over long distances	4	7.6	0	0
Some ICT tools have viruses	3	5.7	0	0
USB memory sticks get lost in many cases	2	3.8		
Some cell phones and digital cameras are complicated to operate	0	0	21	33.8
ICT tool manuals are written in English, thus instructions are difficult to understand	0	0	17	27

Table 10: Challenges Related to the Unavailability of ICT Tools in Managing IK

	ICT Users/beneficiaries 57		Owners and/or custodians of IK 62	
	F	%	F	%
ICT tools are expensive to purchase	15	37.5	62	100
Poor networks in rural communities	0	0	47	75.8
Lack of electricity in rural areas	0	0	41	66
Lack of awareness of proper tools to record and store IK	0	0	41	66
Poor infrastructure	0	0	37	59.6
ICT tools are expensive to maintain	15	37.5	0	0
ICT tools are in short supply, therefore we keep borrowing	12	30	0	0
Batteries are few and shared among us	6	15	21	34
There is no budget for ICTs	6	15	0	0
We do have Internet access and computers	2	5	0	0

The study established that there are problems encountered by ICT users and custodians of IK which are related to the un-availability of ICT tools to manage IK (Table 10). The problems were identified as: ICT tools being expensive to purchase and maintain; a lack of awareness of proper tools; lack of electricity in the community; poor networks in the community; the fact that some ICT tools are shared among many IK recorders, etc.

Conclusion and Recommendations

This study confirms that ICT can be used to manage IK, while also acknowledging skeptics (Oppenneer, 2010; Semali and Kincheloe, 1999) who find them ill-equipped to manage IK. The study recognised Nonaka's (1994) knowledge creation model which supports the management of IK through ICT tools. Evidently, ICT tools are used relatively more frequently by ICT beneficiaries (57; 100%) than by owners of IK (62; 32%). We assume that IK beneficiaries (e.g. researchers, tourists) are expected to use ICT more than IK owners because the former are more aware of ICT benefits and access them relatively easily due largely to their economic status and understanding of their requirements. The use of mobile and other modern voice and image recording systems such as digital cameras seems prevalent. Mobile phones have become an appropriate technology in many social environments that were deprived of telephones; their use for multiple purposes and with increasing access makes them the most appropriate technology for enabling IK access, dissemination and use in many communities in Africa. As noted in Table 5, the Internet and mobile phones play a crucial role in IK dissemination. Reviewed literature in this paper concurs and indicates the increasing use of social media platforms (e.g. Facebook, YouTube and Twitter). This study did not obtain details on the depth and breadth of the use of social media for IK management, but has noted it for further research. It was noted that DVDs are used mostly by IK owners to store, preserve and disseminate IK. The use of multifunctional ICT tools (e.g. computers, mobile phones, the Internet, recording devices) seems to be popular among both ICT beneficiaries and IK owners, although IK beneficiaries use computers and ultimately the Internet most. They (ICT beneficiaries), as was noted, have economic and intellectual advantages and are able to use more sophisticated ICT tools and services. We note that ICT tools are effective in all stages and processes of IK management. The mobile phones, the Internet, modern data recording and storage devices (e.g. digital technology) play a significant role in enabling ICT impact for IK management. The study recognises that several challenges (see Table10; 11) accompany ICT applications. Among them, emerging from this study, is a lack of ICT literacy, e.g. digital skills, computer literacy, media literacy, information literacy; economic drawbacks, e.g. the affordability and sustainability of the technology; systemic limitations of the gadgets (hardware maintenance, software issues) memory, security, access; language of the technology (largely English and does not accommodate local languages; poor networks).

Using ICT for indigenous knowledge management is a relatively broad area of study; therefore, gaps in specific areas (e.g. the Internet, social media, and digitisation) are to be expected and require attention. ICT awareness (e.g. through workshops) among ICT owners is crucial for them to effectively access and use the technologies. Such workshops could be organized (stemming from this study and related studies) as part of a community outreach. Unlike other ICT tools, mobile phones seem to be used most (Table 2, 3, 4 and 5) by owners of IK which is reasonable and sustainable. The application of ICTs in low access and usage areas should be investigated and training provided to enhance access.

This study recommends that because technology changes rapidly, there is an urgent need to manage IK with what is available rather than waiting for proper devices. In that regard, the following needs should be considered:

- Government and NGOs should adopt community-based resource centres that can enhance the flow of IK;
- There is an urgent need to apply readily available traditional and modern technologies that respond to local culture; and
- Focus should be on tools that promote oral interaction such as audio-visual technologies.

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