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A framework for digital preservation of Indigenous knowledge system (IKS) in repositories in South Africa

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Abstract

Purpose – The purpose of this study is to assess the digital preservation policies and plans for long-term digital preservation in selected repositories in South Africa, with a view to develop a digital preservation framework for the preservation of Indigenous knowledge system (IKS) in South Africa.

Design/methodology/approach – Through the multiple case study research design, data was obtained from eight respondents in four Indigenous Knowledge Systems Documentation Centers (IKSDCs) in institutions that are part of the National Recordal Systems (NRS) initiative across four provinces in South Africa using in-depth face-to-face interviews. Data collected was also supplemented with the content analysis of several policy documents in South Africa.

Findings – The findings reveal that there are no digital preservation policies in place in the institutions, especially long-term digital preservation for IKS. However, some of the institutions are formulating policies that will include the management of IKS collected in the institutions. This study also reveals that digital curation, policy formulation and disaster preparedness plans to some extent are measures said to be in place for the digital preservation of IKS.

Research limitations/implications – This study focuses mainly on the NRS initiative in South Africa. Indigenous Knowledge (IK) related to traditional medicine, traditional plants and food are currently being digitized at the IKSDCs by IK recorders. This study will help in ensuring that the South African Government's effort and investment in digitizing IKS and making them accessible online is not wasted. This study will help mitigate the risk of damage and alteration over time, either deliberately or in error.

Originality/value – This study fills a gap in the literature on the digitization and digital preservation of IKS from the context of the NRS project in South Africa. Very few studies have been carried out on the digital preservation of IKS in Africa. This study also proposed a framework for the digital preservation of IKS in South Africa.

Keywords Digitization, Digital preservation, Indigenous knowledge system, South Africa, Institutional repository

Paper type Research paper

Introduction

The study focuses mainly on the National Recordal System (NRS) initiative in South Africa. Indigenous Knowledge (IK) material related to traditional medicine, traditional plants and food are currently being digitized at four Indigenous Knowledge Systems Documentation Centers (IKSDCs) by IK recorders.

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IK is a very important knowledge and developmental tool in Africa. Indigenous Knowledge Systems (IKS) is the body (or bodies) of knowledge of the "indigenous people of particular geographical areas that they have survived on for a very long time" (Mapara, 2009, p. 140). These bodies of knowledge "are developed through the processes of acculturation and through kinship relationships that societal groups form and are handed down to the posterity through oral tradition and cultural practices such as rituals and rites" (Mawere (2010, p. 211). According to Anyaoku *et al.* (2015, p. 34), IK is the "basis for local level decision-making in health care, education and a host of other activities in rural communities." IKS can, therefore, be defined as the collection of interrelated practices that are peculiar to people in a particular place and they influence the way of life of local people (Adeniyi and Subair, 2013). IK involves "cultural expressions, ecology, agriculture, medicine, construction technologies, environment and have generally been passed on from generation to generation, pertaining to a particular people or territory and is constantly evolving in response to the changing environment" (Poorna *et al.*, 2014, p. 1240).

The San and the Khoi (or Khoikhoi peoples) are considered to be the first modern inhabitants of South Africa (Giliomee and Mbenga, 2007). The African indigenous communities in South Africa comprising the San and Khoi are collectively known as the Khoesan or the Khoisan (Güldemann and Vossen, 2000). The Khoi comprise Nama, Koran and Griqua (International Work Group for Indigenous Affairs [IWGIA], 2020). The population of the indigenous people of South Africa is estimated to be about 1% (International Work Group for Indigenous Affairs [IWGIA], 2020). These indigenous groups hold an array of IK in areas like education, craft, medicine, astrology and farming/agriculture. Examples of the IK of these indigenous groups are the Khoisan cultural dance riel (Van Wyk, 2012) and the "Buchu" (boegoe) aromatic plant used for medicinal and cosmetic purposes (Hulley *et al.*, 2016). Although there is more attention on Khoisan indigenous people, the IK of other groups like the neighboring Vendas, Zulus, Sothos and Xhosas are also being studied and captured (Crouch *et al.*, 2020).

The high value of cultural heritage for the present and the future of a country have made their access, preservation and use in education crucial to the evolution of any group of people and their culture (Drijfhout and de Boer, 2015). The World Summit on the Information Society pointed that "in the evolution of the Information Society, particular attention must be given to the special situation of indigenous peoples, as well as to the preservation of their heritage and their cultural legacy" (World Summit on the Information Society 2003: Article 15). Developments in technology have led to IK being digitized. Some early IKS digitization projects implemented in different parts of the world include the Traditional Knowledge Digital Library in India, First Nation Help Desk in Canada (1996 – circa 2006), Native Web in the Americas (1994–2017) and the Netherland's Center for International Research and Advisory Networks' IK Homepage (Chikonzo, 2006). More recently, African countries including South Africa, Uganda, Nigeria and Ghana have become involved in the digitization of IK (Plockey, 2014; Biyela *et al.* and2016; Jain and Jibril, 2016). The South African IKS policy provided a framework for the recognition, development, affirmation, promotion and protection of IKS in South Africa (Alberts *et al.*, 2011), as IK misappropriation associated with biopiracy is an area of concern (Bagley, 2018). This led to the NRS initiative which was designed as a defensive strategy for the documentation and protection of IK against biopiracy and misappropriation (Amechi, 2015; Bagley, 2018).

Examples of IK's biopiracy issues by multinational entities can be found in countries including India, South America and South Africa (Bhattacharya, 2014; Avantika *et al.*, 2015; Kapepiso, 2018). For instance, the documentation and digitization of IK related to medicine have been adopted to deal tackle biopiracy in countries such as Venezuela (Poorna *et al.*, 2014).

Digitization of IK is considered an effective tool for the defensive protection of IKS from biopiracy and it can also help to reduce misappropriation of IK without compensation (Christian, 2009, p. 11). Initially, the NRS focused on Indigenous foods and African traditional medicine with plans to expand to other IK types over time (Bagley, 2018). Currently, South Africa seems to be the only African country with a known National Policy on Digitization of Heritage Resources (DAC, 2010). This was formulated by its Department of Arts and Culture (DAC) in 2010 and acts as a guideline for the digitization of heritage materials (Biyela *et al.*, 2016); it explicitly mentions community rights for indigenous knowledge (DAC, 2010, p. 22).

Digitization is sometimes presented as a panacea for problems of preservation and access. However, access to digitized collections and their preservation, especially in the longer term, may also be problematic. The problems are not only technological but also economic, political, legal and ethical (Pickover, 2008; de la Porte and Higgs, 2019). de la Porte and Higgs (2019) highlight a lack of expertise, human and financial resources, inadequate technology infrastructure and management as some of the challenges faced in digitizing cultural heritage materials. It is important to consider digital preservation (a set of processes, activities and management of electronic information over time to ensure its ongoing accessibility) as a method to ensure the long-term availability of the digitized IKS (Mukasa and Kamusiime, 2012, p. 75).

Problem statement

There are many digitization initiatives across the world but a lack of adequate digital preservation infrastructure or delay in the implementation of certain national policies have become a major challenge, especially in Africa (Kalusopa and Zulu, 2009; Keokapa, 2010; Ngulube, 2012; Ezema and Ugwu, 2013; Gbaje and Mohammed, 2013; Mutula, 2014; Masenya and Ngulube, 2019). This is contrary to the tenets of information management frameworks which emphasize the importance of policies, procedures, structures, systems and the need for long-term strategic plans for digital preservation [International Records Management Trust (IRMT), 1999].

The South Africa Department of Science and Technology (DST)'s 2004 IKS policy framework laid the groundwork for preserving IKS and efforts to digitize IKS in South Africa (DST, 2004). Through the NRS initiative, Indigenous Knowledge Systems Documentation Centers (IKSDCs) were established in academic institutions in South Africa to facilitate the digitization of IKS. In 2016, the Department of Science and Technology (DST) promulgated an additional IKS Bill which aimed at further improving the management of IK in South Africa; the bill was signed into law in 2019 (DST, 2019). Against this backdrop, it is, therefore, important to investigate the digital preservation plans/strategies for IKS and related policies.

Even though research has been conducted on the digitization of IKS (Bishop, 2019; Bourget, 2020; Kapepiso, 2018; Mncube, 2017; Durcan, 2016; Plockey, 2015), there are few studies on the digital preservation of IKS in Southern Africa. The lack of digital preservation policies and guidelines presents a major barrier to the digital preservation of heritage materials in Africa (Kalusopa and Zulu, 2009; Keakopa, 2010; Ngulube, 2012; Biyela *et al.*, 2016; Masenya and Ngulube, 2019). Biyela *et al.* (2016) and Amunkete (2020) are some of the few studies cited on the digital preservation of IKS in Africa. While Biyela *et al.* (2016) is a comparative study of digital preservation practices in three African countries including South Africa, the more recent study by Amunkete covers the digital preservation of IK on medicinal plants in Namibia with a focus on an e-learning platform. These studies have reechoed the same issues with policies. Therefore, this study aimed to assess policies and

plans for long-term digital preservation in four South African institutions to develop a framework that will ensure authenticity, integrity and trustworthiness.

Literature review

The high value of IK has made its preservation very important. Studies have emphasized the importance of IKS and why there is a need to ensure that they are preserved (Hulley *et al.*, 2016; van Wyk, 2017). The risks associated with IK such as misappropriation and loss have made it important to take urgent measures to preserve it (Poorna *et al.*, 2014; Plockey, 2014). The lack of preservation of IKS has resulted in a huge loss of traditional, cultural and customary knowledge in Africa (Plockey, 2014). This regrettable loss underlies the urgent need for adequate documentation to preserve African IK going forward (Okello-Obura, 2018). Efforts to preserve IK using modern technology have begun from countries such as China, Venezuela and India where IK has been compiled within digital databases, inventories or registries over the previous decade (Swanepoel, 2008; Chakravarty and Mahajan, 2010).

Several authors have conducted studies on the digitization of IKS across the globe including Anderson (2012), Bishop (2019) and Bourget (2020). For example, Bishop (2019) focused on the digitization of IK's cultural aspects, such as using digital tools to leverage language revival initiatives, while Durcan (2016) focused on the ways digital tools and indigenous culture can empower culturally embodied architecture. Other studies have specifically focused on the digitization of IKS in South Africa (Kapepiso, 2018; Kapuire, 2013; Mncube, 2017).

Despite the advantages of digitizing materials for preservation and access, Dryden (2009, p. 4) pointed out that "rapidly changing technology, hardware and software obsolescence, media degradation and bad records management all threaten the survival of digital information." Also, the long-term preservation of these materials come with issues such as technological obsolescence, lack of awareness of digital preservation challenges, financial sustainability, lack of policies and legislation, politics, security and privacy (Adu and Ngulube, 2017; Biyela *et al.*, 2016). According to Hockx-Yu (2006, p. 4), digital preservation is considered a "complex process and there are many unsolved organizational, managerial and technical issues that make digital preservation a challenging task for those managing institutional repositories." Digital preservation is essential in ensuring that cultural heritage and democratic history are safeguarded for the longest time possible. The issue of a lack of effective digital preservation policies is common, especially within African countries (Lor, 2005; Kalusopa and Zulu, 2009; Adu and Ngulube, 2017).

A lack of standards and policies for digital preservation is evident at both national and institutional levels across institutions in Africa (Kalusopa and Zulu, 2009; Keakapa, 2010; Ngulube, 2012; Masenya and Ngulube, 2019). Generally, issues regarding the development of sustainable digital preservation policy were unexplored to a large extent (Pennock, 2008). According to Masenya and Ngulube (2019), the lack of established standards, policies and procedures are the major issues faced by digital resources preservation in several academic institutions in South Africa. Although countries such as Ghana and Uganda have policies at the national level for digital preservation, the implementation of these policies can present a major challenge (Adu, 2016; Luyombya, 2010). Any institution involved in digitization initiatives, especially those related to heritage or IKS materials, must have standard digital preservation plans/strategies backed up by well-documented policies.

Previous studies highlighted several digital preservation plans/strategies for metadata (Oehlerts and Lui, 2013; Corrado and Moulaison, 2014; Sugimoto, 2014; TNA (UK), 2014; and Adu, 2016), backup (Kirchhoff, 2009; Corrado and Moulaison, 2014; and Adu, 2016), disaster

planning (Aikin, 2007; Altman *et al.*, 2009; McDonald and Walters, 2010; Schmidt, 2010; and Frank and Yakel, 2013). The issue of metadata is considered a key component of any digital preservation strategy, in part because it stores vital information about file formats (TNA 2014). Metadata is an indicator of the data, location of the data, the ownership relationship and the quality and conditions (Adu, 2016). Therefore, it determines the ease or difficulty of information retrieval in the future. Backup is also an important component of digital preservation which helps to mitigate the risk of losing digital files (Adu, 2016) and to protect data from unforeseen circumstances such as hacking, virus attacks and accidental deletion (Corrado and Moulaison, 2014). To mitigate the issue of data loss, disaster planning is also considered a key component of digital preservation (Altman *et al.*, 2009; McDonald and Walters, 2010; Frank and Yakel, 2013). Making adequate plans for unforeseen disasters, risk management and disaster mitigation are some of the activities which should arise in response to real or anticipated threats to digital collections (Aikin, 2007; Altman *et al.*, 2009).

Trust is a major obstacle that can disrupt the digital preservation process (Jantz and Giarlo, 2007). It is important to determine the trustworthiness of digital materials. The emphasis on trust in the digital preservation community has been centered on the maintenance of trusted digital repositories (Corrado, 2019). To determine trustworthiness, there is important to consider the entire digital infrastructure in which information is managed, as well as the organization that runs the repository. Digital repositories are expected to preserve digital resources for periods allowable by existing preservation methods (Jantz and Giarlo, 2007). Manipulation of digital images is becoming a serious issue and some of these manipulations are not easy to detect (Parry, 2009; Upadhyay and Singh, 2012). It is important to ensure that the digitized IK materials are stored in trusted digital repositories to avoid issues related to authenticity and trustworthiness in the future. A trusted digital repository is expected to have specific features or attributes (RLG-OCLC, 2002). The Open Archival Information System (OAIS) compliance attribute of a trusted digital repository incorporates ISO 14721 (2012) into the design and implementation of digital archives. A trusted digital repository is, therefore, required to conform with the OAIS Reference Model fully or at least address it to some extent (NRF, 2010).

Research questions

The aim of the study is to assess the selected institutions' policies and plans for long-term digital preservation with a view to developing a framework for the digital preservation of IKS that will ensure their authenticity, integrity and trustworthiness. The following three research objectives guided the study:

(1) Are there long-term preservation plans for digitized IK?

(2) What are the measures put in place for the long-term preservation of IK?

(3) Are there digital preservation policies in the institution?

Interviewees were asked ten questions that informed answers to the research objectives.

Methodology

The qualitative research method was adopted for this study. Because of the weakness of the quantitative method, the multiple case study design was used to closely study the IKSDCs. Apart from attempting to develop new knowledge and understanding of the NRS initiative, it was also necessary to focus on the depth of information obtainable through the case study method. In several academic institutions, the IKSDCs are part of the NRS digitization

initiative and have a responsibility to digitize South African IKS. These IKSDCs are, therefore, considered appropriate case studies.

The population of this study comprised the IKS staff members at the IKSDCs in four academic institutions across four provinces in South Africa. These IKS staff are directly involved in IKS digitization activities. The purposive sampling technique was used to select the respondents owing to their perceived knowledge and understanding of the research's subject matter. This technique allows a researcher to use their professional judgment in the selection of respondents (Frey, 2018). Data was collected through interviews and content analysis. All of the IKS staff from the respective institutions selected for this study were interviewed.

In-person interviews of eight key staff at the selected IKSDCs were structured in line with the research objectives to answer the research questions which prompted the study. Interviews were used to gather qualitative data to assess the institutions' long-term digital preservation plans and policies and to evaluate the data management of digitized IK, and how the authenticity of the materials is maintained over time. Because the number of staff at the IKSDCs varies and not all the staff were considered knowledgeable on the issue being research, the selection of the respondents across the IKSDCs is uneven. The interviews which lasted between 45 min and 1 h each were conducted in English. The interviews were recorded by the interviewer, and the sound recordings were later transcribed and organized into themes for analysis. The themes have been mirrored in the findings section of the paper.

Content analysis was mainly used to collect more detailed data on the IKSDCs' policies for the digital preservation of IKS. Inductive content analysis, in which themes emerge from the raw data through repeated examination and comparison, was used to supplement the interviews to identify how IK was harvested, to evaluate content on the National Indigenous Knowledge Management System (NIKMAS) [1] website and those of institutional repositories and to assess the adequacy of the digital preservation policies (where they existed) of the identified institutions.

Findings and analysis

The findings and discussion are based on interviews conducted with the eight respondents from IKSDCs in four institutions across four provinces in South Africa. The findings and analysis are also based on content analysis of the National Policy on Digitization of Heritage Resources and the other strategic policy documents in South Africa listed in the previous section.

Digital preservation plans/strategies

This section looks at the digital preservation plans in place in the selected institutions. The study identified adequate metadata, regularly scheduled backup and implementation of disaster preparedness as some of the measures for digital preservation.

Metadata

Metadata is considered an important component of any digital preservation strategy, in part because it holds vital information about file formats (National Archives of UK, 2014). Metadata also takes cognizance of certain elements such as preservation activities, authenticity, rights management and provenance, (Oehlerts and Lui, 2013). Adu (2016) stated that metadata is an indicator of the data itself, the location of the data, the ownership relationship and the data's quality and conditions. The preservation of both digital resources and the quality of their metadata is crucial to the accessibility of a digital archive

over time. Metadata determines the ease or difficulty of information retrieval in the future (Sugimoto, 2014).

Three respondents at two institutions asserted that one of their digital preservation plans is to have a standard metadata system in place to effectively manage their digital collection. These institutions also currently have some metadata descriptors in place. Two respondents noted that they currently use the Dublin Core metadata schema, while the last respondent mentioned that their repository uses a ready-made template available on AtoM (AtoM is digital archive software that adopts the Dublin Core metadata to some extent). This contrasts with studies by Adu (2016) and Corrado and Moulaison (2014) who asserted that metadata is developed in-house in some organizations. The development of in-house metadata has both advantages and disadvantages. It may support a customized metadata system depending on the collection and specific needs. Not involving an experienced metadata project architect could pose a major setback to the project. According to one of the respondents, even though software like Achivematica's AtoM is an effective system, it contains too many redundant metadata fields.

Backup

Backup is one of the digital preservation strategies mentioned by one respondent. They noted that a backup of the IK is stored in case of loss or data corruption. This is in line with the study by Adu (2016) which alluded to the fact that backup is a component of digital preservation adopted to mitigate the risk of losing digital and audio files. This study like the findings by Corrado and Moulaison (2014) reveals that backup helps to protect data from unforeseen circumstances such as hacking, virus attacks and accidental deletion. The same respondent also mentioned that some of their IK data was corrupted at a point in time and this required them to go back to the knowledge holders and recapture some of the lost data.

The respondent noted that the backups are done on the IK recorder laptops. This means that the machines used to collect the IK data are also used as backups, and this is not in line with basic principles of backups and preservation. It is important to know that these backups may be inadequate, as another respondent expressed fear about the possibility of losing some data because of laptop crashing, being vulnerable to hacking or even loss of data completely in a case where the laptop is lost or stolen in the process of collecting data from the communities or during business travels.

The respondents asserted that the IK recorders are not supposed to use the laptops for personal use or unauthorized connection to another network or the internet, but sometimes they do not adhere to this rule. This can lead to potential hacking of the system or infection from viruses or malware. This backup situation is contrary to the Kirchhoff (2009) finding which posited that backups make adequate provision for the platform as they enable digital records to be copied and stored in different locations to make it possible to easily retrieve data in the event of a system failure, emergency or unforeseen disaster.

Disaster planning

One respondent stated disaster preparedness is part of one long-term digital preservation plan. Disaster response and recovery planning remain one of the most important components of the preservation program in digital repositories (Frank and Yakel, 2013). Planning for unforeseen disasters, risk management and mitigating disasters are activities that may arise from real or perceived/anticipated threats to any collection (Altman *et al.*, 2009; Aikin, 2007). Disaster planning ensures that institutions maintain trusted digital repositories. This is in line with a study by Frank and Yakel (2013) which reported that repositories were engaging in disaster planning activities for the sole purpose of obtaining

trusted digital repository status. However, while a certain amount of preservation elements can be useful in disaster planning, some kinds of disasters might be out of the control of the repository which, therefore, requires mitigating loss of data (McDonald and Walters, 2010).

Frank and Yakel (2013) also asserted that repositories were reluctant to reveal or share part of the disaster preparedness plan and its documentation. This was similar to what was experienced in this study as the respondents in the institution with disaster plans were not willing to share further details or documentation. Although Frank and Yakel (2013) discovered that none of the institutions surveyed had ever used their disaster planning documentation, Schmidt (2010) observes that the occurrence of a major disaster at an institution is relatively inevitable and it is just a matter of time. Therefore, this reluctance to share details is seen as a security measure pertaining to active documentation.

Other strategies/plans

Other plans mentioned by the respondents are policy formation to deal with digital preservation-related problems and networking/outsourcing. One of the respondents mentioned that their institution is currently in the process of working on a plan to come up with a digital preservation policy that will solve problems like access control. Another respondent mentioned networking as one of their digital preservation plans which involves having access to contacts to help solve problems related to required maintenance of equipment. Interview responses state that elements like backup and metadata are not currently included in their plans (although three intend to include metadata).

The findings reveal that currently there are inadequate strategies or plans in place in the institutions for the long-term preservation of IK resources. In institutions where more than one person was interviewed, some of the respondents had no idea of what plans were in place which conflicted with the understanding of their colleagues.

Digital preservation policies

The findings also show that the institutions do not have policies in place to guide the digital preservation of IKS. However, one respondent was aware of the National Policy on Digitization. The general lack of awareness of the policy came as a surprise because the IKS project is part of the NRS implementation and the IKSDCs have played key roles in the recording and handling of most IK digital materials. These IKSDCs, therefore, do not currently have any digital preservation policy to guide the acceptance of digital materials, on digital preservation strategies or life-cycle management. As per the problem statement set out earlier in this paper, this situation is not in line with the information management framework emphasis on the importance of factors such as structures, policy procedures, systems and the need to ensure that there is a strategic plan in place for digital preservation (International Records Management Trust [IRMT], 1999).

The findings are concomitant with previous research studies on the lack of required standards and policies on managing digital materials (Kalusopa and Zulu, 2009; Ezema and Ugwu, 2013; Gbaje and Mohammed, 2013; Mutula; 2014; Masenya and Ngulube, 2019;). The lack of standards and policies was also seen at both the national and institutional levels (Kalusopa and Zulu, 2009; Keokapa, 2010; Ngulube, 2012; Masenya and Ngulube, 2019). Studies by Kalusopa and Zulu (2009), Keokapa (2010) and Gbaje and Mohammed (2013) revealed a lack of policies and specific guidelines on the preservation of electronic records in most African institutions and organizations. This study's findings also reaffirm the assertion of Pennock (2008) that issues regarding the development of sustainable digital preservation policies are largely unexplored. The absence of established standards, policies

and procedures continues to be one of the main issues faced in digital preservation in academic institutions in South Africa (Masenya and Ngulube, 2019).

The National Policy on Digitization of Heritage Resources, which most of the respondents were unaware of, is not being adopted or implemented to manage IK. While this study acknowledges the fact that these institutions do not have their own, or follow any specific digital preservation policy, it is important to formulate a national policy to guide the digital preservation of IKS, and this can be adopted at the institutions. This policy specific to IK should expand on the existing National Policy on Digitization of Heritage Resources and the 2004 IKS Policy. This is important because both policies do not specifically address the digital preservation of IKS. This would go a long way to achieve the goal of long-term preservation of digitized IKS so the efforts being put in the collection now will not be wasted in the future and to prevent the waste of scarce resources on recapturing lost data. This agrees with other research that found when few people are knowledgeable or aware of national policies regarding digital preservation, implementation of these policies is a major challenge (Adu, 2016).

This study also revealed that because there were no specific policies in place for the digital preservation of IK, respondents felt no actions were being implemented. However, some of the respondents feel that because the IK collection is part of a national project, there is no need to have a digital preservation policy at the institutional level. Only one of the respondents acknowledged the importance of having an institutional digital preservation policy and stated that the policy under development will be in line with the national policy. The respondent was asked further questions about the policy and its implementation but was unable to do so.

Strategic document/policies that support digital preservation

Through the interviews and content analysis, the *Indigenous Knowledge Systems policy* (2004), *National Policy on Digitization of Heritage Resources* (2010) and *Managing Digital Collections: A Collaborative Initiative on the South African Framework* (2010) were identified as key documents. The *National Archives and Records Service Digitization Strategy* (2013) is another important document that was analyzed.

The IKS Policy was approved by Cabinet and adopted by the South African Government in 2004. The policy is designed for the recognition, affirmation, development, promotion and protection of IKS in South Africa. The policy comprises four key areas of IK development: affirmation of African cultural values in the face of globalization; development of services provided by IK holders and practitioners; contribution of IK to the economy; and integration of IK with other knowledge systems. While all these four key areas are important, the second and third areas are more notable because they aim to contribute toward the improvement of poor health and alleviating poverty. The IKS Policy is designed for integration with other national policies and legislation in South Africa. Among other things, the IKS policy encourages the development of a mechanism for Recording of IK by the IK holders; Minimum standards for benefit sharing; Agreement on public domain declaration of knowledge; and Agreement on certification of IK holders and their IK rights. The policy document recommends the establishment of appropriate regulating mechanisms to guide the development of protocols and codes of conduct for the documentation and use of IKS resources.

The National Policy on Digitization of Heritage Resources is a draft policy framework released for public review in August 2010. Prior exposure to issues related to digitization through the Digital Innovation South Africa (DISA) project made it necessary to come up with a best practice guideline that prompted the formulation of the National Policy on

Digitization of Heritage Resources. The National Policy on Digitization of Heritage Resources was drafted by the DAC in 2010 (DAC, 2010). The scope of the policy covered the digitization of heritage resources for preservation, the management of ownership and access. This policy was also necessary owing to a review of policy and legislation relating to digital preservation in South African under the aegis of the UNESCO Digital Preservation Project. The policy framework aims to guide projects in South Africa with a specific focus on the digitization of heritage resources. The National Policy on Digitization of Heritage Resources, therefore, comprises a set of 27 policies.

Policy 1 of the national policy framework covers "Getting Digitization Done" which emphasizes the fact that the stakeholder institutions are required to take urgent steps to create their own digitization strategies. The policy does not provide a general strategy template or give a specific set of rules regarding the national priorities to which the institutions must strictly adhere to. Rather, it gives the institutions the autonomy to create their strategies which would depend on their stakeholders and the public; and fit within the national standard. The National Policy on Digitization of Heritage Resources (2010, p. 15) also makes it clear that:

> No matter how much attention is paid today to digital preservation and to the protection of archives and repositories against all kinds of threats, the success of this shift to electronic and digital records is premised on the importance that future archivists, librarians, governments, repository managers and curators will place on the continuity of these digitization initiatives. Whereas the original, physical objects may be retained for long periods with minimal conservation, digital records will, for the foreseeable future, require regular maintenance and upgrading. Given that this is a common problem that impacts on every custodian, a common set of principles must be identified and implemented as part of a national preservation strategy.

This statement places the responsibility of coming up with the appropriate policy on the institutions. It is a standard that should form the blueprint for the formulation of policies for institutions where the digitization of heritage resources is taking place. Its policy statement also highlights topics such as ownership, copyright and foreign funding; access; financing digitization and relationship to other government bodies; repository management; capacity and institution building; and creating support systems for digitization. Although the framework is not a one-size-fits-all policy, it encourages the institutions to develop their respective policies within this national standard. Policy 27 recognizes that owing to the lack of local guidelines on digitization which affects the quality of digital heritage projects, a Digital Body of Knowledge must be "developed and maintained by the digitization community as the representation of good and best practices within the sector, covering all situations both technical and non-technical" (National Department of Arts and Culture 2010, p. 60).

Despite the recommendations in the policy framework, to date, the institutions have not been able to develop their policies accordingly because of challenges such as a lack of clarity on the responsibility of the repositories to manage digitized IKS. Some of the respondents assumed that the responsibility to manage these collections should be borne by the DST. The findings of this study are similar to an earlier Ugandan study by Luyombya (2010) which found that a lack of proper structures at the institutional and managerial levels is a barrier to the complete implementation of policies (Luyombya, 2010). The slow implementation of preservation policies is one of the main challenges to digital preservation (Masenya and Ngulube, 2019).

Managing digital collections: A Collaborative Initiative on the South African Framework document (NRF, 2010) is another strategic document that places the burden of compliance on institutions. The framework was developed to provide a set of high-level principles for

proper planning and management of the digital collection life cycle in South Africa. The document states that institutions should ensure that their digital repositories are OAIS compliant and recommended the adoption of the seven Trusted Digital Repositories attributes as a useful and informative guide. The Framework covers topics such as community practice; copyright and related matters; collection development; digital objects; metadata; infrastructure; preservation; project planning; collections management, quality assurance and evaluation.

It places the responsibility of developing an appropriate policy on institutions but recommends that this should be done within certain national guidelines and recommends that digitization/digital preservation programs should reflect and conform to standards and policies of the digital preservation community to the extent possible. This document also recommends the development of a prioritized set of objectives to accommodate the short-term and long-term growth of the program. Digital preservation program managers are encouraged to share regular updates on their progress to identify challenges and successes in the delivery of digital collections to users.

The National Archives and Records Service Digitization Strategy document was formulated in line with the National Policy on Digitization framework (DAC, 2013). The National Archives played a key role in both the DISA project and the development of the national policy framework. This strategy complies with Policy 3.3 of the National policy framework which states that:

> [. . .] custodian institutions need to create a digitization strategy in line with this policy and to actively engage in digitization initiatives. An environment for such initiatives is provided in terms of the development of institutional digitization strategies which should include the recording and management of rights.

This initiative by the National Archives and Records Office is exemplary and emphasizes the need for institutions to act in accordance with the provision of the national framework to ensure that they are responsible for formulating policies that will preserve their digital collections.

Proposed framework for digital preservation of IKS in South African repositories

The study has argued that there is a need for digital preservation policies in Africa to ensure that institutions attain the status of trusted digital repositories. As revealed in the study, most African countries do not have well-established digital preservation policies for the management of heritage materials and IKS. The findings of this study revealed that there are no institutional digital preservation policies to guide the IKS digitization project. It also revealed that there are no solid digital preservation plans and policies, and the repositories are, therefore, not OAIS compliant. This means that it is vital to have a standard framework for the digital preservation of IKS to ensure its long-term preservation and to secure its integrity, authenticity and future access in academic institutional repositories. Figure 1 is a depiction of the proposed digital preservation framework for IKS in South Africa.

Explanation of the framework. The proposed framework explains the importance of and the connection between certain processes and policies in the management of IKS. It also explains what the South African government should do to ensure the long-term preservation of digitized IKS in repositories at both national and institutional levels. This will ensure that the repositories are OAIS compliant and that they maintain the standard of a trusted digital repository. Functions of the OAIS Reference Model have been criticized as being impracticable (Cunningham, 2008; Ward, 2012; McDonough, 2012; Bettivia, 2016; Wilson, 2017; van Kemenade, 2020). The Preservation Planning entity of the model was also

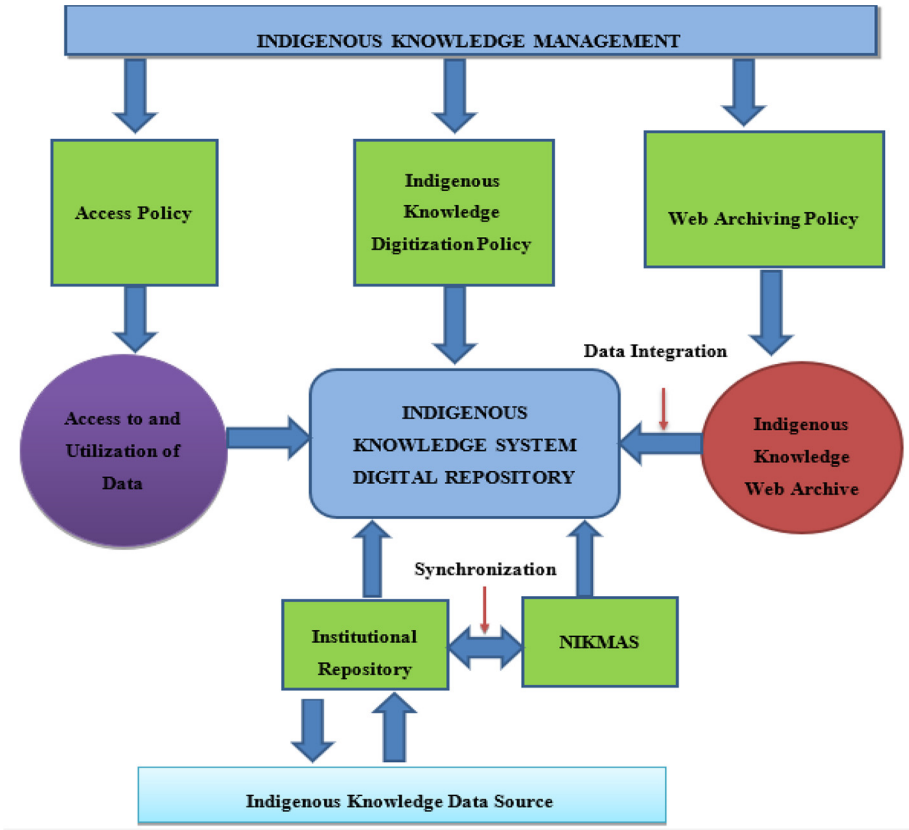

Figure 1.
Proposed digital preservation framework for repositories in South Africa

criticized by repository managers because in reality archives' operations are not as "clean" as the OAIS Reference Model authors view it (Ward, 2012). While acknowledging the limitations of the OAIS model, Lavoie (2014, p. 30) emphasized that "the limitations are not intrinsic to the OAIS reference model itself, but rather to the nature of the work that builds upon OAIS, and how the reference model is perceived and applied." With the issue of practicality in mind, the proposed model incorporates selected components and includes a workable Web-archiving component.

The proposed framework is based on the understanding that there is a need to ensure that digital archives are OAIS compliant and that they also attain and maintain the status of a trusted digital repository. Therefore, it is based on the OAIS Reference Model and its Web Archiving Life Cycle Model that sets out steps for data capture, organization, storage and preservation (Pennock, 2013). Components of these models inform the framework for the digital preservation of IKS and other digital assets in digital repositories in South Africa. The components of the IK framework are IKS Management, Data Sources, the IKS National Digital Repository, Web Archive and Access Policy.

Indigenous knowledge systems management. The IKS Management component in Figure 1 covers some key sub-components, which are essential throughout the life of the IKS development project and which should be put in place before or at its early stages. These

sub-components comprise digital preservation plans, the IK digitization policy, general digital preservation policies and the access policy.

The study revealed that the institutions have inadequate strategies or plans for the long-term preservation of IK resources. There is a need to have plans for metadata, backup and disaster preparedness in place as part of digital preservation. Although there is a National Policy on Digitization of Heritage Resources, it is not being used to manage digitized IK in these institutions. Policy documents were reviewed through content analysis but none of these policy documents specifically covers the digital preservation of IKS. As stated previously, although the IKS Policy recognized the importance of and the need to promote and preserve IKS in South Africa, the policy framework does not include guidelines on digitization or digital preservation of IKS. Lack of policy is a common problem in Africa, but there is now an urgent need to have a digitization policy that covers the preservation plans specifically for digitized IKS [International Records Management Trust (IRMT), 1999].

An IKS digitization policy should be built upon the *National Policy on Digitization of Heritage Resources* framework and must include detailed instructions on specific issues such as the metadata standards that should be adopted across all the projects. The national policy should also be adopted at the national and institutional levels to make provision formats; storage; backup, refreshing and emulation; access; archival description; institution and staff responsibilities; disaster planning and contingency plans; long-term technology usage; funding, data ownership, intellectual property rights (including copyright); and policy implementation of the policy, among relevant subjects. As part of this policy, access needs specific to digitized IKS is a key issue that should be clearly outlined It should also identify issues and conditions related to access, use and reuse of the digital materials (including the archived Web).

The Web archiving policy should be incorporated in the digital preservation policy to cover mission statement and scope, selection, acquisition, descriptive metadata, presentation and access, maintenance, staffing and training and collaboration needed to harvest online material.

Indigenous knowledge data source. The IK data source represented in Figure 1 is analogous to the Ingest function of the OAIS Reference Model. The study revealed that repositories collect data from the knowledge holders in the communities, but most of the data collected by the IK recorders are uploaded to the National Indigenous Knowledge Management System (NIKMAS). The IK Data Source builds upon the ingest functional entity of the OAIS. Therefore, it is recommended that the repositories should make efforts to collaborate with the DST to ensure that data collected from the source are ingested into their digital repositories. Figure 1 also shows that the data captured should be synchronized with the NIKMAS to store them in the Indigenous Knowledge System Digital Repository. An updated IKS policy framework would be necessary to address the integration of the captured IKS data under the NRS project managed by the National Indigenous Knowledge System Office (NIKSO). Although this function appears simple, it is a complex activity that requires IKSDC staff to be proactive in ensuring that source data is received, processed and ingested into their institutional repositories before they are then integrated with other digital materials.

Access. The study established that access to digital materials is currently limited to a large extent. This component of Figure 1 represents access to IK digital materials in the repositories. The figure uses a single access point to represent the entire access interface because of the nature of data collection and the involvement of the DST in the IKS project through the NRS project. The user of IKS material in any of the participating institutions has access to the national digital repository through a unified online platform without

having to log on to the website directly. For institutions with an IKS Special Collection website different from those uploaded on the NIKMAS, there should be a single access point for both sets of digital resources within the same repository [2].

Indigenous knowledge systems national digital repository. This study established that the IKSDC institutions do not have policies in place to guide the digital preservation of IKS. This also extends to a lack of policy for Web archiving as a preservation option for web content. This framework component, therefore, recommends a policy for the preservation of digital materials, which incorporates a policy on the Web archiving of IKS websites. The issues related to access, use and reuse of the digital materials and the archived Web should be identified in such a policy. The policy should outline Web archiving methods. A policy specific to the needs of the digitized IKS is also required. The archival storage function of the OAIS Reference Model relates to the management of the long-term storage and maintenance of digital materials. The IKS Digital Repository in the figure represents part of the archival storage function. The data collected from the source ingested into the institutional repositories should be stored within the IKS digital repository (database). This central repository should also include the archived Web, which should be integrated with the digital collection for long-term preservation and research use in the future. The institutional repositories should rely on the central repository for archival storage and this should be spelled out in the preservation policy.

This study also established that most of the institutions do not use standardized metadata to describe IK data. The lack of a policy at the national and institutional level to guide the digitization project has made the proper application of metadata difficult. The proposed framework identifies the need for effective data management, which reflects a connection between the repositories and NIKMAS. It is, therefore, recommended that there should be a national standard on metadata, which should be adopted in the management of data at the institutional level. The repositories should be more involved in the data management, and this includes using standard descriptive metadata to identify the collected materials before uploading them into their repositories or the NIKMAS. Updating the descriptive metadata should be a shared responsibility; it should be uniform across the institutions to ensure ease of retrieval and long-term preservation. Training staff at the institutional level would make it easier to conform to a uniform metadata system that would aid effective storage, retrieval and sharing of digital IKS material.

Web archive. Because digitization of IK in South Africa is done with the hope to document, preserve and ensure access to IK over time, the NIKMAS focuses on access to IKS. Digitized IK related to traditional medicine, l plants and food considered to be at risk of misappropriation or biopiracy are captured and uploaded to NIKMAS. The IK Web archive in Figure 1 represents the repository where the archived websites should be stored as the deliberate product of a process built on the Web-archiving policy. A Web-archiving policy helps define the mission and scope, selection, acquisition, descriptive metadata, preservation and access, maintenance and other important functions that would make it possible to have a standardized archive that is truly integrated with the IKS digital repository. These processes would lead to data capture and storage of the crawled web pages in the Web archive.

The Web archive would be the main storage repository for harvested web contents and should be informed by the Web archiving policy. The data capture component of the Web Archiving Life Cycle Model includes making decisions on how to capture or crawl data, the frequency of doing so and the types/formats of files that should be archived. In line with

this, it is recommended that data should be captured according to the website's update schedule to maintain a current digital archive. The websites should be crawled multiple times a day if significant changes are made that frequently. Standards for data capture should be included in the Web-archiving policy.

Figure 1 also shows the integration of the IKS Web archive with the IKS national digital repository to enable a single access point. Integrating the Web archive with the IKS digital repository is a very important component of the framework because there is a demonstrated researcher need outside the IKSDC repositories.

Conclusion

The study established that no concrete digitization plans are guiding the NRS IKS digitization initiative at either the project or individual institution levels. This study revealed that metadata, backup and disaster preparedness plans to support long-term digital preservation are in place in some of the repositories. Other plans mentioned by some respondents include those for networking, outsourcing of preservation tasks and policy formation. However, in general, there is low awareness by the IKSDC staff of policies and plans.

The strategic documents or policy frameworks supporting digital preservation were also reviewed. This study revealed that the institutions do not have any digital preservation policy in place to guide the preservation of the digitized IKS. Although the respondents were also unaware of any policy that caters to the digital preservation of IKS, they admitted the importance of having digital preservation policies. Even though the National Policy on the Digitization of Heritage Resources is an important policy document that lays the foundation for the development of policies within a specific standard, the document is not being adopted or implemented at either the institutional or national level. This study suggests that the situation could be mitigated by the use of the OAIS model to create an overall framework to help manage all of the components necessary to develop and implement the policies needed to ensure digital preservation of and access to IKS over the long-term and to ensure that all parties are working to the same standard with the same expectations and goals.

Notes

1. NIKMAS is a "semantic digital repository with custom-developed metadata schemata and a sophisticated security model to protect, preserve IK, an advanced semantic search engine, a sophisticated catalogue system and an overarching integration architecture that combines the subsystems into a coherent, fit for the purpose system." (Seleti, 2015).
2. The project is currently a work in progress. For example, the website (https://nrs.dst.gov.za/) which is supposed to be the access point for the digitized IKS was down at the time this paper was being written. An archived version of the website can be assessed on the Wayback Machine https://web.archive.org/web/20190118170538/nrs.dst.gov.za/

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