Routledge
Taylor & Francis Group

ARTICLE

Check for updates

Institutional readiness for digital archives management at United States International University-Africa

Bonface Ochieng Odhiambo

School of Information Sciences, Moi University, Eldoret, Kenya

ABSTRACT

This article seeks to assess the readiness of the United States International University-Africa (USIU-A) to manage digital archives with a view to proposing strategies to enhance digital archives management at the institution. The study was informed by the Records Continuum Model, the Open Archival Information System Model and the Digital Curation Centre Lifecycle Model. A case study was used as part of a mixed-method research approach with a sample size of 120 respondents drawn from a population of 6937 by using systematic random sampling and purposive sampling techniques. Questionnaires, interviews, observation and documentary review methods were used to collect data. Qualitative and quantitative data was presented and analysed thematically. The study revealed that the infrastructure required for digital archives management was not up to standard. Moreover, a myriad of challenges were unearthed which were found to potentially inhibit the management of digital archives. The study therefore concluded that although USIU-A had taken steps towards digital archives management, more still needed to be done for the institution to effectively manage its digital archives.

Background information

The level of interest and enthusiasm in digital archives management is notable all around the world. Every institution arguably owns material worth digitising.[1] Digital information is all around us, and information is either being reformatted from traditional formats or being born digital. The potentials and possibilities afforded through managing, preserving and sharing digital repositories have led to many organisations undertaking digitisation projects. Academic institutions are particularly interested in these issues and recognise the need to preserve and provide access to the wealth of knowledge generated in their institutions.

In spite of these widespread interests, an analysis of the initiatives undertaken by different organisations reveals two important issues. Firstly, there is no single model of best practice for digital archives management that could be adopted across all firms.[2] Secondly, the challenges of managing digital assets are numerous and constantly

---

CONTACT Bonface Ochieng Odhiambo bkodhiambo@yahoo.com School of Information Sciences, Moi University, P.O. Box 55463-00200, Eldoret 30100, Kenya

evolving.[3] Notwithstanding these observations, there is consensus that effective digital management is reflected in the scope, priorities and resources an organisation develops and adopts to explicitly guide its decision and practices in digital archives management.

This organisational commitment should address among other things the acquisition, records creation, description, storage, access and security of digital archives. These should be enhanced in a structural workflow system by appropriate digital archives management policy, adequate financial resources, appropriate hardware and software, and qualified human resources.[4] With the development of information technology, the preservation of archival materials and special collections has moved from analogue to digital and digitisation has become a global trend. Archivists and record managers therefore need to acquire technical skills and competencies that are necessary for them to remain relevant in the digital cyberspace.[5]

Statement of the problem

Unfortunately, digital archives management in sub-Saharan Africa is growing at a rate slower than in other regions because of a myriad of challenges and barriers. Asogwa's research revealed that some of the impediments to digital archiving in sub-Saharan Africa in this environment of technology include, firstly, the dynamic nature of software and hardware, which has created much pressure on archival institutions because preservation of digital archival collections centres on the interim mechanism for storing the digital information, migrating to new forms and providing long-term access; secondly, the inadequate funding to train African archivists in digitisation and preservation of electronic formats and to frequently upgrade the hardware and software; thirdly, the inadequate skills in information technology in Africa, which results in too many traditional archivists being conservatives and developing a phobia of computers; and finally the inadequate technological infrastructures.[6]

In further qualifying the slow growth of the digital archiving narrative, Kanyengo expounds that challenges such as weak legislative and organisational infrastructure, inadequate information and communications technology (ICT) skills and competences, low level of ICT literacy, political instability, poor funding, issues in backing up records, loss of security and privacy, legal issues and legislative constraints, problems of reliability and authenticity, and finally technological obsolescence were administratively induced problems in African colonies hence limiting the growth of digital archives management in the continent.[7] At the time of independence many of the English-speaking African countries modelled their archival laws and legislations on the old Canadian archival act, which unleashed terrible confusion and consequently weakened archives and records management practices in the continent. This has been aggravated by the fact that records managers and archivists lack the fundamental skills and competences that would enable them to handle records in an electronic environment in most African countries.[8]

For instance, in Zimbabwe, Sigauke and Nengomasha established that undervalued staff, lack of exposure to modern digitisation technologies, undocumented policies governing digital archiving, and insufficient funds were the major limitations hindering the implementation of digital preservation at the National Archives of Zimbabwe.[9] In further analysis, Wamukoya and Mututa reported that, apart from Mauritius, South

Africa, Botswana, Namibia, the Seychelles, Tanzania, Swaziland and Lesotho, the sub-Saharan African countries faced serious challenges of poor infrastructure, low-skilled societies, low education levels, high cost of Internet access and lack of ICT awareness to effectively manage digital archiving and recordkeeping.[10]

Notably, most of the higher institutions of learning in sub-Saharan Africa have inherited the above-mentioned numerous challenges since the statistics show that only 35% of the institutions have developed in-house guidelines on how digital files and records should be managed and that 65% of the institutions are well aware of the risks associated with the inadequate digital preservation measures but have not taken any appropriate measures to enhance the management of digital archives.[11] For example, at the University of Zambia, there are as yet no strategic plans on how to interact with digital information resources.[12] While at the University of Nigeria, Eke reported that the institution faced similar challenges that range from legal aspects, intellectual property rights, inadequate funding, security for digital information and records, technophobia, poor Internet connectivity affecting the rate at which files are uploaded, difficulty in digitising some materials, difficulty in editing digitised works to conform to the standard set for such materials, and finally unavailability of required materials, especially academic works.[13]

Generally, despite the phenomenal growth of digital content in the universities of the Eastern Africa region, those universities face challenges such as the absence of policies governing management of digital content, lack of awareness of the need to manage electronic records over time, and absence or low level of allocation of financial resources towards digital archiving and preservation.[14] This trend is likely to continue to the extent that sub-Saharan African countries and academic institutions that are not taking preparatory measures in handling the situation will be left without efficient and effective procedures for managing and accessing the digital archives and records in the electronic environment.

However, today, a number of universities in sub-Saharan Africa are embarking on integration of technology in their operations. This is serving as a framework for improvement and development in digital archiving and preservation, especially in a situation where attention is drawn to the scholarly contents and ways of digitising and preserving them. Academic institutions should therefore establish, promote and maintain archives services within academic libraries to facilitate quality educational, learning and research services,[15] though at present there are limited documented reports on assessments of institutional readiness for digital archives in the Kenyan context, and more so in institutions of higher learning. Notable exceptions include the works of Kemoni, Mutula, Ratanya, Dlamini and Synthman.[16] But, even then, these works fail to focus on solutions that address the needs of all institutions to fully prepare for the digital archives initiatives. The authors therefore indicate that it is necessary for individual institutions to identify strategies that best fit their needs and capacity, founded on evidence-based decisions. Ensuring protection of information of enduring value for present and future access as well as maintaining the institutional memory is central to the United States International University-Africa (USIU-A).

USIU-Africa is the oldest private university in Kenya, founded in 1969 as part of the USIU system, headquartered in San Diego. The university is located in Nairobi, Kenya, approximately 12 kilometres from the city's business centre. Fourteen undergraduate programs are offered, eight Masters and three doctoral programs, in six academic schools – the School of Business, the School of Science and Technology, the School

of Humanities and Social Sciences, the School of Pharmacy and Health Sciences, the School of Communication, Cinematics and Creative Arts, and the School of Graduate Studies, Research and Extension. In addition to WASC Senior College and University Commission (WSCUC) accreditation, the university has also been accredited by the Kenyan Commission on Higher Education since 1999.

In recent years USIU-A has initiated formal digital preservation and archival programs to preserve its cultural, intellectual and scholarly resources both digitally born as well as material that is converted from traditional to digital formats. As a consequence, USIU-A digital archives management, as many others, remains largely experimental and open to a myriad of risks. In such circumstances, it is necessary for USIU-A to identify strategies that best fit its needs and capacity founded on evidence-based decisions. It has been demonstrated that digital archives management has the best chance for initial and sustainable success when it is adequately planned for.

This calls for USIU-A to develop the required infrastructure for establishing efficient platform and strategies that would enable the institution to develop and maintain appropriate digital preservation, archiving and access structures, bearing in mind that no one solution has been found that addresses the needs of all institutions. It therefore becomes necessary to have an investigation of the infrastructural readiness of the institution to manage digital archives.

Research questions

In conducting this study, the research was informed by the following research questions:

(i) How does USIU-A generate, describe, store, secure and provide access to the digital archives?
(ii) How do the institutional policies and regulations support a commitment to digital archives management?
(iii) How ready is the USIU-A community for digital archives management in terms of its financial capacity and equipment and facilities?
(iv) Does USIU-A have sufficient staff with the necessary knowledge, skills and competencies to manage its digital archives?
(v) What factors hinder the effective management of digital archives at USIU-A and how can they be mitigated so as to enhance an effective digital archives management program?

Theoretical framework

This study embraces a records continuum perspective. It also considers and builds around the six principles of the Open Archival Information System (OAIS) Model, and finally it is underpinned by the Digital Curation Centre (DCC) Lifecycle Model.

Records continuum perspective

A records continuum approach is embraced as fundamental in this study as it provides a multi-dimensional view of records creation in the context of social and institutional

activity, their capture into the records systems, description, organisation within the framework of institutional archives, and pluralisation as collective archives.[17] The approach defines new orientations to virtual archival dynamics within a continuous custody.

In addition, the significant role for today's digital archival institutions is to help identify and establish functional requirements for digital recordkeeping that enable a more systematic approach to authentication.[18] The theory therefore enables the digital archival system to incorporate various perspectives, various ways and multiple different access points for seeing and understanding the archives and recordkeeping process as a fluid and dynamic continuum-based activity.

Open Archival Information System (OAIS) model

This study was built around the six high-level functional components of the OAIS model which, taken together, constitute the mechanisms by which the digital information is preserved and made available to a designated community.[19] These components include firstly the ingestion or the set of processes responsible for accepting information submitted and preparing it for inclusion in the archival store; secondly, the provision of the portion of the archival system that manages the long-term storage and maintenance of digital materials entrusted to the OAIS system; thirdly, the maintenance of the databases of metadata identification and description of the archived information in support of the OAIS's finding aids and the administrative data supporting the OAIS's internal system operations, such as system performance data or access statistics. The fourth component maps out the OAIS's preservation strategy, as well as recommending appropriate revisions to this strategy in response to evolving conditions in the OAIS environment; while the fifth component manages the processes and services to ensure easy location, retrieval and access of information by users upon request of materials stored in the OAIS's archival store. Finally, the sixth component manages the day-to-day operations of the OAIS, as well as coordinating the activities of the other five high-level OAIS services as it serves as the central hub for the OAIS's internal and external interactions by communicating directly with the five other OAIS high-level services that are ingestion, archival storage, data management, access and the OAIS's external stakeholders such as producers, consumers and management.[20]

Based on the OAIS's six components, the model provides a common understanding of what it is that archives do when they preserve digital records. At the same time, it also gives important impulses to move towards greater standardisation in the field of digital archiving, including the development of criteria and procedures to analyse and assess digital archival and dissemination practice. These provisions are very important for preparedness towards digital archives management. The components act as an abstract and highly generic conceptualisation of a preservation that acts as a blueprint that can be used to build an actual digital archival system.[21] This concretisation has been undertaken by initiatives creating sets of concrete criteria to measure the trustworthiness of digital archives.

In summary, the OAIS's six high-level functional components guided this study by providing the guidance and standards of institutional readiness for digital archives management. However, they do not indicate how institutional readiness can be achieved in the institution. They therefore could not be relied upon to take the study to its conclusive stage.

As a result, the Digital Curation Centre Lifecycle Model was adopted to address the last aspect of the research problem and underpin the study which is the strategies that the institution should use to fully achieve its readiness towards digital archives management.

Digital Curation Centre (DCC) Lifecycle Model

To fully anchor this study, the DCC Curation Centre Lifecycle Model (DCC), which offers a graphical high-level overview of the lifecycle stages required for successful digital archiving, was adopted. The model, which applies to simple digital objects and complex digital objects, supported this study through its three key components, as explained by Sarah Higgins. These components include, firstly, the full lifecycle actions that describe and represent information, plan for preservation, maintain appropriate community activities, and participate in the development of shared standards, tools and suitable software, and promote curation and preservation throughout the curation lifecycle.[22] Secondly, the sequential actions that conceive and plan the creation of data, including the capture method and storage options, create data, preserve metadata, receive data in accordance with documented collecting policies from data creators, other archives, repositories or data centres, and if required assign appropriate metadata. The sequential actions also ensure that they evaluate data and select for long-term curation and preservation, transfer data to an archive, repository, data centre or other custodian, ensure long-term preservation and retention of the authoritative nature of data by adhering to authenticity, reliability and usability while maintaining its integrity and storing the data in a secure manner in adherence with relevant standards.[23] The sequential actions further ensure that data is accessible to both designated users and re-users on a day-to-day basis and that new data can be created from the original, for example by migration into a different format, or by creating a subset, by selection or query, and used to produce desired results, perhaps for publication.[24] And finally, the third component is the occasional actions that ensure the disposing of data which has not been selected for long-term curation and preservation in accordance with documented policies, guidance or legal requirements, reappraising the data which fails validation procedures for migrating data to a different format.[25]

Therefore, the study research questions clearly demonstrate the relevancy of the DCC Curation Lifecycle Model as its key components and principles provide a generic graphical high-level overview of the stages required for successful management of digital material from initial conceptualisation. The DCC principles can be used to plan digital archiving activities, to ensure sustainability of digital material, hence ensuring that the institution prepares adequately for digital archiving. Their application can help ensure that all necessary stages are undertaken, each in the correct sequence.[26] The model is useful as an institutional planning tool, it is adaptable to different domains and extensible to allow curation and preservation activities to be planned at different levels of granularity. It can be used to define roles and responsibilities, build frameworks of standards and technologies, and ensure that processes and policies are adequately documented. It identifies digital archiving actions which are applicable across the whole digital lifecycle, those which need to be undertaken sequentially if curation is to be successful, and those which are undertaken occasionally, as circumstances dictate.

The model helps institutions like USIU-A which are in the process of getting ready for digital archives management to identify risks to their digital archives and plan management strategies for the successful curation of these archives. In regards to this study, the DCC Lifecycle Model acts as a benchmark for effective institutional digital archives management.

Methodology

This study adopts a case study method within a mixed-method approach. Methodological triangulation was used to collect data, where the Digital Repository Librarian, the Registrar Student Affairs and the Deputy University Librarian were interviewed, while the archives users and staff were issued with questionnaires. To complement the data collected, observation method and documentary review were also used.

Since the study was both qualitative and quantitative in nature, it was justifiable to randomly select the respondents. To achieve a reliable and accurate representation, the study used a random sampling technique based on the study population. The sample population was based on Yamane formula. It is a simplified formula of proportions that takes into account the acceptable sampling error making it easy to use. The formula for calculating the sample size is:

$$n = \frac{N}{1 + N (e)2}$$

Where n = sample size, N = study population, e = tolerance at preferred level of confidence, take 0.1 at 90% confidence level. Note that e = 0.1 was the desired level of precision selected because the population was too large. Thus the obtained sample size was 99 and 21 for the archive users (both undergraduate and postgraduate students, external researchers, faculty and alumni) and staff respectively, as illustrated in Table 1. In-depth interviews were held with three key informants purposively selected, to predominantly help in obtaining rich insights and personalised data on the phenomena under study from the participants' experiences. They were also useful in comparing and validating responses obtained from the questionnaires. In addition, they provided a good response rate as well as opportunities for further probing.

Of the 99 questionnaires administered to archives users, 79 were filled and returned whereas 18 were filled and returned from the 21 administered to library/archives staff. This resulted in a response rate of 81%, which was considered adequate for data analysis. In conformity with provisions of the mixed-methods analysis, the data analysis involved analysing the data from both the qualitative and quantitative approaches used in the study. This strategy of the data analysis was driven by the overall purpose of

Table 1. Sample size by respondents' category.

Category name	Total population	Number of sample size
Archives users	6910	99
Library/archives staff	27	21
Total	**6937**	**120**

using mixed methods such as triangulation. Consequently, the data was collected and analysed concurrently.

Presentation of findings

This section is organised around the research questions. The themes covered are arranged in the following order: analysis of the existing workflow system for digital archiving; existence of digital archives management policies and regulations; infrastructural readiness for digital archiving and challenges and strategies for digital archives management.

Analysis of the existing workflow system for digital archiving

Generation of digital archives

To increase the validity of the study, the interviewees were asked to explain how the institution generated its digital archives. The Deputy University Librarian, the Digital Repository Librarian and the Registrar Student Affairs stated that 60% of the digital archives are records that have been digitised, while 40% of the archival materials were created as digital records during the processes and operations of the institution. The Digital Repository Librarian further revealed that USIU-A's digital archives and records include: institutional policies and standards operating procedures, conference proceedings, research abstracts, refereed journals, USIU-A's newsletters, strategic plans, files of the university's senior management organs, various reports of accreditation visits, annual budgets and audits, records of admissions, records relating to institutional research, university relations, records of departments, for example minutes, reports, course outlines, faculty vitae and so on.

Observation of digital record generation procedures revealed that only one scanner was being used to digitise materials, and the scanner was not efficient as it could take three minutes to scan a single page, which does not really provide room for digitising large quantities of materials. The scanner (Figure 1) is only meant for small office duties.

Following this observation, the researcher deduced that the process of digital archives generation and/or creation was undermined given that much of the digital archives are generated by the digitisation process only. A single scanner is not sufficient for a large quantity of work hence it limits the amount of the materials being digitised.

Description of digital records

In relation to the description of the digital archives, the Digital Repository Librarian and the Registrar explained that they use the inbuilt Dspace metadata module as a platform to guide them in describing their digital records once they have been generated or created. The Digital Repository Librarian explained the scenario as follows:

> Most of our digitised or already digital records are described by creating metadata through the Dspace item metadata module. The most elements that we concentrate on during metadata creation include the creator of the record, which is the author, the year of creation, and keywords that are derived from the subject of the records (Digital Repository Librarian)

Figure 1. Size and capacity of EPSON GT-1500 scanner used for digitisation.

One of the key determinants of institutional readiness towards digital archives management is proper description of digital archives, therefore the elements should be well integrated with the digital archives management software.

Storage and security of the digital archives

In terms of storage, the data obtained shows that digital archives have been stored in servers and hard drives as backups so as to avoid a disaster that once arose in the institution in 2016 when the server failed and records were lost. However, the security of the digital archives seemed to be undermined. This was deduced from observation made on the server room that showed that it was not under lock and some of the archives were stored in individual staff portable hard disks, thus increasing the security risks for the materials.

Access to the digital archives

From the interview of the key informers, the study established that Dspace allows for searching based on communities, date, authors, title and subject which act as the metadata, hence allowing users to easily browse through the archives under limited access to some specific records. The Digital Repository Librarian observed that digital archives have been granted an open access status but the users are limited to 'read only' as a security mechanism where a URL link to the archives is provided on the institution's website.

To corroborate findings on generation, description, storage, security and provision of access to the digital archives, the archives management standard operating procedures (SOP) were reviewed. The review showed that in the context of USIU-A, electronic records which have research value are considered as archival materials (Section 1(F)). Further, section 5 of SOP describes the generation and storage of such materials as captured in Figure 2.

a) *Records on paper format will be digitized through scanning into digital images.*

b) *File formatting shall be done to the already digitized record to ensure that the digitized file is compatible with the storage medium. The file would either be formatted into JPEG, TIFF or PDF.*

c) *The metadata shall be created for the e-record so as to enhance easier retrieval.*

d) *Finally the e-record will be assigned a code and then stored in the storage medium*

Figure 2. Portion of section 5 of SOP describing the generation and storage of digital archives.

Existence of digital archives management policy

To establish the existence of a digital archives management policy, the respondents (the archives staff) were asked the following question: 'Does your institution have a formal (written) policy, procedures and guidelines that support digital archives management?' In response, out of the 18 archives staff, 12 (67%) indicated that the institution had a general policy that governed the management of archives. However, they were not sure if this policy covered the management of digital archives. Two (11%) members of the archives staff indicated that the institution had no formal policy at all and four (22 %) were not sure whether the institution had a policy or not. With regards to archives users (both undergraduate and postgraduate students, external researchers, faculty and alumni), the largest group, 31 of them (39%), were not sure if the institution had a formal policy governing the management of digital archives in the institution, while 30 (38%) thought that the institution had a formal policy and 18 (23%) thought that the institution had no formal policy, as shown in Table 2.

To corroborate these findings, the researcher asked to be shown the said policy. It emerged that indeed there was a policy in place which covered the management of digital archives. From this finding, it can be deduced that while a policy governing the management of archives in the institution existed, not all users were aware of its existence, which suggests the existence of gaps in the sensitisation efforts.

Table 2. Respondents' awareness of the existence of the digital archives management policy.

	Archives staff		Archives users	
Responses	N = 18	%	N = 79	%
Yes	12	67%	31	39%
No	2	11%	30	38%
Not Sure	4	22%	18	23%

Infrastructural readiness

Technological infrastructure for digital archives management

Concerning the ICT infrastructure, both the staff and the users were asked to rate on a scale of 1–5 (1–Strongly Disagree, 2–Disagree, 3–Uncertain, 4–Agree, 5–Strongly Agree) if the institution had the following ICT infrastructure for digital archives management:

Table 3. Respondents' rating of availability of ICT infrastructure.

| | RATINGS (1–Strongly Disagree, 2–Disagree, 3–Uncertain, 4–Agree, 5–Strongly Agree) | | | | | | | | | |
| | ARCHIVE STAFF | | | | | ARCHIVE USERS | | | | |
FORM OF ICT	1	2	3	4	5	1	2	3	4	5
Infrastructural hardware			■					■		
Internet connectivity to support digital archives management				■					■	
Enough storage medium			■						■	
Institution has backup and disaster recovery plan			■					■		

- hardware and software availability
- institutional backup and disaster recovery plan
- Internet connectivity

The staff rated availability of hardware, enough storage medium, institutional backup and disaster recovery plan at 3, while Internet connectivity was rated at 4. On the other hand, the archive users rated the infrastructural hardware, institutional backup and disaster recovery plan at 3, while they rated Internet connectivity and storage medium at 4, as summarised in Table 3.

In furtherance to the above, an interview with the Repository Librarian, who is in charge of archives, showed that the ICT infrastructure available at USIU-A includes stable access to the Internet, adequate personal computers (PCs) for staff, networked PCs (LAN), LAN connection to other LANs, Intranet and networked access points. He further indicated that Internet connectivity is particularly good and stable and, to top it all, the institution had a generator as an alternate power source in case of power failure. His response can be summarised as: the technological environment for digital archives management at USIU is commendable, both the required hardware and software are in place, Internet connectivity is good and the ICT department takes leadership in ensuring that the technological requirements are made available.

Human capacity for digital archives management

To ascertain the adequacy of the human resource, the staff were asked about their role in the management of digital archives. Over half of the staff (61%) indicated that they did not play any role while only 39% said they played a role. The involvement of only a handful of staff in the management of the digital archives could be in part a factor in the inadequacy in digital archives management competency.

To probe the staff further, they were asked to indicate their highest level of educational and professional qualifications. About 93% of the staff indicated that they had some training in library and information studies with only 7% indicating that they were trained in archives and records management. Their levels of qualification ranged from diploma to Masters with the majority (43%) of the staff being degree holders. Asked whether the institution supported any forms of continued training, responses revealed that it indeed does. Over half of the staff had received institutional support to attend workshops (89%), seminars (68%) and conferences (58%). Such support is significant if staff are expected to enhance and keep abreast of developments and practices in their

Table 4. Staff awareness of digital archives management initiatives and approaches.

FORMS OF INSTITUTIONAL PARTICIPATION IN DAM INITIATIVE AND APPROACHES	RATINGS 1–Strongly Disagree, 2–Disagree, 3–Uncertain, 4–Agree, 5–Strongly Agree				
	1	2	3	4	5
The institution participates in Network of Expertise in Long-term Storage of Digital Resources (NESTOR)			■		
The institution participates in Managing Digital Collections: A Collaborative Initiative on the South African Framework		■			
The institution participates in the International Research on Permanent Authentic Records in Electronic Systems (InterPARES)			■		
Self-Archiving Initiative			■		
Open Archives Initiative			■		
Institutional Repository				■	
Collaboration with sister universities			■		

profession. In terms of awareness, the interviewees revealed that the level of awareness is still low because most staff were not familiar with digital archives.

When asked of their awareness of institutional participation in any digital archiving initiative or approach, 46.7% of the staff said they were aware of such activities while 53.3% of the staff indicated that they were not aware. Respondents who had some prior knowledge of institutional participation in digital archiving initiatives and approaches were further asked to rate, on a 1 to 5 Likert scale, the extent to which the institution was involved in digital archives initiatives and approaches. Their aggregate responses are summarised in Table 4.

The results showing staff awareness of the institutional participation only in the Institutional Repository Initiative could be construed to mean two things: firstly, that the institution has yet to embrace many forms of digital archiving initiatives and approaches, or secondly that the staff level of awareness of the range of digital archiving initiatives is low. This in turn would suggest that most staff were not familiar with digital archives.

Financial resources

In assessing the financial sufficiency of USIU-A in supporting digital archives management programs, the staff were asked whether or not they thought the institution had adequate finances for digital archives management. About 93% of the staff said that the institution did not have adequate financial resources and only 7% thought that it did. The sheer number of staff who felt that the USIU-A did not have adequate funds to support a digital archives management program suggests that the institution may not be fully ready for digital archives management as financial resources are key to achieving an efficient and sustainable program.

As a follow-up to whether or not the institution had adequate finances to support digital archives management programs, the respondents were asked to indicate the sources of funds for the program. Their answers indicate that the institution did not depend on one single source, but a variety of sources. These include institutional budget, donations, grants, external benefactors and loans. In light of the earlier findings presented showing an inadequacy of funds dedicated to digital archives management at

the institution, the consequences of these findings on sources of funds could arguably be considered to be double-edged.

On one hand, they demonstrate the university's commitment to support digital archives management by whatever means possible. However, on the downside, they point to uncertainty in dedicated funding for the program. Dependence on external grants and donations is not an assurance that funds would be available when needed. This could jeopardise the strides made in digital archives management efforts. To establish the continuity of the funding, the archives staff were asked to state the status of the funding program as a measure of a resilient funding which is key to the institutional readiness. The majority (60%) of the staff stated that the funding program for digital archives management is currently ongoing, 21% thought that it was still a start-up, while 19% noted that the institution always set aside some finances for the digital archives management program. Having an ongoing institutional funding program is a positive sign of the institution's commitment and determination to sustain the digital archives management initiative through a planned continuous budget allocation.

Challenges and strategies for digital archives management

Research question five sought to find out the challenges that are experienced in the implementation and management of digital archives and the strategies to mitigate such challenges. In a close-ended question, the respondents were allowed to choose any of the factors they felt were an impediment towards institutional readiness for digital archiving at the institution. However, staff and users identified these challenges differently.

Challenges facing digital archives management

With regards to the challenges affecting the institution's preparedness towards digital archives management, both the archive staff and users were asked to indicate the challenges they thought impede their institution from maturing for digital archives management among the lack of qualified staff, technological obsolescence, lack of systems that facilitate digital archiving at the creation stage, lack of enough storage facilities, absence of standards for describing digital records, lack of migration paths for digital records and archives, legal and organisational challenges, and lack of deep infrastructure.

From Table 5, we see that 78% of the archives staff and 24% of the archives users revealed that the absence of deep infrastructure was one of the key challenges affecting the

Table 5. Challenges facing digital archives management as perceived by staff and users.

| | | FREQUENCY COUNT | | | |
| | | Staff | | Users | |
	FORM OF CHALLENGES	N = 18	%	N = 79	%
1	Inadequately qualified staff	7	39	19	24
2	Technological obsolescence	4	22	20	25
3	Lack of systems that facilitate digital archiving at the creation stage	13	72	27	34
4	Lack of storage facilities	8	44	19	24
5	No standards for describing digital records	11	61	23	29
6	No migration paths for digital records and archives	7	39	19	24
7	Legal and organisational challenges	10	56	26	33
8	Lack of deep infrastructure	14	78	19	24

management of digital archives, while 72% of the archives staff and 34% of the archives users indicated that there were inadequate systems to facilitate digital archiving at the creation stage. The lack of standards for describing digital records attracted 61% of the archives staff and 29% of the archives users who called it a challenge and saw it as hampering the management of digital archives. The study further established that 22% of the archives staff and 25% of the archives users observed technological obsolescence as a limitation, with 56% of the archives staff and 33% of the archives users reporting that legal and organisational challenges were affecting the institutional readiness towards digital archiving.

With regards to staffing, 39% of the archives staff and 24% of the archives users indicated that inadequate staffing was affecting the institution's move towards digital archiving maturity. In terms of storage of digital archives, 44% of the archives staff and 24% of archives users observed that the institution had not enough storage facilities. Finally, 39% of the archives staff and 24% of the archives users reported that the absence of migration paths for digital records and archives was an impediment towards the institution being fully prepared for digital archives management.

Plotting these results on a line graph (see Figure 3) further showed the differences in percentage of staff and users' responses regarding the challenges. It is also important to report that there was a greater level of agreement between staff and archives users on the challenges experienced, with the majority of the staff agreeing on four of the challenges and 35% of the archives users also agreeing on the same four challenges as being the major challenges that hindered the smooth management of digital archives.

When given the opportunity to respond to this study's initial findings, the Digital Repository Librarian confirmed the identified challenges as well as noted other challenges not identified by the staff or the users. The unique challenges identified by the Digital Repository Librarian include poor funding: 'Digital archives management is not allocated sufficient funds'; poor coordination of effort: 'there is no centralised systems to efficiently manage the digital archives at the institution'; poor security measures: 'the security of digital archives is questionable due to the housing of the servers which is mainly within the library'; poor understanding of digital archives management: 'There seems to be a lack of understanding about the management of digital records and archives and most of the university community are not aware.'
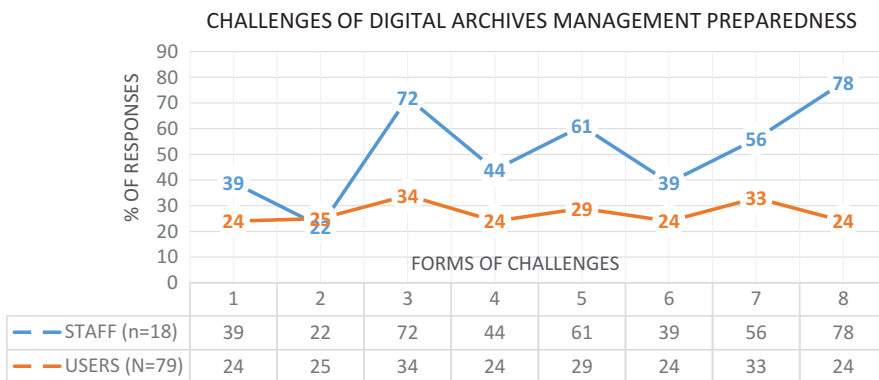
CHALLENGES OF DIGITAL ARCHIVES MANAGEMENT PREPAREDNESS

	1	2	3	4	5	6	7	8
STAFF (n=18)	39	22	72	44	61	39	56	78
USERS (N=79)	24	25	34	24	29	24	33	24

Figure 3. Comparison of staff and users' perception of the challenges.

Areas in which the Digital Repository Librarian agreed with staff and users' responses include the absence of digital archives management support systems: 'There is no proper implementation of digital records and archives management workflow system at the departmental levels of the university hence hindering the overall management of digital archives and records at the main archives'; and the shortage of qualified manpower: 'The archives section is highly understaffed and the current staff are not able to deal with the dynamics of technology that come along with digital archives management.'

Strategies for digital archives management

To counter the above challenges, the respondents were asked to select strategies that could be put in place among employing qualified staff, initiating technological advancements, establishing of systems that facilitate digital archiving, investing in storage facilities, properly describing digital records, ensuring migration paths for digital records and archives, drafting and implementation of policies and regulations for digital archives, and investing in digital archives' infrastructure.

Their suggestions, summarised in Table 6, show that three forms of strategies received great support by both staff and users: (1) investing in digital archives infrastructure (recording 72% and 14% of staff and users' support respectively); (2) initiating technological advancements (recording 67% and 11% of staff and users' support respectively); and (3) establishing systems that support digital archiving at the creation stage (recording 67% and 11% of staff and users' support respectively). Drawing from these results, it can be deduced that the institution needs to prioritise in investing in digital archives infrastructure as well as creating awareness of digital archives management services if its digital archives management program is to be successful.

Key informers, the Digital Repository Librarian, the Registrar in charge of student affairs records and the Deputy University Librarian, were asked to elaborate on the key measures and action points that they would put in place to mitigate the challenges mentioned and ensure USIU-A is ready for digital archives. They unanimously agreed on a number of interventions: firstly, that more funds needed to be allocated for digital archives management; secondly, that proper implementation of digital records and archives management workflow system needed to be done at the departmental levels within the university; and thirdly, that the institution should hire qualified staff and/or retrain the existing ones on

Table 6. Archive staff and users' proposed strategies for addressing DAM challenges.

| | RESPONSE FREQUENCY COUNTS | | | |
| | Staff | | Users | |
PROPOSED STRATEGIES	N = 18	%	N = 79	%
Employing qualified staff	8	44%	7	9%
Initiating technological advancements	12	67%	9	11%
Establishing systems that facilitate digital archiving at the creation stage	12	67%	9	11%
Investing in storage facilities	8	44%	7	9%
Properly describing digital records	8	44%	7	9%
Ensuring migration paths for digital records and archives	5	27%	4	5%
Investing in digital archives infrastructure	13	72%	11	14%

digital records and archives management. Other proposed solutions by the interviewees

included infrastructural development for digital archiving, and creating awareness within the USIU-A community about digital archives management.

Discussion of findings

Assumption of the study

Notable works by Christine Kanyengo, Hellen Eke and Stephen Mutula have explicitly described how most of the institutions of higher learning in sub-Saharan Africa face numerous challenges.[27] Their works collectively confirmed the study findings, which established that the overall components of sound digital archives management are not all sufficiently addressed at USIU-A, and that the institution has unique challenges that require context-sensitive digital archives management strategies as articulated by the said authors. These assumptions can be therefore proven by the findings of the study, which revealed that the digitisation process of analogue archives materials was not sufficiently addressed as the only scanner, EPSON GT-1500 (Figure 1), was only designed for small office purposes. These findings are in clear agreement with Brendan Asogwa's findings that established that digitisation is one of the major challenges hindering the growth of digital archives management in sub-Saharan Africa.[28]

Asogwa noted that inadequate technological infrastructure such as scanning machines has been the impediment, as confirmed by this study's findings.[29] Further findings established that the institution uses the inbuilt Dspace metadata module as a platform in describing its digital archive once it has been generated or created. Although not all the archives were being described as required, the study findings disagree with those of John Chapman, David Reynolds and Sarah Shreeves that stated that the quality and consistency of the metadata has long been a concern in sub-Saharan Africa.[30] The study's findings, which established that the security of the digital archival materials was compromised because the external hard drives were left under the care of individual staff, are in agreement with a study done by Kyobe, Molai and Salie who investigated electronic records management and compliance with regulatory requirements in a South African university. They observed that poor information security issues, that is, cyber-crime, privacy, virus attacks and commercial data mining, are of major concern in digital archives management in academic institutions.[31]

Several challenges, such as the unavailability of infrastructure, shortfall of systems that facilitate digital archiving at the creation stage, absence of standards for describing digital archives, insufficient storage facilities, deficiency of migration paths for digital archives, inadequate number of qualified staff, legal and organisational issues, lack of standards for describing digital records, insufficient funds, improper implementation of digital records and archives management workflow system in the departmental levels, decentralised systems to efficiently manage the digital archives at the institution, lack of understanding about digital archives management and lack of commitment at the top level of the institution's management for digital archival management, were similar to the comments made by Mutula and Asogwa that digital archives management in Africa is being hampered by a limited or complete lack of human, financial and technological resources by the institution with statutory responsibility for archives management.[32]

Given the dynamic nature of digital archives, Mutula advises that it is important to put in place digital archives management strategies such as archival collection, description, preservation, regular backups, physical security and network security among others to ensure that digital resources are preserved and remain accessible and useable over time.[33]

Workflow system for digital archives

A central concern in this case study was to analyse the workflow system for digital archives management by determining how USIU-A generates, describes, stores, secures and provides access to digital archives.[34] The OAIS functional model and Higgins' DCC Lifecycle Model[35] describe in detail the functional and workflow procedures for digital archives management. These models act as measuring tools for efficient management of digital records and archives that institutions need to adapt. In assessing the readiness for digital archives management, the requirements outlined by both Lavoie and Higgins and reinforced by Llanes-Padrón and Pastor-Sánchez were considered.[36] These scholars posit that digital archives, like those in other forms, move through a lifecycle in what constitutes the workflow system for digital archives. Digital archiving initiatives that have adopted these models have illustrated consensus, differences and context influence on applicability of the models. Significantly, the workflow system must be able to contribute to the efficiency of digital archives management through integration of key constructs, the seamless importation of existing data, data exportation, enabling a web-publishing component and the ability to manage and track the operations through generating temporary records and tracking their locations.[37]

With regards to digital records generation, Conway explained that the workflow system for digital archives management should be able to accommodate the digitisation functionality so as to be able to accommodate the transferring process of analogue materials to digital format.[38] This study established that digitisation was done using only one scanner whose capacity to meet the workload was limited as it could take as much as three minutes to scan a single page. The scanner, EPSON GT-1500 (Figure 1) is designed for small office purposes. This is a rallying call for the institution to further invest in digitisation equipment

Digital records description is fundamental as it uniquely describes the digital archives, and identifies and provides access to the records through metadata.[39] Digital archives description should include the creator, the title, the subject headings and other elements that will be used to search for and locate the digital records.[40] In compliance with these requirements, USIU-A describes its digital archives through the already inbuilt Dspace metadata module as a platform to guide them in describing their digital records once they have been generated or created. Providing a reliable, comprehensive, trusted repository and standardised information packages determines institutional readiness towards digital archives management.[41]

Efficacy of digital archives management policies and regulations

The existing literature has demonstrated how enactment and implementation of comprehensive, up-to-date digital archives management policy and legislation is a critical prerequisite for the establishment of an effective, integrated system for managing digital

archives.[42] As such, any archival service is expected to operate under the provisions of specific legislations or policies that validate its operations.

In spite of this emphasis on the need for sound policies to govern digital archives management, Kanyengo notes that most African institutions have no policies on handling information records in digital format that would allow institutions to implement various digital archiving strategies that are in line with their own parent institutions. Instead, they operate within the overall country policy framework.[43] Contrary to Kanyengo's observation, USIU-A had a policy governing the management of archives in the institution. Its shortcoming was the limited awareness of its existence among the members of the community. Such ignorance of the policy existence implied that the majority of the members of the USIU-A were not conversant with the policy specifications and therefore would not be in a position to apply them in the management of the digital archives.

In what may seem a twist of things, the study's findings show that the management of digital archives at USIU-A was guided by the available regulations. This resonates with Schuppan's assertion that Africa as a region has developed potential grounds for the growth of digital archiving.[44] Mutula shares the same sentiment and argues by illustrating that the institutions of higher learning in African countries, including Kenya, are really ready for digital archives management. He cites the example of the University of Nairobi, which submits its records to the Database of African Theses and Dissertations, which is maintained by the African University Association.[45]

Infrastructural readiness for digital archiving

The use of ICT has led to rapid growth of digital archives in universities as a result of grassroots development of personal, departmental and disciplinary digital repositories.[46] Digital archives management need to establish a coherent infrastructure for the management of digital records and archives. The infrastructure includes the provision of adequate resources, buildings, storage equipment and funding.[47] It is in this light that this study sought to establish the ICT infrastructure available at USIU-A. The findings established the availability of stable access to internet, adequate personal computers (PCs) for staff, networked PCs (local area network, LAN), LAN connection to other LANs, intranet and networked access points.

This is in agreement with a study by the International Records Management Trust (IRMT) that observed that sufficient network connectivity is needed to allow the digital archives to be connected to the Internet in order to allow for the submissions and dissemination of content, and the harvesting of descriptive metadata.[48] The findings of this study about the availability of a backup generator at USIU-A also meet that report's recommendation of a power backup system for an institution preparing for an efficient digital archives management program.[49]

Digital archiving is a continuous process not just a one-off issue. Hence there is a need for financial commitment at the institutional level.[50] For institutions to be ready for digital archives management programs, they need to anticipate start-up, ongoing and contingency funding programs to allow for the changes in the scope, content and technology associated with the program.[51] Unfortunately, the findings of this study established that the institution did not have adequate funds to support a digital archives management program. Its main source of funding for the program was the institutional budget allocation. Other sources of

funding included donations, grants, external benefactors and loans. These findings did not meet Kanyengo's and the IRMT's recommendations that for a continuous digital archives management, the institution needs to have strong financial capacity.[52]

Human resources capacity and digital archives management awareness

The personnel in charge of managing digital archives programs should be skilled and qualified so as to properly manage the digital archives.[53] The IRMT's report further asserts that digital archives management is determined by the skill of the staff involved, who should be trained on a regular basis so as to keep with the ever-changing and fluid digital environment program.[54] The human resource scenario at USIU-A does not conform to these suggestions. The findings show that only a handful of staff were involved in the management of the digital archives. In terms of archives staff empowerment, the study established that USIU-A supported staff attendance at conferences and workshops, albeit not as regularly as may be desired.

For digital archives management awareness, Huvila proposes collaboration as a key part of the development of the organisational infrastructure that underpins the institutional digital archiving networks.[55] On the other hand, he advises that digital archivists, as participants, should identify themselves with their organisations and proactively work for a better management and description of existing and forthcoming digital archives. The present study's findings did not conform to these recommendations. The staff for instance were uncertain as to whether the institution is involved in digital archives initiatives and approaches. The study further revealed that the level of awareness is still low and that most staff were unfamiliar with digital archives. Instead, they were only aware of the existence of an institutional repository. The study also indicated that the institution did not participate in the digital archives collaborations or initiatives and that the management did not support this venture.

Challenges experienced by USIU-A in digital archives management

Digital archiving is a costly process that requires extensive resources, skills and knowledge to efficiently and effectively manage and run the program. The study established several weaknesses in digital archives management at USIU-A. These include insufficient funds, improper implementation of digital records and archives management workflow systems at the departmental levels of the university, understaffing, and decentralised systems to manage the digital archives, among others. The presence of this range of inhibiting factors is an indication that the institution is not fully ready for digital archives management. The results are in agreement with views of scholars who pointed out the challenges affecting digital archiving development in institutions of higher learning and particularly in Africa.[56] The works by Asogwa, Ogbebor, and Sigauke and Nengomasha[57] bear some similarities with the study's findings, which established that USIU-A faced several challenges such as unavailability of technological infrastructure which affected the management of digital archiving, shortfall of systems that facilitate digital archiving at the creation stage, absence of standards for describing digital archives, insufficient storage facilities, deficiency of migration paths for digital archives, inadequate number of qualified staff, legal and organisational issues, insufficient funds, improper implementation of digital records and archives management workflow systems at the departmental levels of the university,

decentralised systems to efficiently manage the digital archives in the institution, lack of understanding about digital archives management, and non-commitment of the senior management towards supporting digital archives management.

To counter the challenges in order to come up with a reliable digital archives management program and to understand the applicability of any given solution, one must grasp a number of fundamental issues underlying digital archives management. Several strategies for digital archives management were proposed by this study's respondents. These include investing in digital archives infrastructure, ensuring migration paths for digital records and archives, creating awareness about digital archives management, allocating enough funds to run the program, proper implementation of digital records and archives management workflow systems, and hiring qualified staff and/or retraining the existing ones on digital records and archives management.

The proposed digital archiving strategies are also in agreement with Cocciolo's suggestion that institutions should develop models that adhere to an understanding of digital archiving and adopt a multi-staged approach to address the practices of digital archives management in stages. The stages should involve developing the capacities to accession, preserving and making accessible the born-digital documentation with historic and legal value. Designing detailed workflow systems, ensuring that staff are aware of the capacities for preserving and making accessible born-digital documentation, as well as developing confidence in the process and performance of selection and accession work, contribute towards building a robust digital archiving program.[58]

Therefore, with these numerous challenges, it will be a tall order for the institution to either adopt or implement digital archiving efficiently as it needs to prepare adequately. In regard to this, the study made specific recommendations as presented below on how the institution should get ready for effective and efficient digital archives management.

Recommendations

The study brought to the fore some weaknesses in institutional readiness towards digital archives management. In order to alleviate the situation, the study made the following recommendations that could go a long way to ensuring that effective and efficient digital archives management constructs are put in place as a critical success factor and an integral part of institutional readiness towards digital archives management. Despite the institution having a policy governing digital archives management, most of the university community are not familiar with it and its contents. Therefore, it is imperative for the institution to sensitise its community so that they are aware of the contents of the policy and of its structures. Staff should be directed towards the policy. The policy should be made public to the staff so that it guides them in the administration and management of digital archives.

This study recommends the retention and recruitment of qualified and competent records and archives managers to take responsibility for the digital records and archives management function throughout the university. The management should take further measures to establish a records and archives management cadre with core competencies and skills in records and archives management. The staff should also be exposed to emerging issues in the field through their attendance being facilitated at regular conferences and workshops on digital archiving.

With regards to finances, the study recommends that the institution should invest in digital archives management and allocate enough finances to cater for digital archives management. The funding program should be ongoing to sustain the program and USIU-A should come up with a mechanism to rely not only on the institutional budget as a sole source of finance, but also on other sources.

The institution should also acquire infrastructural hardware and sufficient storage medium. It should have a backup and disaster recovery plan. The acquired ICT software should be able to adhere to digital records attributes such as integrity, content, context, provenance, and reference and stakeholder interest.

Conclusions

Change is inevitable and, in a backdrop of exponentially growing data, digital archiving is rapidly gaining in importance and acceptance across all organisations. By and large however, universities, particularly in sub-Saharan Africa, have been slow in the uptake of digital archives initiatives. But succeeding in making digital copies is merely a fraction of digital archives management. Many organisations have been tempted to digitise their archives because of the potential digitisation provides, without ensuring that the prerequisite measures and controls are in place. Institutional readiness is reflected in their development and adoption of specific sets of actions, procedures and facilities for identifying, storing, retrieving and delivering digital objects. About the ICT infrastructure, the findings revealed that the institution has Internet connectivity that supports digital archiving while the availability of infrastructural hardware, storage medium, and backup and disaster recovery plan were not sufficient.

In terms of finances, the findings reveal that the institution did not have adequate funds to support a digital archives management program and that the institutional budget was the main source of finance for the digital archives management program. This could further jeopardise the readiness for digital archives management. Therefore, the university needs to aggressively innovate more with financial sources so as so successfully manage the digital archives efficiently, which is dependent on sufficient financial support. The overall findings revealed understaffing, decentralised systems to efficiently manage the digital archives at the institution, a lack of understanding of digital archives management and the absence of commitment of senior management towards supporting the program.

In conclusion, it is clear that although USIU-A may not be fully ready for digital archives management, the institution has made remarkable progress towards digital archives management, which resonates with Schuppan's earlier assertions that the African region has developed potential grounds for the growth of digital archiving, but that a lot still needs to be done so that the institution is sufficiently prepared to manage digital archives.[59]

Notes

1. E Yakel, 'Hidden Collections in Archives and Libraries', *OCLC Systems & Services: International Digital Library Perspectives*, vol. 21, no. 2, 2005, pp. 95–9.
2. TC Wilson, 'Rethinking Digital Preservation: Definitions, Models, and Requirements', *Digital Library Perspectives*, vol. 33, no. 2, 2017, pp. 128–36.

3. M Day, 'Towards Distributed Infrastructures for Digital Preservation: The Roles of Collaboration and Trust', paper presented at the 3rd International Digital Curation Conference, Washington, 11–13 December 2007.
4. P Wang, 'Exploring the Value and Innovative Pricing Strategy of Digital Archives', *The Electronic Library*, vol. 32, no. 1, 2014, pp. 96–105.
5. BE Asogwa, 'Digitization of Archival Collections in Africa for Scholarly Communication: Issues, Strategies, and Challenges', *Library Philosophy and Practice*, vol. 11, 2011, p. 651.
6. ibid.
7. CW Kanyengo, 'Managing Digital Information Resources in Africa: Preserving the Integrity of Scholarship', paper presented at the Bridging the North-South Divide in Scholarly Communication on Africa: Threats and Opportunities in the Digital Era Conference, Leiden, 6–8 September 2006.
8. BE Asogwa, 'The Challenge of Managing Electronic Records in Developing Countries: Implications for Records Managers in Sub Saharan Africa', *Records Management Journal*, vol. 22, no. 3, 2012, pp. 198–211.
9. DT Sigauke and CT Nengomasha, 'Challenges and Prospects Facing the Digitization of Historical Records for Their Preservation within the National Archives of Zimbabwe', paper presented at the 2nd International Conference on African Digital Libraries and Archives (ICADLA-2), University of Witwatersrand, Johannesburg, South Africa, 14–18 November 2011.
10. J Wamukoya and SM Mutula, 'E-Records Management and Governance in East and Southern Africa', *Malaysian Journal of Library & Information Science*, vol. 10, no. 2, December 2005, pp. 67–83.
11. FC Ratanya, 'Institutional Repository: Access and Use by Academic Staff at Egerton University, Kenya', *Library Management*, vol. 38, nos. 4/5, 2017, pp. 276–84.
12. Kanyengo.
13. HN Eke, 'Digitizing Resources for University of Nigeria Repository: Process and Challenges', *Webology*, vol. 8, no. 1, June 2011, available at <*http://www.webology.org/2011/v8n1/a85.html*>, accessed 3 October 2018.
14. ibid.
15. ibid.
16. HN Kemoni, 'Management of Electronic Records: Review of Empirical Studies from the Eastern, Southern Africa Regional Branch of the International Council on Archives (ESARBICA) Region', *Records Management Journal*, vol. 19, no. 3, pp. 190–203; Ncamsile Nombulelo Dlamini and Maritha Snyman, 'Institutional Repositories in Africa: Obstacles and Challenges', *Library Review*, vol. 66, nos. 6/7, 2017, pp. 535–48; Ratanya.
17. S McKemmish, 'Placing Records Continuum Theory and Practice', *Archival Science*, vol. 1, no. 4, 2001, pp. 333–59.
18. F Upward, 'Structuring the Records Continuum: Part One', *Archives and Manuscripts*, vol. 24, no. 2, 1996, pp. 268–85.
19. BF Lavoie, 'The Open Archival Information System Reference Model: Introductory Guide', DPC Technology Watch Series Report, January 2004, available at <*https://www.dpconline.org/docs/technology-watch-reports/1359-dpctw14-02/file*>, accessed 24 June 2018.
20. ibid.
21. ibid.
22. S Higgins, 'The DCC Curation Lifecycle Model', *The International Journal of Digital Curation*, vol. 3, no. 1, 2008, pp. 134–40.
23. ibid.
24. ibid.
25. ibid.
26. ibid.
27. Kanyengo; Eke; SM Mutula, 'Status of Digital Heritage Preservation Management in Eastern Africa', *The Electronic Library*, vol. 32, no. 3, 2014, pp. 363–74.

28. Asogwa, 'Digitization'.
29. ibid.
30. JW Chapman, D Reynolds and SA Shreeves, 'Repository Metadata: Approaches and Challenges', *Cataloguing & Classification Quarterly*, vol. 47, nos. 3–4, 2009, pp. 309–25.
31. ME Kyobe, P Molai and T Salie, 'Investigating Electronic Records Management and Compliance with Regulatory Requirements in a South African University', *SA Journal of information Management*, vol. 11, no. 1, March 2009, p. 396.
32. Mutula; Asogwa, 'The Challenge'.
33. Mutula.
34. Lavoie.
35. Higgins.
36. D Llanes-Padrón and J Pastor-Sánchez, 'Records in Contexts: The Road of Archives to Semantic Interoperability', *Program*, vol. 51, no. 4, 2017, pp. 387–405.
37. DA Person and TK Plumb, 'Digital Archives from the Ground Up', *Digital Library Perspectives*, vol. 33, no. 3, 2017, pp. 253–63.
38. P Conway, 'Preservation in the Age of Google: Digitization, Digital Preservation, and Dilemmas', *The Library Quarterly*, vol. 80, no. 1, January 2010, pp. 61–79.
39. MR Barritt, 'Adopting and Adapting Records Management to College and University Archives', *The Midwestern Archivist*, vol. 14, no. 1, 1989, pp. 5–12.
40. SS Lazinger, *Digital Preservation and Metadata: History, Theory and Practice*, Libraries Unlimited, Englewood, CO, 2001.
41. J Askhoj, S Sugimoto and N Mitsuharu, 'Preserving Records in the Cloud', *Records Management Journal*, vol. 21, no. 3, 2012, pp. 175–87.
42. E Oltmans and HV Wijngaarden, 'The KB e-Depot Digital Archiving Policy', *Library Hi Tech*, vol. 24, no. 4, 2006, pp. 604–13; HH Yu, 'Digital Preservation in the Context of Institutional Repositories', *Program*, vol. 40, no. 3, 2006, pp. 232–43.
43. Kanyengo.
44. Schuppan, T. (2009). E-Government in Developing Countries: Experiences from Sub-Saharan Africa. *Government Information Quarterly,*26: 118–127.
45. Mutula.
46. H Falk, 'Digital Archive Developments', *The Electronic Library*, vol. 21, no. 4, 2003, pp. 375–9.
47. A Thurston, M Roper and L Millar, *Developing Infrastructures for Records and Archives Services*, International Records Management Trust, London, 1999.
48. National Research Foundation, *Managing Digital Collections: A Collaborative Initiative of South African Framework*, 2010, available at <*http://wiki.lib.sun.ac.za/images/5/51/Managing_Digital_Collections.pdf*>, accessed 24 June 2018.
49. ibid.
50. ibid.
51. ibid.
52. ibid.
53. E Vassilakaki and V Moniarou-Papaconstantinou, 'Beyond Preservation: Investigating the Roles of Archivist, *Library Review*, vol. 66, no. 3, 2017, pp. 110–26.
54. National Research Foundation.
55. I Huvila, 'The Unbearable Lightness of Participating? Revisiting the Discourses of "Participation" in Archival Literature', *Journal of Documentation*, vol. 71, no. 2, 2015, pp. 358–86.
56. O Ogbebor, 'Challenges of Digital Preservation in Africa', 5 October 2011, available at <*https://osarome.blogspot.com/2011/10/challenges-of-digital-preservation-in.html*>, accessed 24 June 2018.
57. Asogwa, 'Digitization'; Ogbebor; Sigauke and Nengomasha.
58. A Cocciolo, 'Challenges to Born-Digital Institutional Archiving: The Case of a New York Art Museum', *Records Management Journal*, vol. 24, no. 3, 2014, pp. 238–50.
59. ibid.

Notes on contributor

Bonface Ochieng Odhiambo is an Archivist with the Library Department at the United States International University - Africa (USIU-A), Nairobi, Kenya and a postgraduate student of Records and Archives Management, School of Information Sciences, Moi University, Eldoret, Kenya.

ORCID

Bonface Ochieng Odhiambo http://orcid.org/0000-0002-5773-6022