Accessibility and Sustainability of Trusted Digital Repository in Nigerian Public University: A Conceptual Approach

Adeoye Augustine Bamgbose

Faculty of Information Science and Technology
Universiti Kebangsaan, Malaysia

Hassan Mallam Ibrahim

Faculty of Information Science and Technology
Universiti Kebangsaan, Malaysia

Abstract

The paper conceptually reviewed accessibility and sustainability of trusted digital repository (TDR) in Nigerian public universities. The daily lives of people have been affected by the digital transition, which affects practically all aspects of human activity. Academic libraries all over the world are embracing new technologies and information and communication technology (ICT) applications in an effort to both stay up with changes and maintain strong connections with their users. They have created infrastructures and software systems with the ultimate goal of storing and preserving the knowledge produced in universities, the reliable digital repositories, for these reasons. The trusted digital repositories (TDRs) have been successful in gathering research output to a satisfactory level, but more work remains before the TDRs can truly serve as a secure haven for the institutions. By examining the literature in both online and offline libraries, it has been attempted in this research to review concerns regarding the accessibility and sustainability of trusted digital repositories in Nigerian public universities. The paper verified the fundamental idea but also indicated additional functions for the TDRs that can help universities pursue goals other than their typical ones. The population of the TDR is therefore the responsibility of academics who constantly engage in researches. Their wealth of intellectual output will constitute the contents that should be uploaded into the repository. Therefore, the university must engage and train them on how to upload into the provision from their offices and any location of their choice by accessing the provision with login credentials amongst others.

Keywords: Academic libraries, University Libraries, trusted digital repository (TDR), accessibility, sustainability, institutional repository.

Introduction

Accessibility of academic materials to users is expected to benefits students and other users for enhanced sustainability (Itiola, Iwasokun & Adetooto, 2021), this is because the university library plays an important role in satisfying the information needs of the users. Digital repository is an important aspect of academic materials and library services that offers visibility and open access of scholarly work. Accessibility of scholarly output would bring up facts findings, solve societal problems and cause changes in policy making and decision making resulting in national growth and development. Itiola *et al* (2021) stress that access to digital repository create global visibility for research works and can collect content in a single location. It is, therefore, important to note that the success or failure of any public university is contingent, partly on its adoption of institutional repository (IR) (Alumona 2019). However, the emphasis on distance learning and instructional technology at many Nigerian public universities especially during the outbreak of corona virus pandemic (COVID-19) and in the post-COVID-19 effects have led to an increased awareness that the digital content being created by faculty members, staff members, students and the general public of the academic community is an institutional asset. In other words, difficult economic times have heightened the need for universities generally to also identify new ways to generate revenue. As a result, there is a growing interest among university administrators in collecting, in preserving, and in creating value-added services from the digital content produced in conjunction with teaching and researching (Sinha & Bhattacharjee, 2016). This interest aligns well with the mission of academic libraries, although it requires the library to expand its focus to include management of unpublished as well as published electronic content. This is can be achieved with the aid of building a trusted digital repository.

Trusted digital repository therefore, is relatively new concept in Nigerian universities for the collection, management, dissemination and preservation of scholarly works that is created in trusted digital form by faculty and students in universities. The TDR idea is borne out of problems with the current scholarly communication model structured by commercial journal publishers and vendors. To properly implement these repositories, libraries will need to recruit librarians who possess trusted digital skills (the capacity to find, assess, use, share, and create content using digital devices, such as computers, is referred to as having digital skills) and collection management. In addition, training faculty and students to use open archive information system management skills will help them prepare their digital products, involving them in institution-wide policy making, and setting repository goals will be parts of the new tasks that Nigerian public university libraries will face (Anyaoku, Echedom, & Baro, 2019).

Digital repository is a place meant for collection and making accessible to users, information generated in the institution and which may be in form of books, thesis, dissertations articles, conference papers, research works, grey literature or those electronic formats, and is always under the administration of the institutional library. In the present technological era, it is always administered and presented in digital

formats. Jones (2016) stated that digital repository is a centralized service that is often run by the institution's library and that the application themselves require internet technology, to be well developed. Aghwotu and Ebiere (2016) explained that trusted digital repositories are digital archives of the intellectual products create by staff, faculty members and students of universities and which are accessible to end users within and outside the institution.

Trusted digital repository can be described as contemporary service which academic research institutions render to their community members in the form of managing and disseminating their intellectual works through a digital medium (Ridwan, 2015).

Scholarly information is increasingly being produced in digital formats and most bodies involved in the knowledge production process (authors, publishers, vendors and libraries) prefer the electronic form because it has revolutionized the way knowledge is produced and disseminated to the end user, usually in a fast, timely and efficient way (Tapfuma & Hoskins 2019). Suber (2018) also argues that open access literature is digital, online, free of charge, and free of most copyright and licensing restrictions. What makes it possible is the Internet and the consent of the author or copyright-holder. Several online digital library organizations are making use of the Internet in terms of increasing the international visibility of African-published, peer-reviewed journals, although this can only be achieved through support from and collaboration of, African policy-makers and governments, universities, research organizations, donors and the people directly involved in the production of the journals themselves (Murray, 2018).

In the view of Harnad (2019) digital repository is a digital archive of the intellectual product created by faculty, research staff and students of an institution and accessible to end users both within and outside the institution. According to Lynch (2017) digital repository is a collection of services that a university offers to its own members, intended for the management, organization and diffusion of digital works produced by these members. Advancing reasons for the establishment of digital repositories, the author stated that they emerged as new strategy that allow universities to apply serious, systematic leverage to accelerate changes taking place in scholarship and scholarly communication. According to Association of College and Research Libraries (2018), the purposes of institutional repositories include opening up the outputs of the university to the world, maximizing the visibility and impact of the outputs, showcasing the university to interested constituencies like prospective staff, prospective students and other stakeholders.

Trusted Digital Repositories: Important Component of Open Access

Trusted Digital repositories are therefore an important component of Open Access and provide an infrastructure that helps universities and research institutes collate research output, facilitate access and provide a record of research carried out by an institution. Many open access studies have used the terms availability and accessibility

interchangeably or have reported a positive relationship between them, suggesting that increased availability can help to improve accessibility. The Budapest Open Access Initiative (2020) defines open access as 'free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of articles. Similarly, Bullinger (2013) as cited in Moller (2017), in the *Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities*, describe open access as 'granting to all users a free, irrevocable, worldwide, right of access to, and a license to copy, use, distribute, transmit and display the work publicly. That is, open access may increase accessibility for users through making sources available.

Moller (2017) explained that trusted digital repositories constitute a reaction against those publishers that create monopolies by charging for access to publication on research they have not conducted, funded or supported. It was therefore established in line with the doctrine of free and open access to the journal articles and other academic outputs of the various institutions and research centers. Anenene, Alegbeleye and Oyewole (2017) asserted that trusted digital repository has the potential of increasing the visibility, prestige, ranking and public value of researchers and universities. Emphasising on the role and need for trusted digital repositories, Anene *et al* (2017) explained that trusted digital repository provides open access to institutional research output by self-archiving it, create global visibility for an institutions scholarly research, collect content in a single location, store and preserve other institutional digital assets including unpublished or otherwise easily lost or grey literature. Thus, digital repository is very crucial in all universities in this modern era to ensure easy communication of scholarly outputs in the institutions, and also to help create numerous opportunities and advantages for both the institution and members of the academic community through exposure. It accommodates information from various fields of study depending on the focus of the institution.

Contents of Trusted Digital Repositories

Such materials that are contained in trusted digital repositories include thesis works and dissertations, conference papers, e-books, manuals, administrative documents and products of research from various departments of the institutions. It also contains other information sources as may have been deposited by members of the academic community such as librarians, professors, and lecturers, other faculty and administrative staff, as well as students. Trusted digital repository also offers access to information from sources outside the institution as it utilizes internet technology, which it also utilizes to project the performances of the institution and contributors to the outside world (Association of College and Research Libraries, 2018). According to Aghwotu and Ebiere (2016), contents of trusted digital repositories include full text documents such as articles published in peer-reviewed journals with permission from the publishers. Others are thesis and dissertations within universities, seminar, conference and workshop papers written by members of academic staff and students.

According to Aghwotu and Ebiere (2016), these information sources are always available and made freely accessible to university community within and outside the

academic environment. In similar vein, contents of trusted digital repositories as stated by Anenene *et al* (2017) are thesis, dissertations, projects, course notes, seminar papers, conference proceedings, administrative documents, learning objects and other forms of grey literature. A prospective user of the trusted digital repository may come for the reason of depositing information contained in any of the afore-mentioned sources for the purpose of archiving it or to avail him/herself of the use of different types of information contained in the repositories for the purpose of research or other educational goals. The prospective users may be professors, faculty staff, and students.

More specifically, the postgraduate students may be those studying for their Doctor of Philosophy or Master Degrees or those studying to get their Postgraduate Diploma in chosen fields of study. Moller (2017) defined postgraduates as those who already hold their first degrees and who are doing advanced study or research. Trusted digital repository is therefore very suitable and play significant role in the academic activities of this category of users. However, Lynch (2017) stated that trusted digital repository is a novel idea that sprung up in response to journal crises occasioned by incidence of high subscription fees charged by publishers amidst dwindling budget to libraries. It is therefore possible that postgraduate's students including those in public universities may not be aware of the existence of, or have access to digital repositories in their institutions, as well as the benefits accruable from them. If this is the situation, it means that they may not be using the repositories, or utilizing their full potentials in which case, the benefits will be lost and the aim of the trusted digital repositories will be truncated. This is because access is a critical factor in usage. When people can access a particular good product, their interest become automatically aroused and which may culminate in concerted effort to purchase the product. Agbowotu and Ebiere (2016) affirmed that lack of access adversely affects usage. Hornby (2006) defined access as a state of knowing that something exists and is important and being able to use it.

Anenene *et al* (2017) asserted that it would be very difficult for researchers and academics to utilise trusted digital repositories if those who are supposed to have access the benefits associated with the use of it are not. According to the authors, it is only when the individuals responsible for the establishment of digital repositories are aware that they can sensitize others. Awareness can occur through various information sources. For the postgraduate students, the awareness may be from colleagues or fellow students, lecturer, friends, notice board, institutions website, library website, posters, library staff or announcement.

The accessibility will make the students to develop interest and enjoy the full potential offered by the digital repositories (Itiola, *et al.*, 2021). It is no news again that the increasing application of digital technologies has transformed the modern library into a virtual library. In the same light **t**he tasks associated with managing and backing up digital data are well known to digital technologies or information technology managers, but the mere presence of the data stream is not the only criterion for preserving and maintaining digital content.

Sustainability of trusted digital repository recognizes that the continuity of digital information goes well beyond basic storing and managing of data and is integrated into the lifecycle of the information object. It includes technical, social and economic considerations. By trusted digital repository, it means building an infrastructure, both social and technical, which is economically viable for maintaining valuable data without significant loss or degradation (Boama & Tackie, 2015). This includes, as it has been discussed above, the whole socio-technical composition of the repository. Clearly, it is not possible to preserve digital information without a sustainable organizational, economic, social, structural and technical infrastructure.

Accessibility and Sustainability of Trusted Digital Repository (TDR)

Sustainability of trusted digital repositories and preservation plans are about content. Access to valuable information is what drives all the plans and strategies associated with digital preservation. The only real measure of success of a sustainable trusted digital repository, and its concomitant digital preservation plan, is access by the user community to valid and appropriate content (Masenya & Ngulube, 2020). As discussed above, the relationship between data, the user community and a sustainable repository does not always result in clear and unambiguous roles for each; nonetheless, the partnership is a necessity. The value of the data, and the decisions made to sustain and preserve those items must be made not only with technical knowledge and expertise, but also with content, value and usage knowledge. As any sustainable digital access approach will require ongoing support from the institutions that house them, the collection they house must be demonstrably useful. This latter statement does not necessarily mean discarding unused material; libraries and archives have long recognized the need for extensive collections to meet the broad needs of users, and the fact that the perceived relevance of collections changes in the face of research needs.

Accessibility of research outputs from and by researchers from the developing nations were very difficult tasks until the evolution of open access and trusted digital repositories. The university libraries had challenges paying the subscription fees for journals and databases because of their high cost (Masenya & Ngulube 2020). Similarly, researchers found it highly challenging to pay the publication fees for highly rated international journals which has the potentials of making their research outputs globally visible (Alumona, 2019). 43.04% of business to consumer (B2C) memberships charge $25-$49 per month, with 22.78% charging $15-$24 per month and 21.52% charging $1 to $14 per month. Only 12% charge more than $49 per month. For instance, Nigeria with over one hundred and ninety-eight (202) universities have less than 40 per cent with digital repository (NUC, 2022) compared to any other country in sub-Saharan Africa generate large volume of research outputs that are of great important to the scholarly community (Salau & Oyedum, 2019). These important documents, which some of it were presented at local conferences, gather dust in the various departments, faculties and institutional libraries with little or no access to them. Some which eventually gets published in local journals enjoy minimal accessibility rate resulting from poor distributorship, global visibility and reputation

of such journals (Itiola, *et al.*, 2021). Consequently, these vital scholarly materials perish at institutional or local level with the access barriers.

The studies of Itiola *et al* (2021), Grammenis and Mourikis (2020), Masenya and Ngulube (2020), Alumona (2019), have examined the level of accessibility of trusted digital repository by postgraduate students (Ameh, 2018; Masenya, 2018; Moahi, 2018). However, there is paucity of research on the accessibility in the public universities especially in developing country like Nigeria. Kakai, (2018) suggested that further studies on the interaction between level of accessibility towards digital repository should also be considered in other public institutions to enhance generalizability of empirical findings. It is in line of this that this study intended to systematically review issues around accessibility level of trusted digital repository by Nigerian public universities.

It is a known fact that trusted digital repositories are very crucial in attainment of the educational aims of the various institutions where they are situated. This is because they grant researchers, faculty staff, lecturers and students, free access to information generated in the institution, as well as others from other institutions, thereby facilitating the capacity, visibility and research output of the institutions and those of other members of the academic community, including postgraduate students. Universities place great premium on research and trusted digital repositories offer them the resources needed to attain high research output and ensure high academic excellence for users.

The initial literature search had identified that the specific topic of digital skills, with particular reference to the circumstances of trusted digital repositories generally in Nigerian public universities, has been very sparsely or poorly researched and documented – whether as contained in the available organization and management textbooks or in the journal articles. Though, several studies have been carried out on the concept of digital skills, for instance, Anyaoku, Echedom, and Baro (2019), Chisenga (2016), Achieng (2016), Kavishe and Dulle (2016), etc. However, not much has been written on the concept of digital skills in this part of the continent and its impact towards trusted digital repository could not be measured as well. Existing work on the subject matter include Payne (2016), Kjellin (2016). In the same vein, very little scientific research has been done on the actual level of digital skills possessed by students in Nigerian public universities.

It is extremely difficult to determine the actual level because most digital skills are not the result of computer courses, but of learning through practice in particular social user environments. So far, there are only few estimates of skills. A number of large-scale surveys have revealed dramatic differences of skills among populations, also among populations of countries with large new media diffusion (Manfra, 2019). However, these surveys measure the actual level of digital skills possessed only by questions asking respondents to estimate their own level of digital skills towards trusted digital repository. This kind of measurement has obvious problems of validity. This is the reason, why the study intends finding out if digital skills are required by postgraduate

students in utilizing contents of trusted digital repository in public universities in southwest, Nigeria.

A number of studies have been conducted on sustainability dimensions (Ampong, 2016, Bamigbola, 2017). However, as with many developing countries, there is limited research and scholarly studies on sustainability of trusted digital repository (Ameh, 2018; Gbaje, 2018). In other words, several studies have been researched on sustainability challenges. A study conducted by International African Institute [IAI] (2021). The sustainability of the raw data is the retention of the byte-stream in its proper and logical order so that it can be delivered as required identically to how it was first deposited. This is simply the issue of managing and duplicating the data, a task which is fundamental to all data sustainability. Though fundamental to all digital archiving and retention practices, the process still lacks official standardization (International African Institute [IAI], 2021). In spite of the lack of internationally agreed standards for data back up and safety most IT professionals are in general agreement about the processes necessary to produce safe, redundant copies of data. Most IT professionals would be able to measure whether they meet a notion of best practice, and are even likely to call the process "archiving". Many archives hope that by this approach the retention of the byte-stream in its proper and logical order will be achieved, so that it can be delivered as required identically to how it was first deposited. Overall, it is important to note that not much has been written on the concepts of accessibility, digital skills and sustainability of trusted digital repository by postgraduate students of public universities and in this part of the continent in particular could not be measured as well. Existing work on the subject matter include International African Institute [IAI] (2021), Grammenis and Mourikis (2020) and Hider, Mitchell, Galatis and McDowell (2017). Notwithstanding the findings of these scholars, the problem associated with the study has not been concretely addressed.

Given the diverse facets of access, and even physical access, mere availability may not always enhance accessibility. Moller (2017), for instance, argues that other variables such as search tools, search engines and indexing can alter the *physical* accessibility of a document even if it is, strictly speaking, available. It is also noted that individuals' prior knowledge and the context of use can affect accessibility. This implies that open access, even if it does improve availability, may not improve every aspect of accessibility; for one thing, while the relationship between availability and true physical accessibility may be enhanced by open access, open access itself may not be directly related to increasing intellectual and social accessibility. Agbowotu and Ebiere (2016) affirmed that lack of access adversely affects usage. While the current study acknowledges the importance of both intellectual and social access, it focuses on the prerequisite concepts of availability and physical accessibility to explore physical barriers (or, strictly speaking, their virtual analogues) in accessing digital repositories; that is, the potential of digital repositories to make materials both available and easily accessible. As noted above, we investigate availability as the ability of search engines to retrieve clear links to an individual paper within the first two pages of results; that is, availability refers to the simple presence of an item in a set of search results, an indication that the item exists.

Further, it is examined accessibility as the number of clicks required for a user to navigate from those results to the full text of the paper itself; thus, accessibility, in this study, refers to the amount of labour required of a user to actually obtain the item after having determined that it is available. Anenene *et al* (2017) asserted that it would be very difficult for researchers and academics to utilize digital repositories if those who are supposed to have access the benefits associated with the use of it are not.

Bradley (2019) in his submission stresses the sustainability of meaningful access to the content. The major issue according to him is associated with sustainable access to data is accessing the content, so that not only the data is retained, but also it can be rendered in future technical environments and can be comprehended in a manner commensurate with the creators' intentions and user expectations.

Sustainability of trusted digital repositories and preservation plans are about content. Access to valuable information is what drives all the plans and strategies associated with digital preservation. The only real measure of success of a sustainable trusted digital repository, and its concomitant digital preservation plan, is access by the user community to valid and appropriate content (Masenya & Ngulube, 2020).

The ability to sustainably and accurately render an item regardless of how the technological environment has changed is the fundamental aim of digital preservation. There is no better measure of the success of the preservation of a digital object than the ability to sustain access to a digital item. It has an "overall focus on the critical issues of the access continuity and the sustainability of digital collections". Access by the designated community is a critical measure of sustainability; access to an authentic rendering of the informational content in both the short and long term must be the primary aim of any digital preservation programme. This is stated succinctly in the UNESCO Guidelines for the Preservation of Digital Heritage: "Digital materials cannot be said to be preserved if access is lost". Digital preservation practitioners describe various strategies for maintaining access to the content in a digital repository, all which can be categorized as a form of migration, emulation or encapsulation. When the operating systems, the software environment, the access tools or the formats change, access to the content is no longer routine, and some alternate strategy will have to be applied to ensure access.

The most useful tool in this process is the use of appropriate preservation metadata. Phillips, Andrews, and Krahmer (2018) carried out an interesting study to know the overlap use of digital repository and institutional repository of University of North Texas. The user's logs, clicks and sessions have been analyzed and found that users are easily navigating among items which are interrelated and also founding items which are accessed more than other items. The study suggested that the university should work on the development of metadata fields and availability of improved interface with faceted navigation.

Mgonzo and Yonah (2015) carried out a study aimed to know the awareness, use, deposit practices among faculty members at Sokoine University of Agriculture. The

data have been collected by employing questionnaire among faculty members of College of Veterinary Medicine and Biomedical Science (CVBMS). The low level of awareness regarding TDR has been found and library, internet and staff meetings are considered sources of awareness. Unawareness regarding deposits to the repository has been reported and as a result most of the faculty members have never deposited their scholarly works. The major obstacles to the effective use of TDR are reported as lack of awareness of existence of TDR, fear of plagiarism, lack of training and skills and lack of time.

Lee, Burnett, Vandegrift, Baeg, and Morris (2016) conducted a case study to explore the accessibility and use of digital repository by investigating the use of Flora State University's institutional repository which has archived through *DigiNole Commons*. In this way, 170 archived faculty publications have been searched by using Google and Google Scholar. This quantitative measure has also been supported by qualitative data collected through interviews conducted with faculty members. The studies found that majority (96%) of articles are available full-text while 145 (85.3%) articles found with the metadata from the search engines. The study demonstrated that the repository is substantially contributing to the accessibility and availability of the research articles.

Several scholars and authors have described the concept of digital repository but the most frequently cited definition is that of Johnson (2017) who described a Digital Repository as "a digital archive of the intellectual product created by the faculty, research staff, and students of an institution and accessible to end-users both within and outside of the institution to access". The essential characteristics of a digital repository are that it is institutionally defined, scholarly in scope, cumulative and perpetual, open and interoperable (Crow 2019). Many institutions of higher education generate documents (journal articles, conference papers, reports, thesis, teaching materials, research notes, research data) which need to be managed, by providing proper housing, protection from mutilation and theft, library binding, and occasional repair and restoration.

Khan and Bhatti (2017) noted that the main purposes of digital repositories are to bring together and preserve the intellectual output of a laboratory, department, university, or other entity, the incentives and commitments to change the process of scholarly communication. Ball, Groenewald, and Van der Westhuizen (2016) pointed out the benefits of a digital repository as; enhanced global visibility, interoperability with other repositories, sharing of knowledge internationally and tool for peer reviewing. Boama and Tackie (2015), stressed that a challenge posed with this type of materials is that they become obsolete very fast, which can lead to loss of important heritage resources, and if this loss of heritage materials is not checked, it can create gaps in future memories. Masenya and Ngulube (2020) asserts that "scholars use research findings to generate further research, models and archetypes." Thus, findings accruing from research should be made available for others to build upon and for the society to benefit, while advances in digital technologies have led to the development of technical solutions geared towards creating and managing digital assets through IRs. This assertion was supported with the findings of Anenene, Alegbeleye, and Oyewole

(2017) who stated that the opinions of the respondents as highlighted in their study revealed that regardless of the money spent on establishing digital repository, the benefits far outweigh the demerits.

A digital repository is an electronic store of web based scholarly digital documents owned by the institution (Mgonzo & Yonah 2015). These digital documents consist of all electronic publications such as thesis, journals, books and conference papers (Okumu, 2015). Kavishe and Dulle (2016) observed that digital repositories operate well in an open access environment which offers free access to digital content without restrictions. In recent years, digital repositories have become effective in disseminating scientific data and scholarly communication (Okumu, 2015). Digital repositories have become important in scholarly communication, institutional visibility, university ranking and feasible foundation of institutional knowledge management (Kakai, 2018; Anenene, Alegbeleye & Oyewole, 2017).

Digital repositories have also helped to unlock the grey literature, such as unpublished research reports, theses and dissertations, seminar and conference papers (Kakai, 2018). Repositories are increasingly becoming podiums for publishing original and peer-reviewed contents in an open access environment (Saini, 2018). The repositories are essentially being used for acquisition, preservation and dissemination of locally-generated scholarly information. Access to scholarly information from digital repositories can increase the usage of scientific information and author citations and visibility (Ukwoma & Dike, 2017).

The speeding up of digital repositories in Americas, Asia, Australia and Europe, could be traced from the beginning of 21st century. Around 2005, the establishment of digital repositories in almost ten European economies ranged from the lowest 1.5% in Belgium, Denmark, Finland France, Germany, Italy, Sweden, and of course, the United Kingdom to the highest 100% in Germany, Netherlands and Norway (Abrizah, 2019). Also, in 2006, Cullen and Chawner (2015) in their study found all Australian universities have had digital repositories, while in the United States, there has been an increase in number of digital repositories with over 40% of all learning institutions having established digital repositories (Okumu, 2015). Evidently, adoption of digital repositories by continents places Europe at the lead with 47.92% of all global digital repositories. This is followed by North America with 29.28%; Asia with 11.04%, Australia with 5.84%; South America with 4.40% and Africa 1.52% (Saini, 2018).

University Libraries and Trusted Digital Repository

Trusted digital repository development involves a lot of efforts and collaborations and this include the university libraries. It is expected that once the service is up and running, the contents in the repository should be robust enough such that researchers and other users that want to use the provision should be able to find contents that meet their information needs (Eromosele, Adesina, Abdulrazaq & Aliyu, 2021). The population of the digital repository is therefore the responsibility of academics who constantly engage in researches. Their wealth of intellectual output will constitute the

contents that should be uploaded into the repository. Therefore, the university must engage and train them on how to upload into the provision from their offices and any location of their choice by accessing the provision with login credentials. In some universities or academic institutions in Nigeria, faculties are compelled to upload all of their local published articles into the university's repository as part of the aggressive approach of populating the provision (Eromosele, *et al.*, 2021).

From extant literature, it is discovered that faculties in some public universities can only collect their letter of promotion when they show proof of uploading into the repository (Oguche, 2018).

The librarians of the academic and research libraries repository should be the administrator of the repository and must be responsible for uploading the intellectual properties such as theses and dissertations, question papers, conference proceedings, speeches, etcetera, into the setup. Some materials will have to undergo digitization because of their raw state to get the contents in softcopy forms. Digitization is the process of converting hardcopy materials into softcopy using some specialized scanners that are specially designed for book scanning. Resources in raw forms should be converted to digital forms. The information materials in the libraries are usually in some analogue format (that is, printed books, manuscripts amongst others). It is expected that academic and research libraries should convert these materials to digital form through digitization and making them available on the institution's repositories so that they can be accessible. The other form of resources that should constitute the contents in the repository is the "born-digital" materials originally produced in machine-readable digital form (that is, dissertations, theses, projects, conference proceedings, seminar reports, inaugural lectures e-books, e-journals, online databases, digital photographs, websites, and multimedia amongst others) and needs no digital conversion (Pandey & Misra, 2014). It is easier to work with the born-digital contents because they do not have to undergo a complete digitization process. Librarians in the academic and research centres must take the lead and should be in charge of the sustainability of the service by engaging their systems librarian; providing regular training to teaching staff and students and as well training and re-training staff of the libraries that are critical to the operations, choice of software, hardware requirement and policy development as a guide for operating the service.

To corroborate the efforts of making it sustainable, trusted digital repository is very crucial for the library management to employ an ICT technical staff that will be domiciled in the library to manage the setup. This is because the service will be well sustained if such intervention is put in place or personnel in the library should be trained to take up the task of managing the setup and resolving minor or major technical issues for smooth and interrupted operations.

Universities and academic libraries have developed and implemented trusted digital repositories (TDRs) worldwide (Tapfuma & Hoskins, 2019) in order to store, preserve and disseminate the knowledge that is produced in them. Not only in developed countries such as USA (Waugh, Hamner, Klein & Brannon, 2015) but also in developing one's universities adopt IRs (Yateem & Hameed, 2015; Tapfuma &

Hoskins, 2019). This evolution shows that academic libraries indeed are developing new services that from one hand go further their traditional services and on the other hand are stressing their mission in the educational academic environment (Waugh, *et. al.*, 2015).

Digital transformation is a revolution taking place during the last years (Sandhu, 2018) and academic libraries are major participants in this digital revolution. First by creating and using Library Information Systems either as single institution libraries, or as members of libraries' consortia (Grammenis & Mourikis, 2020) and very recently by moving forward to their digital transformation and creating and using digital repositories.

Sandhu (2018) argues that libraries are acting as platforms for digital transformation as their role is getting broader within the academic community. Today libraries adopting new hardware and software in order to adapt to the digital era have become digital masters having new roles in digital pedagogy. By the creation and use of digital repositories, libraries enforce this new role while the same time advancing the role of libraries in digital scholarship (Zervas, Kounoudes, Artemi, & Giannoulakis, 2019).

By creating and using trusted digital repositories libraries acting as digital infrastructure platforms (Sandhu, 2018) that reinforce amongst others the digital experience of their users, who need instant access to store information that in other cases they would have been unable to access, such as old manuscripts or hard copies of books that are not available in digital format. Digital repositories as a digital transformation of modern academic libraries also enhance the role of the libraries in preserving the heritage of their academic organization while the same time enrich that heritage by adding new researches, gray literature (Postgraduate diploma and Master theses and Doctoral dissertations), patents which leads to an increase of the reputation of the institution (Waugh *et. al*., 2015; (Zervas, Kounoudes, Artemi, & Giannoulakis, 2019).

From the preceding paragraphs, it is understood that the very first target of a digital repository is to collect, preserve and share by providing free access to the university research output (Zervas *et. al*., 2019). So, the first role of a trusted digital repository is to be the safe keeper of the university's heritage at no cost. By collecting and sharing the institution intellectual capital a TDR can enhance the scholarly communication and particularly the communication not only between the faculty members but also between professors and librarians (Tapfuma & Hoskins, 2019). Furthermore, the scholarly production now is being created in digital format so the digital repositories can play a vital role in organizing and providing this material to the public in eternity. Librarians are also facing the challenges of preserving the copyrights both of books that are getting digitized, as well as the newly produced acquisitions (Adamou & Ntoka, 2017).

Empirically, Grammenis and Mourikis (2020) explored academic libraries in the digital era: An assessment of the trusted digital repository role in supporting research

as a digital service. The study showed that digital transformation is a reality that has been happening in our daily lives and covers almost all the human activities. In this framework academic libraries worldwide have been adopting new technologies and ICT applications in order from the one hand to keep up with the developments and from the other to remain their patrons strongly connected with them. For these reasons, they have developed infrastructures and software systems with ultimate target to store and preserve the knowledge that is produced in the universities, the Trusted Digital Repositories. So far, the TDRs have managed to collect the research output in satisfied level, but many things need to be done in order the TDRs to be a real safe-keeper for the Universities. In this review, it attempts an assessment of the TDRs' role in supporting academic research as a digital service by studying the literature and conducting open interviews with dedicated librarians. The findings from research not only confirmed our initial essence but revealed new roles for the TDRs that can guide the universities beyond their traditional mission.

Drawing from Stanton and Liew (2012), trusted digital repository being an innovation, will be more likely to be adopted by university students if it is perceived to be advantageous to place of study and if it is consistent with existing publishing and research practice, easy to use, known and easy to access. This conforms to the characteristics stated by the theory for adoption of an innovation which in this review is known as trusted digital repository. The conditions of relative sustainability, advantage, compatibility, complexity, trialability and observability will only be ascertained by the students of public universities in south-west, Nigeria through active use of the trusted digital repositories and this use is hoped to be facilitated through easy accessibility creation, as well as its required digital skills. This review was poised to determine the accessibility and sustainability of trusted digital repository by students of public universities in Nigeria.

Recommendations

It is recommended that universities organise comprehensive awareness-raising and enlightenment campaigns to inform faculty members on the dynamics of copyright in respect to their creative output. Researchers giving up their rights to journal publishers is a practise that has a negative impact on the long-term viability of repository contents.

The utilisation of trusted digital repositories as well as promoting their digitization and preservation services should be a priority for public universities and their library management. These universities should promote their digital preservation services and the advantages of using institutional repositories using tools like pamphlets, brochures, events, research week, library week, open access week, presentations at conferences, organising workshops, using university mailing lists and university blogs, and social media like Facebook and Twitter.

Conclusion

Plans for trusted digital repository accessibility and sustainability revolve around content. All of the plans and initiatives linked with trusted digital repository are driven by access to important information. The community's ability to access accurate and pertinent content is the only true indicator of the effectiveness of a long-term, reliable digital repository and the associated digital preservation plan.

As already mentioned, there are not always clear-cut tasks for each party in the relationship between data, the user community, and a reliable and sustainable digital repository, but the collaboration is still essential. The worth of the data must be considered, and decisions on its maintenance and preservation must take into account its content, value, and usage in addition to technical knowledge and skill. The collection they store must be clearly helpful since any approach to sustainable digital access will need continual support from the institutions that house them. This remark does not necessarily mean getting rid of items that are no longer required; libraries and archives have long understood the importance of having comprehensive collections to meet a range of user needs as well as the fact that collections' perceived relevance shifts as a result of shifting research needs.

Repository software systems are not preservation solutions in and of themselves; rather, they are elements in the socio-technical infrastructure that will ensure the sustainability of access to digital material. In all facets of its execution, the socio-technical imperative of trusted digital repositories is applicable. Since trusted digital archives are a result of the interaction between people and technology, this relationship must continue in order for them to exist.

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