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Digital Object Identifier and their Use in Accessing Online Scholarly Materials in Africa

Joseph Kehinde Fasae
Afe Babalola University, Ado-Ekiti, Nigeria, kennyfash2000@gmail.com

Chuks Daniel Oriogu
University of Africa, Toru Orua, Bayelsa State, Nigeria, orioguchuksdaniel@yahoo.com

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Joseph Kehinde Fasae

Afe Babalola University, Ado-Ekiti

kennyfash2000@gmail.com

and

Chuks Daniel Oriogu

University of Africa, Toru Orua, Bayelsa State

orioguchuksdaniel@yahoo.com

Abstract

Digital Object Identifier (DOI) has been internationally recognized as a standard for identifying information resources on the web. It is an advanced tool that provides unique identification or permanent links to find specific journal articles and other information resources online. This paper discusses digital object identifier and their use in accessing online scholarly materials in Africa. It looks at the extent of Uniform Resource Locators (URL), understanding DOI functionalities, and benefits of DOI, scholarly materials with DOI in Africa with a critical examination of African Online Journals (AJOL) which is the biggest database in Africa. It was therefore discovered that the use and application of DOI in accessing online scholarly materials of African origin is still at crawling stage. The study recommends that the publishers in Africa should take advantage of this development by doing the needful and emulate those journals in African Online Journals (AJOL) to register their publications for DOI. This will enhance wider visibility and easy retrieval of African scholarly materials, while African authors also needs to wake up to explore the benefit of the DOI.

Keywords: Digital Object Identifier (DOI), African Journal Online (AJOL), Online Scholarly Materials, Africa

Introduction

As information resources grow exponentially, there became the need for identification and persistent longevity of information resources on the Web. This has propelled researchers to begin to devise a means to connect, locate and identify information resources. Because identifying digital content items is one of the most significant concerns in the digital content market (Allison et al. 2005). However, papers published in the faked and predatory journals are lost while in many universities, they are not considered as valuable papers. Moreover, some universities, research institutes, and ministry of education have blacklisted those scientific journals (Tiliute, 2016). Tiliute also noted that almost all open access journals with an assigned DOI have good reputation and those that did not have DOIs are divided into respectable and less respectable. As digital object identifiers have gained prominence in the digital world; it is therefore necessary to study their use in accessing online scholarly materials, especially in Africa.

Uniform Resource Locator (URL)

The most common and familiar identifier on the Web is a Uniform Resource Locator (URL) which make available the location of resources (Boudry and Chartron, 2017). URLs tie Internet resources to their current network location and file (Lawrence et al. 2001). The limitation with URL is that once the document is moved to a new location, the document is lost. As the linking hub for scholarly content, most URLs suffer from link rot and can be created, deleted or changed at any time which eventually leads to problem when trying to cite them (Wass, 2016). Alfred and Edda (2017) affirmed that 44.1% web citation of health sciences online journals in East Africa selected for studies were inaccessible. The findings also show that the average half-life for the URLs cited in journals articles were 10.5years which all generates questions on the value of URLs in accessing scholarly materials. Therefore, a new system of resource identification on the web which is the DOI becomes necessary. However, Feeney (2010) asserted that each DOI is unique and once assigned to an item, remains a constant locator, not changing even as object moves from URL to URL. The DOI for a document is permanent, whereas its location and other metadata may change. Referring to an online document, DOI provides more stable linking than simply referring to it by its URL, because if its URL changes, the publisher need only update the metadata for the DOI to link to the new URL (Witten, Bainbridge and David, 2010).

Understanding Digital Object Identifier

DOI system was developed by International DOI Foundation, with the aim to provide a framework for managing intellectual content, link customers with publishers, facilitate electronic commerce, and enable automated copyright management (Tiliute, 2016). A digital object identifier (DOI) is a character string used to uniquely identify an electronic document or other object. DOI is a tool for the location and identification of digital information published on the Internet. It is an advanced tool that provides unique identification or permanent links to identify specific journal articles and other information resources on the web. The DOI is typically located on the first page of an electronic document near the copyright notice and on the database landing page for the document (America Psychological Association, 2018). Developed by a group of international publishers, the DOI system provides a way to guarantee that digital copies of articles can remain accessible even if a journal changes its domain name or ceases publishing (Hume-Pratuch, 2014).

Digital object identifiers have been compared to barcodes because they are persistent identifiers that catalog content and track movement (Ye, 2007). DOI is specifically in online contents. The contents that have been identified by DOI so far are journals and journal articles, books and book chapters, conference proceedings, technical reports, working papers, preprints, standards, theses and dissertations, components (e.g. graphs, figures) and reviews (CrossRef, 2017). Higgins (2017) noted that the versatility of DOIs means they can be assigned to journal articles, datasets, supplemental material and addendum; to audio, video, streaming media, and 3D objects; to theses, dissertations, technical reports, visualizations and to pre-prints of articles. Even though that the DOI system does not provide a central search capability as stressed by Tiliute (2016), most web search engines will show DOI names in the results of a search by title, by name, or by topic or related terms, while the reverse will also work.

In another development, DOls as a tool can be employed in some studies relating to Altmetrics and Bibliometric (Hausten, Costal, and Lariviere, 2015). Altmetrics are social web metrics for academic publications incorporating a number of variables like downloads, view count, and comments, so as to measure the impact of articles (Galligan and Dyas-Correia, 2013). Kasdorf (2012) opine that it is high time to make DOIs as indispensable to scholarly books, conference proceedings, reports, and datasets as they are to journals. More so, that citation counts and citation metrics are increasingly depending on DOIs, hence scholarly materials that do not have

DOIs can be ignored by the systems which generate these important metrics. Thereby, giving rise to underestimation of the impact of such academic publication. Interestingly, all major publications within any given scientific field now use a digital identifier which is DOI for each electronic published document noticed either on the electronic version of the paper either on the printed version or both (Tiliute, 2016).

Unique set of functionalities provided by DOI system and Benefits of implementing the DOI systems as mentioned by International DOI Foundation (2015) are:

  Functionalities provided:

  1. Persistence, if material is moved, rearranged, or bookmarked;
  2. Interoperability with other data from other sources;
  3. Extensibility by adding new features and services through management of groups of DOI names;
  4. Single management of data for multiple output formats (platform independence);
  5. Class management of applications and services; and
  6. Dynamic updating of metadata, applications and services.

  While, benefits of implementing the DOI systems are:

  1. Facilitating internal content management.
  2. Enabling faster, more scalable product development, by delivering four key advantages in making it easier and cheaper.

Kasdorf (2012) noted that DOI is not an identifier of digital objects but a digital identifier of objects (physical or digital), that provides a persistent, interoperable as well as giving actionable link to whatever its owner want it to link with. This show why DOIs do not change, they always and forever identify the same objects as soon as they are assigned to that object which differentiate it from URLs. An article with a DOI reduces its risk of becoming lost according to PéterJacsó in Higgins (2018), who argued that keyword searches by title or author in Google, including Google Scholar, frequently provide inaccurate information: titles are attributed to the wrong authors, particularly those with common names; citations of articles are mistaken for the original article; publication years converted to volume numbers; to mention a few.

DOIs are assigned and maintained by registration agencies such as CrossRef, which provides citation-linking services for scientific publishers (Hume-Pratuch, 2014) and scholarly content

Kasdorf (2012). Kasdorf (2012) also expressed that DataCite, a DOI Registration Agency (RA) established in 2009 provide links to set of scientific data (Research Data). CrossMark which is a service of Crossref provides the most recent versions of documents, FundRef gives a unique ID for funding agencies, and Open Researcher and Contributor ID (ORCID) offers unique identity to researchers (Jeong and Huh, 2016). Each registration agency provides specific services for the community it serves, depending on specific metadata that it requires of registrants.

Registration Agencies and the Registrant

International DOI Foundation (2016) stated that Registration Agencies provide services such as allocating prefixes, registering DOI names and providing the necessary infrastructure to allow Registrants to declare and maintain metadata and state data to Registrants. This service is likely to cover quality assurance measures, in order to maintain the integrity of the DOI system as a whole at the highest possible level. IDF highlighted the roles of Registration Agency and Registrant as follows;

Registration Agency:
1. Offers services for registration of prefixes and individual DOI names using the DOI system.
2. Provides added-value services for registrants and other customers.
3. Must be a member of the IDF.
4. Engages in marketing, training, development, etc. for their chosen community.
5. May maintain a Handle mirror site (optional).
6. May subcontract their service provision (optional).

Registrant:
1. Can be any individual or organization that wishes to uniquely identify entities using the DOI system.
2. Registers DOI names with a Registration Agency. If a registrant has multiple types of content or application requirements, it may choose to use several RAs to provide services.
3. Ensures appropriate content management of their own material (maintenance of URLs and data), either directly or by contract (e.g. with RA).
4. Does not need to be a member of the IDF.

5. Has an agreed relationship as a customer or client of a Registration Agency.

Hendricks (2018) noted that for consistency and usability for all members and users, Crossref as updated their DOI display guidelines, in part to ensure security (with https), effective from March, 2017 showing recent changes to guidelines. These new guidelines introduce two important changes that differ from the previous guidelines:

1. It dropped the **dx** from the domain name portion of DOI links e.g
   http://dx.doi.org/10.1037/arc0000014
2. It recommends the use of secure HTTPS rather than HTTP. Hence, the new format will now be in this form:
   https://doi.org/10.1037/arc0000014

However, the previous form, for DOI links using http://dx.doi.org will still continue to work as long as Crossref and the DOI system exist.

With the new format, Higgins (2018) expressed that DOI has three parts as illustrated below:

Resolver service

https://doi.org/10.1037/arc0000014

Prefix

Suffix
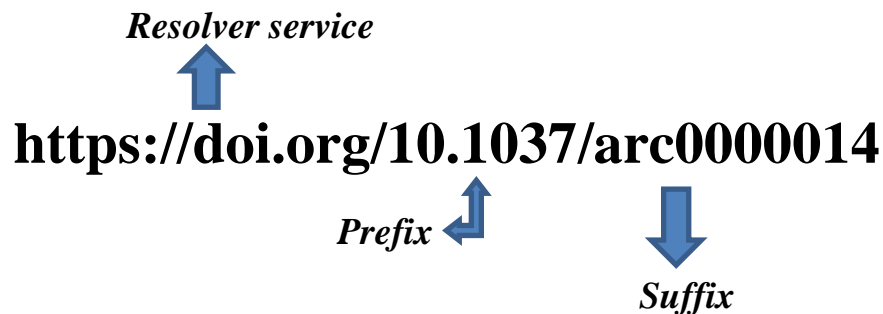
Resolving service

DOIs enable research output to be discoverable and accessible. Online publishing and digital archiving have made them almost a necessity for scholarship, and they have become the main standard for identifying research output.

Prefix

The prefix is the beginning of a unique, alphanumeric ID that certainly represents a digital object which creates an actionable, interoperable, persistent link to the work. It uses to associated with the entity or organization, and can allow users to trace the digital material back to its source.

Suffix

This part of the alphanumeric ID is unique to its assigned object. Integrity of DOIs is guaranteed because they do not rely alone on URLs and the web's DNS (Domain Name System) servers for resolution. A DOI is therefore both an online location and a unique name and description of a specific digital object and it runs on a managed global network dedicated to their resolution.

Scholarly Materials with DOI

Gorraiz (2016) carried out a study aims to shed light on the implementation of the digital object identifier (DOI) in the two most important multidisciplinary databases, namely Web of Science Core Collection and Scopus, within the last decade (2005–2014). The results show a generally increased percentage of items with DOI in all the disciplines in both databases, while the percentage of citable items with a DOI has already reached 90% in the Sciences and the Social Sciences in 2014. The values for Books and Proceedings are even lower despite the importance of these document types, particularly for the Social Sciences and the Arts & Humanities. The fact that there are still journals with a large number of items still lacking DOIs in 2014 should be alarming for the corresponding editors and give them reason to enhance the formal quality and visibility of their journals. However, Jeong and Huh (2016)'s survey in Korea found out that the degree of adoption of digital standards in Korean medical journals is very high, compared to those of international journals. The adoption of digital standards was more common in the 199 open access journals than in the 57 non-open access journals. It also discovered that in the 130 English-language journals, all were equipped with DOIs.

Scholarly Materials with DOI in Africa

The adoption rate of digital object identifier systems is still low despite the potential benefits and capabilities of digital object identifier systems (Seybold Report, 2004). This assertion was corroborated by the study carried out by Bondry and Chartron (2017) who discovered from 268,790 articles sampled in PubMed database in 2015 in the world, 232,281 (86.42%) articles have DOls, while from 1385 articles sampled in Africa, 1072 (77.40%) have DOls. The study shows that the percentage of articles with DOls over the period 1996-2015 from their study is in increasing order. This implied that only 13.58% of the articles did not have DOls and by

implication according to Braile (2011), it will be difficult to identify those articles without DOIs online which will negatively affect the journal's impact.

In Africa, that is the world's second largest and second most-populous continent, the development and application of DOIs is not so encouraging compared to other continents such as in Europe, North America, and others. The reason for this is not far fetch from the low rate of awareness of authors and researchers on DOIs. Users with the fundamental capacity to make use of a resource must become aware of its existence (McGregor and Guthrie, 2015). Most authors in Africa do not take their time in finding out if the current publication of the intending publishers is assigned with DOIs. Moreover, financial problem, poor infrastructure, government policy, poor leadership, and fear of taking risk by the publishers, amongst others are issues authors and researchers are still battling with in most African countries. Historically, scholarly information has flowed from North to South and from West to East, while it has also been difficult for African researchers to access the work of other African academics.

For the purpose of this study, to effectively discuss the application and the use of DOIs on scholarly materials in Africa, we will like to take a look at African Journals Online (AJOL), even though some few journals from Africa were not indexed in AJOL, since they did not register with AJOL. African Journals Online which is the world's largest online collection of African-published, peer-reviewed scholarly journals initiated in May 1998, but solidify in 2015 after it has successfully scale through series of changes before it came into being, partners with hundreds of journals from all over the continent, so that African-origin research output is available to Africans and to the rest of the world (AJOL, 2018a). AJOL is a Non-Profit Organization based in South Africa, have scholarly journals from 32 countries in Africa as illustrated in Table 1 below. AJOL hosts 521 Journals, including 245 Open Access Journals, and the site has 13,002 issues containing 153,149 Abstracts. There are 149,284 full text articles for download, of which 92,284 are Open Access (AJOL, 2018a), while about 70 Journals index have DOIs.

Table 1: Journals Indexed in AJOL

S/n	Countries	Number of Journals
1	Algeria	5
2	Benin	2
3	Botswana	3
4	Burkina Faso	3
5	Cameroon	8
6	Congo, Republic	1
7	Côte d'Ivoire	4
8	Egypt, Arab Rep.	14
9	Eritrea	1
10	Ethiopia	30
11	Ghana	27
12	Kenya	29
13	Lesotho	1
14	Libya	2
15	Madagascar	1
16	Malawi	4
17	Mauritius	3
18	Mozambique	1
19	Nigeria	221
20	Rwanda	3
21	Senegal	6
22	Sierra Leone	1
23	South Africa	96
24	South Sudan	1
25	Sudan	3
26	Swaziland	3
27	Tanzania	19
28	Togo	1
29	Tunisia	2
30	Uganda	12
31	Zambia	2
32	Zimbabwe	12
	Total	521

Source: Extracted from *https://www.ajol.info/index.php/ajol/pages/view/about-AJOL-African-Journals-Online*

Table 1 shows the numbers of journals in each of the 32 countries that appeared in African Online Journals (AJOLS). From a total of 521 journals registered with AJOLS, Nigeria has the highest numbers of registered journals with 221 followed by South Africa with 96 journals and

Ethiopia having 30 journals. While, Congo, Republic, Eritrea, Lesotho, Madagascar, Sierra Leone, South Sudan and Togo has a journal each registered with AJOLS database.

Table 2: Journals in AJOL with DOIs

S/n	Journal Title	Website	DOIs
1	Makerere Journal of Higher Education	https://www.ajol.info/index.php/majohe	Available
2	African Journal of Psychiatry	https://www.ajol.info/index.php/ajpsy	Available
3	Eastern Africa Journal of Rural Development	https://www.ajol.info/index.php/eajrd	Available
4	Ethiopian Veterinary Journal	https://www.ajol.info/index.php/evj	Available
5	Acta Structilia	https://www.ajol.info/index.php/actas	Available
6	South African Journal of Philosophy	https://www.ajol.info/index.php/sajpem	Available
7	Sahel Medical Journal	https://www.ajol.info/index.php/smj2	Available
8	Nigerian Journal of Surgical Research	https://www.ajol.info/index.php/njsr	Available
9	Rwanda Journal ISSN 2305-2678	https://www.ajol.info/index.php/rj/article/download/.../152787	Available
10	Dar Es Salaam Medical Students' Journal	https://www.ajol.info/index.php/dmsj	Available
11	Zambezia: The Journal of Humanities of the University of Zimbabwe	https://www.ajol.info/index.php/zjh	Available
12	Information Impart: Journal of Information and Knowledge Management	https://www.ajol.info/index.php/iijikm	Available
13	Sierra Leone Journal of Biomedical Research	https://www.ajol.info/index.php/sljbr	Available
14	Lagos Journal of Library and Information Science	https://www.ajol.info/index.php/ljlis	Available
15	Communicate: Journal of Library and Information Science	https://www.ajol.info/index.php/cjlis	Available
16	Ghana Journal of Development Studies	https://www.ajol.info/index.php/gjds/issue/view/15817	Available
17	Journal of Ethiopian Medical Practice	https://www.ajol.info/index.php/jemp	Available
18	Egyptian Journal of Medical Laboratory Sciences	https://www.ajol.info/index.php/ejmls	Available
19	Cameroon Journal of Experimental Biology	https://www.ajol.info/index.php/cajeb	Available
20	SAHARA-J: Journal of Social Aspects of HIV/AIDS	https://www.ajol.info/index.php/saharaj	Available
21	Uganda Journal	https://www.ajol.info/index.php/uj	Available

Source: Extracted from https://www.ajol.info/index.php/index/search/google?q=Journals%20with%20DOI

Table 2 above reveals twenty one (21) reputable journals in various different disciplines in AJOL assigned with DOI. With the application of DOI in journal, articles can be located after a while.

If the journal titles change, the researcher would still be able to retrieve the particular publication online. This was corroborated by Kasdorf (2012) who noted that DOI is not an identifier of digital objects but a digital identifier of objects, which provides a persistent, interoperable as well as giving actionable connection to a desirable object. Kasdorf further stated that that is the reason DOI forever identifies the same objects as soon as they are assigned to that object which differentiates it from URLs. To some extents, researchers are able to identify information materials or journals which will stand text of time online from the "Predatory Journals" that does not subject article(s) receive to proper review but only published to make money by accepting article for publication from author(s) the very day or a day after receiving the submitted article(s). These predatory journals are managed by publishers or publishing firm who enrich themselves from the pressure of "publish or perish" syndrome. Regrettably, most authors have never heard about DOI before, let alone being familiar with it (Awojobi, 2010). In Africa, as a result of difficulties in accessing African-published materials, the scholarly works in Africa have been under-utilized, under-valued and under-cited in the International and African research discourse. However, the Internet had provided a good avenue to change this, but many hundreds of worthy, peer-reviewed scholarly journals publishing from Africa cannot host their content online in isolation because of resource limitations and the digital divide (AJOL, 2018b). This is one of the reasons Onyancha (2017) calls on African governments, researchers and librarians to deploy sustainable mechanisms in increasing global visibility of African research findings using open access platforms.

Conclusion and Recommendations

The assurance of persistence of digital object identifier in retrieving scholarly materials is a welcome development to information seekers especially researchers in Africa. The DOI System identifies content objects in the digital environment with its names assigned to any entity for use on digital networks. It provides an easy method to access and re-use scholarly materials, facilitates the citation of data and therefore increases the availability and acknowledgement of research materials (Neumann and Brase, 2014). In Africa today, the present of DOI has created a reliable, fast and convenient means of locating and recovering documents on the Web after a while. It brought relieved to people working in academic environment, research institutes, ministries of education and others with scholarly related activities that needs to publish in reliable and reputable journals in Africa. This to some extents safe guide authors from publishing

firm who enrich themselves from the pressure of "publish or perish" syndrome. In Africa, many scholars and authors have not really key in into this platform, probably they are not aware of its existence, important, or benefits. In order to enhance wider visibility and easy retrieval of scholarly materials, the publishers in Africa should therefore take advantage of this development that is still at crawling stage by doing the needful and emulate those journals in African Online Journals (AJOL) to register their publications for DOI. Also, African authors needs to wake up to explore the benefit of the DOI.

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