

Measuring the Impact of Institutional Repositories in selected Zimbabwean State Universities

Ndhlovu, Phillip^{1*} and Notice, Pasipamire²

¹Library, National University of Science and Technology

*Corresponding Author: phillip.ndhlovu@nust.ac.zw

and

²Department of Library and Information Science, National University of Science and Technology

notice.pasipamire@nust.ac.zw

Abstract

Purpose

This paper reports on a study that was conducted to investigate the citation impact of institutional repositories (IRs) in selected Zimbabwean state universities using the Scopus cited reference search facility. The study assessed the extent to which archived content is cited by publications indexed in Scopus.

Design/methodology/approach

The Scopus cited references search facility was used to mine for documents citing IR content from 2014 to 2018. Results from Scopus searches were exported into text files then transported to excel workbooks for filtering and analysis. The impact of an IR was analysed from two perspectives; cited and citing documents characteristics including but not limited to the number of publications, document types and country affiliation of citing authors.

Findings

Results show that on average 8.6 documents per year were cited for all IRs combined within the 5 year period selected for the study. The most frequent Scopus indexed document type citing IR content were research articles, constituting over 50% of all citing documents across all IRs selected for the study. The most cited document types in all IRs were thesis and dissertations followed by research articles. The University of Zimbabwe IR was found to be the most influential, with 34 citers affiliated in 12 countries.

Originality/value

The study demonstrated the feasibility of using the Scopus cited reference searching facility to mine for documents citing IRs. The research puts forward a new measure of research impact which involves analysing the extent to which IR content is cited by documents indexed in a major commercial citation database (Scopus).

Keywords

Citation impact; Institutional repositories; Research impact; Scholarly impact; Scopus

1. Introduction

Institutional repositories (IRs) have been established by many institutions of higher learning worldwide. The main goal is to preserve and disseminate the institution's intellectual research output (Youngseek & Jong, 2018; Doctor & Ramachandran, 2008). Their growth is mainly attributed to the open access movement in response to escalating costs of subscription-based journals (Bangani, 2018). The rationale for developing IRs was premised on affording researchers the opportunity to disseminate research findings and providing worldwide access to information with minimum restrictions to the general public. The notion of IRs has matured and several studies have been conducted to demonstrate their impact in scholarly communication especially in developed countries. Bangani (2018) however notes that very little empirical evidence exists in Africa to support the assertion that IRs have made research output easily accessible, visible and citable as acknowledged by some scholars.

In 2005, the University of Zimbabwe Library was the pioneer in establishing an institutional repository in Zimbabwe (Matsika, 2007). Thereafter, many university libraries followed suit. Tapfuma (2016) in a study of the utilisation of open access institutional repositories in Zimbabwe discovered that nine IRs were in the public domain and of these, two IRs were established between 2007 and 2009 and seven IRs were established between 2010 and 2012. With the increasing use of IRs to store and make available the research output of institutions, there is increasing interest in evaluating the impact of institutional repositories (Smith, 2009). However, the researchers did not come across studies that addressed the citation impact of Zimbabwean state universities IRs in scholarly communication. Many studies have looked at the status of IRs and concentrated on factors affecting the adoption and populating of institutional repositories (Nyambi & Maynard, 2012; Kusekwa & Mushowani, 2014; Tapfuma, 2016).

Most studies have used measurements of quantity (Wacha & Wisner, 2011) to evaluate the impact of IRs based on upload and download counts, citation counts, usage statistics, webometrics and web analytics (Thomas, 2007; O'Brien, Arlitsch, Sterman, Mixer, Wheeler & Borda, 2016; Dzobo & Naik, 2013; Day, 2004; Bruns & Inefuku, 2015). Recently social media metrics or alternative metrics have gained ground in the evaluation of scientific publications (Weller, 2015) and are being viewed as opportunities for IRs to demonstrate the impact of scholarly publications and supplement traditional usage statistics (Konkiel & Scherer, 2013).

However, many authors have suggested that citation impact is the most important quantitative method for measuring the research impact of scientific publications (Hicks *et al.*, 2015; O'Brien *et al.*, 2016; Kratz & Strasser, 2015). Despite limitations of citation metrics for research evaluation (Kaplan & Nelson, 2000), citation impact remains a principal value that authors naturally strive for (Buehler, 2013). It is therefore instructive to demonstrate to researchers, in addition to emerging metrics, the impact of their own research that is archived in IRs using traditional citation like bibliometric measures. This is vital as Westell (2006) notes that the capacity to track citations and analyse the contributions of repository content to scholarship, is an important incentive for scholars to add their research to the repository.

Although citation tracking of IRs to ascertain impact is seen as important, it is difficult to carry out as online repositories are not indexed by major citation databases such as the Web of Science or Scopus (Thelwall, 2018; Smith, 2009; Kaplan & Nelson, 2000). A number of studies have therefore opted for webometric measures in evaluating the impact of IRs instead of using bibliometrics (Smith, 2009, Arlitsch, Wheeler, Pham & Parulian, 2021, Saha, 2018, Aguillo, Ortega, Fernández & Utrilla, 2010, Ghosh and Roy, 2021). Various web-based methods to estimate the online impact of IRs have been used. These include counting hyperlinks to IRs using web search engine queries or web crawlers as well as web citations and URL citations searches. These methods, however, have their own drawbacks. For instance, Vaughan and Yang (2012) highlights that researchers of web hyperlink analysis are faced with a scarcity of commercial search engines from which to collect hyperlink data. Web and URL citation searches method have been usually applied on small scale analyses due to their laborious nature. In the absence of comprehensive citation databases, cited references search facilities in traditional citation indexes have been used to estimate the citations to specific IR content such as theses or dissertations (Kousha & Thelwall, 2019). However, no studies have used cited reference search facility in Scopus to estimate citations to all types of IR content. This study therefore attempts to determine the impact of IRs by examining the extent to which content deposited is being embedded in authoritative global research as reflected by citations to IR content by publications indexed in Scopus.

Using the Scopus cited reference facility; this paper measures the citation impact of IRs in five Zimbabwean universities. As material deposited in IRs has also been published elsewhere, the method for extracting data for this study makes it possible to attribute citation counts to

versions deposited in IRs alone. However, this study makes no attempts at demonstrating the open access citation advantage of content deposited in IRs selected for the study. Analysing the extent to which IR content is cited in reputable publications indexed in Scopus is crucial, given the pressing need to demonstrate return on investment of IRs. This research is intended to provide a methodological and practical contribution to the evaluation of research impact of IRs.

2. Research objectives

- 1) To establish the number of documents indexed in Scopus citing IR content in Zimbabwean state universities;
- 2) To discover the number of publications in IRs in Zimbabwean state universities cited by publications indexed in Scopus;
- 3) To examine the document types citing IR content in Zimbabwean state universities;
- 4) To determine author affiliations of documents citing IR content in Zimbabwean state universities; and
- 5) To identify the cited document types of IR content Zimbabwean state universities.

3. Previous studies

There is a significant body of work evaluating the use of and citation to materials in institutional repositories as well as open access publications (Stone & Lowe, 2014). A study by Smith (2009) investigated the kind of links made from the general web to IRs and found that formal links that are equivalent to citations comprised only 1.85%. Similar low levels of citation impact were found by Kaplan and Nelson (2000) who performed a citation analysis on selected publications distributed by Langley Technical Report Server (LTRS) repository. Results showed that only 11 of the 50 selected publications were cited.

Angelo, Walsh, and Thomson (2016) examined how IR content In New Zealand IRs was being cited. Results showed that over 1000 unique items were cited almost 2000 times in articles indexed by Scopus. The majority (71%) of the cited documents were theses and dissertations. Similarly Wani and Shafi (2015) performed a citation analysis targeting scientific journal literature archived in select Open Access Institutional repositories in the field of Health Science listed by Directory of Open Access Repositories (OpenDOAR). A total of 99 articles were selected and searched in Google Scholar and Web of science to establish whether they were

any publications that cited them. The results from Google Scholar showed that 59.57% of the articles were cited while Web of Science showed that 40.42% were cited.

A review of literature discovered that many studies examining citation of IR content focused specifically on thesis and dissertations (Kousha & Thelwall; 2019; Bangani, 2018; Wolhuter, 2015; Ferreras-Fernández, García-Peñalvo & Merlo-Vega, 2015). Stone and Lowe (2014) investigated publications citing undergraduate theses archived in United States IRs. Selected theses and dissertations titles were searched using the forward citation feature in Google Scholar to establish if and where undergraduate scholarship was being cited. Study findings showed that 24% of citations to theses and dissertations were in peer-reviewed journals, and 33% in dissertations and theses. Wolhuter (2015) used a Google Scholar search and a search of the ERIC database to assess the scientific impact of 97 South African doctoral dissertations in educational sciences from 2008. He found out that 72% made no citation impact.

Ferreras-Fernández, García-Peñalvo and Merlo-Vega (2015) studied the benefits of scientific communication model through open access repositories by assessing the impact of doctoral theses at the University of Salamanca in Spain. Using Google Scholar, study findings showed that 32% of all Experimental Sciences Electronic Thesis and Dissertations (ETDs) received at least one citation followed by Humanities and Social Sciences at 20% each, then Life Sciences at 16%, while Technological Sciences was least with 4%. Bangani (2018) investigated academic and societal impacts of the engineering electronic theses and dissertations (ETDs) at the North-West University. Using Google scholar, he discovered that 41.2% of the theses and dissertations received at least one citation. Kousha and Thelwall (2019) used a multistage method to extract Google Scholar citation counts for large collections of dissertations from American repositories indexed by Google to assess their academic impact. Findings showed that 15,860 theses (20%) out of 77,884 theses examined, had at least one Google Scholar citation. In spite of the above investigations, no study has been conducted to ascertain the possibility of using cited reference searching facility in Scopus to determine the citation impact of content deposited in IRs. Additionally, most of the studies did not highlight the types of documents citing IR content.

4. Methods

A quantitative approach was used in this study to identify publications citing IR content using Scopus. The rationale being that Scopus is generally considered a reputable citation database that indexes high quality publications. In turn, these publications are more likely to cite high quality literature. Therefore, the quality of an IR can potentially be assessed by examining the extent to which its content is cited by documents indexed in Scopus.

To gain confidence and credibility in using Scopus, a pilot study was carried out to test the feasibility and suitability of using Scopus to identify documents citing IR content since no study was found to have used Scopus. The University of Pretoria (UP) IR was analysed for this purpose and the Scopus reference search facility successfully identified 104 documents cited by Scopus indexed documents from 2014 to 2018. Scopus was then employed in measuring the impact of IR in Zimbabwean state universities

In order to mine for publications citing IR content in Scopus, the advanced search feature of searching within references was used. Using the base URL of the selected repository excluding the internet protocol at the beginning as a search term, a manual search of all publications citing documents in Zimbabwean IRs from 2014 to 2018 was carried out. Excluding the internet protocol broadened the search. For instance, some authors cite UP IR as <https://repository.up.ac.za/> while others cite it as <http://repository.up.ac.za/>. The starting year 2014 was chosen such that the last IR to be established was given at least 2 years to have begun accumulating meaningful citations.

A typical formulation, for example for documents citing the University of Zimbabwe IR was: "ir.uz.ac.zw". It was assumed that all documents citing content in IRs would at least include the basic URL in the references. The results from the Scopus search would then list all documents containing "ir.uz.ac.zw" in their references as an indicator of citing material archived in the IR. Scopus functionality of exporting cited references into text file was then used instead of exporting directly to an excel spreadsheet for analysis. The text file was saved and then exported back to excel using the text import wizard set to delimited data type using the 'Tab' delimiting option. The column data format was set to 'General'. Converting the cited references results to a text file first was done in order to have control over how the references are arranged in excel for effective filtering of references to show only results with references pointing to a particular IR basic URL only, in this example "ir.uz.ac.zw".

The powerful ‘analyse search results’ feature of the Scopus was used to identify the number of documents indexed in Scopus citing IR content by year, by document types, by author country affiliation and by subject area. The Scopus classification scheme was used to classify document types citing IR content.

The citations to IR content found by Scopus through the filtering process described above were manually checked to establish citing document type (journal article, conference paper, book/book chapter, thesis, or other). This was done mainly by visual inspections of the references as most could clearly show whether the cited item in the IR was a ‘Thesis’, ‘Journal article’ or ‘Conference paper’. References with no indication of the cited document type were searched for using the title of the reference directly in the concerned repository in order to determine how it was classified. However, the selected repositories at times had different ways of classifying deposited items. The researcher, therefore, used categories in the OpenDOAR classification scheme (Tsunoda *et al.*, 2016) to classify cited IR content into 6 document types.

Most content deposited in open repositories is not exclusively available in IRs. As such, using the ‘search in references’ feature of the Scopus ensured that any citation in the references sections of articles indexed in Scopus is attributed to the availability of the cited documents in IRs alone. Only IRs in Zimbabwean state universities with at least one document cited by publications indexed in Scopus were included in the study. These include the University of Zimbabwe (UZ), National University of Science and Technology (NUST), Midlands State University (MSU), Zimbabwe Open University (ZOU) and Bindura University for Science Education (BUSE).

5. Results and Discussion

Results and discussion follow the pattern of objectives presented in the background section of the paper.

5.1 Number of documents indexed in Scopus citing IR content in a 5 year period

The cited reference facility search results in Scopus using the basic URL of a repository excluding the internet protocol were used as the basis for determining the number of documents indexed in Scopus citing IR content. The numbers of documents citing Zimbabwean IR content for the period 2014 to 2018 on average were 8.6. Figure 1 shows a general increase in the number of documents citing IR content for the 5 year period. This is most evident in the case

of the U.Z IR, NUST IR, and the MSU IR. Although the University of Zimbabwe IR is the most cited among the Zimbabwean IRs as shown in Figure 1, its citation impact is extremely low. This is reflected by the fact that only 4.8 documents on average are citing the UZ IR. This is not consistent with the fact that the university is generally considered the most reputable institution of higher learning in Zimbabwe. Wacha and Wisner (2011) lamented that the quality of the materials maintained in institutional repositories is often not representative of the institution's academic stature.

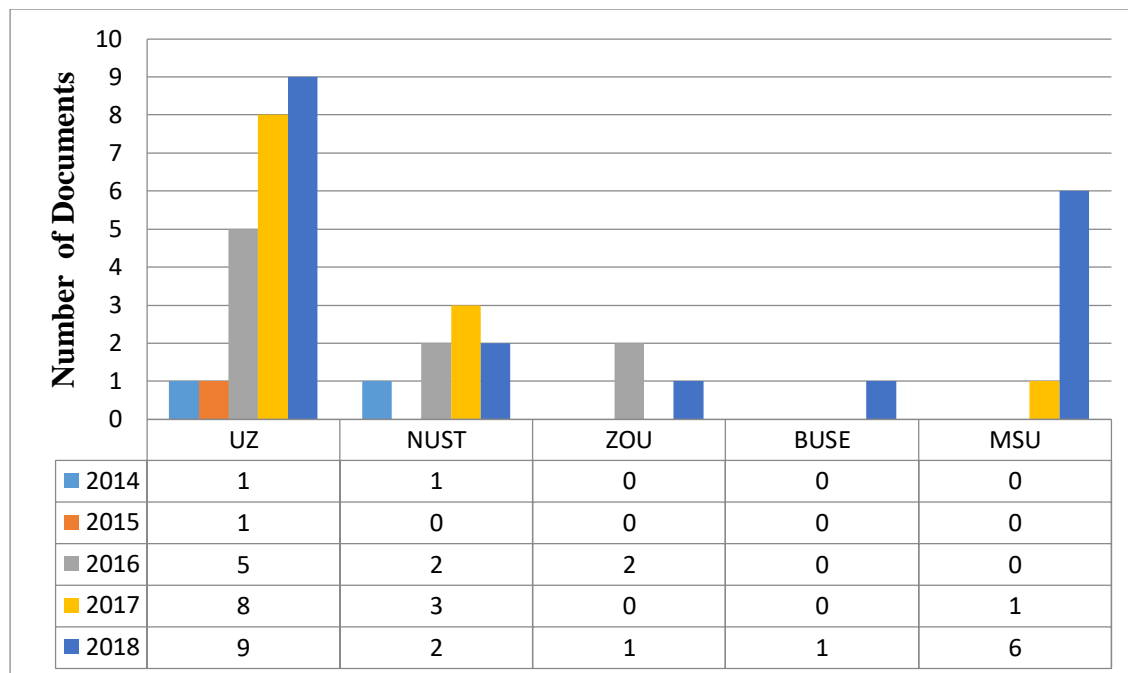


Figure 1: Documents citing IR content by year

The 'documents by subject area' search results in Scopus were used to categorise documents citing IR content by major subject discipline as shown in Table 1. The majority of citing documents for U.Z IR (48.7%) and NUST IR (43.12%) belonged to the natural and applied sciences. This is in sharp contrast with the ZOU IR (66.7%), BUSE IR (100%) and MSU IR (72.7%) where social sciences based documents constituted the majority of citing documents. These results may imply that U.Z and NUST IRs are very influential in the natural and applied sciences while, ZOU, BUSE and MSU IRs are influential in the social sciences.

Table 1: Distribution of Scopus indexed documents citing IR Content by Discipline

Discipline	U.Z IR	NUST IR	ZOU IR	BUSE IR	MSU IR
Business	7.7%	17.4%	0.0%	0.0%	9.1%
Humanities	10.3%	13.0%	0.0%	0.0%	18.2%
Natural and applied sciences	48.7%	43.2%	33.3%	0.0%	0.0%
Social sciences	33.4%	26.1%	66.7%	100.0%	72.7%

5.2 Number of documents in IRs cited by Scopus indexed documents

The data filter tool in excel was used to establish the number of documents cited by Scopus indexed documents in various IRs selected for the study from the lists of all references cited by documents citing IR content. Study results showed that the number of cited documents was equal to the number of citing documents indexed in Scopus. For example, UZ had 24 cited documents and 24 citing documents. NUST had 8 cited documents and 8 citing documents. The rest of the findings are captured in Figure 2. The relatively low number of documents that were cited for all IRs investigated is consistent study findings of Kaplan and Nelson (1999), who discovered that only 11 of the 50 selected publications for citation analysis were cited.

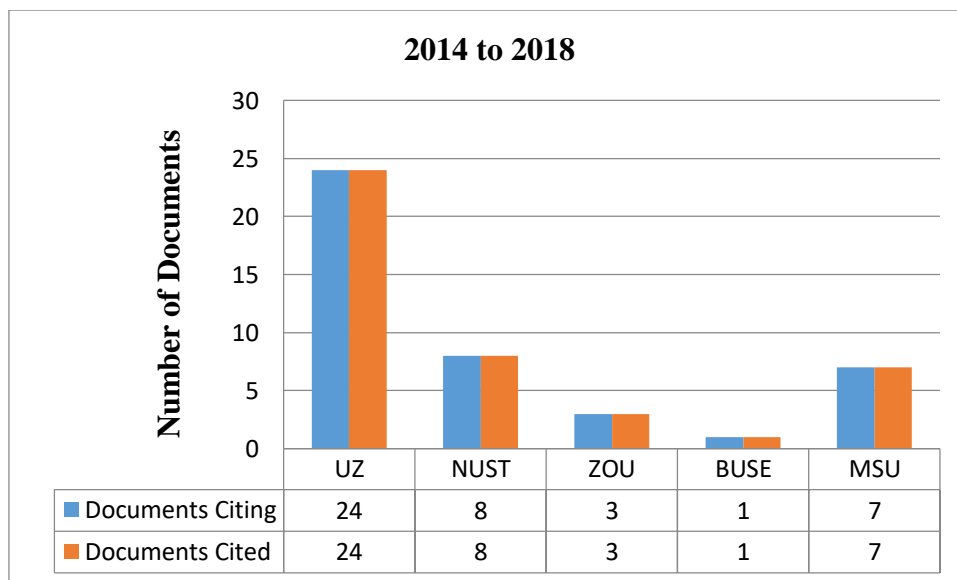


Figure 2: Number of documents in IRs cited by Scopus indexed documents

5.3 Document types citing IR content

The Scopus classification scheme was used to classify document types citing IR content. The most frequent document type citing IR content was ‘Article’, constituting over 50% of all citing articles across all IRs selected for the study. This is consistent with the fact that the Scopus indexes primarily journal literature. The thesis and dissertations were not included as they are not indexed by Scopus. Table 2 shows these findings in detail.

Table 2: Documents types citing IR content (2014 – 2018)

Document Type	U.Z IR	NUST IR	ZOU IR	BUSE IR	MSU IR
Articles	71%	62.5%	67%	100%	57%
Books	0	12.5%	0	0	0%
Book Chapters	13%	12.5%	33%	0	14%
Reviews	8%	0	0	0	0%
Conference Papers	4%	12.5%	0	0	14%
Editorials	0%	0	0	0	0%
Articles inPress	4%	0	0	0	14%
Letters	0%	0	0	0	0%

5.4 Author affiliations of documents citing IR content

The study also investigated the sphere of influence of IRs based on the country affiliation of citing authors. The UZ IR was cited by 34 authors originating from 12 countries, NUST IR, 10 authors in 8 countries, MSU IR, 7 authors in 6 countries, ZOU IR, 3 authors in 3 countries and BUSE IR, 1 Country. A much closer analysis revealed that all the Zimbabwean IRs were cited by authors from 20 countries. Table 3 captures these countries. The number of documents citing IRs by country seems to be high because of collaborated papers. Equal credit was given to all collaborating author country affiliations, regardless of the number of authors from that country.

Further scrutiny of the results also showed that the proportion of non-African countries citing the IRs selected for study is greater than African countries. This seems to confirm a lack of interest in research output from African countries by other African scholars and researchers (Iroaganachi, Itsekor and Osinulu, 2014; Becker and Chiware, 2015. Bangani (2018) attributes

this phenomenon to a lack of appreciation by African scholars of research output from fellow colleagues in a study which indicated that ETDs attracted a mere eight citations from other African countries. This phenomenon could, however, be explained by poor visibility of the IRs on the World Wide Web (Tapfuma, 2019).

Table 3: Distribution of Documents Citing IRs by Author Country Affiliation

UZ IR		NUST IR		ZOU IR		BUSE IR		MSU IR	
Country	Documents	Country	Documents	Country	Documents	Country	Documents	Country	Documents
South Africa	9	Zimbabwe	3	Colombia	1	South Africa	1	South Africa	2
Zimbabwe	9	Canada	1	Serbia	1			Australia	1
Malawi	3	Egypt	1	Zimbabwe	1			Russian Federation	1
United Kingdom	3	Ethiopia	1					United Kingdom	1
United States	3	France	1					Zimbabwe	1
Australia	1	Nigeria	1					Undefined	1
Ghana	1	South Africa	1						
Italy	1	United Kingdom	1						
Kenya	1								
Romania	1								
Senegal	1								

Spain	1					
Total	34	10	3	1	7	

5.5 Cited document types in IRs

As shown in Table 4, thesis and dissertations, as well as research articles, were the most cited document types in the Zimbabwean state universities IRs. BUSE had a 100% on theses and dissertation cited while NUST had a 100% on research articles cited. This means that NUST IR did not have any thesis and dissertations cited and BUSE IR did not have any research articles cited. Overall theses and dissertations were the most cited with an average of 49, 8%, followed by research articles with an average of 43.5%. Table 3 shows these findings in full. These findings are in agreement with the study of Angelo, Walsh, and Thomson (2016) that found out that the majority (71%) of the cited documents in IRs studied were theses and dissertations. It is noteworthy to mention that only UZ had their reports, conference papers, book chapters and books cited. The other 4 universities had only research articles, and theses and dissertations cited. This may indicate that the repositories either do not have the highlighted document types or they exist but not of sufficient quality to warrant any citation.

Table 4: Cited document types in IRs (2014 – 2018)

Document Type	U.Z IR	NUST IR	ZOU IR	BUSE IR	MSU IR
Research Articles	8%	100%	67%	0	43%
Reports	4%	0	0	0	0
Conference Papers	13%	0	0	0	0
Theses and Dissertation	59%	0	33%	100%	57%
Book Chapter	8%	0	0	0	0
Book	8%	0	0	0	0
False references	0	0	0	0	0

7. Conclusions and recommendation for further research

The study revealed that Zimbabwean IRs have a significantly low international scholarly impact. This was reflected by the fact that, the highly cited IR, namely the U.Z IR, only accumulated 24 citations between 2014 and 2018. While further research is required to complement the study findings, the study made a methodological and practical contribution to the evaluation of research impact of IRs by successfully demonstrating the feasibility of using the Scopus cited reference searching facility to mine for documents citing IRs. Thus the research managed to put forward a new measure of research impact which involves analysing the extent to which IR content is cited by documents indexed in a major commercial citation database (Scopus). It is recommended that future studies make use of the same method but using a different data source which allows for cited reference searching such as Web of Science. This will enable a comparison of results and further test the practicality of the method. The method used to identify documents citing IR content retrieved only references containing a uniform resource locator {URL} reflecting the archive, for instance, <http://ir.uz.ac.zw/xmlui/handle/10646/2934>. The challenge is that the same article can be referenced using its Uniform Resource Identifier (URI) which is more persistent (<http://hdl.handle.net/10646/2934>). The implication of this is that some documents which used persistent identifiers in citations and not the URL of the resource may have been excluded resulting in undercounting of documents citing IR content selected for the study. This problem could also have been made worse by the tendency of some authors to refer to the conventionally published version in their citations even though a document could have been originally sourced from an IR. In addition, citation analysis performed for this study could have been limited by the fact that Scopus does not index IR content. A higher level study can also be carried out in Zimbabwean State universities to establish the intellectual level of impact of IR cited articles in the citing studies by analysing the citation types.

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