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ASSESSMENT OF INSTITUTIONAL REPOSITORY INITIATIVES AND DEVELOPING A LOCALIZED KNOWLEDGE REPOSITORY FRAMEWORK FOR ETHIOPIAN HIGHER EDUCATIONAL INSTITUTIONS

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ABSTRACT

This study's interest is to assess the present status of Institutional Repository (IR) in Ethiopian Higher education institutions for its Existence, Usage, Policy issue, Content variety, Availability, and Software Type of digital repository collections available to academic community and industries as open access. For this purpose, selected Ethiopian higher education institutions have been consulted to assess their digital strategies through wide- ranging data collection approaches. Subsequently the paper focuses to design and develop a cloud based Knowledge Repository System's Framework for institutional repositories in Ethiopian context. Results showcased few operational institutional repositories, which were in place at some institutions, but the majorities were not experiencing such a system. The study contributes to a more informed understanding of the development of IRs and identifies a framework for better availability of existing institutional repositories and for future IR developments. For the functionality and validity assurance, the prototype has also designed and tested in real world scenario for virtualized cloud environment and found practical and useable.

KEYWORDS

Institutional Repository, Higher Education, Framework, Availability, Open Access, Open Source etc.

INTRODUCTION

The advent of internet and the World Wide Web has changed the way of information dissemination in many ways. The scenario in academic institutions is not far from this truth. These institutions are the main sources of knowledge and excellence and have remarkable contribution in societal development.

The Institutional Repository (IR) is an information system that collects, preserves, disseminates and provides access to the intellectual and academic output of the university community (HEFCE, 2009). An institutional repository can also be viewed as a "...a set of services that a university offers to members of its community for the management and dissemination of digital materials created by the institution and its community members. This includes materials such as monographs, academic journal articles, both preprints and post prints undergoing peer review, as well as electronic theses and dissertations (ETDs) (Ithaka, 2006).

Nowadays, the IR is a key tool of the scientific and academic policy of the university. On the other hand, access to the full text of the digit13al learning objects makes the repository become a fundamental support tool for teaching and research, whilst at the same time multiplying the institution's visibility in the international community (Werner Z et. al. 1999).

A repository contains mechanisms to import, identify, store, preserve, recover and export a set of digital objects, usually from a web portal (Buehler and Boateng, 2008). Labels ('metadata') that facilitate their recovery describe those objects. From a conceptual point of view, the IR forms an authentic management system of contents, given that, apart from the documents themselves, the repository offers to the academic community a set of services for the management of that output (ANBL, 2007). The IR is a means of scientific communication, but it cannot be understood

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as a publication channel; it must be understood as a complement to the process of scientific publication formalized with peer review (BIS, 2009).

In the last few years, the increased acceptance of Open Access (OA) movement has gained a lot of strength among the academic and scientific institutions and this leads to the spread of institutional repositories. The OA supports the paradigm of the open access and the self-archiving of the publications.

Budapest Open Access Initiative (BOAI) defines open access as: "Free availability on the public internet, permitting any users to read, download, copy, distribute and/or print, with the possibility to search or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself".

PROBLEM STATEMENT

Over the last two decades, higher education institutions (HEI) in Ethiopia are expanding drastically; same time they are facing a number of challenges. In recent years, considerable interest has focused on identifying those challenges, identifying opportunities and threats and proposing ways to address them. Limited visibility of the scholarly contributions of the institutions to the different domains of sciences and industries are identified as one of the challenges by many researches. In addition lack of funding, collaborating in research and talent, quality of research, critical thinking and argumentation, personal and group knowledge construction are identified as challenges facing higher education institutions.

Institutional Repositories can provide linking to other repositories and can support HE institutions to address some of the challenges.

This research is planned to be conducted to address those challenges by assessing the status of the institutional repositories in Ethiopian Higher education institutions and to design a framework, which is interoperable and can be deployed in all Ethiopian Higher education and research institutions with minimal or no modification. Therefore, the research tries to get answers for the following research questions extracted from the problem statement.

Is an institutional repository system deployed in Ethiopian Higher Education Institutions?
If IR is already deployed, how is the usage and service availability of the systems?
How is the content variety? What kind of software platform is used?
Does the repository offer Open Access information? Is there an Open Access policy?

LITERATURE REVIEW

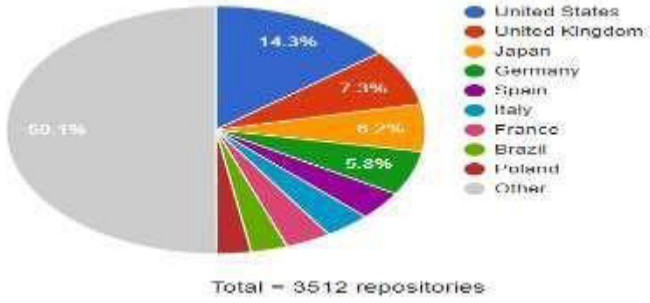
In the past two decades, institutional repositories (IRs) have become a common part of the scholarly communication ecosystem (Farhana S., et. al. 2010). As presented on Fig 3.1 the fast growth of institutional repositories is initiated from the year 2006, before this year there were only less than 500 repositories worldwide. As many research results are demonstrated; the development of institutional repositories has fasten the academic institutions linkage with the industries and the visibility of the institutions scholarly outputs has created collaboration among other institutions. As an increasing amount of government funding is now directed to open access publishing, this may foster the development of institutional repositories worldwide even more.

The Directory of Open Access Repositories (OpenDOAR) currently (March 2018) reports 3,512 institutional repositories worldwide of which 502 (14.3%) are in the US, 256 (7.3%) in the UK, 217 (6.2%) in Japan and 203 (5.8%) in Germany. The figure below presents the proportion of repositories worldwide as of March 01, 2018.

Figure-1: The Growth of OpenDOAR Database Worldwide over the years 2006–2017 (OpenDOAR March 2018)

Sources: Authors Compilation

Figure-2: Proportion of Institutional Repositories by Country - Worldwide (OpenDOAR 01 March 2018)



Sources: Authors Compilation

Several surveys of librarians in many countries' higher education institutions have been conducted in order to gain a better picture of the overall state of IR development; however, the vast majority of these surveys have focused on large comprehensive research universities and other large research organizations. A few authors have conducted similar surveys that were more inclusive. A recent, more broadly based survey from (DIUS, 2008) confirms other study is finding that large research universities are advanced in the development of their IRs but are not representative of the majority of colleges and universities. (Alma Swan et. al. 2009) Describe the impact of establishing and operating an IR on the roles and careers of reference librarians.

After analyzing the existing literatures related to the study in hand we have observed that no or minimum researches has conducted to examine the overall state of IR development in Ethiopian Higher education institutions and this research outcome would be a new contribution to the domain in Ethiopian context.

MATERIALS AND METHODS

Research Design

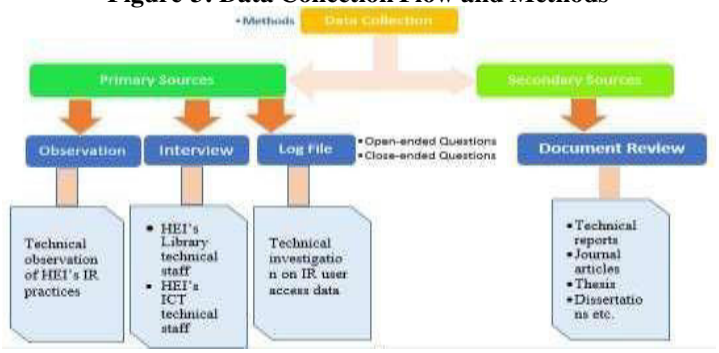
The study is mixed mode / form of exploratory cum constructive research designs (Deepshikha and Sharma, 2014). Initially the research starts with efforts to explore the institutional repositories in Ethiopian Higher Education institutions. It explores the answer for the research questions, Later the research study made an effort to construct a Knowledge Repository Framework as a prototype that can be used as a preservation center for existing and future

research works done at all Ethiopian Higher education and research institutions. Finally, the conceptual framework model has been implemented and deployed in a working infrastructure for the functionality and usability assurance. The whole scenario justifies that this study is exploratory cum constructive.

Research Approach

The Study used different approaches / methods for gathering relevant facts/ data and technical information in the domain of research. Figure-3 presents the major data gathering approaches used in this study. Based on chosen research design and required data the research approach used in this study was qualitative for technical interview of stakeholders / experts, system log file analysis and Personal technical observation of researchers. As a general concept, qualitative research is considered suitable for gaining an in-depth understanding of underlying reasons and motivations.

Figure-3: Data Collection Flow and Methods



Sources: Authors Compilation

DESCRIPTIONS FOR DATA COLLECTION PROCEDURES

Interview

Different HEI's Library and ICT experts are interviewed using open-ended and close-ended questions for better understanding of the status of Institutional Repository initiatives, System models, software platforms, content size, open access policy issues etc.

Sampling Size and Selection Strategies

The sampling method of the population in this research was Purposive sampling that includes directors and technical staffs of Library and ICT directorates at different Higher Education Institutions in Ethiopia. Thirty (30) domain experts (Directors of Library and ICT and Technical staffs) from Fourteen (14) public HEIs were interviewed using purposive sampling technique.

Technical Observation

Direct observation methods for collecting data regarding current status of IRs in the fourteen HEIs were applied to understand IR's deployment status, Models, Software platform, Performance, Interoperability, access methods, content and developmental framework. Later these observatory facts were critically analyzed.

Log Files

A log file is a system file, which provides evidence about user access information based on time and data type. In this research in addition to interview and technical observation, log file information is used to analyze the accessibility of IRs in selected Ethiopian HEIs.

Selection Strategies for Testing Tools and Technologies

Different software and designing tools and techniques were used to accomplish the research tasks. Open source DSpace digital repository platform is used to testing and functionality assurance of the proposed cloud based knowledge repository framework.

RESULT AND DISCUSSION

The study investigated the development and initiatives of institutional repositories in Ethiopian Higher Education Institutions. Keeping this in view, it was decided to structure the interview questions so that it helps us to address the research questions (Sharma and Alazar, 2016). The questions were designed to be in five major sections such as Demographic Information, Institutional Repository Assessment, Availability and Accessibility of Research Outputs, Institutional Policies and Conclusion. In addition, all the data collection procedures are structured to address the following parameters, which are aligned with the objectives of the study.

Existence,
Usage,
Policy issue,
Content variety,
Availability, and
Software Type

In the following sub section the analysis and discussion is presented according to the parameters. Total 14 institutions were identified for the study. Interview questions were presented in person for Library Directors, Library ICT staffs and ICT technical staffs of the 14 institutions. Responses were received from Library Directors / Staffs of 14 institutions, which is 100.00% of the total sample.

Existence of IR in the Institutions

Table 1 presents the IR existence assessment in the 14 higher education institutions. The result showcases only 6 institutions (42.86%) are deployed IRs and the remaining 8 institutions (57.14%) does not deployed IR.; from this 57.14% , 35.71% of the institutions (5) are planning to deploy institutional repositories in the near future. Figure 4 shows the Summary of IR Existence in the institutions.

Table-1: Institutional Repository Existence in the Study Population

S. No.	Name of the Institution Repository	Deployment of IR Done?	Remark
1	Debre Markos University	Yes	Mixed With Digital Library
2	Bahir Dar University	Yes	
3	Woldia University	No	
4	Wollo University	No	
5	Debre Birhan University	No	
6	Addis Ababa University	Yes	
7	Jimma University	Yes	
8	Wolkitie University	No	
9	Ethiopian Institute of Textile Technology	No	
10	Haromaya University	Yes	
11	Arba Minch University	Yes	
12	Gondar University	No	
13	Wachamo University	No	
14	Wolayta Sodo University	No	

Sources: Authors Compilation

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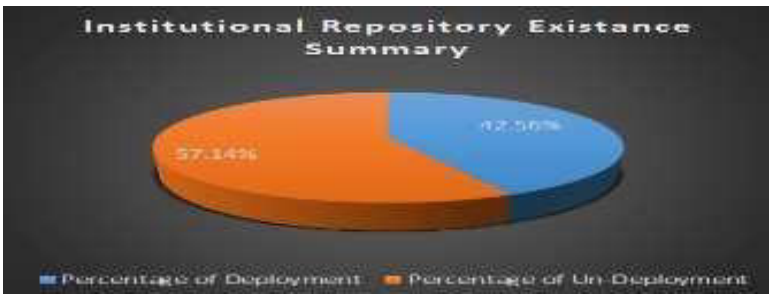
Figure-4: Summary of IR Existence in the Institutions



Sources: Authors Compilation

Usage of IR System of the Institutions

From the list of the institutions who already deployed Institutional Repository systems most of the usage statistics shows that the access is made from local machines, which are members of the local network infrastructure. In fact To disseminate its research output to the wider audiences and to maximize the outputs of research for the benefits of the community; the research outputs needs to be accessible to the global community including similar Educational Institutions, Industries, Funding agencies and etc...

IR Policy Issues in the Institutions

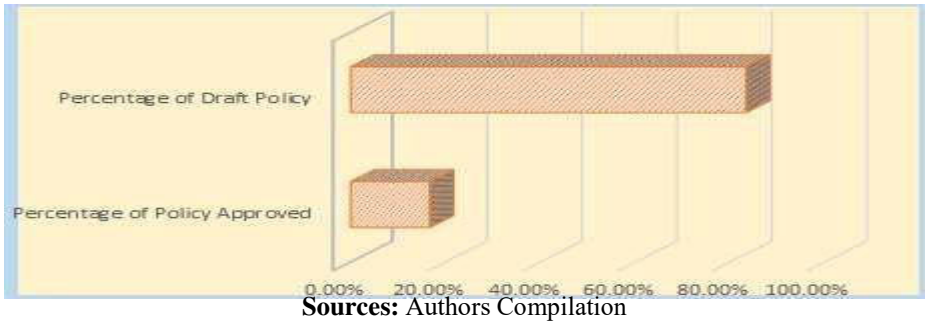
Accordingly, from the discussion and observations made the main barrier for the limited usage statistics is the result of Open access policy of the repositories. From the total number of IRs deployed in the sample institutions only 1 institution has an approved open access policy, which grants all public funded research outputs to be disseminated as broadly as possible to the global audiences. The rest 4 institutions are working on the draft policy preparation. Table-2 and Figure-5 present the summary of IR policy implementation and draft policy formulation activities in the sample institutions.

Table-2: Open Access Policy in the Institutions

S. No.	Institution's Name	Approved IR Open Access Policy	Draft IR Open Access Policy
1	Debre Markos University	No	No
2	Bahir Dar University	No	Yes
3	Addis Ababa University	No	Yes
4	Jimma University	No	Yes
5	Haromaya University	No	Yes
6	Arba Minch University	Yes	Yes

Sources: Authors Compilation

Figure-5: Summary of IR Policy Implementation and Draft Formulation in the Sample Institutions



Sources: Authors Compilation

Content Variety of IRs in the Institutions

Table-3 indicates distribution types of contents listed in the institutional repositories in Ethiopian Higher Education Institutions. Among the 6 sample institutions which are already deployed IR, 4(66.67%) repositories for Articles; Conference Paper; Theses; Dissertations and 2(33.33%) repositories for only Articles; Conference Paper; Theses; Books; Learning Materials.

Table-3: Distribution of Contents in IRs in EHEIs

S. No.	Content	Number of IR	Cumulative Percent
1	Articles; Conference Paper; Theses; Dissertations	4	66.67%
2	Articles; Conference Paper; Theses; Books; Learning Materials	2	33.33%

Sources: Authors Compilation

Service Availability of IRs in the Institutions

In online settings – such as IRs - there may be comparable impediments limiting the availability of items that are present (and, thus, available) in a collection, that is because the mere presence of papers within an IR does not guarantee their availability. The service availability mainly depends on the ICT infrastructure of the institutions i.e. the network bandwidth, server capacity, power backup systems and the software licensing issues. Among the 6 institutions 83.33% responded that they have stable ICT infrastructure; thus the service availability in the institutions is granted with acceptable downtimes. 16.67% of the institutions responded that they have barriers on their running ICT infrastructure; thus more down time problem facing.

Software Platforms Used By the Institutions

Table-4 indicates the list of software used by the institutional repositories in Ethiopian higher education institutions. Among the 6 repositories, 16.67% repositories are using AgriOceanDSpace software, and 83.33% are using DSpace. Actually, AgriOceanDSpace is an Institutional Repository software platform specifically designed for agricultural research repository development. Thus, we can conclude that all institutional Repositories in Ethiopian higher education institutions are using DSpace software platform families.

Table-4: Distribution of Software Platforms by IRs in EHEIs

S. No.	Software Platform	Number of IR	Cumulative Percent
1	DSpace	5	83.33%
2	AgriOcean DSpace	1	16.67%

Sources: Authors Compilation

Proposed IR Framework

The study proposed a cloud based institutional Repository framework which can serve the entire Higher education institutions (Public and Private) in Ethiopia without a major change on the existing institutional repositories which only needs some configuration for integration with the national cloud based IR (Alemseged and Sharma, 2016). Hence, Cloud computing is a new paradigm that provides a wonderful advantage in terms of latest technological support, economic aspects (i.e. pay as you use), bendable computing competences, real time availability, reliability of services with limitless computing power and many.

The proposed cloud based institutional Repository framework for Higher Education Institutions contains three tires.

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Local / on Premise Infrastructure Layer

This layer comprises IR servers distributed at different higher education institutions, which provides services like security and monitoring, standardization and interoperability and storage.

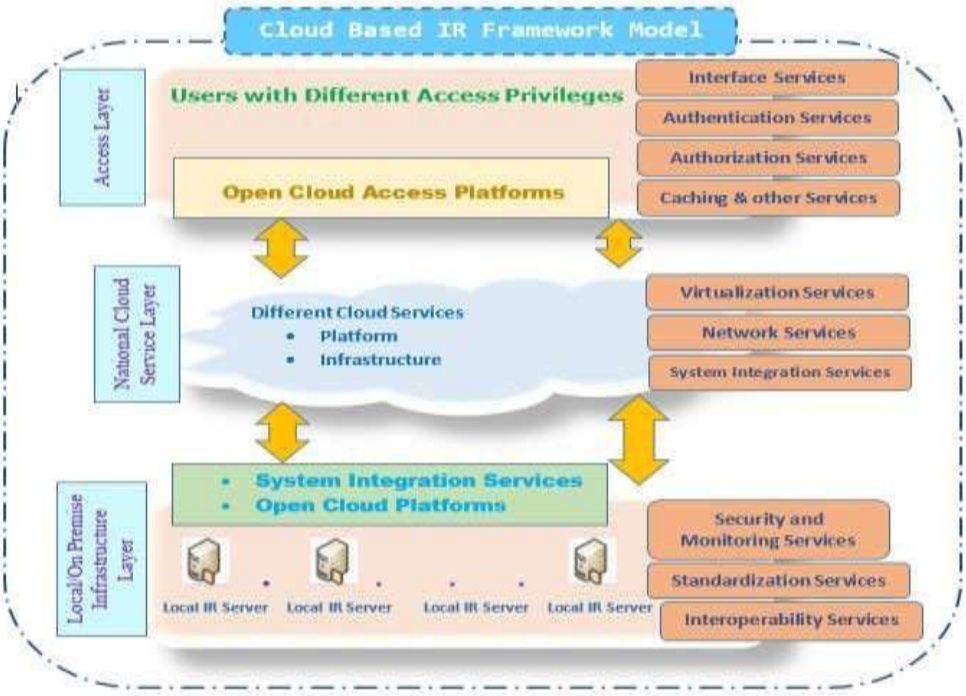
National Cloud Service Layer

This layer performs the task of integrating on premise ICT infrastructure to the access layer so that the services seem to be rendered from a single service center.

Access Layer

This layer performs user access operations (i.e. Authentication, Interface service, catching), different cloud controllers can be used for this layer to manage such services e.g. Eucalyptus open source cloud.

Figure-6: Layered Cloud based IR Framework, which is proposed by the Study



Sources: Authors Compilation

CONCLUSION

Institutional Repositories have a vital role for the development of institutions, community and industries, in that removing the barriers related to the IR initiatives will accelerate research and development works, enrich education, and share learning. The main barriers identified in this research related to IR initiatives are: 1) small number of institutions deployed IR system; 2) limited implementation of open access policy in the institutions, 3) ICT infrastructure Limitations especially in the new generation institutions and 4) collaboration among ICT department and the Libraries is minimal in many institutions. It is good effort for accessing all the IRs in one place all over the world, thus this research proposed a cloud based IR framework which can be deployed by all HEIs with no or minimal modifications. For the functionality and usability assurance, the framework is tasted at Arba Minch University ICT infrastructure as a case and a virtual cloud infrastructure found functional and usable.

RECOMMENDATION

Because of the huge positive impact of Institutional Repositories (for the institutions, community and industries), we recommend: First; all HEIs in the country to start working on IR deployment, with minimized barriers by taking lesson from their predecessors. Second; ICT and Library departments to work collaboratively. Finally; the institutions higher bodies should support Open access policy formulation. Further, the proposed framework should be deployed in a working environment and other enhancements will be expected from future research works.

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