STATUS OF OPEN ACCESS REPOSITORIES: A GLOBAL PERSPECTIVE

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Abstract **Purpose:** *The present study attempts to highlight the status of open access repositories globally.*

Methodology*: Present study is based on the data gathered from open-DOAR. Data gathered were thoroughly analyzed based on chosen parameters, viz., geographical distribution, software usage, language diversity, operational status, repository type, and subject coverage.*

Findings: *Open access (OA) repositories have witnessed potential growth trends particularly in developed countries. On the other hand, developing countries have also shown promising growth rate of open access repositories. This evidently signifies that these nations have become conscious of the need and importance of OA repositories. However, there is still much wider scope for their growth and development.*

Research Limitations/Implications*: The study highlights status of only 2168 repositories registered in the Open-DOAR (Directory of Open Access Repositories) as on February 8-10, 2012.*

Future Research: *The study provides wider perspective of open access repositories and further, can be enriched by including research facets like, content management policies, and impact of OA repositories on scholarly communication.*

Keywords: *Open Access, Scholarly Communication, Open Access Repositories, and Directory of Open Access Repositories (Open-DOAR).*

1. INTRODUCTION

Present era is the epoch of digitization that has opened up unprecedented opportunities for the dissemination of scientific knowledge. Information Technology has fundamentally changed the way information is created, stored, and shared (Zheging, Huiwei, & Wenjing, 2010). However, sharing this knowledge competently is crucial for the future research throughout the world. One much debated way of sharing scientific knowledge is open access (Potonick, 2008). Open access means free, immediate, permanent online access to the full text research (Pinfield, 2005). It facilitates the availability and distribution of scholarly communication as a means and effort to solve the problem of inaccessibility primarily due to financial constraints in addition to other factors viz., geographical barrier, political barrier etc. (Ghosh & Das, 2007). However, in order to accomplish the real purpose of open access, there is a need to archive open access material, which leads to the concept of open access repositories. Open access (OA) repositories are digital archives of research materials deposited by their authors (also known as self-archiving). These are created and maintained to provide universal and free access to information in electronic format as a means of facilitating research and scholarship (Reitz, N. D., as cited in Bhat, 2010).

OA repositories form a permanent and critically important part of the scholarly communication process (Swan, 2005). Their primary role is to provide open access to research literature. Moreover, services may be added to repositories to provide extra functionality (Chan, 2004) which can enhance global dissemination of information. In this context, a repository is a mechanism for centrally storing,

disseminating, and preserving digital material. It may belong to an institution, such as a university, or a discipline, such as Physics or Economics and can contain a variety of content types and formats, for example, scholarly articles and preprints, reports, theses, audio, video, images, and other materials (Davis and Connolly, 2007). As repositories expose metadata of each item, they allow the repository content to be found by Google or other search engines such as *OAIster* (Ottaviani & Snavely, 2003). Therefore, OA repositories need to be created so as to be seen and emulated by other institutions. Moreover, the escalating cost of journal subscriptions and diminishing library budgets have caused *"Serials Crisis"* in the field of scholarly communication. To overcome this hindrance, many academicians resorted to publication of their articles in sites, which are *"open"* for all and free of cost (Suber, 2012). The open access journals and open access repositories are the products of this outlook. Similarly, there are many such knowledge spots on the internet viz., the Directory of Open Access Repositories (DOAR), Open J – gate, Project Gutenberg and ERIC database (Amerada, Gopakumar, & Baradol, 2011). Thus, keeping in view the immense importance of open access repositories in fulfilling the real purpose of open access researchers, their institutions and their funders need to be informed vis-à-vis the benefits of providing open access and should be inculcated on how quickly and minimally it is done.

2. PROBLEM

Open access has gained much popularity throughout the world as nowadays more and more research is being published in open access mode. However, open access repositories have entered an arena of explosive growth. So, it becomes imperative to identify the trends followed by open access repositories worldwide. In this context, the present study attempts to highlight the status of open access repositories globally, describe their characteristics in terms of geographical distribution, software usage, language diversity, operational status, repository type, and subject coverage.

3. OBJECTIVES

- To evaluate the status of open access repositories globally on the basis of chosen parameters.
- To analyze the growth trend of open access repositories.

4. SCOPE

The scope of the study is confined to 2168 repositories registered in the open-DOAR (Directory of Open Access Repositories) as on February 8-10, 2012.

5. METHODOLOGY

The present study is based on data gathered from Open-DOAR. Data gathered were thoroughly analyzed based on chosen parameters viz., geographical distribution, software usage, language diversity, operational status, repository type, and subject coverage. Further, to analyze the growth trend the data for the year 2008 is taken from the study conducted by Wani, Gul & Rah (2009).

6. LITERATURE REVIEW

A number of studies have been carried out to highlight the importance of open access (OA) repositories in fulfilling the real purpose of open access .This section reviews several studies conducted to assert the status of open access repositories across the world.

OA gives authors a worldwide audience larger than that of any subscription-based journal, no matter how prestigious or popular the journal is, and demonstrably increases the visibility and impact of their work **(**Willinsky, 2010; Suber, 2010; as cited in Jain, 2012). Jacso (2006) states that the prevalent collections of scholarly full-text documents are accessible via digital depositories and repositories maintained by government agencies, associations, universities, professional volunteer groups, as well as new and traditional scholarly publishers (directly or indirectly through their digital facilitators). Another study reveals that the best way to achieve major improvement in scholarly communication in the short and medium term is to make it mandatory to deposit the research papers in open access institutional repositories (Pinfield, 2004). Abrizah, Noorhidawati, and Kiran (2010) observe that the open access self-archiving movement initiates to facilitate access to scholarly communication. Barker, James, and Knight (2004) (as cited in Wani, Gul, & Rah,2009) state that an open access repository is more than simple document storage, as it uses metadata to enable the users to find suitable material. Many universities and colleges world over have initiated projects to develop repositories that enable faculty and researchers to upload and download scholarly literature and use it to share resources with each other either within the institution or across the region, or more widely still. Sharing materials in this way may lead to an improved quality of teaching and research, the sharing of good practice, greater consistency, and an enhanced sense of community development. Johnsen (2002) (as cited in Wani, Gul, & Rah, 2009) comment on OARs as a practical, cost effective, and strategic means for institutions to build partnerships with their faculty to advance scholarly communication. Further, Chan (2004) observes that open access through institutional repositories is a low-cost and low-barrier strategy to fulfill the real purpose of open access mission.

A study by Lynch & Lippincott (2005) reveal that in the USA, more than 40% of the higher education institutions have functional institutional repositories, while 88% of non-deployment institutions have planned to launch one. Westrienen and Lynch (2005) (as cited in Abrizah, Noorhidawati & Kiran, 2010) in their study attempt to highlight the deployment of institutional repositories along with their content in universities within 13 nations including Australia, Canada, USA and 10 other European countries using a survey method. Wilson and Jantz (2011) found that institutional repository deposits among the American Research Libraries (ARL) shows great variation across disciplines, and is lagging behind in Humanities scholarship, particularly History, English, and Linguistics. Furthermore, Abrizah, Noorhidawati & Kiran (2010) in their study reveal that institutional repositories in Asian countries are not as successful as would have been expected from the considerable benefits attached to the principles of sharing. Moreover, a study by Gautam, Mishra, Pandey, Hariharan, Guttikonda, & Aneeja (2010) highlight that great efforts are on to make the research available to the public without any restriction by open access (OA) repositories in India. Chan (2004) while

Table 1: Continental Growth Rate of Repositories

Continent	No. of repositories (2008)	No. of repositories (2012)	Growth rate
Europe	599	1010 (46.59)	68.61%
North America	366	484 (22.32)	32.24%
Asia	138	374 (17.25)	171.01%
South America	55	153 (7.05)	178.18%
Australasia	0	71 (3.27)	_
Africa	19	50 (2.31)	163.15%
Caribbean	0	12 (0.55)	_
Central America	0	10 (0.46)	_
Oceania	0	1 (0.05)	_
Total	1250	2168	73.44%

*Figures in parentheses indicate percentage

**Percentage total does not equal 100% due to rounding off

Table 2: Country-Wise Growth Rate

Country	No. of repositories (2008)	No. of repositories (2012)	Growth Rate
United States	317	409(18.86)	29.02%
U.K	136	208(9.59)	52.94%
Germany	129	152(7.01)	17.83%
Japan	69	136(6.27)	97.10%
Spain	0	87(4.01)	-
Poland	0	75(3.46)	-
Italy	42	68(3.14)	61.90%
France	0	66(3.04)	-
Brazil	0	62(2.86)	-
Taiwan	0	58(2.67)	-
Australia	68	57(2.63)	-16.18%
Netherland	45	24(1.11)	-46.67%
Canada	44	56(2.58)	27.27%
(91)Others	400	710(32.75)	77.5%
Total	**1250**	**2168**	**73.44%**

*Figures in parentheses indicate percentage

**Percentage total does not equal 100% due to rounding off

highlighting the importance of OA repositories reveals that knowledge workers in developing countries are currently getting access to scholarly and scientific publications and electronic resources at a level that is without comparison historically, as this is extremely important, if developing countries need to meet the millennium development goals through information and knowledge. Since the OA movement and the growing number of Open Archive Initiative-compliant institutional repositories guarantee to provide even greater access to resources and publications that were previously inaccessible. Consequently, the low cost technology and interoperability standards are providing great opportunities for libraries and publishers in developing countries to disseminate local research and to bridge the knowledge gap. This evidently implies that the concept of OA repositories and benefits acquired by them need to be familiarized in all knowledge-based institutions. Xia (2012) views OA repositories as a necessary infrastructure to achieve OA (as cited in Gul & Shah, 2013).

7. FINDINGS

7.1. Continental Distribution of Repositories

Europe emerges out as the top contributor with 1010 (46.59%) repositories followed by North America, Asia ,South America, and Australasia with 484 (22.32%), 374 (17.25%),153 (7.05%), and 71(3.27%) repositories respectively. 50 (2.31%), the least number of repositories is contributed by Africa. Further, among the sub-continents Caribbean emerges out to be top contributor with 12 (0.55%) repositories followed by Central America 10(0.46%) while as least no. 1 (0.05%) repository is contributed by Oceania (Table1).

7.2. Growth Rate

The growth rate of open access repositories maintained by different continents is compared with study conducted by Wani, Gul, & Rah (2009). The trend analysis reveals that South America emerges out to be top contributor towards the growth of open access repositories with maximum growth rate of 178.18%, followed by Asia with 171.01%, and 163.15% by Africa. Least growth rate (32.24%) is shown by North America. It is worth noticing that developing continents that are lagging behind are now emerging as potential contributors of OA repositories (Table1).

8. COUNTRY-WISE DISTRIBUTION OF REPOSITORIES

U.S.A. leads with 409 (18.86%) repositories, followed by U.K. 208 (9.59%), Germany 152 (7.01%), and Japan 136 (6.27%) respectively. Four European countries viz., Spain, Poland, Italy, and France maintain 87(4.01%), 75(3.46%), 68(3.14%), & 66(3.04%) repositories correspondingly. Further, the countries contributing repositories between 62-56 include Brazil, Taiwan, Australia, & Canada. In addition, there are another 91 countries, which contribute from 1 to 53 repositories each and account for 710 (32.75%) repositories collectively (Table 2).

8.1. Country-Wise Growth Rate of Repositories

The trend analysis reveals that repositories maintained by Japan have increased exponentially with maximum growth rate of 97.10%, followed by Italy and U.K. with a growth rate of 61.90% & 52.94% respectively. On the other extreme, Netherlands and Australia have shown diminishing growth rate of -46.67% and -16.18% respectively (Table 2).

8.2. Software Usage by Repositories

DSpace tops the list with 843 (38.88%) repositories, followed by EPrints 332 (15.31%), Digital Commons 92 (4.24%), DLibra 57 (2.63%), and OPUS 56 (2.58%) respectively, while, as 74 other software's (less in number) are used by 385 (17.76%) repositories. However, 403(18.59%) repositories that have not specified the type of software used by them and have been put under the category *"Unknown"* (Table 3).

Table 3: Software Usage by Repositories

Software	No. of Repositories (2012)
DSpace	843(38.88)
EPrints	332(15.31)
Digital Commons	92(4.24)
DLibra	57(2.63)
OPUS	56(2.58)
Other(70)	385(17.76)
Unknown	403(18.59)
Total	2168

*Figures in parentheses indicate percentage

**Percentage total does not equal 100% due to rounding off

8.3. Growth Rate of Various Softwares

The study reveals that the repositories using DSpace software have shown maximum growth rate of 144.35% in the usage preference by repositories, followed by EPrints (38.91%), and OPUS (9.80%). There is a marked decrease in the usage of some softwares viz., Bepress, Wildfire, ETD-db, and

HTML showing negative growth rate of -90.91%,-95.65%,-9.52%,-4.17% respectively (Table 4).

Table 4: Software Usage by Repositories

Softwares	No.Of Repositories		Growth Rate
	2008	2012	
DSpace	345	843	144.35%
EPrints	239	332	38.91%
Digital Commons	-	92	-
DLibra	-	57	-
OPUS	51	56	9.80%
Bepress	55	5	-90.91%
HTML	24	23	-4.17%
Wildfire	23	1	-95.65%
ETD-db	21	19	-9.52%
Other	206	337	63.59%
Unknown	286	403	40.91%
Total	1250	2168	73.44%

8.4. Repositories According to Host Domain

Institutional repositories leads with 1779 (82.06%), followed by Disciplinary 241 (11.12%), and Aggregating 97 (4.47%), while the least share of 51 (2.35%) repositories is contributed by Governmental organizations (Table 5).

8.5. Growth Rate of Repository Type

Among the different types of repositories, governmental repositories have shown the maximum growth rate of 104%, followed by institutional repositories with 77.72%, and aggregating repositories with 67.24%. Least growth rate of 45.18% is shown by disciplinary repositories (Table 5).

Table 5: Growth Rate of Repository Type

Type	No. Of Repositories		Growth Rate
	2008	2012	
Institutional	1001	1779(82.06)	77.72%
Disciplinary	166	241(11.12)	45.18%
Aggregating	58	97(4.47)	67.24%
Governmental	25	51(2.35)	104%
Total	**1250**	**2168**	**73.44%**

*Figures in parentheses indicate percentage

**Percentage total does not equal 100% due to rounding off

9. OPERATIONAL STATUS OF REPOSITORIES

Maximum no. of 1989 (91.74%) repositories are operationally functional, followed 108(4.98%) trail & 53(2.44%) broken repositories while as least no. of 18(0.83%) repositories are closed (Table 6).

9.1. Growth Rate of Operational Status Repositories

Among the different types of repositories, broken repositories have shown the maximum growth rate of 562.50%, followed by operational and trail repositories with 75.24%, and 18.68% of growth. On the other hand, least growth rate of 12.50% has shown by closed repositories (Table 6).

Table 6: Growth Rate of Operational Status of Repositories

Type	No. Of Repositories		Growth Rate
	2008	2012	
Operational	1135	1989(91.74)	75.24%
Trail	91	108(4.98)	18.68%
Broken	8	53(2.44)	562.50%
Closed	16	18(0.83)	12.50%
Total	**1250**	**2168**	**73.44%**

*Figures in parentheses indicate percentage

**Percentage total does not equal 100% due to rounding off

10. CONTENT TYPE ARCHIVED BY REPOSITORIES

Of the total 12 content types identified, the study revealed that majority of content is in the form of journal articles with 1447 (21.73 %) out of the total, followed by Theses and dissertations with 1142 (17.15%), and unpublished reports and working papers with 803 (12.06%). On the other extreme least preferred content types are patents and softwares with 61 (0.92%) and 34 (0.51%), (Table 7).

Table 7: Content Type Archived by Repositories

Most Frequent Content Type	Number
Journal article	1447(21.73)
Theses and dissertation	1142(17.15)
Unpublished reports and working papers	803(12.06)
Books, chapters and sections	769(11.55)
Conference and workshop papers	753(11.31)

Multimedia and audio-visual materials	508(7.63)
Bibliographic references	376(5.65)
Other special items types	347(5.21)
Learning objects	338(5.08)
Datasets	80(1.20)
Patents	61(0.92)
Software's	34(0.51)
Total	**6658**

*Figures in parentheses indicate percentage

**Percentage total does not equal 100% due to rounding off

Note: Content type exceeds no. of repositories as one repository archive more than one type of content

Table 8: Growth Rate of Content Types Archived by Repositories

Most frequent content type	Number	Number	Growth RATE
	2008	2012	
Journal article	757	1447	91.15%
Theses and dissertation	623	1142	83.31%
Unpublished reports and working papers	599	803	34.06%
Books, chapters and sections	388	769	98.19%
Conference and workshop papers	451	753	66.96%
Multimedia and audio-visual materials	298	508	70.47%
Bibliographic references	183	376	105.46%
Other special items types	212	347	63.68%
Learning objects	184	338	83.69%
Datasets	65	80	23.08%
Patents	21	61	190.48%
Software's	27	34	25.92%
Total	3808	6658	74.84%

10.1 Growth Rate

Present study reveals that among the various categories of contents archived by OA repositories maximum growth rate of (190.48%) is shown by patents, followed by bibliographic references, books, chapters and sections, journal articles with (105. 46%), (98.19%) & (91.15%) , while the least growth rate of (23.08%) is shown by datasets (Table 8).

11. LANGUAGE INTERFACE OF REPOSITORIES

English is the most prominent language interface among all. Table 9 shows the ranked list of top ten languages prominently used by OA repositories. Of the total 2168 OA repositories, 1587 repositories are in English. Spanish, German, Japanese, French with 233, 182, 137, and 126 repositories respectively follow the English based repositories (Table 9).

Table 9: Top Ten Language Interfaces of Repositories

Rank	Language	Number
1	English	1587
2	Spanish	233
3	German	182
4	Japanese	137
5	French	126
6	Portuguese	107
7	Chinese	96
8	Polish	74
9	Italian	67
10	Swedish	48

Note: Language interface exceeds no. of repositories as one repository develop

Interface in more than one language.

12. SUBJECT COVERAGE BY REPOSITORIES

Maximum number of 1338 repositories archive under multidisciplinary heading which is obvious due to the fact that it is combination of more than one subject. Apart from multidisciplinary subjects, Health and Medicine emerge out to be predominant subjects archived by 186 repositories followed by History and Archeology by (168) while as Geography and Regional Studies are archived by (112) repositories (Table 10).

Table 10: Top Ten Subjects Covered by the Repositories

Rank	Open Doar Subjects	Number
1	Multidisciplinary	1338
2	Health & medicine	186
3	History &archeology	168
4	Science –general	141
5	Technology general	138
6	Law & politics	131
7	Business and economics	119
8	Computers &It	118
9	Social sciences general	117
10	Geography &regional studies	112

Note: Number of subjects covered exceeds no. of repositories for the reason that one-repository archives content on more than one subject area

13. CONCLUSION

OA repositories are more prevalent in developed and western countries which is evident from the fact that more than 75% of repositories are contributed from European and other Western countries. This can be attributed to the fact that these nations have became conscious about the need and importance of knowledge-based society due to which they keenly support more and more research activities, which ultimately leads to knowledge generation. Consequently, these nations became technologically much advanced which in turn helps them to increase their overall progress in terms of GDP etc. However, at the same time, they are also aware of significance of knowledge dissemination, which leads them to promote growth of open access repositories.

OA repositories in developing countries are still under progress, which is apparent from the fact that Japan, is the only developing country contributing more than 100 repositories. However, other developing countries viz., India, Taiwan, China, and Malaysia also contribute a good number of repositories because they too have become aware of importance of knowledge generation and dissemination. However, the other developing countries like Afghanistan, Syria, Pakistan, Sudan and many such countries are still lagging behind. The key possible reason behind this could be the political turmoil these countries are facing which in turn doesn't allow them to advance in the field of research and development.

Growth rate of OA repositories has shown remarkable progress among developed as well as developing regions of the world which is supported by the fact that highest percentage of growth rate is shown by South America while as Asia and Africa are the two leading developing regions that have shown tremendous growth rate. This clearly indicates that developing countries are also gradually becoming aware of benefits of open access.

Among the various types of repositories, governmental repositories are still less although their number has considerably increased. This in turn signifies that governmental institutions must try to provide greater support for creating and maintaining OA repositories. On the other hand, institutional repositories are highest in number which can be attributed to the fact that majority of institution promote research based activities which leads to develop a system for knowledge generation and dissemination.

English emerges out to be prominent language interface of OA repositories. The potential reason for the same is that majority of the countries have accepted English as common language for communication and is the official language of 54 countries and 27 non-sovereign entities (English Language, 2013). However, efforts should be made to develop language interface in more than one language so that genuine purpose of open access could be fulfilled.

Journal articles emerge to be top content type archived by OA repositories. This is due to the fact that maximum research work is published through journal articles because of their wide acceptance in research community. Since the work published through this medium is generally peer-reviewed, which makes them much more favorable when compared to other content types archived. Although research is also being published through thesis and dissertations but their digitization is still under progress and in a starting phase all over the globe especially in the developing parts of the world.

DSpace is the most preferred software among OA repositories that can be endorsed to the fact that DSpace has the largest community of users and developers globally. It is the most widely used open source software preferred by educational, governmental, private and commercial institutions viz., museums, state and national libraries, state archives, journal repositories, consortiums and commercial companies to manage their digital assets. Further, the most worthy thing to mention is that DSpace comes with an easily configurable web-based interface, which any system administrator can install on a single Linux, Mac OSX or windows box to get started and can manage and preserve all types of digital content like PDF, Word, JPEG, MPEG, TIFF files, etc. (Top reason to use DSpace, 2013).

The most preferred subject area among OA repositories is Health and Medicine. The key prospective grounds for this is that every nation tends to progress in the field of Health and Medicine because a healthy nation leads to a sound and stable nation in terms of achieving an authentic goal of knowledge based society. Consequently, majority of countries support more and more research in these fields, which in turn leads to knowledge boost in these areas. However, there is need to advance in other subject areas also because progress in every field leads to real development of a nation.

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