OPEN ACCESS DIGITAL REPOSITORIES IN INDIA AND CHINA: A COMPARATIVE STUDY

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The main objective of the study is to make a comparative study of Indian and Chinese repositories on various parameters like regional distribution, subject coverage, language diversity, content archived, collection development, operational management, etc. To achieve the objectives of the study, the OpenDOAR was selected as the source for identification of repositories from India and China. The results reveal a total number of 115 repositories were registered in the OpenDOAR from India and China in which India has more repositories than China; however, repositories from China are content rich (in terms of collection size) as compared to India. The repositories from China accept contents only in two languages - Chinese and English whereas repositories from India accept contents in 11 languages. More repositories from China have active links and are OAI-PMH compliant than India whereas more repositories from India have well defined metadata, preservation and content submission policies than China.

Keywords: Open Access; Green Open Access; Digital Repositories; Institutional Repositories; OpenDOAR.

INTRODUCTION

Open access is the most successful movement of the 21st century in the scholarly world. It has made information freely available to the scholarly communities across the globe. According to the Budapest Open Access Initiative (2002), "Open access to the literature means the free availability of the literature on the public Internet, permitting any users to read, download, copy, distribute, print, 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 any financial, legal, or technical barriers other than those inseparable from gaining access to the Internet itself". There are two primary roads to open access: the 'golden' road and the 'green' road [1]. In golden road, article is directly published in an open access journal whereas in the 'green' road, i.e. article is published in a non-open access journal but also self-archive it in an open access repository. Besides archiving the journal articles, the digital repositories archive theses, dissertations, patents, research reports, books, book chapters, conference proceedings, theses, monographs, learning objects, etc. According to Hayes [2] "A digital repository is where digital contents and assets are stored and can be searched and retrieved for later use". Digital repository' is simply an online archive that makes its contents available to users without any restriction. In order to observe the progress of the open access digital repositories across the globe, the Registry of Open Access Repositories (ROAR) was created by Tim Brody at the University of Southampton (UK) while as the Directory of Open Access Repositories (OpenDOAR) was officially launched by the University of Nottingham (UK) in 2006. The OpenDOAR is an authoritative directory of academic open access repositories. Currently OpenDOAR lists 3448 repositories and allows breakdown and selection by a variety of criteria for in-depth analysis of

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the repositories across continents, countries, subjects languages, institutions, etc. (http://www.opendoar.org/). The present study aims to explore various parameters of repositories contributed by India and China for a valuable comparative study.

LITERATURE REVIEW

The open access movement is at full bloom worldwide. In 2006, only 792 repositories were listed in OpenDOAR, mostly contributed by developed countries and currently, it lists 3448 repositories from almost all countries of the world [3]. Wang and Su [4] stated that although open access started with developed countries, it is appealing to developing countries and is spreading throughout the world quickly. The institutional repositories were first initiated by Europe followed by North and South America [5]. Roy, Biswas and Mukhopadhyay [6] depicted that more or less every continent is contributing to open access by maintaining open access repositories in the OpenDOAR; Asia occupies the third position in terms of its contribution. Loan [7] identified the contribution of the Asian nations in the Directory of Open Access Repositories (OpenDOAR) listed 2,299 repositories. The study revealed that Asia is the third biggest contributor in terms of number of open access repositories after Europe and North America. The largest number of repositories from Asia is contributed by Japan (34.50%), followed by both India and Taiwan (14.50%) jointly. Singh [8] conducted a study and revealed that Europe is the major contributor of repositories with 1241 (45%) repositories followed by North America's 543 (20%). The Asian continent contributes 503 (18%) repositories; Japan has the largest number of repositories followed by India, Taiwan, Turkey, China, Republic of Korea, and Indonesia respectively.

Open Access movement of India started with the Budapest Open Access Initiative. Many prominent scholars advocates for open access to information in India as well. The Bangalore Declaration (2006) and the National Knowledge Commission (2007) also supported open access movement and advocated for open access institutional repositories in India. As a result, the Indian Institute of Science (ePrints@IISc) first established an institutional repository followed by Indian Institute of Management, Kozhikode; Indian

Statistical Institute, Bangalore; Indian Institute of Technology, Delhi; National Institute of Technology, Rourkela; National Aerospace Laboratories, Bangalore; National Chemical Laboratory, Pune; Information and Library Network (INFLIBNET), Ahmedabad; National Institute of Oceanography, Goa; and Raman Research Institute, Bangalore respectively [9]. Ahmed and Rather [3] conducted a study and found that the Indian open access digital repositories are mostly subject specific, and commonly use open source software like DSpace for creating and operating these repositories. Lone, Rather and Shah [10] revealed that India shared 10th position with Spain and Sweden in OpenDOAR in terms of number of repositories in the world and ranked the second in Asia after Japan in 2008. Abrizah et al. [11] identified the 191 institutional repositories contributed by the Asian countries in which Japan leads in terms of numbers (25), followed by India (8) and Taiwan (6). Roy et al. [12] argued that the growth rate of institutional digital repositories (IDRs) per year is not satisfactory in compare to other developed countries. The study shows that there has been a steady growth in this context. The total number of IDRs was only 4 in 2004 and now it has been 77 in 2011 (December), an average increase of about 10 new repositories per year. Ganaie et al. [13] conducted a study to evaluate the current trends of the open access digital repositories in Library and Information Science. The results revealed that the USA is the top contributor with 16 (16.16%) repositories followed by the United Kingdom 12 (12.12%), Germany 8 (8.08%) repositories respectively. India shares the fourth position with Brazil, and France having 4 (4.04%) repositories each. Kumar and Mahesh [14] visited 69 Indian repository websites on the last date of each month during the one year period from July 2015– June 2016 and noted the number of items in the repository. The researchers revealed that out of 69 repositories, just 12 repositories added atleast one item during a month. And there were 17 repositories that did not add even a single item during the one year (12- months) period. The rest of the 40 were irregular in adding items to their repositories.

China responded positively to the worldwide movement of open access started with the Budapest Open Access Initiative in 2002. The funding agencies and research communities in China fully

supported the open access movement and acknowledged the importance of accessing and sharing the information using open access models. The first paper on open access was published in China in 2004 and in 2006, about 50 papers were found from the biggest Chinese full text journal database in China (CNKI) [15]. Interestingly, the first repository was created in 2004 and number of repositories reached 82 till 2008. However, only 27 Chinese institutional repositories are registered in the Registry of Open Access Repositories (ROAR), listed separately under China mainland, Hong Kong, and Taiwan [16]. Open access repositories are not widespread and the percentage of institutional repository systems in Asian countries are about 4-10 percent except in mainland China which has a centralized institutional repository system for about 300 universities [17]. Zhang [18] reported that the Xiamen University Library was the first of the university libraries to develop an institutional repository (IR), but other academic libraries in mainland China have been catching up fast. The academic library consortium (CALIS) started its IR Initiative in 2011, growing from five universities in the beginning to 28 by November 2013. Most of the major academic institutions in the Hong Kong and Taiwan areas have been also covered. Das and Singh [19] identified 39 institutional repositories in China in which 25 (64.10%) were created by the research institutions, 11(28.21%) by universities and 3 (7.69%) by research libraries. Open Access (OA) movement in the Asia is developing at its speed, and slowly as compared to the Europe. India and China both are the powerful nations of the Asia and have contributed significantly in open access movement. India and China also have progressed in the green road of open access with the time span. Therefore, there is a need to make a comparative study of the Open access digital repositories in India and China.

OBJECTIVE OF THE STUDY

The present study aims to fulfil two broad objectives these are as follows:

➢ To discover the regional distribution of the open access digital repositories in the OpenDOAR with special reference to India and China.

➢ To make a comparative study of Indian and Chinese repositories on various parameters like subject coverage, language diversity, content types, collection development, operational management, OAI-PMH compatibility, and metadata and preservation policies.

METHODOLOGY

To achieve the objectives of the study, the OpenDOAR was selected as the source for identifying and analyzing the repositories from India and China. The OpenDOAR listed a total of 115 repositories from India and China during the period of study (August-September 2017). The requisite data about these repositories were collected manually and transferred to a Microsoft Excel file for tabulation and analyses.

LIMITATIONS OF THE STUDY

The study is limited to the Indian and Chinese repositories registered in the OpenDOAR, Therefore, the findings can't be generalized across directories and countries.

DATA ANALYSIS

Contribution by Continents

OpenDOAR lists 3448 repositories in total contributed by countries of all continents. The majority are contributed by Europe (45.18%) followed by Asia (20.33%) and North America (17.81%) respectively (Table 1). In 2006, only 792 repositories were registered in the OpenDOAR [3] and currently, it lists 3448 repositories with almost 435% increase in one decade. The Europe is the major contributor of repositories with 1241 (45%) repositories followed by the North America's 543 (20%) and the Asia 503 (18%) respectively (Singh, 2016). However, the present study confirms that the Asia has surpassed the North America in terms of number of repositories in the OpenDOAR and has become the second biggest contributor after the Europe.

Contribution by the Asian Countries

The Asian countries contributed 701 repositories in OpenDOAR; the maximum repositories are contributed by Japan (217, 30.96 percent) followed by India (76, 10.84 percent), Turkey (75, 10.70 percent), Indonesia (69, 9.84 percent), Taiwan (60, 8.56 percent) and China 39 (5.56 percent) respectively (Table 2). Loan [6] identified the contribution of the Asian nations in the Directory of Open Access Repositories

(OpenDOAR). He revealed that the largest number of repositories from Asia was contributed by Japan (34.50%), followed by both India and Taiwan (14.50%) jointly. However, Taiwan has been surpassed by the Turkey and Indonesia whereas India is still the second biggest contributor and China is the sixth biggest contributor in terms of number of repositories listed in OpenDOAR.

Table 1: Continent-wise number of Repositories

S. No	Continents	No. of Repositories	Percentage
1.	Africa	155	04.50
2.	Asia	701	20.33
3.	Australasia	70	02.03
4.	Europe	1558	45.18
5.	North America	614	17.81
6.	South America	308	08.93
7.	Others	42	01.22
	Total	**3448**	**100**

Table 2: Contribution of the Asian Countries

S. No	Country	No. of Repositories	Percentage
1.	Japan	217	30.96
2.	India	76	10.84
3.	Turkey	75	10.70
4.	Indonesia	69	09.84
5.	Taiwan	60	08.56
6.	China (Mainland)	39	05.56
7.	Korea	34	04.85
8.	Malaysia	22	03.14
9.	Others	109	15.55
	Total	**701**	**100**

Collection Size

India has more repositories than China. However, repositories from China are content rich as compared to India as 38.46 percent (15) Chinese repositories have 10000 & above items in their collection as compared to 22.37 percent (17) of Indian repositories whereas only one repository (2.56%) from China has less than 1000 collection as compared to 26 (34.21%) repositories from India. However, the collection in repositories from China is almost 7 times more than collection in the Indian repositories (Table 3).

Table 3: Collection Size of Repositories

Collection Size	India		China	
	No.	Percentage	No.	Percentage
Less than 1000	26	34.21	1	2.56
1000-5000	30	39.47	12	30.77
5000-10000	3	3.95	11	28.21
10000 & above	17	22.37	15	38.46
Total size	**796,141/**		**5,622,221/**	

Subject Coverage

The majority of the repositories are multi-disciplinary in nature irrespective of regional differences. Out of 76 Indian repositories, 67 (88.16%) are multi-disciplinary whereas, 9 (11.84%) are subject specific repositories. The subject specific repositories cover Science General (3), Technology General (2), Library and Information Science (2),

Social Science General (1), and Architecture (1). Out of 39 repositories from China, 37 (94.88%) repositories are multi-disciplinary whereas only 2 (5.12%) are subject-specific- one repository covers Science General and another repository Technology General (Table 4). A repository is essential element for all academic and research institutions to deposit their research productivity irrespective of subject disciplines. It is mandatory to create subject specific repositories at national level, where national research productivity in a particular field can be archived for the future use. However, there is need to have a single web portal for accessing the contents of all digital repositories in both the countries so that the time of the users can be saved.

Table 4: Subject Coverage of Repositories

Subject Coverage	India		China	
	No.	Percentage	No.	Percentage
Multidisciplinary	67	88.16	37	94.88
Science General	3	3.95	1	2.56
Technology General	2	2.63	1	2.56
Social Science General	1	1.31	0	0.00
Library & Information Science	2	2.63	0	0.00
Architecture	1	1.31	0	0.00
Total	**76**	**100**	**39**	**100**

Content Coverage

The majority of the digital repositories from India and China archive multi-contents like articles, books, proceedings, learning objects, software, datasets etc. The maximum percentage of repositories from China (92.31%) archives multi-contents in comparison to repositories from India (76.32%). However, India has more content specific repositories (23.68%) than China (7.69%). The content specific repositories from India archive articles (9.21%), theses (7.89%), books (3.95%) conference papers (1.31%), and learning objects (1.31%) whereas the repositories from China store articles (5.13%) and datasets (2.56%) only (Table 5). The information available in any form and format is essential for the growth and development of the knowledge. Therefore, the digital repositories need to archive information available in any form.

Table 5: Content Coverage of Repositories

Contents	India		China	
	No.	Percentage	No.	Percentage
Multi-Content	58	76.32	36	92.31
Articles	7	9.21	2	5.13
Theses	6	7.89	0	0.00
Books	3	3.95	0	0.00
Conference papers	1	1.31	0	0.00
Datasets	0	0.00	1	2.56
Learning objects	1	1.31	0	0.00
Total	**76**	**100**	**39**	**100**

Content Language

The repositories in the OpenDOAR accept contents in different languages. However, the repositories from China accept contents in two languages only Chinese (92.31%) and English (76.92%) whereas repositories from India accept contents in 11 languages including English (97.37%), Hindi (13.16%), Gujarati (3.95%), Arabic (2.63%), and Malayalam (2.63%). The other languages include Bengali, Persian, Kannada, Tamil, Sanskrit, Marathi etc. (Table 6). The linguistic analysis shows that China archives contents written in only two languages i.e. Chinese and English because these two languages are the prominent languages operational in educational system of China. Indian repositories store contents in few

regional languages as well. It is a good sign because the traditional knowledge in India is scattered in these languages and need to be preserved for future use. However, the translation facilities of these contents are also need of the hour for their optimum utilization.

Table 6: Language of Content

Language	India		Language	China	
	No.	Percentage		No.	Percentage
English	74	97.37	English	30	76.92
Hindi	10	13.16	Chinese	36	92.31
Gujarati	3	3.95			
Arabic, Malayalam	2 (Each)	2.63			
Bengali, Persian, Kannada, Tamil, Sanskrit, Marathi	1 (Each)	1.31			

Software Used

In all, the experts have used 11 types of software brands to create and operate repositories and DSpace is the only common software used in both the countries. DSpace is used by 89.74 percent (35) of repositories from China and 59.21 percent of repositories from India. In India, E-prints software is the second widely used software, used by 30.26 percent (23) repositories to operate and maintain digital collections. C-Space Calibre, Drupal, Greenstone, HTML, Vu-Fund etc. is used by only one repository each. However, 3 repositories (i.e. one from India and two from China) do not provide any information regarding use of software to manage the collection (Table 7). In 2011, DSpace was used by more than 1000 digital repositories [20] and presently the number reached to 1541. It is software of choice for academic, non-profit and commercial organizations for building digital repositories. It is better for the digital repositories using commercial software to switch to DSpace for managing their digital repositories collection free of cost.

Table 7: Software Used by the Repositories

S. No.	Software	India		China	
		No.	Percentage	No.	Percentage
1.	DSpace	45	59.21	35	89.75
2.	E-prints	23	30.26	0	0.00
3.	Architexturez	1	1.31	0	0.00
4.	C-Space	0	0.00	1	2.56
5.	Calibre	1	1.31	0	0.00
6.	Drupal	1	1.31	0	0.00
7.	Greenstone	1	1.31	0	0.00
8.	HTML	1	1.31	0	0.00
9.	Metastudio	1	1.31	0	0.00
10.	Nitya	1	1.31	0	0.00
11.	Vu-Fund	0	0.00	1	2.56
12.	ND (not defined)	1	1.31	2	5.13
	Total	**76**	**100**	**39**	**100**

Operational Status

China contributes 39 repositories in which 79.49 percent (31) have active links and 20.51 percent (8) have inactive (dead) links. Among 79 repositories from India, 69.74 percent (53) are operational and 30.26 percent (23) are inactive (Table 8). The repositories that aren't functional have no value at all. Therefore, the need is to make the non-functional repositories functional so that their collection can be used. The repositories with active links and updated collection aren't only more useful for the information seekers but authors and their institutions as well. The optimum usage of the

contents in these repositories increases the h-index of authors and their institutions besides the impact factor of the publications.

Table 8: Operational Status of Repositories

Operational Status	India		China	
	No.	Percentage	No.	Percentage
Active Links	53	69.74	31	79.49
Dead Links	23	30.26	8	20.51

OAI-PMH Compatibility

Among 76 Indian repositories, 59.21% (45) are compatible with OAI-PMH and 40.79% repositories (31) aren't compatible with OAI-PMH whereas among 39 Chinese repositories 71.79% (28) repositories are compatible with OAI-PMH and 28.21% (11) don't support OAI-PMH compatibility (Table 9). Metadata harvesting is very important for interoperability and efficient retrieval of information for some search engines. The majority of the users aren't aware about these repositories and hardly access them from their homepages. Therefore, these repositories must be OAI/PMH compatible so that their contents can be retrieved from all the web search engines.

Table 9: OAI-PMH Compatibility

OAI-PMH	India		China	
	No.	Percentage	No.	Percentage
Yes	45	59.21	28	71.79
No	31	40.79	11	28.21

Metadata Policy

All the repositories from China (39, 100%) and majority of the repositories from India (63, 82.89%) don't have a well-defined metadata policy. Only 17.11 percent (13) of Indian repositories have a well-defined metadata policy (Table 10). Metadata facilitates digital identification via standard numbers that uniquely identify the resource the metadata defines and helps in the effective resource discovery. It also is an effective means of organizing and management of electronic resources so that the information can be extracted and reformatted through use of software tools. Metadata is as a means of facilitating interoperability and integrating resources. This permits the most effective levels of interoperability between and among many systems with disparate operating platforms, data structures and interfaces. In turn, it facilitates resource searches across the network. However, the majority of the digital repositories in India and China lack the standard metadata re-use policies and may become a hurdle for the use of other beneficiaries.

Table 10: Metadata Policy

Metadata Policy	India		China	
	No.	Percentage	No.	Percentage
Defined	13	17.11	0	0
Un –Defined/Un-Analysed	63	82.89	39	100

Content Submission Policy

Among 76 repositories contributed by India, 85.52 percent (65) don't have a well-defined content submission policy as compared to 94.88 percent (37) of Chinese repositories whereas only 14.47 percent (11) repositories have a defined content submission policy among Indian repositories as compared to 5.12 percent (2) of Chinese repositories (Table 11). The majority of the digital repositories from India and China don't have a well-defined content submission policy. These repositories need to create well defined content submission policy. The evaluation of the contents submitted should be mandatory to endorse and guarantee the accuracy of information for building a trustworthy information and knowledge base.

Table 11: Content Submission Policy

Submission Policy	India		China	
	No.	Percentage	No.	Percentage
Defined	11	14.47	2	5.12
Un –Defined/Un-Analysed	65	85.52	37	94.88

Preservation Policy

Repositories from India and China also lack a well-defined preservation policy as 94.74 percent (72) Indian repositories and 100 percent (39) Chinese repositories have undefined preservation policy and only 5.26 percent (4) Indian repositories have a well-defined preservation policy (Table 12). Preservation is a crucial element in the process of managing electronic information resources in the digital repositories. The aim of preservation is to prolong the life span of information resources so that these could be made available for use to present and future generations. In the light of this, preventive measures should be put in place for the preservation of information resources in open access digital repositories.

Table 12: Preservation Policy

Preservation Policy	India		China	
	No.	Percentage	No.	Percentage
Defined	4	5.26	0	0
Un-Defined/Un-Analysed	72	94.74	39	100

CONCLUSION

The open access movement is considerably gaining momentum all over the world. The open access digital repositories have increased very fast in the last decade. In 2006, only 792 repositories were registered in the OpenDOAR, and the number reached to 3448 in 2017 with the increasing rate of 435% approximately. The Asian countries provide full support to the open access movement. The Asian nations are actively participating in the open access movement on global level by establishing archives, institutional repositories, document specific repositories, and subject specific repositories. India is the second and China is the sixth biggest contributor in terms of number of repositories registered in the OpenDOAR. India has more number of repositories than China whereas repositories from China are content rich as compared to India. China archives contents written in only two languages, *i.e.* Chinese and English whereas few Indian repositories store contents in local languages as well. The majority of the digital repositories from India and China are neither content-specific nor subject-specific. These repositories archive multi-contents from multi-disciplines like articles, books, proceedings, learning objects, software, datasets etc. dealing with various branches of knowledge. However, the majority of the repositories, irrespective of regional differences, have few common issues like inadequate collection, inactive (non-functional) links, lack of OAI/PMH compatibility, and lack of defined metadata, content submission and preservation policies, which need serious efforts to be addressed.

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