

Global visibility of Asian universities' Open Access institutional repositories

A. Abrizah, A. Noorhidawati and K. Kiran

Digital Library Research Group

Faculty of Computer Science & Information Technology

University of Malaya, Kuala Lumpur, MALAYSIA

e-mail: {abrizah; noorhidawati; kiran}@um.edu.my;

ABSTRACT

This paper highlights the current state of open access repositories of Asian universities. It describes their characteristics in terms of types, contents, disciplines, language, technical and operational issues, and policy. The web performance of Asian institutional repositories as reflected through global visibility and impact of the repositories in Open Directory of Open Access Repository (OpenDOAR), is also examined; as well as the performance of Asian top-ranked universities in the archiving and sharing their research output through institutional repositories, based on the Ranking Web of World Repositories (RWWR). Findings signify Japan as the biggest contributor of Asian repositories, followed by India and Taiwan. An investigation of the status of these universities revealed that out of the 191 Asian organizational institutional repositories identified in this study, only 48 are listed in the Top 400 RWWR. This implies that only 12% of Asian institutional repositories are visible and incorporate good practices in their web publication as extracted from the quantitative webometrics indicators used by the ranking. Out of these 48 institutions, 29 are among the Asian Top 200 universities. However, only 14 of these 29 universities were ranked top 100 in the RWWR. It is revealed that some of the top ranked universities in Asia are not actively contributing to the open access movement. It is suggested that if the web performance of an institutional repository of a research institution is below the expected position, the university authorities should reconsider their web policy to increase the volume and quality of their intellectual output / research publications through institutional repositories.

Keywords: Institutional repositories; Open access initiatives; Ranking Web of World Repositories; Asian university ranking; Digital libraries

INTRODUCTION

Open Access emerged in response to the restrictive access to knowledge in scholarly and scientific journals imposed by commercial publishing houses via subscription fees, license fees or pay-per-view fees (Gideon 2008). The principle of Open Access is supported by Institutional repositories through self-archiving copies of already published research articles in the author's institutional archive which are made available for free. Institutional repositories are now becoming a component of the technical infrastructure in research intensive institutions and a favoured option for providing open access to research output. This technical infrastructure has originated since 2002 when major research universities in the U.S.A (such as the MIT and Cornell University), and the U.K. (such as Southampton and Oxford University) launched their own institutional repository systems using DSpace and E-Prints software respectively. In the early stages, the deployment of institutional

repositories was predominantly observed at the research-intensive higher education institutions. It was mainly to disseminate their work as widely as possible (increased impact) and to contribute to knowledge building within their field (Chan 2004), without the constraints of access and costs. However, institutional repositories have now expanded to include courseware, backfiles of journals articles, subject specific repositories, conference papers, technical reports, theses and dissertations, and many more institution specific materials.

Though there has been a steady increase in institutional repositories, the uptake of this infrastructure in universities is slower than it was hoped for (Kim 2006; Zuber 2009). Most authors are unfamiliar with Open Access and making their works available on institutional repositories (Foster and Gibbons 2005), and a more serious problem is the lack of awareness of the existence of institutional repositories (Kim 2006). Despite the promising potential for institutional repositories to improve scholarly communication, this mode of knowledge sharing is not yet wide spread in developing countries when compared to developed countries (OpenDOAR 2010).

The uptake of institutional repositories around the world has received much attention in the literature. A comprehensive study by Lynch and Lippincott (2005) to investigate the deployment of institutional repositories in the United States (USA) up to the year 2005, reported that, out of the 97 universities categorized as 'doctoral universities', 40% had already operated Institutional repositories. Whereas, among the non-implementers, 88% were in the planning stage of institutional repository deployment. They predicted that the growth in the future will be evident and that institutional repositories will be considered an essential infrastructure for scholarship in the digital world. However, Lynch and Lippincott (2005) pointed out that deployment of institutional repositories beyond the doctoral research institutions in the USA was extremely limited and that most of the institutional repositories in non-research universities were in institutions with strong commitments to locally created materials for teaching and learning.

Another survey undertaken in 2005 at ten European countries – Belgium, France, the United Kingdom (UK), Denmark, Norway, Sweden, Finland, Germany, Italy and the Netherlands by Van Westrienen and Lynch (2005) found that the number of Institutional repositories varies from as low as 1.5% (Finland), to as high as 100% (Germany, Norway and the Netherlands). The focus was on acquisition of content almost exclusively on faculty publications. Henty (2007) reported that by mid 2006, all Australian universities had established Institutional repositories. The main purpose was to provide researchers with a vehicle to enhance the availability of their publications.

In comparison to USA, UK and other European countries, the promotion and development of institutional repositories in Asia started relatively late. Studies on Asian institutional repositories revealed that Open Access repositories are not widespread and the percentage of institutional repository systems in Asian countries is about 4-10 percent except in mainland China which has a centralized institutional repository system for about 300 universities (Chen and Hsiang 2009). On the other hand, the numbers of institutional repository systems in Japan and Korean universities are increasing very quickly (Lee 2008). As for India, Fernandez (2006) asserts that the lack of infrastructure for establishing institutional repositories is a major barrier to the growth of institutional repositories in the country.

From an examination of the institutional repositories registered in the Open Directory of Open Access Repository (OpenDOAR) database, it is evident that in recent years (2005-

2010), institutional repositories worldwide have grown in numbers and in the volumes of materials deposited. Similar pattern of growth is evident in Asian countries too. However, a comprehensive study investigating the status of institutional repository deployment across the Asian continent is unavailable as to date. Although several Asian studies have reported isolated findings of institutional repository growth on a broad spectrum, such as in India (Fernandez 2006), Japan (Mukarami and Adachi 2006), China (Zhong 2009), Taiwan (Chen and Hsiang 2008), and Malaysia (Kiran and Chia 2009), a slow progress is evident. Mukarami and Adachi (2006) reported the growth of institutional repositories in Japan to be increasing as much as three times a year since 2004. A more comprehensive study by Chen and Hsiang (2008) found that the number of institutional repositories in Japan, India, Australia, Korea, Russia and Taiwan are more than in other Asian countries. Kiran and Chia (2009) reported that the adoption of institutional repositories in Malaysia is rather low, even in the country's top four research-intensive universities. Zhong (2009) used data from the Registry of Open Access Repositories (ROAR) and found only 27 Chinese institutional repositories, listed separately under China mainland (15), Hong Kong (3), and Taiwan (16). He contributed the small number to lack of awareness among potential contributors and lack of government policies on institutional repository implementation.

This paper attempts to present an overview of the current status of institutional repositories across Asian countries. It also relates to the institutional repositories' performance which may lead to the provision of impact to the university research ranking.

LITERATURE REVIEW

This section provides a baseline understanding of the current state of research in institutional repositories around the world and specifically, in Asia. It reviews several studies conducted to affirm the state of the art of institutional repositories across the world highlighting the method used as well as reporting the findings for comparison. The growth in literature demonstrates that institutional repositories are gaining in momentum throughout academia. Generally, research in institutional repositories focuses on (a) a snapshot of the state of institutional repository in a particular institution or country; (b) survey of authors or contributors and libraries regarding requirements, usage and attitudes; or (c) impact of Open Access publishing.

There are several previous surveys on institutional repositories conducted to provide a 'snapshot' of the state of the institutional repositories in particular countries such as the USA (Lynch and Lippincott 2005; van Westrienen and Lynch 2005; Rieh et al 2007), European Union (Van Eijndhoven and Van Der Graaf 2007; Melero et al 2009), Australia (Kennan and Kingsley 2009), India (Fernandez 2006; Prabhat and Gautam 2009), Japan (Mukarami and Adachi 2006), China (Zhong 2009), Taiwan (Chen and Hsiang 2008), and Malaysia (Kiran and Chia 2009).

In the USA, over 40% of the higher education institutions have institutional repositories in operation, while 88% of non-deployment institutions have planned to establish one (Lynch and Lippincott 2005). Van Westrienen and Lynch (2005) additionally gathered data using a survey method on the deployment of institutional repositories in universities in 13 nations including Australia, Canada, USA and 10 other European countries. The 2005 survey reported a total of 305 institutional repositories in the 13 nations, with the highest number of institutional repositories (103) residing in Germany. As for the average number of records, the Netherlands demonstrated the highest average (12, 500 records), while other nations generally showed for only several hundred records.

Rieh et al (2007) used a different approach while conducting an e-mail survey (targeted at academic library directors) for institutional repositories deployment across the USA. The researchers divided the institutional repository development in several different stages which showed 41% of institutional repository implementation stage (IMP), 63% of planning and pilot testing stage (PPT) and 84% of planning only stage (PO). Their findings generally showed that the major contributors to the operational institutional repositories are faculty or graduate students and the most widely used platform is DSpace. They found that the number of documents in the institutional repositories did not correspond to the age of the repositories. Prevalent types of documents are doctoral dissertations, working papers, journal articles, and raw data files that result from doctoral theses and master's dissertations. They also suggested that faculty librarian were more prominent contributor than the researchers or authors themselves, probably because most of the items were digital archives. This study demonstrates a comparable implementation rate with the study done previously by Lynch and Lippincott (2005). It was suggested that this is probably due to the uncertainty of the universities as to what direction institutional repository should be focused on in terms of its collection and services (Rieh et al. 2007). Jantz and Wilson (2008) found that institutional repository deposits among the American Research Libraries (ARL) shows great variation across disciplines, and is lacking in humanities scholarship, particularly History, English and Linguistics.

In the European Union (EU), under the DRIVER 1 project, Van Eijndhoven and Van Der Graaf (2007) investigated the development of institutional repositories through means of web survey, wiki and telephone interviews. Their findings reported that approximately 230 (40%) universities in EU have deployed one or more Institutional repositories in which textual materials (90%) are the predominant research output being deposited. Melero et al (2009) subsequently conducted a nation wide web survey on Spanish institutional repositories which included academic, research and cultural organizations. The study aimed to investigate the materials deposited in the institutional repositories, technical infrastructure and issues, institutional policies and services created for the institutional repositories. The survey which resulted with a 36.5% response rate (25% responses from institutions that already had institutional repositories, and 13% from institution that did not have institutional repositories) revealed that 78.3% of institutional repositories in Spain are registered in BuscaRepositories. The findings also report that Spanish repositories contained mainly full-text and metadata of journal articles and theses. The most used software platform is DSpace, followed by EPrints; and Dublin Core metadata is the common standard used for describing the materials deposited. As for the services, the high priorities were research assessment and evaluation services, and usage statistics services. On the other hand the lower priority services were 'print on demand' and 'publishing'. Both studies by Van Eijndhoven and van der Graaf (2007) and Melero et al. (2009) consistently highlighted several important factors that encouraged institutional repository development. Among the factors were: to increase visibility and citation of the research work, the friendliness and ease of use of the institutional repository facilities and additional services that an institutional repository could offer- such as search and citation index services. Subsequently, the absence of policies, lack of national and international integration, and lack of awareness effort from academicians in the universities had demotivated the implementation.

The institutional repository development phenomenon in Australia and New Zealand is encouraging. Kennan and Kingsley (2009) conducted a web-based survey to investigate the status of Australian institutional repositories. Their study demonstrated a very high rate of institutional repository implementation (84.2%) that derived from 97.4% response rate of a total of 39 Australian universities. They indicated that the high rate of institutional

repository implementation is expected due to the Australian government who has been supportive of the Open Access development through funding and establishing policies in order to make their research output more accessible. In Australia, Fedora is a more popular platform for institutional repository development and most deposited content type are journal articles and conference paper.

In a recent study in New Zealand, Cullen and Chawner (2010) investigated factors affecting the adoption and success of institutional repositories. An interesting conclusion led by these researchers is that although the overall development of institutional repository is lagging, there is an increase in subject based or disciplinary repositories. They posit that this may be due to the fact that New Zealand researchers are more motivated to share research outputs with a specific community, compared to recognition of individual (or institutional) and academic award. They propose that the establishment of institutional repositories need to be within a framework of 'scholarly communication patterns' of particular disciplines in order to encourage increase in content contribution.

The Asian countries too have been striving to keep abreast with the institutional repository adoption. Japan, India and Taiwan have been recognised as big contributors to the growth of institutional repositories in Asia. In October 2008, Wani, Gul and Rah (2009) conducted a study on the growth of institutional repositories in Asia using the data from the OpenDOAR. Their findings indicate that the total number of institutional repositories in Asia is 138, with Japan as the biggest contributor (69) followed by India (30), while other countries in Asia contributed between 1 to 6 institutional repositories each. DSpace (95 countries) was the most used software followed by EPrints (15 countries). The most prominent content type deposited were journal articles, and English was the most widely used language for the materials deposited.

Matsuura's (2008) study reported that Japan has been placed as the fourth biggest contributor by counts of institutional repositories in OpenDOAR and ROAR. According to the researcher, although Japan university libraries and research institutes began to contribute to institutional repositories only in 2005, the successful growth of institutional repositories can be contributed to the government's support as well as sponsorship from Japan's National Institute of Informatics (NII), a leading inter-university research institute aiming to build a nation-wide knowledge distribution network. Japanese institutional repositories can be accessed both at the individual local level and through a single web portal called JAIRO (Japanese Institutional Repositories Online). While 85 university repositories can be accessed through the JAIRO portal, this represents only 11.2% of the total 756 universities in Japan for the 2008 academic year. An interesting finding is that a majority of the content of these institutional repositories are departmental bulletins (*kiyo*) followed by academic journal articles, especially those in English language.

Another recent study (Prabhat and Gautam 2010) placed India as the second in the Asian region as a contributor to the world institutional repositories. Institutional repositories in India have received much coverage from both the academia and librarians. The authors explored the Indian institutional repositories registered in ROAR as at February 2010. Out of the 221 Asian institutional repositories, they found 49 (22.2%) deployed by India. India has shown a steady growth in this phenomenon from 4 institutional repositories established in 2004 to a total of 49 in 2009, an average increase of about 9 new institutional repositories per year. Indian institutional repositories are mainly from research institutions and the software used is mainly Dspace. This is consistent with Gaury's et al. (2009) study that reported out of 52 institutional repositories in India, 23 were using DSpace and 19 used EPrints.

Kiran and Chia (2009) studied the success of institutional repositories in Malaysia from the end-users point of view. They reported that in 2009 Malaysia was the 4th largest contributor of institutional repositories in Asia based on ROAR data. There were a total of 12 institutional repository initiatives, all of which are universities. The most used software is ePrints and a large number of materials deposited in the institutional repositories are theses and dissertations. They concluded that institutional repository adoption in Malaysia is at its infancy because of the 'empty collections'. This is an indicator of the lack of institutional repositories in Malaysia. Though studies have shown that content recruitment of institutional repository content tends to drop significantly after the first few months/years (Xia 2007), prolonged empty collection completely defeats the purpose of establishing institutional repositories.

OBJECTIVES AND METHODS

It is important to know the extent of institutional repository adoption in Asia (the Global south) and how it fares compared to USA and Europe (the Global North). Since scholarly visibility is the main aim of an established institutional repository, it is hoped that the top ranking universities in Asia are pioneering the institutional repositories initiatives and paving the path for the new universities, especially in the developing countries. This study aims to analyse the current state of Asian open-access institutional repositories and to describe their characteristics and performance. It addresses the following research objectives:

- a) To analyse the current state of Asian Open Access repositories and describe their characteristics in terms of types, contents, disciplines, language, technical and operational issues as well as policy;
- b) To identify the web performance of Asian institutional repositories as reflected through the global visibility and impact of the repositories; and
- c) To identify the performance of the Asian top-ranked universities in the archiving and sharing their research output through their institutional repositories.

Data to achieve objective (a) were gathered through an analysis of repositories registered in the Open Directory of Open Access Repository (OpenDOAR), hosted by the University of Nottingham in United Kingdom. This directory has been made public since 2006. It is an authoritative directory of academic open access repositories and has been awarded the SPARC Europe Award for Outstanding Achievements in Scholarly Communication (OpenDOAR 2010). Data to achieve objectives (b) were gathered through an analysis of institutional repositories listed in the Ranking Web of World Repositories (RWWR), an initiative of the Cybermetrics Lab, a research group belonging to the *Consejo Superior de Investigaciones Cientificas* (CSIC), the largest public research body in Spain. The aim of this ranking is to support Open Access initiatives and the free access to scientific publications in an electronic form and other academic materials. The web indicators are used to measure the global visibility and impact of the scientific repositories (Ranking Web of World Repositories 2010). This RWWR data used in this study is the January 2010¹ which listed the top 400 institutional repositories from about 700 repositories worldwide. To avoid duplicating previous Asian institutional repository surveys, the authors conducted a census of academic institutions in Asia that are ranked by their academic performance and

¹ Data for the July 2010 edition listed the top 800 institutional repositories from almost 1000 repositories worldwide.

involved in the institutional repository movement. As such data to achieve objective (c) were obtained through analysing the number of records and contents of the institutional repositories deployed at top-ranked Asian universities.

A web analysis conducted in June 2010, found that there are 25 Asian countries included in OpenDOAR, with a total of 191 open access repositories². This puts the Asia continent in the third place after Europe and North America, as a contributor to the growth of institutional repositories. The highest number of repositories are in Japan (78, 38%), followed by India (39, 19%) and Taiwan (22, 11%), which sequence is similar to Wani, Gul and Rah's (2009) findings. Seventeen other countries (Afghanistan, Azerbaijan, Bangladesh, Georgia, Iran, Israel, Kazakhstan, Kyrgyzstan, Nepal, Pakistan, Philippines, Qatar, Saudi Arabia, Singapore, Sri Lanka, Thailand and Vietnam) has one (1) repository each which contributes 13% of the overall distribution. This number is slightly different from Chen and Hsiang (2008), who reported that the number of repositories in Japan, Taiwan and Korea was 85, 37 and 215 respectively. This is reasonable, as Chen and Hsiang (2008) collected the data via personal communication with the corresponding countries while this study used the data derived from OpenDOAR - voluntary basis of the institution to register their repositories in the directory. Figure 1 presents the percentage of distribution of Open Access repositories in Asian countries and incorporates the percentage of distribution of the 191 repositories used as the sample in this study. Each organisation is counted only once even though it holds more than one repository. Based on the figures, Japan again shows the highest number of organisations which is 74 (39%). This is then followed by India (35, 8%), and Taiwan (21, 11%), Malaysia and Turkey each have 9 organizations (5%), whereas China (7, 4%), Indonesia and Korea (5, 2.5%) follows closely. The other 17 Asian countries have less than 5 organisations that hold Open Access repositories which indicate 13% of the overall distribution.

FINDINGS AND DISCUSSION

The Current State of Open Access Repositories in Asia

A total number of 1 016 883 records were deposited in the Asian countries Open Access Repositories as at 10 June 2010. The highest percentage of the records are from Taiwan (35%), followed by Japan (27%) and Saudi Arabia (12%), as shown in Figure 2. Figure 3 subsequently demonstrates the distribution of content types in the Open Access repositories. The majority of deposited content are journal articles (79%), followed by theses and dissertations (50%). While the least deposited content type is software (1%).

Based on Figure 4, it is evident that the distribution of subjects in the Open Access repositories is multidisciplinary. This is reasonable as most of the large institutions essentially hold all subjects in their repositories and therefore are categorised as 'Multidisciplinary' in OpenDOAR. On the other hand, some repositories are specialised institutions or disciplinary repositories that are dedicated to specialised subjects as such Health and Medicine (6.4%), Science General (5.9%), Technology (5.4%), Mathematics & statistics (3.9%) and others, as depicted in Figure 4. As for the language of the collections in IRs, the most widely used language is English (84%). It is also notable that there are a high number of collections in Japanese (37.7%) and Chinese (14%).

² Data collected in June 2010. As at 6 Sept 2010, there are a total of 228 Open Access repositories in Asia (OpenDOAR 2010)

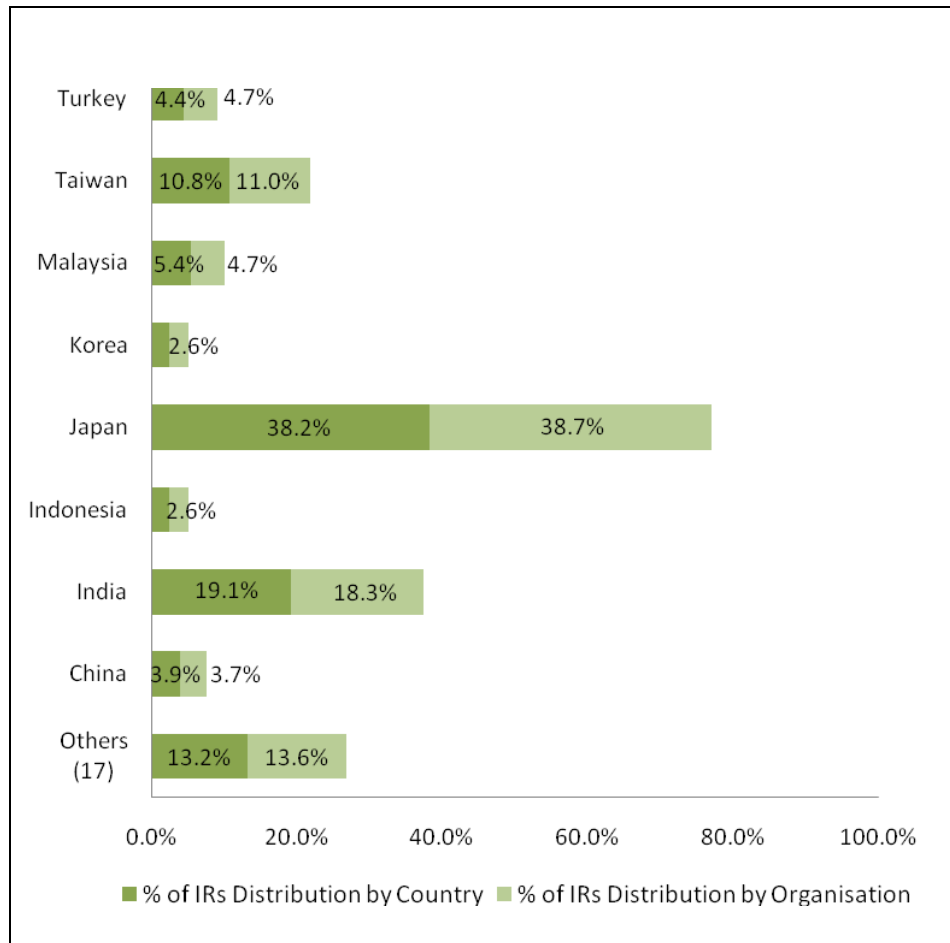


Figure 1: Proportion of Open Access Repositories in Asian Countries as at 10 June 2010 (n=191)

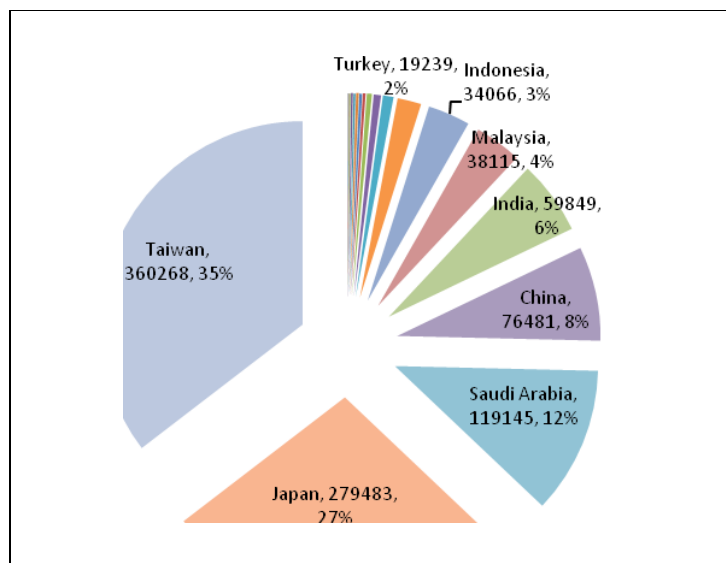
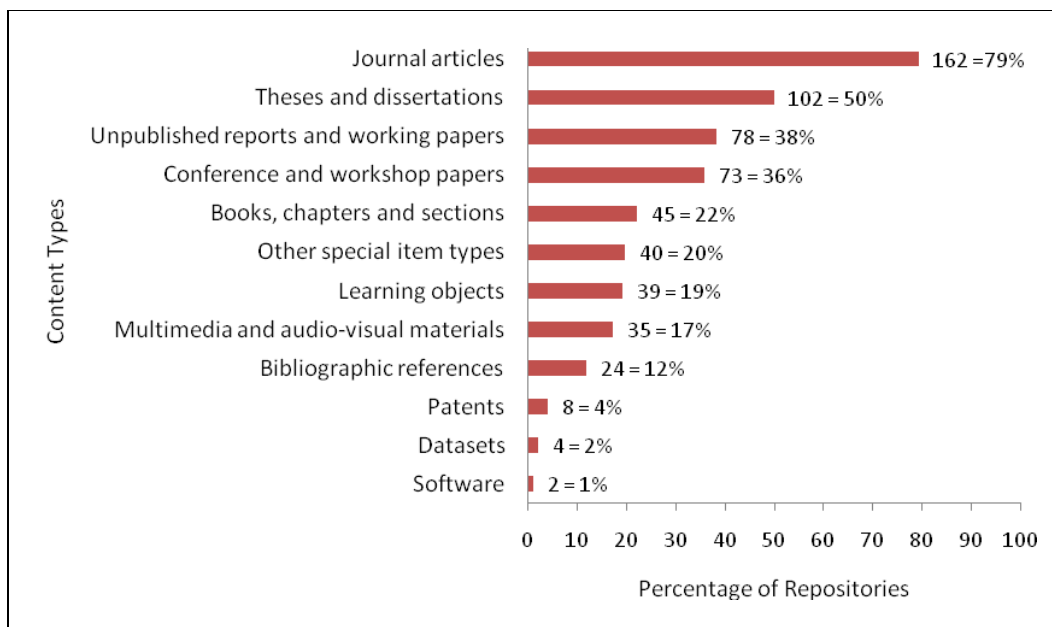


Figure 2: Proportion of Record Number in the Open Access Repositories as at 10 June 2010 (n=1 016 883)



Note: Most repositories hold several content types

Figure 3: Content Types in Open Access Repositories

Technical and Operational Issues

Figure 5 shows the distribution of the platform or software used for the deployment of Open Access repositories in Asia. The most widely used software is the open source application DSpace (66%), followed by Eprints (13%). In addition, the highest percentage of Open Access repositories type is institutional or departmental repositories (92%), whereas 5% of the repositories are disciplinary (cross-institutional subject) repository. A small number of the Open Access repositories are aggregating (an archive aggregating data from several subsidiary repositories) and governmental (a repository for governmental data), which account for 2% each. The Open Access repository operational status demonstrates that 97% of the open access repositories are operational or fully functional, 2% are on trial and 1% are broken (i.e. technically malfunction).

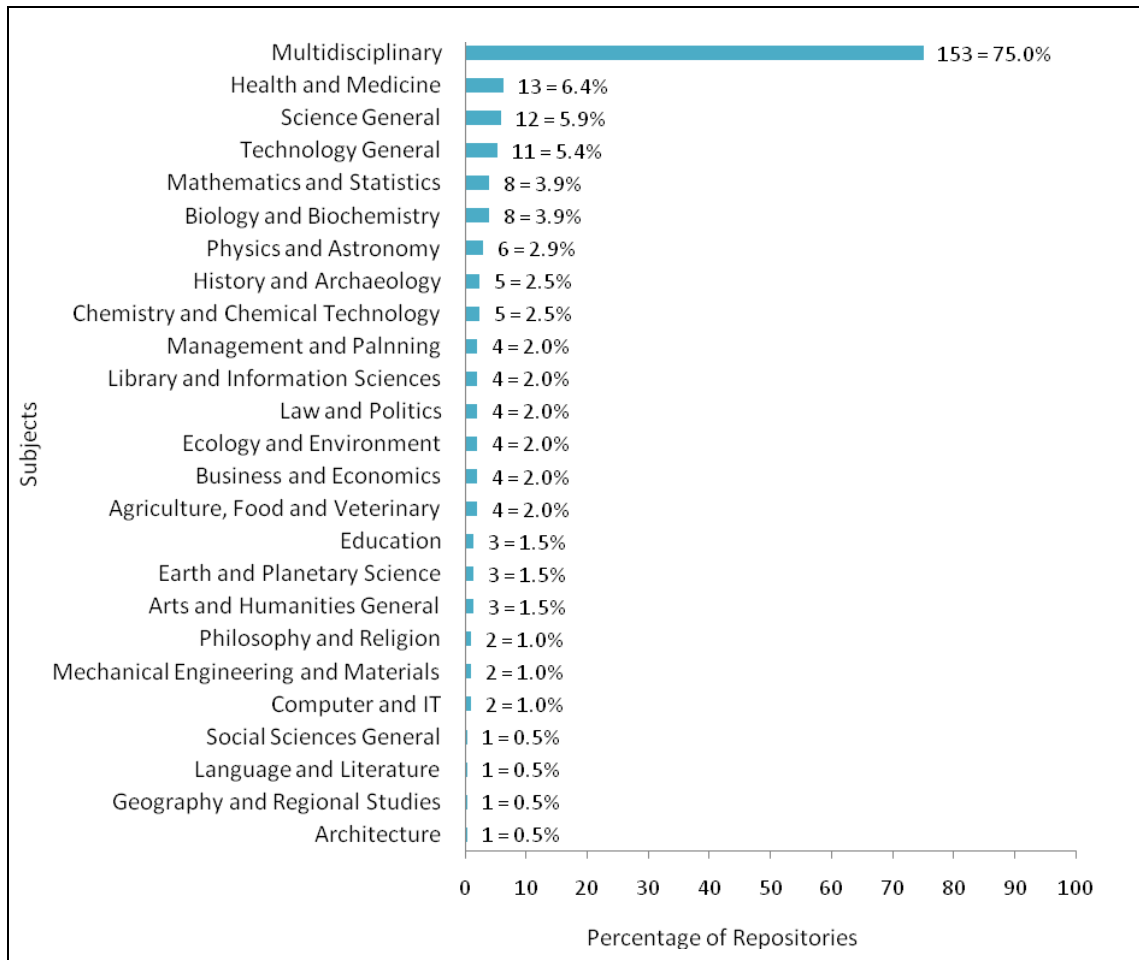


Figure 4: Subjects in the Open Access Repositories

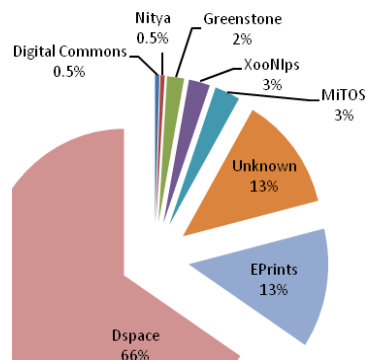


Figure 5: Distribution of Usage of the Open Access Repository Software

Open Access Repositories Policies

In the OpenDOAR directory, there are five main types of policies as depicted in Figure 6, namely Recorded Metadata Re-Use Policies, Full-Text Data Re-Use Policies, Recorded Content Policies, Recorded Submission Policies and Recorded Preservation Policies. It is evident that a high majority of the repositories has an 'Undefined' policy for content, submission and preservation. Only a small percentage of repositories have defined Recorded Content Policies (4.4%), Recorded Submission Policies (8.8%) and Recorded Preservation Policies (3.4%).

As for the Recorded Metadata Re-Use Policies, only 2% of the repositories have Non-profit (Metadata re-use permitted for not-for-profit purposes) policies while another 1% has either No Right (all metadata re-use prohibited) or Commercial (Commercial metadata re-use permitted) policies. Findings also show that for the Recorded Full-Text Data Re-Use Policies, only 3.4% have Non-Profit (Re-use of full data items permitted for not-for-profit purposes) policies, while the other 1% has either No Robots (Harvesting full data items by robots prohibited) or Variable (Rights vary for the re-use of full data items).

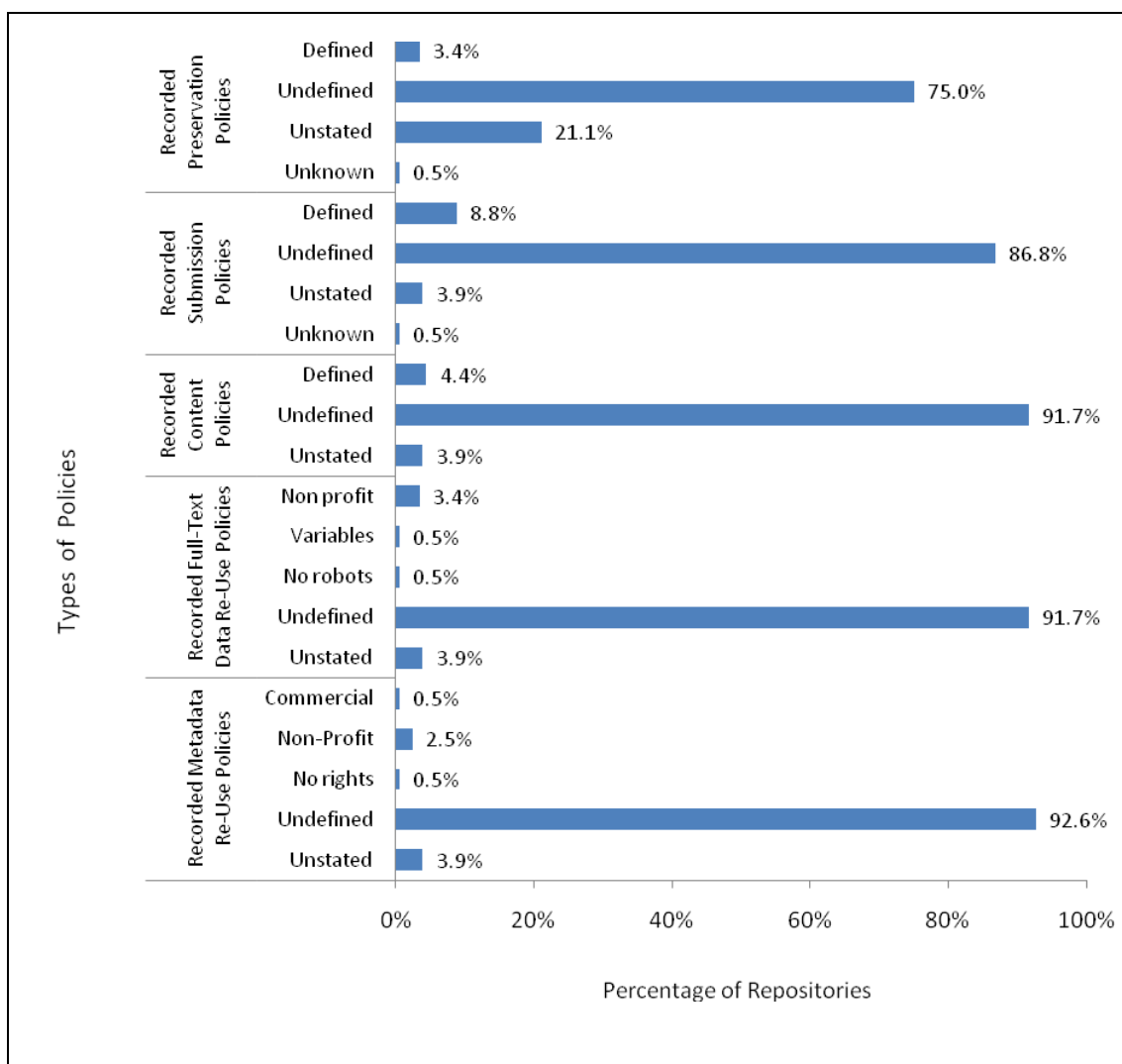


Figure 6: Distribution of the Recorded Repositories Policies

(b) Web Performance of Asian Institutional Repositories

In an attempt to identify the web performance in terms of global visibility and impact of the Asian institutional repositories, the study used the RWWR that measures web performance indicators. This web ranking aims to 'support open access initiatives and free access to the world's scientific publications and research output' (Ranking Web of World Repositories 2010). This ranking reflects the impact of online scholarship through the process of generation and communication of scientific knowledge. The following quantitative web indicators are used in RWWR:

- i) size (S) which refers to the number of pages recovered from the four largest engines: Google, Yahoo, Live Search and Exalead;
- ii) visibility (V) which refers to the total number of unique external links received (inlinks) by a site can be only confidently obtained from Yahoo Search and Exalead;
- iii) rich files (R) which refers to the number of text files in Acrobat format (.pdf) extracted from Google and Yahoo; and
- iv) scholar (Sc) which refers to the mean of the normalised total number of papers and those (recent papers) published between 2001 and 2008 from Google Scholar database. The four ranks were combined according to a formula where each one has a different weight but maintain the ratio 1:1 between activity (size) and impact (visibility).

Out of the 191 Asian institutional repositories identified, 48 (about 23%) are listed in the Top 400 Ranking Web of World Repositories³ of which Japan leads in terms of numbers (25), followed by India (8) and Taiwan (6) (Figure 7). Hong Kong, Indonesia and Malaysia has two universities each that made it to the top 400 in the list. China, Turkey and Pakistan are also listed, with one university each. Surprisingly, Korean universities are missing from this list. The Appendix presents the list of the Asian institutional repositories included in the Top 400 Ranking Web of World Repositories.

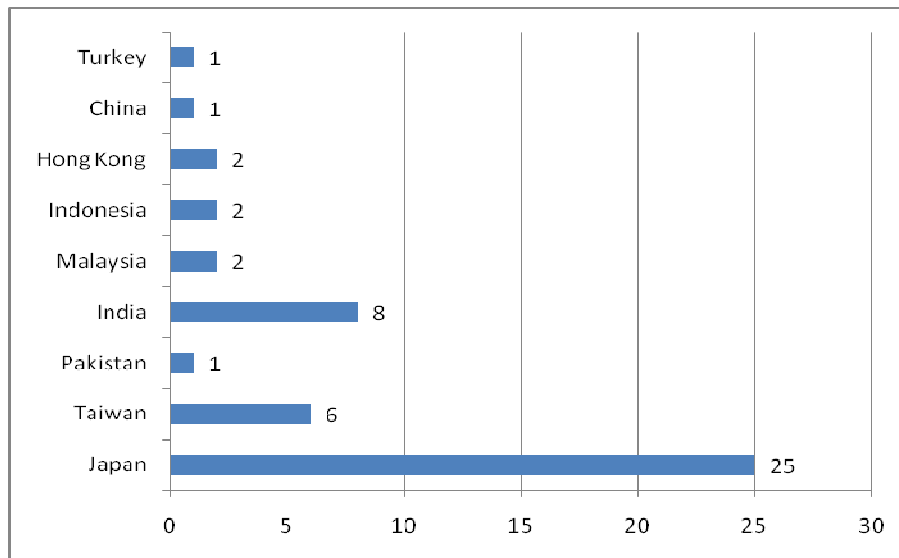


Figure 7: Asian Institutional Repositories Listed in the Ranking Web of World Repositories (n=48)

³ Of 400 institutional repositories listed in the January 2010 Web Ranking of World Repositories, 130 came from the American continent, 193 Europe, 48 Asia, 23 Australia and 6 Africa.

This finding seems to suggest that only 12% (48 out of 400) of Asian institutional repositories are visible and incorporate good practices in their web publication as extracted from the quantitative webometrics indicators used by the ranking, namely size, visibility, rich files and scholar. However, it should be noted here that this ranking should be interpreted with caution as it does not take into considerations the critical parameters of an institutional repository, especially in terms of full-text deposit and document types.

(c) Performance of Asian Top-Ranked Universities

Institutional norms, as promulgated by the university senate, may increasingly encourage faculty to place their research output into institutional repositories (Lynch and Lippincott 2005). Picking up from this statement that seems to suggest that research universities are the driving force behind most institutional repositories since an institutional repository has been articulately made and largely accepted for faculty scholarly output, this study attempts to identify the presence of the Asian Top 200 Universities in the RWWR.

Only 29 Asian Top 200 universities were included in the ranking, comprising 18 from Japan, six (6) from Taiwan, 2 (two) each from Hong Kong and Malaysia, and one (1) from China (Table 1). However, only 14 of these 29 universities were ranked top 100 in the RWWR. Japanese universities landed in good positions with 11 universities (Tokyo, Kyoto, Nagoya, Kyushu, Hokkaido, Chiba, Waseda, Nagasaki, Kanazawa, Okayama and Ochanomizu) ranked top 100. Two universities in Taiwan, *National Taiwan University* and *National Hsing Hua*, made it to the top 100 in the list, at 53 and 80 respectively. *University Teknologi Malaysia* ranks 89th, making it the only Malaysian university listed in the top 100 of the web ranking. Two of Asia's best universities from Hong Kong did not make it to the Top 100 RWWR. Being the first and second top universities in Asia, *University of Hong Kong* and *Hong Kong University of Science and Technology* landed in position 217 and 193 respectively in the RWWR, suggesting that their institutional repository visibility is below the expected position of their academic and research excellence. Another top Asian university that obviously need to have an institutional repository that reflect accurately its research activities is the *University of Malaya*, which is ranked 42 in Asia, but landed in 372 in the RWWR, way below other universities such as Doshisha and Shinshu (Japan), National Chengchi (Taiwan) and Xiamen (China) in terms of RWWR.

It is curious to note that a number of highly-ranked universities are missing from RWWR. These include the *National University of Singapore* (NUS Singapore), the *Chinese University of Hong Kong* (CUHK Hong Kong), *Seoul National University* (South Korea), *Peking University* (China), *Korea Advanced Institute of Science & Technology* (KAIST) (South Korea), *Pohang University of Science And Technology* (POSTECH) (South Korea), *Nanyang Technological University*, (NTU Singapore) and *Yonsei University* (South Korea) – all listed in the top 20 universities in Asia. The problem with duplicate domains may explain their poor performance in webometrics ranking. A large number of universities in Korea for example maintain two or more main web domains that clearly penalize not only their webometrics ranking but more importantly their position in search engines and global internet visibility (Cybermetrics Lab 2009). Perhaps this is also the case of NTU Singapore that maintains two digital repositories, an open access for journal articles and conference papers, and a restricted access for theses and final year projects. NUS Singapore, on the other hand does not have a dedicated institutional repository. The current repository is hosted by the School of Computing and is not accessible to the public, making it serves just like an online library catalogue. CHUK and Peking University are not even listed in OpenDOAR. As one of the most promising ways to distribute the research output of the universities is to deposit scientific papers and related materials at institutional repositories, these top universities

should seriously consider making their quality intellectual products openly available to increase the depth and diversity of raw material for research and developments with their other Asian university counterparts.

Table 1: Asian Top 200 Universities whose Institutional Repositories included in the Ranking of Web of World Repositories (n=29)

No	Asia Univ. Ranking	Repository Name	RWAR/ RWWR	Country
1	1	University of Hong Kong Scholars Hub	25 / 217	H.K
2	2	Hong Kong University of Science and Technology Institutional Repository	22 / 193	H.K.
3	5	University of Tokyo Repository*	7 / 60	Japan
4	8	Kyoto University Research Information Repository*	1 / 25	Japan
5	10	Nagoya University Repository*	10 / 73	Japan
6	17	Kyushu University Institutional Repository*	2 / 44	Japan
7	21	National Taiwan University Repository*	3 / 53	Taiwan
8	22	Hokkaido University Collection of Scholarly and Academic Papers*	14 / 99	Japan
9	33	Chiba University Repository*	5 / 57	Japan
10	34	National Tsing Hua University Repository*	12 / 80	Taiwan
11	34	National Tsing Hua University Institutional University	24 / 214	Taiwan
12	38	Hiroshima University Institutional Repository	15 / 102	Japan
13	39	Waseda University Dspace*	4 / 54	Japan
14	42	University Malaya's Institutional Repository	29 / 372	Msia
15	47	Nagasaki University Academic Output*	9 / 64	Japan
16	51	Kanazawa University Repository for Academic Resources*	6 / 59	Japan
17	54	Okayama University Digital Information Repository*	11 / 75	Japan
18	55	Kumamoto University Repository	20 / 156	Japan
19	58	National Central University (Taiwan) Repository	17 / 130	Taiwan
20	61	Yokohama National University Repository	21 / 164	Japan
21	71	National Chiao Tung University Institutional Repository	19 / 137	Taiwan
22	82	University Teknologi Malaysia Institutional Repository*	13 / 89	Msia
23	93	Ochanomizu University Web Library Institutional Repository*	8 / 63	Japan
24	94	Mie University Scholarly E-Collections	28 / 289	Japan
25	113	Kagoshima University Repository	23 / 213	Japan
26	123	Doshisha University Academic Repository	16 / 128	Japan
27	125	National Chengchi University Repository	18 / 132	Taiwan
28	134	Shinshu University Institutional Repository	26 / 220	Japan
29	181	Xiamen University Institutional Repository	27 / 241	China

RWAR – Asia score; RWWR – World score

* Ranked Top 100 in the RRWR

How dedicated are these top-ranked Asian universities in archiving and sharing their research output through their institutional repositories? This study found that most institutional repositories are dedicated to distribute the research output of the universities in the form of theses (18 universities), conference papers (13 universities) and unpublished works (15 universities), and most of the institutional repositories have also strong commitments to locally created materials for teaching and learning (15 universities). However, already published articles (post-prints), which represent the main source of research results that largely remain kept behind subscription barriers, are deposited by only 4 Japanese universities and one university from Malaysia. This seems to suggest that the primary goal of open access archiving to maximise the accessibility of the research publications and their impact has not been fully embraced by many top universities in Asia. This is perhaps due to the lack of awareness on the part of authors regarding the rights associated with author self-archiving of published articles, or lack of a clear institutional policy from the university management, or the lack of academic libraries' role to establish

policy, promote usage and recruit content for their established institutional repositories. These are all conjectures, but are highly plausible. The performance of the top-ranked Asian universities is shown in Table 2.

Table 2: Performance in terms of the Number of Records and Contents of the Institutional Repositories Deployed at Top-Ranked Asian Universities

Rank	Repository Name (QS Asian University Ranking 2010 Classification*)	No of records	Pubs	Conf	Theses	Unpub	Others
1	Kyoto University Research Information Repository (A1)	9440				+	+
2	Kyushu University Institutional Repository (B1)	2725			+	+	
3	National Taiwan University Repository (A1)	45479			+	+	+
4	Waseda University Dspace (A2)	2610		+	+	+	
5	Chiba University Repository (B1)	2176	+	+	+	+	+
6	Kanazawa University Repository for Academic Resources (C1)	3094			+	+	+
7	University of Tokyo Repository (B1)	22764	Information not available				
8	Ochanomizu University Web Library Institutional Repository (D2)	862	+	+		+	
9	Nagasaki University Academic Output (C3)	3249			+		
10	Nagoya University Repository (B1)	3930	+				
11	Okayama University Digital Information Repository (B1)	21253	Information not available				
12	National Tsing Hua University Resiptory (B1)	10734		+	+	+	+
13	University Teknologi Malaysia Institutional Repository (B2)	9371	+	+	+		
14	Hokkaido University Collection of Scholarly and Academic Papers (B1)	8942				+	+
15	Hiroshima University Institutional Repository (B1)	12204	+	+	+	+	+
16	Doshisha University Academic Repository (B2)	12252	Information not available				
17	National Central University (Taiwan) Repository (C2)	23655			+		
18	National Chengchi University Repository (B2)	1810				+	
19	National Chiao Tung University Institutional Repository (B2)	17549			+		+
20	Kumamoto University Repository (C1)	1025		+	+	+	
21	Yokohama National University Repository (C2)	2368			+	+	+
22	Hong Kong University of Science and Technology Institutional Repository (C2)	3044		+	+	+	+
23	Kagoshima University Repository (C1)	2294		+	+		+
24	National Tsing Hua University Institutional University (B1)	10734		+	+	+	+
25	University of Hong Kong Scholars Hub (A1)	26739			+		+
26	Shinshu University Institutional Repository (C1)	8412	Information not available				
27	Xiamen University Institutional Repository (A1)	69149		+			+
28	Mie University Scholarly E-Collections (E2)	1614		+			+
29	University Malaya's Institutional Repository (B1)	824		+	+		
	TOTAL		5	13	18	15	15

The universities highlighted are those achieving content totals over 10,000 items

* A1 = Large; Fully Comprehensive; Very High Research Activity
 A2 = Large; Fully Comprehensive; High Research Activity
 B1 = Large; Comprehensive, Very High Research Activity
 B2 = Large; Comprehensive; High Research Activity

C1 = Large; Focused; Very High Research Activity
 C2 = Large; Focused; High Research Activity
 C3 = Large; Focused; Moderate Research Activity
 E2 = Medium-sized; Fully Comprehensive; High Research Activity

Although the study is not able to ascertain the quality of deposited content as one indicator of successful recruitment, the sheer quantity has been identified as necessary for repositories to further the cause of open access. Repository quantity or size is also one of the most tangible, quantifiable mechanisms for evaluation of institutional repositories (McDowell 2007). While Lynch and Lippincott (2005) addressed the difficulties in determining a standard unit of measurement for repository size, Davis and Connolly (2007) have referenced item and record number totals in examining performance of institutional repositories. Using QS Asian University Ranking classification as the predictor of repository content totals, the study found that 11 universities achieving content totals over 10,000 items (highlighted in Table 2). However, it is not surprising that all these academic institutions are classified as high (HRA) or very high research activity (VHRA) universities by the QS Quacquarelli Symonds Limited. Conversely, 8 institutions have institutional repositories with totals records of between 3000 – 10000; 7 have 1500 – 3000 and the

remaining 3 have 100 – 1500 records. One plausible explanation for this is that institutional repositories with small quantity (100-1500 records) are deployed by research groups as in the case of University of Malaya (824 records) as self-archiving is still seen as a concern among authors (Abrizah 2009), and those with more records are deployed by the academic libraries (as in the case of University Teknologi Malaysia with 9371 records) as they are perceived to be appropriate locations for institutional repositories and should lift their institutional repositories as a full-fledge infrastructure digital library.

CONCLUSION

Open access repositories through institutional repositories can transform the research scene from one of isolation and marginalisation, to one of inclusion and international cooperation. In general the findings in Asia indicated that almost each country has operated institutional repositories, although diverse distribution is reported from one country to another, as well as to common materials deposited in the repository and the low-existence of policies to support and promote the institutional repository implementation. Though Asian countries contribute 191 institutional repositories in OpenDOAR, only a small number (48) of these IRs are listed in Top 400 RWWR. Out of these 48, only 29 universities are among the Asian Top 200 Universities. In general, the growth of IR in Asia is not very encouraging. Cullen and Chawner (2010) also claim that the concept of the institutional repository has failed to gain much attraction with the academic community it was intended to benefit.

Based on the data obtained from OpenDOAR and RWWR, there are a few important conclusions that can be drawn. The open access self-archiving movement was initiated to facilitate access to scholarly communication restricted mainly by publishers and limited financial resources. From a slow uptake by discipline based self-archiving repositories, the growth of institutional based open access repositories have contributed to the realization of this movement. It is thus expected that top-ranked universities that are the pioneers in high-impact research will also be in the frontiers of archiving and sharing their research output, especially for the benefit of developing countries. However, this has not been the case for a number of top ranked universities in Asia. The Open Access movement has not been openly embraced by some top ranked universities, where the researchers there probably have well-established routines of publication in prestigious journals and see little benefit in alternative methods of access to the same material.

As advised by the Cybermetrics Laboratory (Ranking Web of World Repositories 2010), this paper concludes that if the web performance of a research institution is below the expected position according to their academic excellence, university authorities should reconsider their web policy, promoting substantial increases of the volume and quality of their intellectual output / research publications. However, it should be noted that although web ranking combines in a single figure all the universities missions, it does not provide enough details to understand the relative contribution of each. Good ranks are probably correlated with higher number of potential authors who self-archive (scholars and postgraduates) and the effort made by the academic library to collect and disseminate the university's intellectual output. Open Access mandates the presence of large scientific repositories and the technological infrastructure of the university, as well as providing large quantities of full-text academic pages in the English Language. Libraries have been perceived to be appropriate locations for these institutional repositories since information management, the application of metadata, understanding copyright issues and open access mandates were considered instrumental for successful implementation. As such

academic librarians are in an ideal position to act as change agents in the promotion and visibility of their own university's institutional repository as potentially valuable sources of information for their clients worldwide.

Overall it can be said 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. Greater dedicated participation from Asian top ranked universities is expected to lead the way, as it is not yet the case. It is important to identify the factors that may have contributed to this phenomenon.

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Asian Institutional Repositories included in the Top 400 Ranking Web of World Repositories

	RWWR Ranking	Asian University Ranking 2010	University	Country	Size	Visibility	Rich files	Scholar
1	25	8	Kyoto University Research Information Repository	Japan	138	31	17	28
2	44	17	Kyushu University Institutional Repository	Japan	121	36	38	169
3	53	21	National Taiwan University Repository	Taiwan	77	100	71	15
4	54	39	Waseda University Dspace	Japan	88	74	39	144
5	57	33	Chiba University Repository	Japan	246	61	12	206
6	59	51	Kanazawa University Repository for Academic Resources	Japan	31	140	58	45
7	60	5	University of Tokyo Repository	Japan	125	93	80	26
8	63	93	Ochanomizu University Web Library Institutional Repository	Japan	18	106	30	331
9	64	47	Nagasaki University Academic Output	Japan	90	114	64	55
10	72	NR	Indian Institute of Science Bangalore ePrints	India	43	156	35	101
11	73	10	Nagoya University Repository	Japan	339	69	126	49
12	75	54	Okayama University Digital Information Repository	Japan	70	162	26	88
13	80	34	National Tsing Hua University Resiptory	Taiwan	21	245	18	72
14	89	82	University Teknologi Malaysia Institutional Repository	Malaysia	141	176	53	39
15	99	22	Hokkaido University Collection of Scholarly and Academic Papers	Japan	106	24	50	550
16	102	38	Hiroshima University Institutional Repository	Japan	74	65	4	550
17	128	123	Doshisha University Academic Repository	Japan	134	189	69	275
18	130	58	National Central University (Taiwan) Repository	Taiwan	135	152	402	7
19	132	125	National Chengchi University Repository	Taiwan	50	312	22	138
20	137	71	National Chiao Tung University Institutional Repository	Taiwan	73	297	100	64
21	156	55	Kumamoto University Repository	Japan	75	213	91	394
22	160	NR	Tokyo Gakugei University Repository System	Japan	56	219	227	238
23	164	61	Yokohama National University Repository	Japan	104	291	79	164
24	167	NR	Indian Statistical Institute Digital Library	India	118	153	263	311
25	189	NR	Tokyo University of Foreign Studies Prometheus Academic Collections	Japan	136	227	111	396

Global visibility of Asian universities' Open Access institutional repositories

26	193	2	Hong Kong University of Science and Technology Institutional Repository	HK	103	350	159	56
27	206	NR	Indian Institute of Astrophysics Dspace	India	223	260	195	229
28	213	113	Kagoshima University Repository	Japan	170	295	137	310
29	214	34	National Tsing Hua University Institutional University	Taiwan	464	120	464	12
30	216	NR	Otaru University of Commerce Academic Collection	Japan	209	278	153	341
31	217	1	University of Hong Kong Scholars Hub	HK	7	349	313	279
32	220	134	Shinshu University Institutional Repository	Japan	234	324	179	129
33	229	NR	Obihiro University of Agriculture and Veterinary Medicine Academic Repository	Japan	213	322	140	169
34	234	NR	National Institute of Oceanography India Digital Repository	India	146	393	139	142
35	235	NR	Universitas Muhammadiyah Surakarta Digital Library	Indonesia	324	371	148	43
36	241	181	Xiamen University Institutional Repository	China	129	434	96	112
37	259	NR	Japan Advanced Institute of Science and Technology Repository	Japan	277	415	118	79
38	265	NR	Raman Research Institute Digital Repository	India	114	382	178	337
39	289	94	Mie University Scholarly E-Collections	Japan	361	384	138	231
40	308	NR	Kitami Institute of Technology Repository	Japan	272	395	228	350
41	315	NR	Ankara University Archive System	Turkey	460	261	344	378
42	340	NR	Institute of Developing Economies Academic Research Repository	Japan	265	426	283	357
43	348	NR	National Aerospace Laboratories Institutional Repository	India	301	462	278	215
44	363	NR	Institut Teknologi Sepuluh Nopember Repository	Indonesia	417	147	419	550
45	372	42	University Malaya's Institutional Repository	Malaysia	386	465	264	239
46	374	NR	Pakistan Research Repository	Pakistan	176	404	467	319
47	386	NR	Indian Institute of Management Kozhikode Dspace	India	336	499	253	292
48	389	NR	Indian Institute of Science Bangalore Electronic Theses and Dissertations	India	411	396	413	317

NR: Not ranked in the Top 200 Asian Universities 2010