

Open access disciplinary repository in S&T: a potentiality study for SAARC countries

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Most of the SAARC countries are unable to subscribe to high-priced research publications. Open access disciplinary repositories could provide them access to latest research results of any discipline. The objectives of this study are to find out the potentiality/possibility of developing open access disciplinary repositories for SAARC countries and provide suggestions for development of the same. Data were collected through a web search and then analysed. The article first discusses the current status of open access in the SAARC countries. Then, it presents a brief statistics of research output of the SAARC countries as found in Web of Science along with the collaboration pattern amongst SAARC countries. It also presents research output from these countries in terms of patents granted as found in the WIPO website. The study reveals that it is possible to develop disciplinary repositories for SAARC countries as sufficient material is available with them.

Keywords: Disciplinary repository, open access, potentiality study, SAARC countries.

ONE of the objectives of SAARC (South Asian Association for Regional Cooperation) is to promote the welfare of the people of South Asia and to improve their quality of life. Science and Technology (S&T) plays an important role to improve the quality of life. We carry out R&D for the development in S&T. Further, it is now considered that R&D activities could be maximized making research results freely available. The SAARC objective is also to promote active collaboration and mutual assistance in the economic, social, cultural, technical and scientific fields. Ultimately, this will accelerate economic growth and well-being of the people living in the member states of SAARC. Making research results freely available on the web is now a movement in order to give access to research publications to anyone free at the point of access through open access (OA). Open access scholarly publishing can enhance the visibility and accessibility of the intellectual outputs of an author and contribute to knowledge sharing and advancement of scholarship¹.

Significant achievements have been made regarding OA and its worldwide adoption. Open access provides unrestricted on-line access to peer-reviewed scholarly research. It is primarily intended for scholarly journals, but is also provided for a growing number of theses, book chapters and monographs. Open access comes in two degrees: gratis, which is free on-line access, and libre, which is free on-line access plus some additional usage rights. These additional usage rights are often granted

through the use of various specific Creative Commons licenses. Only libre open access is fully compliant with definition of open access such as the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities. The two ways authors can provide open access are (i) by self-archiving their journal articles in an open access repository, also known as 'green' open access, or (ii) by publishing in an open access journal, known as 'gold' open access. With green open access authors publish in any journal and then self-archive a version of the article for gratis public use in their institutional repository, in a central repository (such as PubMed Central), or on some other open access website. With gold open access, authors publish in open access journals, which provide immediate open access to all of their articles, usually on the publisher's website. Hybrid open access journals are subscription journals that provide gold open access only for those individual articles for which their authors (or their author's institution or funder) pay an open access publishing fee².

Objectives of the study

The objectives of this study are to find out potentiality/possibility of developing Open Access Disciplinary Repositories for SAARC countries and to make suggestions for their development.

Characteristics of disciplinary repository

A disciplinary repository or subject repository is a repository for academic papers in a particular subject area. It

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contains works or data or research result on a subject. In contrast to institutional repositories, disciplinary repositories can accept work from scholars from any institution. A disciplinary repository shares the roles of collection, dissemination and archiving of work with other repositories, but is focused on a particular area. Examples – AgEcon: Agricultural and Applied Economics, Astrophysics Data System: Astrophysics and ArXiv – Physics³.

Current status of open access repository in SAARC countries

A search was conducted to see the status of the repositories of the SAARC countries on DOAJ (Directory of Open Access Journals)⁴ as on 7 October 2014 and DOAR (Directory of Open Access Repositories)⁵. The result of the search is given in Table 1. Out of total 10,020 Journals of DOAJ, SAARC countries have 838 (8.36%) open access journals and out of a total of 2729 Repositories of DOAR, they have 85 (3.11%) repositories. Of the 838 open access journals of DOAJ, India possesses maximum number of open access journals – 600 (71.59%). Similarly, of 85 open access repositories of DOAR, India possesses maximum number of open access repositories – 68 (80%). India is the key player in this repository movement within SAARC countries. Afghanistan has made a beginning towards digital information. The same is the case with Bhutan where open access awareness is slowly spreading. Pakistan is in a better state and occupies second position in the repository movement within SAARC countries.

A search was conducted on country-wise analysis on the website of UNESCO Global Open Access Portal (<http://www.unesco.org/new/en/communication-and-information/portals-and-platforms/goap/access-by-region/asia-and-the-pacific/>) to find the status of open access of SAARC countries. The result found on status of open access of SAARC countries is given in the following.

Table 1. Status of open access repositories in SAARC countries

Country	DOAJ (total no. of journals = 10,020)	DOAR (total no. of repositories = 2729)
Afghanistan	0	1
Bangladesh	29	8
Bhutan	2	0
India	600	68
Maldives	0	0
Nepal	17	1
Pakistan	177	3
Sri Lanka	13	4
Total	838 (8.36%)	85 (3.11%)

DOAJ, Directory of open access journals; DOAR, Directory of open access repositories.

Afghanistan

The Afghan government announced that it will give approved researchers access to the raw data it collects in its demographic and economic surveys, expanding access from the prepared data sets it provides now. This step is taken towards enhancing open data plan in the country. Afghanistan, still in its post-war phase has underdeveloped conditions in terms of infrastructure, personnel training and funding. Decision to build Integrated Library System is an open concept: open access, open source and open standards, are influenced by globalization of open user behaviour and expectations.

Bhutan

Open access awareness is slowly spreading in this democratic country though only recently. Awareness and use of Free/Open Source Software is being considered; for instance the digital library project of the Department of Information Technology and Telecom in collaboration with the University of Virginia. Preservation and promotion of traditional and cultural values is mandated by the Bhutan Information and Policy Strategy, which asserted that 'Bhutan will use ICT to preserve and promote its cultural heritage and boost the creation of local content to develop an invaluable record of Bhutanese culture for Bhutanese students and researchers. It aims to bring all stakeholders together to develop one digital library encompassing bibliographies, folktales, digital reprints of religious and ritual texts, journals, and audio and video collections. It will create online cataloguing records, transcripts, and analysis of audio-video collections of all Bhutanese cultural contents and other artifacts.'

India

India has seen rapid growth in digitized and born digital data. Major part of the information produced may be attributed to government research establishments such as CSIR (Council of Scientific and Industrial Research) laboratories, institutes of higher learning – mostly universities, both central and state level universities and reputed institutes such as IISc, IITs (Indian Institutes of Technology), IIMs (Indian Institute of Management). R&D organizations such as Regional Research Labs, Industrial R&D divisions also contribute to scientific data. There is as such no mandate to dictate that publicly funded research should be reported in OA journals and repositories. However, it can be said that open access acceptance is growing both in public sector information as well as in academic institutional mandates.

Table 2. Economic status of SAARC countries

Country	Population (million) (2012)	Rank	Gross domestic product (billion US\$) (constant 2005 US\$ (PPP)) (year)	Rank
Afghanistan	29.82	42	35.94 (2011)	91
Bangladesh	154.7	8	251.06 (2012)	42
Bhutan	0.74	158	4.28 (2012)	144
India	1236.69	2	4131.28 (2012)	3
Maldives	0.34	170	2.65 (2012)	151
Nepal	27.47	46	35.15 (2012)	92
Pakistan	179.16	6	446.34 (2012)	24
Sri Lanka	20.33	57	109.45	62

Nepal

Nepal is trying to keep up with digital publishing and ICT applications despite its sporadic internal political turmoil. Ministry of Education has been making strides to improve the educational infrastructure of the country. In 1993, National Centre for Educational Development was established. Since the tertiary and higher education sector is growing, notably in the areas such as medical sciences, the generation of resources and research output started increasing. Lack of adequate Internet connectivity has hindered communication and scholarly network. However, it is appreciable that Nepal has produced many Online OA journals. Projects like Nepal Journals Online host about 51 journals in different disciplines (funded by INASP). Open repositories development has been rather slow, since the diffusion of open source technologies, localization of software, content development platforms, and technical know-how are lacking. Creating a union catalogue of libraries in Nepal is underway under the aegis of eFIL. E-Pustakalaya Digital Library project has been set up with the support OLE Nepal to develop content in Nepali language, especially eLearning resources for children and young adults.

Sri Lanka

With open source movement steadily catching up among the enthusiasts in Sri Lanka, there are a variety of initiatives and projects taken up. University of Sri Jayewardenepura, Sri Lanka has repository with journals being published in Applied Science, Arts, Management and Science, and Medical Sciences. Open source based applications are starting off in a small scale for use in schools and higher educational institutions. OSS based projects like Hanthanlinux, Lanka Linux User Group and Sri Lanka FOSS, are working for the benefit of communities to deploy technology in a cost effective way⁶.

Behind this current status one important aspect is economic status of the SAARC countries, as economic conditions play a major role for the development of every

aspect of a country. The rank of the economic status of the SAARC countries out of total 192 countries along with the population and Gross Domestic Product is shown in Table 2 as available on WIPO site. Here also we found that India occupies first position in respect of rank of economic status amongst the SAARC countries, whereas Maldives is in the last position.

Potentiality/possibility study of developing an open access disciplinary repository

In order to see potentiality/possibility of developing Open Access Disciplinary Repository in S&T for SAARC countries, it was felt to study three items.

- Performance of research of SAARC countries
- Identification of collaboration in S&T of SAARC countries
- Identification of significant trends of the fields in science to prioritize subject areas to develop Disciplinary Repository of SAARC countries.

An Open Access Disciplinary Repository contains works or data or research results on a subject. So the issue is whether the stuff, i.e. works or data or research result in S&T is sufficiently available to develop the repository. Therefore, it was felt to see the performance of research of SAARC countries. Some of the indicators to see the performance of research in SAARC countries could be measured by seeing the number of research papers published, number of patents granted and applied/filled for Non-residents and residents etc. Data were collected conducting search on the web – *Web of Science (WoS)*⁷ and World Intellectual Property Organization (WIPO)⁸. Search was conducted typing country name in the address field of *WoS* as this contains the address of the authors belonging to the country. Research performance of SAARC countries in terms of papers published in *WoS* (1950–8 October 2014) and collaboration – between two countries – is shown in Table 3. Of the total 1,177,127 papers, India has published 89.89% papers and other

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Table 3. Research performance of SAARC countries in terms of papers published in the *Web of Science (WoS)* (1950–8 October 2014) and collaboration between two countries

Country	Papers	Afghanistan	Bangladesh	Bhutan	India	Maldives	Nepal	Pakistan	Sri Lanka
Afghanistan	467 (0.03%)	N/A	5 (0.02%)	0	23 (4.92%)	0	7 (1.49%)	52 (11.13%)	2 (0.42%)
Bangladesh	24,198 (2.05%)	5 (0.02%)	N/A	7 (0.02%)	822 (3.39%)	0	127 (0.52%)	260 (1.07%)	56 (0.23%)
Bhutan	326 (0.02%)	0	7 (2.14%)	N/A	43 (13.19%)	2 (0.61%)	13 (3.98%)	3 (0.92%)	7 (2.14%)
India	1,058,175 (89.89%)	23 (0.002%)	822 (0.07%)	43 (0.004%)	N/A	15 (0.001%)	736 (0.06%)	1184 (0.11%)	448 (0.04%)
Maldives	99 (0.008%)	0	0	2 (2.02%)	15 (15.15%)	N/A	4 (0.04%)	1 (1.01%)	5 (5.05%)
Nepal	9219 (0.78%)	7 (0.07%)	127 (0.37%)	13 (0.14%)	736 (7.98%)	4 (0.04%)	N/A	82 (0.88%)	55 (0.59%)
Pakistan	72,431 (6.15%)	52 (0.07%)	260 (0.35%)	3 (0.004%)	1,184 (1.63%)	1 (0.001%)	82 (0.11%)	N/A	200 (0.27%)
Sri Lanka	12,212 (1.03%)	2 (0.01%)	56 (0.45%)	7 (0.05%)	448 (3.66%)	5 (0.04%)	55 (0.45%)	200 (1.63%)	N/A
Total	1,177,127								

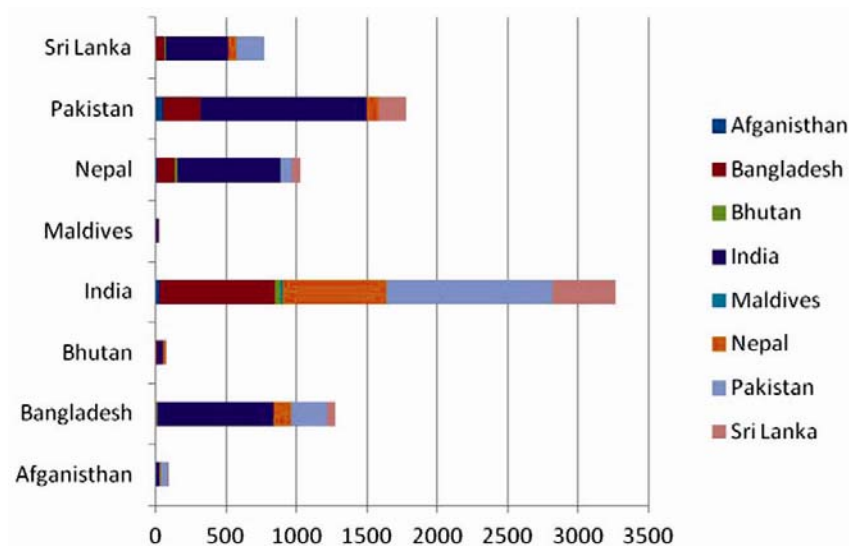


Figure 1. Collaborative papers published between two countries.

countries together have published 10.06%. A bar chart is shown in Figure 1 to have an immediate overview of the bilateral collaboration.

Collaborations amongst more than two countries include: India and Pakistan and Bangladesh = 75; India and Pakistan and Bangladesh and Sri Lanka = 18; India and Pakistan and Bangladesh and Sri Lanka and Nepal = 9; India and Pakistan and Bangladesh and Sri Lanka and Nepal and Afghanistan = 0; India and Pakistan and Bangladesh and Sri Lanka and Nepal and Bhutan = 1 and India and Pakistan and Bangladesh and Sri Lanka and Nepal and Bhutan and Sri Lanka = 0.

WIPO Statistics country profiles provide information on patents, utility models, trademarks and industrial

designs. They cover different dimensions of IP activity, including incoming and outgoing filings, the share of filings in different technological fields, total patents in force, and the use of international IP systems by applicants. Search was conducted clicking the country name in WIPO.

The patent information for the SAARC countries for the period 1998 to 2012 is shown in Table 4. The filings and grants are divided into the following categories: ‘resident’ – domestic filings; ‘non-resident’ – filings coming in from other countries; ‘abroad’ – filings going out to other countries. Filled patent are given within brackets. This discussion indicates that SAARC countries have sufficient matter and collaboration as found by

analysing of papers and patents, to develop disciplinary repositories.

Proposed fields/subjects for open access disciplinary repository

Search was conducted typing country name in the address field of *WoS* (1950–1 May 2015) and further refined to find out the top research areas of the country as on 1 May 2015. The result is shown in Table 5. Further, it was felt to see the patent applications by top fields of technology to prioritize subjects for the development of the Open Access Disciplinary Repository in S&T for SAARC countries. For this purpose, the share of patent filings in different technological fields of the country was collected. The top subject areas of the countries are given in Table 6.

Analysing top research areas of SAARC countries, it was found that Disciplinary repository may be developed for Pharmaceuticals, Biotechnology, Medical technology, Organic fine chemistry, Environmental technology, Materials, Metallurgy, Computer technology. Since its establishment in 1983, TC09: Science and Technology (TC09) committee has undertaken a wide variety of programmes which include short-term activities like Seminars/Workshops, Training Programmes, Joint Research Projects, preparation of state-of-the-art reports and compilation of Directories. This committee is working for various networking arrangements. Further, as networking arrangements are being established for the SAARC countries in the fields of Bio-technology and Genetic Engineering, Energy Modeling Techniques, Technology Information and Low Cost Housing and Building Technologies, these are the high priority areas for the disciplinary repositories for the SAARC Countries⁹.

Barriers for open access disciplinary repository

It would not be easy to set up open access disciplinary as there are lot of barriers. The potential barriers as reported

Table 4. Research performance of SAARC countries in terms of patents: WIPO statistics (1998–2012)

Country	Grants (filed)		
	Resident	Non-resident	Abroad
Afghanistan	0	0	6 (17)
Bangladesh (2012=0)	264 (745)	2193 (3879)	19 (31)
Bhutan	0	0	0 (3)
India	17,647 (76,807)	60,464 (283,282)	15,273 (45,517)
Maldives	0	0	1
Nepal	16 (0)	7 (0)	1 (17)
Pakistan	224 (1193)	4557 (16,067)	37 (169)
Sri Lanka	1028 (1977)	1741 (3172)	36 (152)

in UNESCO Global Open Access Portal are summarized here. The portal did not have information for Pakistan. For Afghanistan it stated, 'Socio-political condition is in dire straits in the post-war period. Most resources are dedicated to re-building the physical infrastructure and fighting terror. Hence barriers to Open Access of information resources are war, migration, and economic hardships in addition to lack of local content in Arabic/Persian/Farsi/Dari Languages'. For Bangladesh the portal stated, 'Due to lack of IT infrastructure, most of the stakeholders are not aware of open access. Students and academics from few universities, such as American International University–Bangladesh are aware of open content development. The present Bangladesh Government has taken different initiatives for ICT development despite the barriers such as funding, and infrastructure development issues. Prices of scientific journals and non-affordability further necessitate the need for open access content development'. For Bhutan the UN portal stated 'Lack of essential resources, public awareness and institutional infrastructure are the barriers for the emerging open access concept. Language skills especially English language for technical communication are lacking. Need to create content in the national language Dzongkha is essential'. 'The main barrier to OA in India is undoubtedly the absence of a National mandate on OA publishing. The National Knowledge Commission recommendations include a statement of OA in its report but 3 years after the recommendation no formal move has been made towards OA mandates. On the contrary, it is still the belief that resources such as research articles in OA are not standard and do not have the authority stamp of "peer reviews"'. For Nepal UN portal states, 'The scale of IT infrastructure requires to be urgently upgraded to keep up with advancement in other countries. Even if computers are available, electricity is not reliable or in many regions there are no phone lines to access the Internet. Capacity building, building awareness and proactive programmes can help overcome some of the practical barriers'. For Sri Lanka it stated, 'Technology diffusion, strengthening the information architecture of higher education is required to facilitate open access. Print form publishing is still prevalent. Lack of awareness of OA benefits among research community is noticed. Training and development of technical workforce is equally important for starting digitization projects for Sinhalese and Tamil content. Lack of infrastructure is a big cause of concern, as long civil war has caused hardships to the population, environment and economy, although rehabilitation is taking place slowly'⁶.

For Pakistan, there is no information on the matter on the site. One of the barriers for Pakistan as reported on DOAJ is the Non-availability of fund to run OA journal. ICT growth rate is also a matter in Pakistan. Fixed wired internet subscriptions per 100 inhabitants is more than in India, but, and fixed wired broadband subscriptions per 100 inhabitants is less than that of not only India, but also

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Table 5. Top research areas of SAARC countries in terms of papers published in WoS

Country	No. of S&T papers	First	Second	Third	Others
Afghanistan	498	General internal medicine (97)	Public environmental occupational health (71)	Health care science services (68)	Infectious diseases, paediatrics, surgery
Bangladesh	24,963	Engineering (3590)	Computer science (1298)	Telecommunications (389)	Environmental science, ecology, materials science, water resources, physics, etc.
Bhutan	348	Agriculture (52)	Environmental science, ecology (46)	Infectious diseases (41)	Public environmental occupational health, immunology, etc.
India	1,047,058	Chemistry (169,452)	Biochemistry, molecular biology (20,219)	Physics (122,788)	Engineering, pharmacology, pharmacy, materials science, computer science, agriculture, etc.
Maldives	109	Marine fresh water biology (25)	Environmental science, ecology (22)	Public environmental occupational health (12)	Methodology, atmospheric science, paediatrics
Nepal	9,143	Paediatrics (1445)	Public environmental occupational health (1209)	Infectious diseases (851)	Pharmacology, pharmacy, health care science services
Pakistan	75,407	Chemistry (9,586)	Plant science (7574)	Pharmacology, pharmacy (7354)	Physics, engineering, Biochemistry, molecular biology, etc.
Sri Lanka	12,333	Engineering (1090)	Public environmental occupational health (884)	Agriculture (968)	Pharmacology, pharmacy, paediatrics, etc.

Table 6. Patent applications by top fields of technology of SAARC countries (1999–2013)

Country	First	Second	Third	Others
Afghanistan	Electrical machinery, apparatus, energy (20.69)	Pharmaceuticals (13.79)	Handling (10.34)	Medical technology, basic materials chemistry, optics, control, biotechnology, materials, metallurgy, others
Bangladesh	Pharmaceuticals (17.24)	Materials, metallurgy (13.79)	Environmental technology (13.79)	Control, biotechnology, furniture, games, digital communication, computer technology, food chemistry, handling, others
Bhutan	Organic fine chemistry (100% share)			
India	Pharmaceuticals (20.40)	Organic fine chemistry (18.61)	Computer technology (14.31)	Biotechnology, basic materials chemistry, materials, metallurgy, food chemistry, chemical engineering, medical technology, digital communication, others
Maldives (25% each)	Handling (25.00)	Textile and paper machines (25.00)	Thermal processes and apparatus (25.00)	Furniture, games (25.00)
Nepal	Electrical machinery, apparatus, energy (25.00)	Control (16.67)	IT methods for management (8.33)	Measurement (8.33), Medical technology (8.33), biotechnology (8.33), pharmaceuticals, macromolecular chemistry, polymers, Basic materials chemistry, transport – (all 8.33), others
Pakistan	Computer technology (10.69)	Pharmaceuticals (10.69)	Audio-visual technology (6.92)	Engines, pumps, turbines, medical technology, organic fine chemistry, furniture, games, civil engineering, materials, metallurgy, chemical engineering, others (35.87)
Sri Lanka	Other consumer goods (11.57)	Computer technology (8.80)	Electrical machinery, apparatus, energy (7.87)	Other special machines, furniture, games, engines, pumps, turbines, civil engineering, transport, surface technology, coating, medical technology, others (30.24)

less than in Bangladesh and Afghanistan. Percentage of individuals using Internet since 2000 though initially increased, later on it has been more or less constant, a slow rate of increase is visible. Further, the illiteracy rate is also high as a UNESCO fact-sheet shows: – it is 1 in 12 of out-of-school children, 5.1 million, live in Pakistan. Literacy rates in Pakistan are stagnant at 58% of the population, with only 50% of the rural population ever attending school¹⁰.

Suggestions for developing an open access disciplinary repository

It is not an easy task to develop the Open Access Disciplinary Repositories for SAARC countries. Maintaining repositories and their perpetuity are costly affairs. Still some of the suggestions are made here for the development of the Open Access Disciplinary Repositories for SAARC countries.

- We need commitment and co-operation for working with developing Disciplinary Repository amongst SAARC countries.
- SAARC countries should form a body preparing strategies, guidelines, policies, mandate, to execute the activities.
- A common mandate is needed.
- Capacity-building and training to build Disciplinary Repository is essential.
- There is a need to address global challenges.
- Last but not the least, awareness should be created.

Conclusion

For the sake of the development of the SAARC countries, disseminating and preserving scholarly publications and

other forms of research outputs and their future access are significant issues. It is found that open access movement in SAARC countries is building momentum. This further could be enhanced developing Open Access Disciplinary Repository in S&T for SAARC countries. We have material which is the soul of the repositories. Only we need commitments amongst us. To conclude, if we do not act now and act fast we may be left behind and that will not be good for the region with ambitions of improving the quality of life of the people.

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