Need of open access repositories for NARS in India

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India's National Agricultural Research System (NARS) is one of the world's largest, with 26,178 full-time equivalent research staff functioning in government, public and higher education institutions and universities (http://www.asti.cgiar.org/data). It comprises the Indian Council of Agricultural Research (ICAR)'s 45 national institutes, 17 national research centres, 6 national bureaux, 25 directorates and 4 national institutes with deemed university status (http://www.icar.org.in/node/325); and one central agricultural university, 45 state agricultural universities and various other universities which have agricultural faculties. About 93% of the funds for NARS research and development (R&D) are sourced from the government. In 2003, the Government of India had spent about 0.36% of gross domestic product (GDP), amounting to US$ 949 million (http://www.asti.cgiar.org/data), with a mission for sustainable growth of Indian agriculture by interfacing education, research and extension initiatives. During 2004–08, out of 126,000 research papers published from India in journals indexed by Thomson Reuters, 5634 are from agricultural sciences and 10,190 are from plant and animal sciences[1]. The number of papers from NARS could be more than reported as there are journals which are not indexed by Thomson Reuters. The research produced in Indian NARS complemented with efficient and effective institutional infrastructure and policy support could be made visible to the world. Shukla and Singh[2] report that in the Thomson Reuters study, no institution from the southern hemisphere featured in the list of the world's 20 best agricultural institutions based on institution-wise citations per paper. This evidently shows that the research output published in peer-reviewed journals is not able to reach other peer groups working in the same field in India and the world. This could be because most of the Indian journals are print-only and not online. Even if they are online, they are not in interoperable formats and/or closed by subscription and other accessibility barriers. On the other hand, articles by international commercial publishers are priced at US$ 20–40 each for which neither researcher as an individual nor the institutions in NARS can afford to subscribe to all the journals of agriculture and related subjects. Thus, publicly funded research output in India is not able to reach all the stakeholders due to the technological and other policy-related issues. Now with the initiative of Consortium of e-Resources in Agriculture (CeRA), a sub-project under World Bank funded National Agricultural Innovation Project (NAIP) is allowing 126 NARS institutions to access the commercial as well as not-for-profit journals for their research activities (http://www.cera.jccc.in/Members/members.asp). This project will end by March 2012 and to keep alive the spirit of the project, its operating costs would be heavy. This is a peculiar situation wherein, taxpayers have to fund for the research and also pay for accessing it!

Sharing of research output

Only shared research can enable new research to build upon the earlier findings (http://www.arl.org/sparc/greater-reach/index.shtml) and published research results and ideas are the foundation for future progress in science and medicine (http://www.plos.org/). In the present digital world, with high bandwidth internet connectivity, the scholars can make the most of web 2.0 technologies for wider dissemination of information and increased efficiency in science. Internet, Free/Open Source Software (FOSS) and the consent of the author make it possible to share the research and build new knowledge by what is known as Open Access (OA). OA literature is digital, online, free of charge, and free of most copyright and licensing restrictions (http://www.earlham.edu/~peters/fos/brief.htm). Thus, OA is free, immediate and a permanent online access to research articles for anyone in the world to improve upon the existing research findings. These free and online articles fetch more citations to authors and create impact of the research[3]. Budapest Open Access Initiative (BOAI) proposes two ways by which any researcher can provide OA to his research articles either by placing a copy of accepted/published article in an open access repository (OAR), which is called as green route to OA, or by publishing articles in an open access journal, which is called as gold route to OA.

Institutional repositories

In NARS, about 118 journals are published by various institutes and scientific/scholarly societies. However, only seven journals are OA journals and the rest are traditionally print-only journals and hosted-online journals[4,5]; 187 open access journals are registered from India (http://www.doaj.org). Scopus is indexing 308 journals out of which only 56 are open access journals (http://info.scopus.com/scopus-in-detail/facts/). In this situation, embracing green route to OA by creating OARs in NARS institutions is the best possible way to give OA to agriculture literature. Thus, OARs in NARS institutions would have all the digital collections of research articles deposited by their scientists/scholars either before (pre-prints) or after publication (post-prints). As many of the international commercial publishers are now allowing authors to archive either the pre-prints or post-prints of published articles (http://www.sherpa.ac.uk/romeo.php), this green route to OA is very legitimate with no copyright violations. The University of Nottingham along with various other partners is developing and maintaining a database that lists journals and publishers copyright agreements under the SHERPA/RoMEO project. The authors can consult SHERPA/RoMEO to check whether the publication can be archived or not. If the copyright policy is not available for a particular journal/publisher, authors can use the science commons/SPARC (Scholarly Publishing and Academic Resources Coalition) authors' addendum to negotiate and retain the author's rights for archiving their publications in an OAR. Unfortunately many scientific/scholar societies publishers have copyright policy – 'All Rights Reserved'. Awareness among authors and publishers about licensing the created content even after keeping all rights reserved for themselves is needed.

Something similar to the SHERPA/RoMEO, United Kingdom; the OAKList (http://www.oaklist.qut.edu.au/), Australia; and SCPJ, Japan projects is needed in India for creating copyright database for Indian publishers as well[6].

Advantages of repositories

The establishment of OAR would be a good opportunity for all the institutes and universities in NARS to showcase and publicize their research to the world and enable access to the work of its staff and students. The OAR would present the institution's academic work, which is spread amongst hundreds of journals in one place. All the FOSS repositories software, viz. eprints, DSpace or Fedora-Commons are compliant with the open archives initiative protocol for metadata harvesting (OAI-PMH), which would make the contents interoperable and help in crawling by Google Scholar or other web search engines, harvest and make them available online. The open access repository of an institute collects and collates all the research output into a single location, and makes it accessible to researchers worldwide. The repositories can be inhouse articles, conference proceedings, working papers, technical reports, and other research grey literature, which would otherwise go unnoticed/unused without being used for any meaningful output. When OAI harvester is installed at a server in location, it would harvest all the records from various crawled OARs and multidisciplinary/centralized thematic ones like for example, crop sciences, horticulture, animal sciences, fisheries and other related discipline repositories. The Asian journals online (AsiaJOL) harvester collects information from the open access journals published in Bangladesh, Nepal, the Philippines, Vietnam, Sri Lanka and Indonesia, and makes available all the research articles when searched with keywords. Similarly, the Scientific Commons project (http://en.scientific-commons.org/) accesses all the largely distributed sources and makes a vast number of scientific publications available at a single common interface. It identifies authors from all archives and makes them visible to the world along with their publications. By the end of January 2007, it had indexed about 13 million scientific publications and successfully extracted 6 million authors' names out of the indexed data.

Other benefits of OAR (http://www.rsp.ac.uk/repos/justification):

For a researcher:

- The research would have increased visibility thereby increasing citation. The work done on citation analysis has demonstrated that research that is made freely available is easier to cite[7].
- Management and storage of all digital content including data of the research done would be easy and can be found at a single location online.
- Personalized publications lists and curriculum vitae could be created, shared and submitted to the institute's authorities.
- Usage metrics like hits/downloads of papers could be used for citation analysis.

For the institution:

- Increases the visibility and prestige of institution by showcasing research output.
- A repository with its quality content could be a 'shop window' for stakeholders.
- Repository can store other types of content that is not necessarily published (grey literature) which may be used for other meaningful inferences.
- Learning and teaching materials could be stored and shared centrally to increase their potential for use and re-use.
- A repository could be an important tool in an institution's research projects cell (RPC) for research management and assessment (http://www.openscholarship.org/jcms/c_6219/instutional-repositories-for-research-management-and-assessment).

The RPC would know, what is being published from an institution and where it is being published; how much impact it is having; where are the upward trends and downward trends; how much collaborative work is being done; what is the rate of returns of investment in a particular department, and which are the research departments attracting more number of students.

For the global community:

- Stakeholders, taxpayers and others would have access to the publicly funded research output.
- It assists research collaboration through facilitating free exchange of scholarly information.
- It aids in the public understanding of research endeavours and activities.

Institutional repositories in India

In India, so far 53 open access repositories exist (http://www.roar.org) and the recent additions from NARS are Eprints@IARI established by the Indian Agricultural Research Institute (IARI); OpenAgri, an initiative of ICAR and Indian Institute of Technology, Kanpur; and Eprints@CMFRI by the Central Marine Fisheries Research Institute, Kochi; from agriculture and allied sciences. It is unfortunate that in NARS, only two institutional repositories and one common repository for agriculture and allied sciences are present. This shows that there is great need for more advocacies on OARs among the agricultural scientists, and also the policymakers in NARS. The efforts of creating the three repositories in NARS are largely individual efforts. As e-Granth, a sub-project under NAIP is in progress, policy endorsement from the policymakers may soon be announced. These initiatives may influence other NARS institutions to establish their respective OARs; scientists/scholars in NARS can upload their articles into OpenAgri. The Council of Scientific and Industrial Research (CSIR) has established its National Open Access Periodicals Repository (NOPR). Similarly, ICAR should create a portal which can harvest all the records of OARs in NARS. The Indian Institute of Science's repository ePrints@IISc is the oldest one which was started in April 2004 and till date, it is the most active and most populated OAR ranking at 72 under institutional repositories category in the world (http://repositories.webometrics.info). This means that OARs in India are at infancy, and a lot needs to be done to bring any of our OARs into the top 20 world rankings. The NAIP's project 'strengthening of digital library and information management' under NARS (e-Granth) aims to create open access institutional repositories at the Indian Agricultural Research Institute[5], New Delhi, Indian Veterinary Research Institute, Izatnagar, Acharya N.G. Ranga Agricultural University, Hyderabad and University of Agricultural Sciences, Bangalore by digitizing rare books and old journals.

Conclusion

Concerted efforts are needed to sensitize and create awareness among NARS scientists/scholars in building institutional repositories. Similar to Zonal Technology Management Units (ZTMU) and Institutes Technological Management Units (ITMU) in ICAR, which are working for securing patents and commercialization of the technological advances of ICAR institutes, other NARS institutions should also establish Research Assessment Metrics Cell (RAMC) to address the issues related to sharing of published research and copyrights. ICAR and Indian Agricultural Universities Association (IAUA) should make it mandatory to establish OARs in all the ICAR institutions and SAUs to deposit all the published research output, and then agricultural research knowledge would be freely available to all the stakeholders. The National Institute of Technology, Rourkela was the first to mandate OA in India and the only agriculture research institute to mandate OA for all its research publications is the International Crops Research Institute for Semi-Arid Tropics, Hyderabad (http://www.eprints.org/openaccess/policysignup) to share and disseminate wisely the results of its research and development activities. Similarly, NARS institutions should also make its OA mandates. In a recent study on the impact of the internet on institutions in the future by Janna Quitney Anderson of Elon University; the technology experts and stakeholders said that the internet would make government agencies more responsive and efficient by 2020 through innovative forms of online cooperation[8]. Are we ready to make most use of the internet for agriculture research and development? Or should we wait till the Indian government passes legislation for accessing publicly funded research?[6].

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Drill cuttings and fluids of fossil fuel exploration in north-eastern India: environmental concern and mitigation options

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Energy producing companies require drilling fluids and additive oils for drilling, gas and lubricants that are essential for modern civilization and industrialization. Biological wastewater is conventionally treated for the elimination of organic and inorganic pollutants. In the fossil fuel industry, drill cuttings and fluids are the piled up wastes and an environmental hazard. The high complexity of this hydrocarbon mixture (aromatic or napthenic nature) makes it highly resistant to biodegradability. Besides, the antibacterial agents, which are frequently used in the drilling operations, increase the difficulty of the biological treatment.

Several major oil and gas companies such as Oil and Natural Gas Corporation, Oil India Ltd, Canoro Resource Ltd, Geoenpro Petroleum Ltd, Jubilant Energy, Geopetrol International Inc. and Premier Oil, are involved in exploration activities in north-east India. The Ministry of Environment and Forests (MoEF), Government of India has accorded environmental clearance (EC) for drilling over 400 exploratory wells to ONGC and about 100 exploratory wells to the Oil India Limited. Also EC has been accorded to several private companies for carrying out exploratory activities in the north-eastern states of Assam, Arunachal Pradesh, Nagaland and Tripura. Since the implementation of Environment Impact Assessment Notification in 2006, handling of drilling cuttings and fluids of fossil fuel exploration has been a subject of environmental concern. The major EC stipulation with regard to management of drilling fluids (mud) and drilling cuttings includes only water-based mud (WBM). WBM is considered comparatively less hazardous than oil-based mud (OBM) and synthetic-based mud (SBM). OBMs are very effective but highly polluting, and environmental regulations insist on their restricted use in several countries. Exploratory companies are required to comply with guidelines for disposal of solid wastes, drill cuttings and drilling fluids for onshore drilling operation as per the notification vide GSR.546 (E) dated 30 August 2005. In order to reduce the mud toxicity, Hamed and Belhadri[1] developed a WBM system using two biopolymers, viz. xanthan gum and scleroglucan. It is generally accepted that these biopolymers exhibit high permeability for complex geometries such as horizontal wells.