CHANGING LANDSCAPE OF INDIAN AGRICULTURAL INFORMATION MANAGEMENT IN DIGITAL ERA

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Abstract
This article presents an overview of the current trends of agricultural information management in globalized digital eraof Web2.0 technologies and social networks. It discusses the impact of Web2.0 technologies and globalization overthe agricultural research information access, management and use. It further talks about the free and open access to agricultural scholarship, mass digitization, and some concernsonlong term preservation, access and authentication of digital agricultural information. It finally discusses new roles for agricultural librarians in globalized agricultural research information access and management policy.

Key Word: Internet, Web2.0, RSS, Digital Information, Information overload, Information Management, Agricultural Librarians, Wikipaedia, Agropaedia, Agroweb,

Introduction

Blogs, Folksonomy Mashups, Social book marking, tagging, filters, information architecture, podcasting, harvesting web content etc. may not be having their place in earlier day agricultural librarianship, but they have now becomes the parts and parcel of daily personal and professional lives of agricultural librarians. Though many artic leson information management have been written from information technology view pint, but this article is written from the agricultural information specialist 'sperspec-tive. Traditionally Librarians' specific skill isto organize information and build collections for need based information dissemination. But in view of new breeds of digital information and information seeking behaviorsof users, the role and skills of agricultural librarians have changed and called upon to integrate the traditional library management practices and services with new land scapeof internet based information having its own terminology, access, and delivery mechanisms.

1. Changing Landscape of Agricultural Information

I have witnessed to the profound transformation in access and use of agricultural libraries and information. My interest and expertise with agricultural information management is based on my own background. Being from farmer family, agriculture graduate and having 23 years professional experience in one of the best Indian bioscience (Potato based-agriculture) library at Central Potato Research Institute, (CPRI) Shimla, H.P, I experienced and felt these changes from very close quarter. In my current position at Central Potato Research Institute, Shimla, as Assistant Chief Technical Officer (Senior Librarian), I am actively involved in all aspects of agricultural information management right from acquisition to processing and

dissemination. These changes clearly reflect through following windows.

1.1 Internet and Globalization

The internet and globalization are the two key forces recognized world over to have a deep impact on our society. There is a digital revolution (internet) interconnecting our most activity in every walks of life be it education, research, trade, entrepreneur ship or daily life comforts, and agricultural research is no exception. Though these two forces look separately, but they are intrinsically interwoven and have profound influence on the work of agricultural librarians in management of agricultural information. The internet and digital revolution while caused information overload with information coming from different directions on one hand, it has increased access speed of users on other hand, where they expect almost instant response from the service providers.

Globalization has been defined as the process of integrating nations and peoples—politically, economically, and culturally—into a larger community. The focus is not on one nation but on the entire globe. There is a complex, controversial, and synergistic process leading to vastly expanded migration of people, money, goods, services, and information. [1] This process has caused digital divide in forms of haves and haves not access to internet and internet enabling services in agricultural research also. But, it does not mean that the internet has become the only source of agricultural information. On the contrary, the printed sources like books, journal articles, technical/extension bulletins etc. are the still rich and essential literature for agricultural research beyond the internet and online sources. However, there is a possibility of an online edition of the hard copies of printed documents of agriculture possibly in a blog or web site to facilitate up to date and quick simultaneous access to agricultural research information.

1.2 Web 2.0 and Information Overload

The advent of Web 2.0 technologies based applications have contributed a lot to information overload. The information overload is a phenomenon wherein people find themselves overlapped in multiplicity of information and bewildering state to choose correct information. It refers to the difficulty a person can have understanding an issue and making decisions that can be caused by the presence of too much information. [2] The Web 2.0 applications have empowered the users of these technologies to contribute anything and everything. This has resulted not only a great swamping of information but also the way we see, seek, access, use and share information. Today we hear about breaking news faster through the internet than the daily newspapers, or even TV channels, because of the new information accessibility and immediacy for millions of people around the world. The dilemma we are facing in coping with this torrential information is to whom to turn up for correct information. According to Peter Nicholson and others, increasingly the answer is – "Well, to ourselves of course, as individuals empowered by a world wide web that has rapidly evolved into asocial medium." [3] This medium today supports massively distributed collaboration on a global scale.

Web 2.0 was first mentioned in 1999, and popularized by Dale Dougherty, O' Reilly

Company in 2004. [4] It refers to the second generation internet going from a collection of website to a platform of services. It is built around social network-ing, collaboration, and sharing among users.[5] The principles of Web 2.0 are that it is a platform of services, not just a collection of links, and that users become co-developers of applications. It takes advantage of the "collective intelligence," with always evolving interfaces. While the applications like Wikis, Podcasting, Blogs, RSS, Flickr, You Tube, My Space, Twitter, customized personal page, and collaborative search engines etc. contributed a lot on information empowerment, it causes the information overload also. The advantages of Web 2.0 technologies are its simplicity, and personalization, and its drawbacks include the lack of sustain ability, reliability and credibility. It's true that some of these technologies may be useful for management of agricultural information, and others may not. But they present fascinating solutions to information overload, and alternative information delivery mechanisms. As such few of them as mentioned below may can improve many library services to users or create brand new services to reach users in new ways in agricultural research.

1.2.1 Agricultural Blogs

A blog (the word is derived from web log) is a web site made up of posts that are arranged chronologically, and are archived by date and category. Blogs have evolved from a starting point with little organization or structure to a whole taxonomy of specialized blogs in different areas, written by different professionals. Blogs have become use ful updating services for various agricultural specialties, keeping agriculture professionals well informed.

1.2.2 Wikipedia

Wikipedia is the best example of a collective intelligence, where every one can freely contribute and edit, and is based on the wiki technology. It is one of the most visited web sites worldwide.[6] The notion of collective intelligence has generated much commentary and controversy, alternatively called the "wisdom of crowds" by James Surowiecki,[7] or the "kingdom of idiots" by the philosopher Norbert Bolz.[8] In the area of agricultural research it is known by the name Agropaedia.

1.2.3 RSS (Really Simple Syndication)

RSS is a syndication format developed by Netscape in 1999, which has become very popular for aggregating updates to blogs and news sites. RSS has also stood for "Rich Site Summary" and "RDF Site Summary."[9] RSS presents an alternative delivery platform because the user gets only relevant content, is notified automatically when new content arrives, and is not required to learn new technologies. The user can decide which content to subscribe automatically from the millions of blogs, news services, and content providers offering RSS feeds.

1.3 Free Access to Government Agricultural Policies Documents

Like many countries of the world, in India also many official documents pertaining to government agriculture policies, practices, and activities are now available on the Govt. departments' web sites to provide better access to agricultural information for the public. In view of the Indian government policy that citizens should have free access to government information, most central and state government publications are in the

public domain, without being subject to copyright, and many official documents pertaining agricultural legislation, regulatory, and legal texts are now available on the internet free of charge. The internet has thus greatly facilitated world wide access to agricultural information.

1.4 Open Access to Agricultural Scholarship

Open access is the electronic publication of scholarly work that is available for free without copyright constraints other than acknowledgment, and where the author keeps the copyright. [10] The open access movement has arisen in the scientific field because of the high cost of print and electronic publications and the search for an alternative form of publication. Because of the internet, now authors publish on their own web sites, and also deposit their articles, in draft or working paper series in institutional repositories, before submitting them to commercial publishers for publication. Generally, agricultural librarians can be advocates of greater open access to agricultural scholarship by educating authors, e.g. their faculty members about the importance of retaining copyright, rather than assigning it to journal, which creates barriers to the future distribution of their works.

Recently ICAR has adopted open access policy to extend free access to scholarly contents generated in National Agricultural Research System (NARS) by developing Institutional Repositories and putting majority of scientific and technical literature published by its institutes, scientific societies. The detailed information on this subject can be found on website of Directorate of Knowledge Management in Agriculture, ICAR, New Delhi. [11]

1.5 Mass Digitization Projects

In the past several years, individuals, institutions, and commercial companies have engaged in the business of digitizing print collections. Mass digitization projects like Google Book Project, and Microsoft Book project,[12] which is done in cooperation with the Open Content Alliance (OCA),[13] are the pioneer projects in mass digitization. The Google Book Project is inspired by Google's philosophy, "to organize the world's information and make it universally accessible and useful."[14] It intends to scan every book ever published, and to make the full texts searchable.

In India the mass digitization programme in agriculture has been launched in the form of eGranth project wherein mass digitization work has been undertaken to digitize the institutional publications, rare books, and other intellectual contents produced in NARS and considered to be useful but outside of copyright act.

1.6 Internet and Agricultural Research Information

In spite of huge technological advances, access to information is different from that of use as a reliable source. An incredible amount of information is accessible in an easy and convenient way on the internet, but all are not credible or authentic. Many of this information are raw and unfiltered. On the web currently, there is no organized control of information, so it is hard to know what we are missing in information search, or if we find the information, how much is accurate and authoritative [15] and relevant to the specific needs of research. Researchers want easy, convenient access to the most reliable

materials that directly relate to their research interests. This is the reason library indexing and classification tools and systems have been designed in the first place to facilitate precise access to research information. Unfortunately, these tools are unavailable in full text searching.[16]Full text online searching can yield a wealth of information, but it often lacks the proper context and direction to ensure the mass of information retrieved is highly relevant to the topic of search at hand.

Although the internet makes agricultural information much more accessible to the public, but it is not clear that greater accessibility makes the agriculture more understandable, because it may lack context and may also put a greater burden on the agricultural professional to explain the agriculture. So, what is there to do? In evaluating a web source in agriculture, the questions like what is the source, is this source is reliable, is it up-to-date or it is the official and final version of a text? These questions need to be asked and answered with confidence.

1.7 Authenticity of Official Agricultural Digital Sources

There is trust deficit with regard to authenticity of agricultural information/ knowledge available on the internet as everyone can put his ideas, knowledge without getting into rigorous checks and authentication process through which print information passed through before publishing. Therefore in every country of the world, in an environment where online sources have replaced official print agricultural information, citizens need to trust the "official word of the agriculture" in the same way that they trust print information. Since the digital medium is vulnerable to errors in management and control, corruption, and tampering, it is of utmost importance to make the digital information both official and authentic.

1.8 Long Term Access to Digital Agricultural Information

In various countries of the world, official documents are going digital for good reasons, including easy distribution and access over the Internet, and cost savings for government which can be minimize if not discontinue the print costs. The process is irreversible politically and economically. However, digitalin formation is characterized by fragility and rapid technological obsolescence. Under good conditions, books printed on acid-free paper, can last for centuries, while the lifespan of a CD or disk can be at most 10 to 30 years, its lifespan can further be reduced by the hard wareand software needed to read it. This means that digital information may become obsolete within five years or so unless it is refreshed or migrated to an ewer technology or emulated. Refreshing data (copying it periodically to more stable media) cannot solve the long-term preservation and access management problem. Because it saves simple ASCII files, but anything more complex may lose functionality that is built into it. Migration means moving files to a new system. But it has risks, too, such as lossor change of information in the migration. Emulation is a digital preservation technique that consists of designing hardware and software to emulate an older system, which again is not an easy option. Therefore much more research needs to be done on solving these technological issues. A checklist of digital certification criteria applicable to a range of

digital repositories and archives developed by RLG (Research libraries Group) and CRL (Center for Research Libraries), can be good source of information to make digital repositories capable of reliably storing, migrating, and providing access to digital collections. [17]

Beyond the technical problems related to the fragility of the digital medium, there are a number of financial and legal policy issues at stake with digital agricultural information e.g. Who will decide what to preserve? Who will pay for preserving digital information? And who is going to be responsible for continued and long-term access to authoritative digital primary agricultural information sources? This is especially important in a democracy where freeaccess to government information is supposed to be a right. The rapidly evolving technological changes and ever-expanding digital information have created a new set of problems unheard of in the print world. These issues and concerns include loss of research skills, preservation and authentication of born in digital agricultural information, and copyright issues. These issues are rapidly evolving in the digital environment.While the copyright considerations may impede the dissemination of scholarship, the open accessotherwise stimulating it.

In view of these developments, it is proposed that agricultural research information be managed using information life cycle approach which advocates information management right from its creation to preservation and use.

2. Life Cycle Approach to Manage Agricultural Information

As we move into the electronic era of digital contents it is important to know that we are moving into an era where much of what we know today, much of what is coded and written electronically, will be lost forever, consequently, it falls to librarians and archivists to hold to the tradition which preserves history and the published heritage of our times. [18]

The rapid growth in the creation and dissemination of digital contents by authors, publishers, corporations, governments, and even librarians, archivists and museum curators, has emphasized the speed and ease of information dissemination with little regard for the long-term preservation of digital information. However, digital information is fragile in ways that differ from traditional technologies, such as paper or microfilm. It is more easily corrupted or altered without recognition. Digital storage media have shorter life spans, and digital information requires access technologies that are changing at an ever-increasing pace. Some types of information, such as multimedia, are so closely linked to the software and hardware technologies that they cannot be used outside these proprietary environments.[19]Because of the speed of technological advances and obsolescence, the time frame in which we must consider agricultural information management becomes much shorter.

Unlike print environment where traditions of stewardship and best practices for information preservation, archiving and management have become institutionalized, many of these traditions are inadequate, inappropriate or not well defined among the stakeholders in the digital environment. The content originators in the digital environment are able to bypass the traditional publishing,

dissemination and announcement processes that are part of the traditional path from creation to archiving, preservation and management. In such situation the findings of cutting edge projects on digital archiving and management that emphasized the archiving and managing information at all stages of the information life cycle - creation, acquisition, cataloging/identification, storage, preservation and access, can serve as a reference tool for agricultural research information management.

2.1 Creation of Agricultural Information

Creation is the act of mental thought process producing the intellectual contents in the form of information product. The producer may be a human author or originator, or a piece of equipment such as a sensing device, satellite or laboratory instrument. Creation is the first stage where long-term preservation and management of agricultural information must start. The information created must be classified and preserved at the individual researcher's level. The researchers must be educated to save, preserve and have backup copies of digital information in different devices. Because even in rigorously controlled situations, the digital information may be lost without the initial notice of the originator.

Sensing this criticality, the U.S. Department of Agriculture's Digital Publications Preservation Steering Committee[20] has suggested that the creator should provide a preservation and management indicator in the document. This would provide an indication of the long-term value that the creator, as a practicing researcher, attaches to the document's contents.

Secondly, the preservation and archiving

process is made more efficient when attention is paid to issues of consistency, format, standardization and metadata description in the very beginning of the information life cycle. It would be the best practice to create the metadata of the digital documents at the creation stage, or to create the metadata in different stages of creation augmented by additional elements during the cataloging/identification stage.

2.2 Acquisition and Collection Development

Acquisition and collection development is the stage in which the created digital contents are acquired and incorporated physically or virtually into the libraries or existing information system. The main concerns of the digital contents acquisition are as under.

2.2.1 Collection Policies

In most countries, the major difference in collection policies between formal print and electronic publications is the questions related to selecting what to acquire, archive and to what extent? In the network environment, any individual with access to the internet can be a publisher, and the network publishing process does not always provide the initial screening and selection at the manuscript stage on which libraries have traditionally relied in the print environment.

The extensive use of hypertext links to other digital contents in electronic publications raises the question of whether these links and their content should be archived along with the source item. Most organizations archive the links (the URLs or other identifiers) but not the content of the linked objects. So the traditional wisdom should be

adopted to discard the non-essential items of digital contents for procurement and processing.

2.2.2 Refreshing the Archived Content

In cases where the archiving is taking place while changes or updates may still be occurring to the digital contents, as in the case of on-going Web sites, there is a need to consider refreshing the archived contents. However a balance must be struck between the completeness and currency of the archived contents and the burden on the system resources. Because as and when archive is refreshed it's bound to burden the information system.

2.2.3 Intellectual Property Rights

Intellectual property remains a key issue in the acquisition process of digital information as the approaches to intellectual property rights differ from country to country. The differences are based on variant national information policies or agricultural information deposit laws. In many countries, the law has not yet caught up with the digital environment, and the libraries must make their own decisions.

2.3 Identification and Cataloging

Once the libraries have identified and acquired the digital contents, it is necessary to catalog it. Cataloging allow the libraries and archiving organization to manage the digital contents over time and provides a unique key for finding the digital source of information and linking that source to other related resources. Cataloging in the form of metadata supports contents organization and access.

There are issues related to how the metadata is created, the metadata standards and content rules that are used, the level at which metadata is applied and where the metadata is stored. As of now the majority of the libraries created metadata in whole or part at the cataloging stage. However, there is increasing interest in automatic generation of metadata, since the manual creation of metadata is considered to be a major impediment to digital archiving and management of agricultural information.

2.4 Storage

Storage is often treated as a passive stage in the information management life cycle approach, but storage media and formats of information storage is of prime concern because the wrong action or not timely action may cause loss of information forever. Since the storage media, their access mechanisms and operating systems are changing over time, the most organizations responding to the data and media migration with anticipated periodicity of 3-5 year cycle to tame this problem. Although this approach is not only expensive, but always have concern of the loss of data or problems with the quality of look and feel of the original text, pictures etc. when a transfer is made.

2.5 Preservation

Preservation is the aspect of archival management of agricultural information that preserves the content as well as the look and feel of the digital contents. While the studies showed that there is no common agreement on the definition of long-term preservation, the time frame can be thought of as long enough to be concerned about changes in technology and changes in the user community information seeking behavior.

Currently migration and emulation or the two approaches being followed for long term preservation of information. While under migration, the data/information is transported to new media and format, it does not guaranteed to work for all data types, and it becomes particularly unreliable if the information product has used sophisticated software features. There is generally no backward compatibility, and if it is possible, there is certainly loss of integrity in the result.

Apart from migration, the emulation, which encapsulates the behavior of the hardware/software with the digital object, is considered as an alternative to migration. Under emulation the look and feel of the text, pictures, and diagrams can be preserved as the metadata information provided with the digital content indicates how to reconstruct such a documentat the bits and bytes level. At the specific format level, there are several approaches used to save the "look and feel" of material. For journal articles, the majority uses image files (TIFF), PDF, or HTML. While TIFF is the most prevalent formats for those organizations that are involved in any way with the conversion of paper back files into electronic file, the PDF is the most preferred format for inborn electronic documents,. This provides a replica of the Postscript format of the document, but relies upon proprietary encoding technologies. PDF is used both for formal publications and grey literature. While PDF is increasingly accepted, concerns remain for long-term preservation and it may not be accepted as agricultural depository format, because of its proprietary nature.

One of the paradoxes of the networked environment is that in an environment that is so dynamic and open to change, there is a greater and greater emphasis on standards. Therefore, the emphasis in these areas is on the development of standards for interoperability and data exchange.

2.6 Access

The previous life cycle functions that have been discussed are performed for the purpose of ensuring continuous access to the digital material in the libraries and archives. Successful digital content management practices must consider changes to access mechanisms, as well as rights management and security requirements over the long term. Because today it is the Web, but there is no way of knowing what it might be tomorrow.

3. Indian Government Steps to Promote Agricultural Research Information Management

Sensing the importance of agricultural research information management for improving Indian agriculture, Government of India, Ministry of Agriculture, have taken several steps through the ICAR (Indian Council of Agricultural Research) to promote the management and use of agricultural knowledge. It establishes an exclusive Directorate namely "Directorate of Knowledge Management in Agriculture" (erstwhile DIPA "Directorate of Information and Publications of Agriculture") for management of agricultural knowledge.

The Directorate of Knowledge Management in Agriculture is committed to promote ICT driven technology and information dissemination system for quick, effectual and cost-effective delivery of agricultural research information to all the stakeholders in agriculture through use of print, electronic and web media. This directorate

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works on following thrust areas for agricultural research information management. [21]

- Dissemination and sharing of agricultural knowledge and information through value added information products in print, electronic and web mode.

- Development of e-resources on agricultural knowledge and information for global exposure.

- Facilitation for strengthening e-connectivity among ICAR institutes State Agricultural Universities and KVKs.

- Capacity building for agricultural knowledge management and communication.

In addition to establishing an exclusive Directorate for Knowledge Management in Agriculture, ICAR went in for massive computerization and digitization of agricultural information resources available under NARS through launching of different research projects on strengthening of IT infrastructure in general and agricultural libraries in particular under NAIP.

Because of these initiative most of the ICAR institutes and Agricultural Universities libraries developed their separate web portals integrating printed and digital library e-resources for online access and use. The library computerized catalogue (OPAC) was created and institutional repositories are being created using different digital library software like Dspace, Green Stone, E-print and other open source digital library software. The full texts of institute publications are being archived in these institutional repositories and are

proposed to be made available to all users of NARS. This has enabled the better management of agricultural research materials and publications in professionally maintained repositories with greater visibility and accessibility over time.

Some of the most promising IT based steps taken by ICAR for management and use of agricultural information are establishment of Consortium for e-Resources in Agriculture (CERA), E-Publishing and Knowledge System in Agricultural Research (E-PKSAR), Mobilizing Mass Media support for sharing Agro information, Krishi Prabha, e-Granth and AGROWEB.

3.1 Consortium for e-Resources in Agriculture (CERA)

The CERA was initially launchedin the year 2007 at IARI, New Delhi for three years under centralized funding and subscription of the National Agricultural Innovative Project (NAIP). Currently 126 agricultural libraries under NARS are the member of this consortium and consortium provides online full text access to more than three thousand journals of the publishers like Springer Verlag, Annual Reviews, CSIRO Australia, Oxford journals, Tylor& Francis, Wile Online Library, Indian Journals.com, American Society of Agronomy Journals and J-gate of Informatics India Pvt. Ltd. covering subjects like Agriculture, Veterinary Sciences, Fisheries, Crop science, Socio-economic, Computer Science, Soil Science, and Animal Sciences etc. This is a novel project of ICAR facilitating cost effective access and use of agricultural information through CeRA platform (www.cera.jccc.in) for effective research information generation, use and

management.[22]

3.2 E-Publishing and Knowledge System in Agricultural Research (E-PKSAR)

A project on E-Publishing and Knowledge System in Agricultural Research was launched in 2009 by NAIP under DIPA (then "Directorate of Information and Publications of Agriculture", now "Directorate of Knowledge Management in Agriculture") with aim to provide improved communication link among information generators and its users for poverty alleviation and income generation. This project is designed to develop fully automated online publishing system of agricultural research information. [23] Currently 19 Indian Agricultural Research Journals have been made web enabled under this project where anyone involved with agricultural research can submit their research results for publication, can monitor the processing stages of their research manuscript for publication and can access, download and use their online research articles. [24] It is highly desired that back files of all journals published by ICAR, its different scientific societies and SAU's journals must be digitized and opened for open access to facilitate best utilization and management of agricultural research information at the institutional as well as individual level.

3.3 Mobilizing Mass Media Support for Sharing Agro-Information

The project "Mobilizing Mass Media Support for Sharing Agro-Information" is designed and developed with the objective to enhance the agricultural communication and awareness in the country at grass-root level by using effective communication and information tools. The project is being implemented in the participatory mode with active contribution from consortia partners like IIHR, CISH, IIVR, IISR, CIFT, CIPHET, ICAR Research Complex for NEH, TNAU and GBPUAT and link with esteemed media organizations. Directorate of Knowledge Management in Agriculture is the lead centre in this project. The project is focusing on documentation and dissemination of agricultural success stories in print, audio and video format for motivation of the farming community and general public at large using different modes of communication and helping in agricultural research information management.[25]

3.4 Krishi Prabha – Indian Agricultural Dissertations Repository

Krishi Prabha was established as a sub project of e-Granth under NAIP, mainly to develop, organize, and sustain knowledge base of Indian Agricultural Dissertations in digital form and making it accessible online. The repository was created at Chaudhary Charan Singh Haryana Agricultural University, Hissar wherein 6000 Indian Agricultural Doctoral Dissertations submitted by research scholars to the 45 State/Deemed Agricultural Universities during the period from 1.1.2000 to 31.12.2007 were digitized and online full text access were provided for further research and development. [26] There is an urgent need to digitize not only doctoral theses but also of the P.G level theses covering from latest to oldest one. Now a day's many universities have made it mandatory for research scholars to submit their theses soft copy also. This I see a very promising step in managing agricultural research information.

3.5 e-Granth

E-Granth a consortium for "Strengthening of Digital Library and Information Management under NARS" is designed to provide digital and open access to ICAR and SAUs Libraries resources. This consortium was sponsored by NAIP wherein initially 12 institutions viz. ICAR Hq, IARI, IVRI, CIFE, NDRI, GBPUAT, UAS, ANGARU, CCHAU, CSKKV, MPKV, and TNVAS were identified for digitizing, standardize and merging their collections catalogue into union catalogue to upload in OCLC World Cat. Simultaneously the library resources (old journals and rare books) of four institutions viz. IARI, IVRI, ANGRAU and UAS Bangalore were digitized and hosted on D spacebased digital repository for making online availability and use of digitized contents. In 2013 this project has been extended to 26 more NARS organizations for similar kind of activities to promote the agricultural research information management and use.[27]

3.6 Agroweb

AGROWEB a Digital Dissemination System for Indian Agricultural Research (ADDSIAR) is also a NAIP sub project where 9 ICAR research institutes viz. NBPGR, CIBA, CRIDA, IARI, ICAR, IIHR, NAARM, NCIPM, and NDRI are member. It aims at developing an ICAR portal as centralized consolidated information source of Indian agriculture and implementing uniformity in websites of ICAR institutes through content management system for effective management and use of agricultural research information.[28]

3.7 Agropaedia

Agropaedia is an online knowledge repository for information related to agriculture in India, was launched on 12 January 2009 as an open access online resource project. It includes universal meta models and localized content for a variety of users with appropriate interfaces built in collaborative mode in multiple languages. This national portal, designed as an "agricultural Wikipedia" hosts wide range of agricultural information on a variety of crops, with an aim to empower farmers with crop information. Eventually it aims to use weekly alerts from scientists on different crops, to send text messages to farmers across India[29] helping in better management and use of agricultural research information.

4. Roles for Agricultural Librarians in the Digital Age

In this rapidly evolving technological environment, and in the face of constant change, what are the new roles for agricultural librarians? Technology does not replace human expertise, and agriculture librarians are called upon to provide guidance in a proactive way, reaching out to their clients/users, since the users may not come to them. The ultimate goal of agricultural librarians should not be just to facilitate access to digital information but just-in-time to the critical want of end-users.

In the digital era, there can be a tall order of the new roles for agricultural librarians, because they have to keep pace with the breakneck speed of emerging technologies and adjust to the new research needs and information seeking and use behaviors of scientists, students, faculties, farmers and entrepreneurs.

Further they have to evaluate the quality of print and electronic information, educate agricultural researchers on new techniques of information management, access,

searching, filtering and retrieval and, have to be seen as core participants in the missions of their institutions.

As such at this stage, it is difficult to define what the exact role of agricultural librarian would be in long term in the ever changing digital environment, but few things are very clear that I can see are as under.

4.1 Agricultural Librarians as Experts in Evaluation of Quality Agricultural Information

While the internet provides much useful information, the information it provides is not necessarily relevant or even correct. It is up to agriculture librarians to ensure that accuracy and authenticity of agricultural information, by telling each researcher with confidence-"This is the information you need, this is the information from a reliable source, and it will be here for you a year from now." Stephen Abram[30] refers to the new breed of librarians as "Librarian 2.0," the guru of the information age."

4.2 Agricultural Librarians as Teachers of Agricultural Research Information Finders

A particular new role for agricultural librarians is educating and teaching information management. Librarians occupy the special niche in agricultural research information delivery and management. They do this in libraries, formal classroom settings or in informal one-on-oneinteractions with patrons. In this age of technologies, there are many new information providers that compete with librarians. Finding information and doing research effectively require different sets of competencies. Agricultural librarians are the true agricultural research experts. They may not know everything of agriculture but

they definitely know how to find everything reliable and authentic in agricultural research. They are methodical in finding the specific information that their faculty, students, farmers, or entrepreneurs need.

4.3 Agricultural Librarians as Core Participants in the Mission of their Institutions

For librarians to perform their roles most effectively, they need to be considered as core participants in the mission of their institutions. In a digital environment, they now have to be proactive and reach out to library users' in the communities where they work, rather than passively waiting to be asked. One cannot be effective without being visible. Promoting the visibility oflibrarians has been a particular focus of AALDI and many NAIP projects related to strengthening of libraries under NARS in recent years.

4.4 Agricultural Librarians for Global Networks of Information Professionals

There is a strong network of agriculture library associations throughout the worldand of course, our own Association of Agricultural Librarians and Document alists of India (AALDI) and International Association of Agricultural Information Specialist (IAALD) that play a key role in bringing agricultural librarians from different countries together. The benefits of international meetings are numerous. Personal contacts are formed leading to subsequent professional communications and exchanges in information management. Besides, provides a potential network of contacts to help retrieve difficult to find agricultural research information and assistance of information management as well as technical know-how.

4.5 Agricultural Librarians Promoter for Open Access of Agricultural Information

Agricultural librarians can beg reat promoters of open access to agricultural literature by conducting information literacy programmes among researchers, imparting trainings on e-publishing, access and use of e-resources in open access domains. They can utilize their professional platforms like AALDI and IAALD to advocate their positions of interest in promotion of agricultural knowledge in open access domain.

Conclusion

Information reliability, authenticity, precision, relevance, accuracy, and version control are the some challenges posed by digital information. The long term consequences of the digital world are unknown. There is so much information available, but without any context, this raises many issues pertaining agricultural information management like "standards for creating digital contents", "metadata description in agricultural research", "what to select and acquire of the digital work", the archiving of related links and refreshing the contents of website etc. A variety of metadata formats, content rules and identification schemes are currently in use, with an emphasis to support interoperability, while standardizing as much as possible. Issues of storage and preservation (maintaining the look and feel of the content) are closely linked to the continuous development of new technologies. Current practices of addressing archiving and management issues is to migrate information from one storage medium, hardware configuration and software format to the next. This is not only arduous and expensive process but also very technical and risky. In such situation the agricultural librarian's role is going to be very critical in offering consultancy to the users in evaluating information sources, using electronic information services, navigating, searching and retrieval of digitized information through Web documents spanned world over in different digital libraries besides educating the users in management of agricultural information at personal level. I am confident that agricultural librarian fraternity while embrace the new opportunities of information dissemination and management offered by internet and web 2.0, will keep the long tradition of providing credible and quality information services which has been the trademark of libraries and librarians.

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