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Special Issue on

Knowledge Management for Agricultural Librarians and Information Professionals

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About the Issue

Agriculture is becoming more knowledge-intensive, primarily because all Agri-food systems are shifting towards market-oriented. Agricultural Research and Extension are evolving concurrently with evolving Agri-food systems and ICTs innovations to meet the demands of many actors and stakeholders from government departments, researchers, scientists, agripreneurs, input suppliers, NGO functionaries, Farmer Producer Organization to consumers and not farmers alone. The Librarians, Information and Knowledge Managers, Communication and Outreach Specialists who play a critical role in disseminating Agricultural Information and Knowledge need to update their knowledge on the Innovations in Agricultural Information and Knowledge Systems and build capacities to provide practical support to Agricultural Extension Services in the country.

Realizing the importance of knowledge management in agriculture, MANAGE had organized a two-day "Conference on Knowledge Management for Agricultural Librarians and Information Professionals" during 16-17 February 2022 to brainstorm on the latest trends and developments in agricultural information and knowledge management; share experiences on good practices, case studies, successful projects and innovations; and identify collective actions by various actors at the national level and strengthen institutional commitment, partnerships and networking.

More than 100 Agri-Librarians, Information Specialists, Knowledge Managers, and Extension Specialists representing ICAR Institutions, SAUs, NGOs, Agrioperneurs and Agri Startups participated in the conference. Besides three important keynote speeches by experts, twenty-nine papers were presented at the conference.

I am glad to inform you that the journal's special issue is to share 29 papers presented at the conference. These papers cover the latest knowledge in knowledge management, digital agriculture, and digital librarianship and focus on reorienting agricultural librarians to take knowledge resources to the farmers' doorstep to solve field-level problems. I am sure that Agricultural Librarians, Information Specialists and Knowledge Managers in India and abroad will find it helpful to update their knowledge.

(Dr. P. Chandra Shekara)

Director General, MANAGE

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CONTENT

Innovations in Agricultural Libraries and Information Management

Raj Kumar Singh[1]

Abstract

The article expresses the basic ideas and objectives of the agricultural libraries in the modern perspectives and paradigm shift in agricultural information services and knowledge management. The digital interference in the library services shows glimpses of change in the library system to fulfill the thirst of the agricultural scholars in the present e-documentary information system. Innovation of agricultural library information services with KOHA LMS is very sophisticated and assists easy functionality of the library day-to-day works with security. KOHA is a free open source software that provides comprehensive functionalities expected from a modern integrated library management software. An RFID system had been developed and integrated with KOHA using middleware software. This paper highlights the innovative development of agricultural library services and integration procedure of the RFID system with KOHA and the challenges faced during the process.

Keywords: Agricultural Library, Innovative Ideas, Digital System, Paradigm Shift, Shodhganga.

Introduction

Innovation refers to something new, such as an invention, or the practice of developing and introducing new things. Innovation is often a new product, but it can also be a new way of doing something or even a new way of thinking to create a new primary component concerned with any field of knowledge.

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Every area of human life relies heavily on information. We live in a time where information is exploding at an unprecedented rate and when knowledge becomes absolute much too quickly.

The agricultural library has become one of the primary information sources for agricultural researchers and students. Information services such as cross-database retrieval, full-text recovery, document transmission, virtual orientation, and user training have become popular. These services have moved towards the idea of "access to any document, at any time, in any place". However, most agricultural library construction efforts are still directed to resource optimisation. The services provided are confined to providing information for users, which has to be changed. Enabling innovation in information access and management allows information to be supplied as a seamless, borderless service that users can utilise right away, whether nearby or far away.

Innovative technologies which impact library services

i. **Big data:-** Big data means a massive amount of information that can be managed and conserved for future use.

ii. **Artificial Intelligence:-** Artificial intelligence is the application of Software in the library to automate the functions of the libraries and go with modern digital services and e-services.

iii. **Blockchain technology:-** A blockchain is a distributed database shared among the nodes of a computer network. As a database, a blockchain stores information electronically in digital format. As new data comes in, it is entered into a new block. Once the block is filled with data, it is chained onto the previous block, chaining it together in chronological order. Different types of information can be stored on a blockchain, but the most common use has been as a ledger for transactions.

iv. **Internet of Things:-** The Internet of Things (IoT) is a network of physical objects-"things"-embedded with sensors, software, and other technologies to connect and exchange data with other devices and systems over the Internet.

v. **Library bookmark apps: -** They are archiving tools to create a personal, organized, searchable reference library online public access catalog accessible for holding library documents.

vi. **User-focused interfaces and application: -** User interface (UI) design is the process, designers use to build interfaces in Software or computerized devices, focusing on looks or style. Designers aim to create interfaces that users find easy to use and pleasurable in search of graphical information.

vii. **Augmented reality:-** Augmented reality or AR is a technology that presents us with virtual objects and information in our field of vision. If we look at a street, for example, and point my smartphone towards that street, it may give me more information, such as the names of cafes, gyms, dentists, etc.

viii. **Digital interfaces for printed books:-** Digital interfaces for printed books detect the users' fingers and what it is touching and create an interactive touch screen where they can select the part they want to and transpose it into a digital form, where it can be processed.

Paradigm shifts

A paradigm shift is defined as a shift in the patterns and methods used to operate any system or process. "A significant change that occurs when a new and different way of thinking about or doing something replaces the traditional way." It refers to a dramatic shift in how something operates or is performed in worldview, concepts, and practises. A paradigm change in agricultural libraries can occur in various circumstances, ranging from scientific approaches to information provision and management of both print and non-print information, including e-books, e-journals, and e-databases, among other things.

Types of innovative information access and management

Innovative information access methods are advantageous in the library platform. Even small libraries can also get advantages of using these things. The types of innovative information access and management are as follows:

1. Consortiums for e-Resources in Agriculture (CeRA)

The Consortium for e-Resources in Agriculture, popularly known as CeRA, facilitates online access based on the static IP address to about more than 3400 journals in agriculture. The allied sciences to all researchers comprising scientists, teachers, faculty, research fellows, and students in the National Agricultural Research System (NARES) through IP authentication. At present, there are 150 members (along with regional stations, KVKs, and colleges) in CeRA comprising ICAR Institutes, SAUs, NRCs, PDs, etc., in the NARES. About 3,400 journals are now accessible in CeRA [http://cera.iari.res.in & http://www.jgateplus.com], which is now the most sought-after online platform by scientists/teachers in the NARES for literature search through IP authentication. The impact of CeRA in research publications is revealed through Web of Science, which indicates a qualitative and quantitative increase in the number of published papers during post-CeRA (2008-12) than Pre-CeRA (2003-07). The Consortium includes publishers viz. Springer, Annual Reviews, CSIRO, Elsevier, Taylor & Francis, Oxford Journals, American Society of Agronomy, Informatics, Wiley, and over 800,000 articles from Indian Journals downloaded by researchers. 24 x 7 online accessibility of scientific articles is provided to researchers in NARS through IP authentication. Not accessible through CeRA, specific articles are made available through Document Delivery Request (DDR) System. So far, 46,190 printed articles have been delivered under DDR. The impact of CeRA on the level of research publications at Institutions in NARS was initiated in 2010.

2. Indian Digital Ensemble of Agricultural Libraries (IDEAL)

IDEAL is a ready platform for Agricultural Libraries of Indian National Agricultural Research & Education System (NARES), which enables them to adopt an Integrated Library Management System for their day-to-day operations of all their library functionality. It is a software platform built on the 'Software as a Service (SaaS)' concept to provide a hassle-free, ready-to-use, international standards-based platform for sharing library holdings through AgriCat) union catalog. An integrated digital library delivered at the desk of researchers, faculty, and students of NARES can boost the quality of research output and save time. Libraries can reduce the cost incurred in procuring books & other library resources by sharing through this digital system. At present, 38 libraries of NARES as a part of an e-Granth project supported by the National Agriculture Innovation Project (NAIP) of the Indian Council of Agricultural Research (ICAR) have endeavored to establish an IDEAL platform that is easily extendible to more libraries covering the whole NARES. Vast resources spread all over NARES can be accessible with a few clicks. For library users all over NARES, an Online Public Access Catalog (OPAC) of their library provides an easy and enhanced experience of using the library online, sitting at their desk either in lab or home. Even while on the move, they can access their library using smartphones. An integrated catalog of the whole NARES (AgriCat) provides access to holdings of other libraries of NARES. A robust set of servers and failover servers operational at the data entry of Indian Agricultural Research Institute (IARI), Pusa, New Delhi, provide hosting facilities for customized KOHA open source software running independent instances for each library. Local mirror servers at individual libraries in sync with their KOHA instance at the central server ensure redundancy and high availability. However, those not running their local server may run offline KOHA modules on any desktop to ensure uninterrupted circulation services in the event of connectivity failure. All circulation data can be easily uploaded to a central server for maintaining a complete record as soon as connectivity is restored. IDEAL is a ready platform for Agricultural Libraries of Indian National Agricultural Research & Education System (NARES), enabling them to adopt an Integrated Library Management System for their day-to-day operations of all their library functionality.

- It is a software platform built on the 'Software as a Service' (SaaS) concept to provide a hassle-free, ready-to-use, international standards-based platform for sharing library holdings through a union catalog (AgriCat 2.0).
- For library users all over NARES, an Online Public Access Catalogue (OPAC) of their library provides an easy and enhanced experience of using the library online, sitting at their desk either in lab or home. Even while on the move, they can access their library using smartphones.
- An integrated catalog of the whole NARES (AgriCat) provides access to holdings of other libraries of NARES.
- Any library under NARES willing to be part of IDEAL needs to bring their catalog data to a standard format and learn how to use KOHA ILMS for library functioning. It is not necessary to run any server or KOHA software locally.

3. OPAC and Web OPAC

OPAC means Online Public Access Catalog. It is a database of a library or group of libraries. Any library user can access such a database to know the study materials (books, CDs, DVDs, cassettes, videotapes, articles, etc.) available in the library or libraries concerned. The concept of Web OPACs is relatively new. It acts as a portal to the resources owned by the individual library and the holdings of other collaborating libraries that do not have a local collection but have access to resources at the regional, national, and worldwide levels. It allows users to interact with documents stored on computers worldwide and makes catalogue data, such as bibliographic entries, more accessible. Library users can also use Web-OPAC from anywhere. Such innovative service saves users time searching their required study materials stored in various libraries. Now agricultural libraries in India are ensembled with the KOHA Library management software; every library of the agricultural institution and universities has a central library OPAC based on KOHA and online public access. For instance, http://

chfcau.ideal.egranth.ac.in a library of the college of horticulture and forestry library OPAC. OPAC for the public with direct access to a library's bibliographic details through the use of a terminal.

4. Krishikosh Repository

"Institutional repository is a set of services that a university offers to the members of its community for the management and dissemination of digital material created by the institution and its community members. It is most essentially an organizational commitment to the stewardship of these digital materials, including long-term preservation where appropriate, as well as organization and access or distribution." (Clifford Lynch, 2003).

Krishkosh is an institutional repository developed under the E-Granth subproject of the National Agriculture Innovation Project funded by ICAR and governed by IARI, New Delhi, NAIP (National Agriculture Innovation Project). Digitization and creation of open access Institutional Repository using Krishikosh.

Krishikosh is a digital repository of accumulated knowledge in agriculture and allied sciences, with a collection of old and valuable books, old journals, thesis, research articles, popular articles, monographs, catalogs, conference proceedings, success stories, case studies, annual reports, newsletters, pamphlets, brochures, bulletins, and other grey types of literature scattered across the country in various ICAR Research Institutions and State Agricultural Universities (SAUs). Under the ICAR's Open Access policy, Krishikosh provides a ready software platform to implement all aspects of the open access policy, similar to 'Cloud Service' for individual institution's self-managed repository with central integration. E-Granth two products, (i) Krishikosh and (ii) IDEAL, are used by all SAUs/DUs/CUs & ICAR Institutes.

After completing the NAIP era, ICAR has institutionalized the E-Granth scheme under the Division of Agricultural Education to ensure continued services by intrusting this responsibility to AKMU, ICAR-IARI, New Delhi.

Under the ICAR's Open Access policy, it is mandatory to upload all Institutional publications viz., research articles, popular articles, monographs, catalogs, conference proceedings, success stories, case studies, annual reports, newsletters, pamphlets, brochures, bulletins, a summary of the completed projects, speeches, and other grey works of literature available with the various SAUs in the Krishikosh. Besides this, M.Sc., Ph.D. thesis/dissertations (entire contents) and completed research projects will be submitted in the Krishikosh repository. After completion of the work, the metadata (e.g., title, abstract, authors, publisher, etc.) will be freely accessible from the time of deposition of the content and can be freely used through Open Access.

For easy access to this repository, new initiatives have been taken up for efficient development and dissemination of Krishikosh to the end-users of NARES. These initiatives include the efforts to add a new library, development of tutorial video, development of the database for NARES library, uses of social media, upgrade the Dspace version from 4. x to 6. x, development of the mobile application for Krishikosh and others. In the last ten months, 50 more Institutes / SAUs have been added to the Krishikosh repository; 83 SAUs, CAUs / ICAR institutes are registered in Krishikosh. Currently, this repository has more than 83,000 articles, including nearly 35,000 theses.

Features of Krishikosh

- Krishikosh is a digital repository platform capable of Decentralized Management of Content but Centralized Hosting and maintenance for the convenience of multiple users.
- Each institution has its repository with complete control without botheration of maintaining hardware/software, which is centrally managed at ICAR-IARI, New Delhi.
- Krishikosh Institutional repository of NARES provides open access to institutional knowledge. Krishikosh has been developed by customizing open-source Software DSpace.

- At present, Krishikosh has more than 20 million digitized pages in 83,000 digital items (volumes) like old books, old Journals, reports, proceedings, reprints, research highlights, training manuals, historical records.
- It includes more than 35,000 Ph.D. and M.Sc. theses submitted by various ICAR Institutes / SAUs, CAUs, and full-Text searchable facilities.
- Krishikosh provides a ready software platform, similar to 'Cloud Service' for individual institution's self-managed repository with central integration of all individual repositories.
- It is full text searchable open access repository. Semantic search enabled through the integration of Agrotags.
- Comprehensive search and browse options are available.
- Easy to register for additional facilities
- Making provision for continuous improvement through Users' feedback.
- Subscribed users can get collection updates.
- Institutional users can administer their repository and upload, remove, set embargos on their institutional content.

5. Libraries with RFID Systems

Radio - Frequency Identification (RFID) is a wireless system that uses electromagnetic fields. This system automatically identifies and tracks the chip attached to the books and materials of the library. It is one of the self-service schemes where a library user can take his required books. The identity of books, name of the user, and date of issuing the book are automatically recorded in the e -register of the library. The library using an RFID system does not allow the users to take any book or material unless a proper procedure of recording the issued books and about its use is not followed, which ultimately avoids the risk of theft. To avail of the facilities of such a library, the users are required to be a member. The nominal charges for using the library materials will be deducted automatically from the user's bank balance. It also helps in the proper arrangement of all materials of the library. Such a system also needs less human resources and helps reduce the monotonous work of the librarian. For integrating the RFID system with KOHA, a new table has been created in the MySQL database of KOHA. This table stores UID of each RFID tag and the corresponding accession number of the library holding. These two fields should have properties NOT NULL and UNIQUE, respectively.

The Library users intending to issue holdings will be required to place the desired holdings on the RFID reader affixed on the self-check-in/out kiosk. The user will then be required to click on the check-out button on the kiosk console. This will send the ISO Inventory command (0x01) to the reader from the kiosk PC over a serial link. The reader collects all the UIDs in its vicinity and sends them to the PC on getting the inventory command. Using UIDs received by the PC, the library identifiers corresponding to each of the UIDs are fetched from the tags. If each fetched identifier conforms to our library, accession numbers corresponding to each of the UIDs are fetched from the KOHA database. A further query to the 'ITEMS' table of KOHA is made to know the statuses, reserved and on-loan, of every holding intended to be checked out. If the two statuses permit check out of a holding, 'ISSUES' is updated with borrowers ID and accession number in the KOHA database table. The EAS field of the tag is reset by issuing manufacturer-specific ISO command 0xA3. The check-out process completes with the user logging out of the system. Subsequently, if the user walks out with the checked-out holding(s) through the security gate, the gate will allow smooth passage without raising any alarm. Check-in of library holdings is similar to check-out, except that the reader sets the EAS field of the tag, and the database table 'issues' of KOHA is also updated.

Other Initiatives

Shodhganga: A Reservoir of Indian Theses:

Theses and dissertations are the rich and unique source of information, often the only source of research work that does not find its way into various publication channels. Theses and dissertations remain an untapped and under-utilized asset, leading to unnecessary duplication and repetition that, in effect, is the antitheses of research and wastage of enormous resources, both human and financial.

The UGC Notification (Minimum standards & procedure for award of M.Phil. / Ph.D. Degree, Regulation, 2009 Amendment made on 2016) dated May 5, 2016, mandates submission of the electronic version of theses and dissertations by the researchers in universities intending to facilitate open access to Indian theses and dissertations to the academic community worldwide. Online availability of electronic theses through centrally-maintained digital repositories ensures easy access and archiving of Indian doctoral theses and will also help raise the standard and quality of research. This would overcome the severe duplication of research and poor quality resulting from the "poor visibility" and the "unseen" factor in research output. As per the regulation, the responsibility of hosting, maintaining, and making the digital repository of Indian Electronic Theses and Dissertation (called "Shodhganga"), accessible to all institutions and universities, is assigned to the INFLIBNET Enter. "Shodhganga" is the name coined to denote the digital repository of Indian Electronic Theses and Dissertations set-up by the INFLIBNET Enter. The word "Shodh" originates from Sanskrit and stands for research and discovery. The "Ganga" is the holiest, largest, and longest of all rivers in the Indian subcontinent. The Ganga symbolizes India's age-long culture and civilization, everchanging, ever-flowing, ever-loved, and revered by its people, and has held India's heart captive and drawn uncounted millions to her banks since the dawn of history. Shodhganga is the reservoir of Indian intellectual output stored in a repository hosted and maintained by the INFLIBNET Enter.

e-ShodhSindhu

Based on the recommendation of an Expert Committee, the Ministry of HRD (now renamed as Ministry of Education) has formed e-ShodhSindhu, merging three consortia initiatives, namely UGC-INFONET Digital Library Consortium, NLIST, and INDEST-AICTE Consortium. The e-ShodhSindhu provides current as well as archival access to more than 10,000 core and peer-reviewed journals and several bibliographic, citation, and factual databases in different disciplines and many publishers and aggregators to its member institutions, including centrally-funded technical institutions, universities, and colleges that are covered under 12(b) and 2(f) Sections of the UGC Act.

ShodhGangotri

ShodhGangotri is a new initiative that compliments "ShodhGanga." ShodhGangotri hosts a synopsis of research topics submitted to the universities in India by research scholars for registering themselves for the Ph.D. Program. On the one hand, the repository would reveal the trends and directions of research being conducted in Indian universities; on the other hand, it would avoid duplication of research. ShodhGangotri is an open access repository of Indian research in progress, which is a new initiative that complements ShodhGanga - the reservoir of Indian theses. ShodhGangotri hosts an electronic version of approved synopses and research proposals submitted to the universities in India by research scholars for registering themselves for the Ph.D. program, revealing the trends and directions of ongoing research in India, and helps to avoid duplication of research. A study on the current status of ShodhGangotri in different aspects, namely universities, issue date, discipline, and state. University-wise analysis shows that Shri Jagdishprasad Jhabarmal Tibrewala University submits 48% of the full synopses, 8.9% by Swami Ramanand Teerth Marathwada University, 8.7% by Dayalbagh Educational Institute, and 5.7% by Mahatma Gandhi University, and they occupy 1 to 4 positions, respectively. It concludes with a suggestion that all universities and research institutions should make it mandatory to submit approved synopses and research proposals at the time of their Ph.D. registration to make it experience the pulse of ongoing Indian research.

Conclusion

The Indian National Agricultural Research & Education System (NARES) is a vast agricultural and related knowledge repository. It consists of rare and valuable books, reports, theses, surveys, statistical data, maps, bulletins, newsletters, journal back volumes, and other documents housed in the libraries of various Agricultural Research Institutes and State Agricultural Universities across the country. The Digital Repository entitled 'KrishiKosh' was built under the 'e-Granth' project of the National Agricultural Innovation Project (NAIP) ICAR to provide online access to this unique resource to scholars and scientists worldwide. The 'e-Granth' is a collaborative initiative that aims to strengthen libraries by implementing data standards, standardised Integrated Library Management Software, and easy cataloguing for a smooth day-to-day operation and improved user experience. Individual library OPACs, a Union catalogue for exchanging materials, a Digital Repository with Electronic Theses and Dissertations (ETDs), and increased capacity building are all built into the system. Its goal is to serve as a portal to Indian agricultural knowledge via the Internet and share research information with the rest of the world through cutting-edge information and communication technologies.

References

Chandrasekharan, H., Patle, S., Pandey, P. S., Mishra, A. K., Jain, A. K., Goyal, S., Pandey, A., Khemchandani, U., & Kasrija, R. (2012). CeRA - the e-Journal Consortium for National Agricultural Research System. Current Science, 102(6), 847-851.

Harter, S. P. (1997). Scholarly Communication and the Digital Library: Problems and Issues. Journal of Digital Information, 1(1), Article 1. https://journals.tdl.org/jodi/index.php/jodi/article/view/jodi-3

INFLIBNET Enter Gandhinagar. (n.d.). Retrieved January 30, 2022, from https://inflibnet.ac.in/

Jain, A. (2014). Strengthening of Digital Library and Information Management under NARES (eGranth). Undefined. https://www.semanticscholar.org/paper/Strengthening-of-Digital-Library-and-Information-Jain/7b9d5b9fb5d09c1c4dcbbf3789e9c97e5548ea91

Jain, A. K., & Veeranjaneyulu, K. (2013). Repository Of Indian National Agricultural Research & Education System (NARES): Open Access To Institutional Knowledge [Working Paper]. http://oasis.col.org/handle/11599/1830

Jain, A. K., Chandrasekharan, H., & Kumar, R. (2014). Final Report of NAIP sub-project 'Digital Library and Information Management under NARS (e-GRANTH).' Indian Agricultural Research Institute.

Jain, A. K., Kumar, A., & Kapur, S. (2016). Reference Manual on Krishikosh-A Repository for NARES. ICAR- Indian Agriculture Research Institute.

Jain, S. (n.d.). Development of union catalog and digital institutional repository: A case study. In Role of agricultural libraries in knowledge management (pp. 364-373). BS Publications.

Krishikosh: Home. (n.d.). Retrieved January 30, 2022, from https://krishikosh.egranth.ac.in/

Kumar, A., Sharma, R., & Sharma, A. Batra K, Kapur S (2016). Digital Initiatives for Agricultural Research & Education under ICAR in India. pp49-68.

Lynch, C. A. (2003). Institutional Repositories: Essential Infrastructure For Scholarship In The Digital Age. Portal: Libraries and the Academy, 3(2), 327-336. https://doi.org/10.1353/pla.2003.0039

NAIP (National Agricultural Innovation Project). (2014). In an Initiative towards Innovative Agriculture (p. New Delhi). National Agricultural Innovation Project, ICAR.

National Agricultural Innovation Project | भारतीय कृषि अनुसंधान परिषद. (n.d.). Retrieved January 30, 2022, from https://icar.org.in/node/1890

Rathinasabapathy, G. (2015). Strengthening of digital library and information management under national agricultural research system egranth: an overview. Journal of Library, Information and Communication Technology, 4(1-2), 73-78.

Shodhganga: A reservoir of Indian theses @ INFLIBNET. (n.d.). Retrieved January 30, 2022, from https://shodhganga.inflibnet.ac.in/

Singh, R. K. (2019). Innovative Agricultural Information Library Services in India. In Information Resources management in Digital Era (pp. 177-190). Shree Publishers and Distributors.

Veeranjaneyulu, K. (2012). Innovative practices in agricultural information systems and services in India. In Innovative practices in management of agricultural libraries in the ICT environment (pp. 144-156). Association of Agricultural Librarians and Documentalists of India.

Veeranjaneyulu, K., & Rajagopal, T. (2001). Networking of agricultural information centers in Andhra Pradesh (AP-AGRINET): A model. International Library Movement, 23(3), 162-176

Library Web Portals in Knowledge Management at UASB - A Case Study

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Abstract

The UAS Library's birth dates back to the collection in the Department of Agriculture (which was established in 1899, and a significant share of this Library was taken away by the Agricultural Library, Hebbal, in 1946), which forms the nucleus of the present UAS Library. This paper traces the services available at the University of Agricultural Sciences, Bengaluru; specifically, this paper aims to illustrate the knowledge management service provided by UASB to the faculty and students and document web portals available to the users in general. Services available at the University of Agricultural Sciences, Bengaluru include useful Web Portals such as OAPEN: Online Library and Publication Platform, Kidrex, and DOAB. In the wake of changing times and the technology revolution, it is an axiom to note that knowledge management calls for integrating e-resources web portals besides books, Journals & open/paid sources to augment users' knowledge in the years to come.

Keywords: Knowledge Management, e-Resources, Web Portals.

Introduction

The UAS Library's birth dates back to the collection in the Department of Agriculture (which was established in 1899, and a significant share of this

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Library was taken away by the Agricultural Library, Hebbal, in 1946), which forms the nucleus of the present UAS Library. Available sources of information indicate that the Library of the Department of Agriculture, during 1923-24, contained over 3,000 works of reference books and 6,500 bulletins, and 1000 reports, 84 Indian and foreign periodicals with bearing on agriculture and livestock were either subscribed for or were received by way of exchange. The use of the Library was open to those interested in agriculture. To aid the users, several valuable books were set apart for reading. It is significant to observe that a specially printed catalog was also issued to benefit the clientele. The collection of inherited books from the Agricultural College and the Department of Agriculture formed the nucleus of the University Library soon after the formation of the University in 1966; steps were taken to pool the available resources and build a university library building to provide facilities that are expected of a modern University Library at GKVK Campus.

The collection of inherited books from the Agricultural College and the Department of Agriculture formed the nucleus of the University Library soon after the formation of the University in 1966; steps were taken to pool the available resources and build a university library building to provide facilities that are expected of a modern University Library at GKVK Campus.

The present University Library building stone was laid by the then prime minister Smt. Indira Gandhi on July 12, 1969. During the early '70s, when the UAS was shifted to the spacious Gandhi Krishi Vignana Kendra (GKVK) campus, a new library building was planned. The library building started functioning in 1976 with a lavish space allocation.

Objectives of the study

This paper traces the services available at the University of Agricultural Sciences, Bangalore; specifically, the objective of this paper is to:

- Illustrate the knowledge management service provided by UASB to the faculty and students and;

- Document web portals available to users.

Library Web portal

A web portal is a website that frequently acts as a single information access point. It can also be thought of as a personalised and categorised information library. A web portal can assist with search navigation, personalisation, notification, information integration, task management, collaboration, business intelligence, and application integration.

The online library portal is becoming more popular to organise and access library content. Web portals become positive potential frameworks for bringing order to an otherwise chaotic situation. Libraries of all types are becoming active in thinking, planning, and constructing diverse frameworks and services for their libraries as portals become a primary means of transacting information and business. The concept is not new in library and information science, as LIS professionals should be aware. The term "Library Portal" refers to OPAC and Web discovery tools hybrid. This combination of OPAC and more important discovery tools have been called "library portals" by librarians and library automation businesses. The portal is not a new notion for librarians; it is the transformation of the card catalogue into Library gateways. Many libraries think of the portal as a limited view, but it is not; it emerged from the typical Web OPAC extension. The library can use the portal to direct people to their favourite resources. Because librarians invented this technology, it must be adopted in today's libraries. Librarians should be enthusiastic about new technology and how it may be used to meet users' needs.

Services available at University of Agricultural Sciences, Bengaluru

- Book Loan Service
- Reference Service
- Literature Search
- Reprographic Service

- Current Awareness Service
- Selective Dissemination of Information Service
- Document Delivery Service
- Database and Internet-based Services
- Inter Library Loan Service
- Online Services
- Textbook Bank Semester
- Krishi Kosh
- Social Media link service
- Intuitional Repository DSpace
- Newspaper clipping
- Lib-Agri Live
- Content Management Service
- User Education

Useful Library Web Portals

OAPEN: Online Library and Publication Platform: The OAPEN Deposit Service supports open-access policies of research funders and practitioners (research institutions, universities, and their libraries). - https://oapen.org/

Z-Library: Z-Library is a shadow library project for file-sharing access to scholarly journal articles, academic texts, and general-interest books. - https://z-lib.org/

Kidrex: KidRex.org is a visual child-safe search engine powered by Google Programmable Search Engine. The website utilizes Google Safe Search and maintains its inappropriate websites and keywords database. - http://www.kidrex.org/

DOAB: DOAB is a community-driven discovery service that indexes and provides access to scholarly, peer-reviewed open access books and helps users find trusted open access book publishers. - https://www.doabooks.org/

OAJAR: The Open Access Journal of Agricultural Research deals with advanced agriculture worldwide. Agricultural research can be broadly defined as any research activity to improve the productivity and quality of crops through genetic improvement, better plant protection, irrigation, storage methods, farm mechanization, efficient marketing, and better management resource. - https://medwinpublishers.com/OAJAR/

F1000 Research: F1000 Research is an Open Research publishing platform for scientists, scholars, and clinicians offering rapid publication of articles and other research outputs without editorial bias. - https://f1000research.com/

DOAJ- Directory of Open Access Journals - https://doaj.org/

PubMed: PubMed is a free search engine primarily accessing the MEDLINE database of references and abstracts on life sciences and biomedical topics. - https://pubmed.ncbi.nlm.nih.gov/

PMC: It is a free full-text archive of biomedical and life sciences journal literature at the U.S. National Institutes of Health's National Library of Medicine (NIH/NLM). - https://www.ncbi.nlm.nih.gov/pmc/

BMC: BioMed Central is a United Kingdom-based, for-profit scientific open access publisher that produces over 250 scientific journals. All its journals are published online only. - https://www.biomedcentral.com/

PLOS: PLOS is a nonprofit open-access science, technology, and medicine publisher with a library of open-access journals and other scientific literature under an open-content license. - https://plos.org/

Springer Journals: The Springer journals collected many ground-breaking articles written by international experts in the field and influential researchers across all subject areas, including many Nobel Prize winners. - https://www.springeropen.com/

Pre-Print: In academic publishing, a preprint is a version of a scholarly or scientific paper that precedes formal peer review and publication in a peer-reviewed scholarly or scientific journal. - https://www.preprints.org/

SSRN: The SSRN, formerly known as Social Science Research Network, is a repository for preprints devoted to the rapid dissemination of scholarly research in the social sciences and humanities and more. - https://www.ssrn.com/

Arxiv org: This is an open-access repository of electronic preprints and post-prints approved for posting after moderation, but no peer review. - https://arxiv.org

BioRxiv: Do John Inglis and Richard Sever co-founded an open-access preprint repository for the biological sciences in November 2013. The Cold Spring Harbor Laboratory hosts it. As preprints, papers hosted on BioRxiv are not peer-reviewed but undergo essential screening and are checked against plagiarism. - https://www.biorxiv.org/

ChemRxive: ChemRxiv is an open-access preprint archive for chemistry. It is operated by the American Chemical Society, Royal Society of Chemistry, and German Chemical Society. - https://chemrxiv.org/

Lens.org: Lens serves global patent and scholarly knowledge as a public good to inform science and technology-enabled problem-solving. No account is required.- https://www.lens.org/

Shibboleth: Shibboleth is a single sign-on log-in system for computer networks and the Internet. It allows people to sign in using just one identity to various systems run by federations of different organizations or institutions. - https://www.shibboleth.net/

Project Gutenberg: Project Gutenberg is a volunteer effort to digitize and archive cultural works, as well as to "encourage the creation and distribution of eBooks." - https://www.gutenberg.org/

Eprints: EPrints is a free and open-source software package for building open access repositories compliant with the Open Archives Initiative Protocol for Metadata Harvesting. - https://www.eprints.org/uk/

National Digital Library of India (NDLI) is an initiative by the HRD Ministry Government of India. It is a vast collection of learning resources; nearly eight crore plus books from Primary to PG level students can use it free of charge. Developed by IIT Kharagpur. - https://ndl.iitkgp.ac.in/

Library Web portal links

S. No		**Name URL**
1	Agbioforum	https://agbioforum.org/
2	Agbiotech Reporter agbiotech-reporter/	http://www.gate2biotech.com/
3	Agnic	https://www.agnic.org/
4	United States Department of Agriculture National Agricultural Library	https://agricola.nal.usda.gov/
5	Agriculture Engineering International	https://cigrjournal.org/index.php /Ejounral
6	Agriculture Outlook	https://stats.oecd.org/ Index.aspx? Data SetCode=HIGH_AGLINK_2014
7	Agricultural Research	https://www.springer.com/ journal/40003
8	Farm Journal Today	https://www.farmjournal.com/

9	Journal of The Agricultural Education Online	https://www.jae-online.org/
10	Journal of The Agricultural Research Search	https://jsure.org.in/
11	Journal of Extension	https://archives.joe.org/
12	Journal of International Agricultural and Extension Education	https://www.aiaee.org/index.php/journal
13	Intute	http://crl.du.ac.in/Publication
14	Ice Virtual Library	https://www.icevirtual library. com/
15	Agriculture Research Guide: Online Resources	https://libguides.lib.msu.edu/c.php?g=95552&p=624179
16	Agriculture Online Books	https://www.e-books directory. com/
17	Bioagents for Management of Plant Parasitic Nematodes	https://vikaspedia.in
18	The Directorate of Economics and Statistics (DES)	https://eands.dacnet.nic.in/
19	The American Phytopathological Society (APS)	https://www.apsnet.org/Pages/default.aspx
20	High-Iron Pearl Millet for Better Health	https://www.cgiar.org/innovations/high-iron-pearl-millet-for-better-health/
21	National Agricultural Library	https://www.nal.usda.gov/
22	Ipmnet	https://extension.umd.edu/
23	Big Sleep Study Guide	http://www.bibliomania.com/

24	E-Book Central	https://www.proquest.com/
25	The National Academies Press	https://www.nap.edu/
26	Doaj	https://doaj.org/
27	Project Gutenberg	https://www.gutenberg.org/
28	The Online Book Page	http://onlinebooks.library.upenn.edu/

Conclusion

In the wake of changing times and technology revolution, the innovations in knowledge management calls for integrating e-resources web portals besides books, journals and open/paid sources to augment users' knowledge in the years to come.

References

Akpojotor, L. (2016). Awareness and usage of electronic information resources among postgraduate students of Library and information science in Southern Nigeria. 2016.

Library Hand Book. (2021). University of Agricultural Science

Newspaper Reading Habits at University of Agricultural Sciences (UAS) Bangalore - A Case Study

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Abstract

Newspapers are the best vehicles to spread information to the grassroots level. Newspapers provide current information on social, econicms, political, academic, cultural, crime, sports etc. They are treated as primary source of information with facts and reliability. This paper examines the newspapaer and e-newspapaer clipping reading habits of users of UAS Library.

Keywords: Newspaper, e-newspaper, University of Agricultural Sciences (UAS)

Introduction

Newspapers are periodic publications that are published daily, weekly, or at other regular intervals and contain news, editorials, features, and other material of public interest, as well as advertisements. The Relation aller Furnemmen und Gedenckwurdigen Historien was published by Johann Carolus (1575-1634). (Collection of all Distinguished and Commemorable News). The Globe Association of Newspapers and many writers consider the 'Relation' to be the first newspaper published in the world. James Augustus Hickey is the Father of Indian Newspapers.

A newspaper, according to Webster's International Dictionary, is a daily or weekly publication that contains news, opinion articles, features, and

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advertisements and according to the Macmillan dictionary: newspaper is a series of big printed sheets of folded paper carrying news, stories, and other information is often issued every day, according to the Macmillan definition.

Newspapers are divided into two categories. Tabloid newspapers tend to focus on sports, television personalities, and startling crime tales, whereas broadsheet newspapers focus on serious news. The library contains 13 English and Kannada newspapers on its shelves.

UAS Library

In 1964, the University of Agricultural Sciences Library (UAS) was founded to meet the information requirements of students, faculty, and others. Its collection has increased from 26,000 books and bound periodicals to approximately 2 lakh collections.

Features of Newspapers

General-interest newspapers are usually journals of current news. These include political events, crime, business, culture, sports, and opinions (either editorial, columns, or political cartoons). Newspapers use photographs to illustrate stories; they use editorial cartoonists, usually to illustrate opinion writing rather than news.

Some specific features a newspaper include are:

- Weather news and forecasts
- An advice column
- Critic reviews of movies, plays, restaurants
- Editorial opinions
- Comic strips and other entertainment, such as crosswords, sudoku, and horoscopes
- Sports column
- Food column etc.,

Objectives of the study

- To study the reading habits of newspaper readers
- To find out the amount of time spent on reading newspaper
- To know the awareness and usage of library e-newspaper service
- To ascertain the most preferred newspaper for competitive exams

Methodology

The population who visited the library from February to December 2021 was examined. The basic data was collected via a random sample procedure by sending 100 questionnaires to UAS Library users and information thus gathered by a questionnaire distribution are collated, evaluated, and presented under several sections.

Table-1 User Preference for Newspaper

S. No.	Media	Number	Percentage
1	Print Media	41	41
2	Electronic Media/ Computer/ Smart Phones	26	26
3	Both	33	33
	Total	**100**	**100**

Table 1 shows a preference for reading newspapers; out of 100 (41%) respondents preferred reading the newspaper in printed form, 26% preferred reading the newspaper on electronic media in the form of computers, smartphones and 33% preferred both print and electronic form. It shows that print media is the most preferred source of information. It could be further explained by the fact that mass media (print media) sources were the most consulted sources in less developed countries like India could be brought here to substantiate this finding. This view was supported by Naika (1986).

Table-2 Frequency of Reading Newspapers

S. No.	Frequency	Number	Percentage
1	Daily	66	66
2	Weekly	34	34
	Total	**100**	**100**

Table 2 shows the frequency of reading newspapers. One-third read the newspaper every day, whereas 34% of users read once a week. It shows that the habit of reading newspapers daily among users is the highest, and the literacy rate in the state has increased vis-a vis national average by 50%.

Table-3 Time Spent on Reading Newspapers

S. No.	Duration	Number	Percentage
1	30 Min-1 hour	42	42
2	20 Minute	35	35
3	Less than 20 Minute	23	23
	Total	**100**	**100**

Table 3 shows the amount of time spent while reading a newspaper. 42% read the newspaper for 30 minutes to 1 hour, (35%) of users liked reading the newspaper for 20 minutes, and 23% spent only less than 20 minutes in reading the newspapers. This table shows that most users prefer reading a newspaper for 30 minutes to 1 hour. It indicates that the amount of time spent reading is less than westerns, where they spend nearly 2-3 hours daily.

Table-4 Genre of News Articles Preferred

S. No.	Purpose	Number	Percentage
1	Sports	15	15
2	Business	9	9
3	Political	12	12
4	Academic News	24	24
5	Competitive Exams News	40	40
	Total	**100**	**100**

Table 4 explains that 40% of users read the newspaper for competitive exam-related articles to make notes, 15% of them read sports-related stories, 9% related to business, 12% read politically related articles, and 24% read news about academic news. It shows that the highest users read news about competitive exam-related articles, and reading habits vary with topical interest.

Table-5 Most Eye-catching Aspects of Newspapers

S. No.	Most eye-catching aspects of newspaper	Number	Percentage
1	Image	71	71
2	Text	16	16
3	Color	7	7
4	Logos	6	6
	Total	**100**	**100**

Table 5 shows the most eye-catching aspects of newspapers. Close to three-fourth of the users said that the most eye-catching aspects of a newspaper are Images compared to 16% for Text, 7% for Color, and 6% for Logos. This study shows that Images dominate to convey any sort of information effectively, which is considered as a universal language where one photograph is equal to a thousand words - A Chinese proverb

Table-6 Awareness of e-Newspaper Clipping Service

S. No.	Response	Number	Percentage
1	Aware	72	72
2	Not aware	28	28
	Total	**100**	**100**

Table 6 indicates that 72% of the users are aware of e-newspaper clipping services and 28% were not aware of the service. It indicates the e-newspaper service is active in its function, which calls for up-gradation of e-newspaper services in days to come to cater to many audiences.

Table-7 Type of e-Newspaper Clippings

S. No.	Response	Number	Percentage
1	New Version	44	44
2	Old Version	20	20
3	Not Answered	32	32
4	Not Accessed till Now	4	4
	Total	**100**	**100**

From Table 7, it is evident that 44%of users prefer the newer version of the e-newspaper clippings service in the library, 20% prefer the older version, and 4% have not accessed the e-newspaper until now. This study shows that users are aware of using the e-newspaper and prefer the new version.

Table-8 Preferred Newspapers for Competitive Exams

S. No.	Newspapers Preferences	Number	Percentage
1	The Hindu	80	80
2	Prajavani	4	4
3	Indian Express	4	4
4	Times of India	8	8
5	Vijaya Karnataka	4	4
	Total	**100**	**100**

Table 8 shows the preferred newspaper for competitive exams. 80% of users said that the Hindu is a good source for competitive exams, 4% of users selected (Kannada) daily Prajavani, 4% for Indian Express, 8% for Times of India, and 4% for Vijaya Karnataka. It shows that the Hindu is the most referred newspaper among the respondents over other papers. However, the preference varies among the users, and the language they read, font size, nature, news covered and depth of news, etc.

Conclusion

This study has found that the 41% of readers prefer reading newspapers in printed form, 66% of the readers read newspapers daily, 42% of the readers read the newspaper for 30 minutes to 1 hour, 40% of readers read competitive articles in the newspaper. 71% of users mentioned "Images" were the most eye-catching aspects in the newspaper, and 72% were aware of e-newspaper service. The present study shows that the newer version of the e-newspaper service is better than the old newspaper service. 80% of readers, especially students, prefer reading The Hindu newspaper. Further, the following suggestions need immediate attention to improve the facility: a good lighting facility should be provided, and more competitive related newspapers should be subscribed. User study should be conducted to know users' problems and check the satisfactory services level in the years to come.

References

Merits and Demerits of Advertising in Newspapers. (n.d.). Retrieved January 30, 2022, from https://accountlearning.com/merits-demerits-advertising-newspapers/

NEWSPAPER (noun) definition and synonyms | Macmillan Dictionary. (n.d.). Retrieved January 30, 2022, from https://www.macmillandictionary.com/dictionary/british/newspaper

Newspaper | History & Facts | Britannica. (n.d.). Retrieved January 30, 2022, from https://www.britannica.com/topic/newspaper

Newspaper Definition & Meaning-Merriam-Webster. (n.d.). Retrieved January 30, 2022, from https://www.merriam-webster.com/dictionary/newspaper

Papegowda, M., & Walmiki, R. H. (n.d.). A case study of University of Agricultural Sciences University Library. 68-71.

ICT Tools for Building Agricultural Knowledge and Information Systems

Aman Kumar Yadav[1] and Reena Yadav[2]

Abstract

In India, the Agriculture sector plays a crucial role in our country's economic and social development; about 60% of our population is engaged in agriculture directly or indirectly. E-agriculture library should be developed which is attached to a higher education institution. The Agriculture libraries must focus on collection development since comprehensive collections are not feasible. ICTs help agriculture libraries connect with specific networks and information sources. Agriculture libraries typically provide access to subscription-based online resources, including research databases and ebook collections, in addition to physical books and journals. ICT plays a crucial role in developing library building, library book collection, user data, book acquisition, delivery of information, information exchange service, current awareness service and selective dissemination of information, reference service at lower cost, faster and up-to-date information to the end-user.

Keywords: ICT, Agricultural Library, Agriculture Research Information System, Agricultural Knowledge Management.

Introduction

India is called the farmers' land as most people are directly and indirectly involved in agriculture. Farming is the process of growing a wide variety of crops. India has a diverse culture with approx many languages. In India, farmers refer to people actively engaged in economic and livelihood activities. Its arable land is about 159.7 million hectares, the second-largest area-covered country globally and irrigated crop area.

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Agriculture libraries provide resources and services to support the farmers by providing or sharing all kinds of agriculture information. It includes upcoming trends, crops cost, and suitability for farming which helps the farmers to give the best practices. ICTs play an important role in processing the real-time information like weather data and market information and disscreminate it to farmers.

Definition of Information Communication Technology (ICT)

The word Information and Communication Technology (ICT) is first used in IT Sector. Whilst Information Technology (IT) was used in World War II for information sharing. The universal term, ICT, deals with using electronic computers and computer software to convert, store, protect, process, transmit, and retrieve information. ICT combines infrastructure and software components to interact with a modern computing system.

Requirement of Information Technology

Because of the information explosion, it is challenging to handle information with the traditional library tools like manual catalogs, bibliographies, etc. In today's digital environment where all users use multimedia phone and access online information. ICT has become a necessity for agricultural libraries for improved services.

Impact of Information Communication Technology on the Agricultural Libraries

ICT has changed agricultural productivity and strengthened the agriculture sector by providing timely and updated information on agriculture-related emerging threats in crops. Weather information or forecasting crop prices in different local areas and global markets. In this way the farmer can get desired information and services effectively in the shortest time. Information technology is growing faster and more secure with the advanced security feature implemented in the network.

The continuous increase in global population and food market integration has intensified the agriculture sector's competition and efficiency. It has brought unique opportunities to include more smallholders into supply chains so that the market demand and supply would fulfill society. The application of ICT transformed the collection, storage, and retrieval of data from source to destination in agriculture libraries. It is needed to speed up accurate and reliable data transfer in the future. In the early days, the danger of non-availability of hard copies of the document is common, but now it is available only on CD-ROM, hard disk and cloud storage. Many international databases like DIALOG, MEDLARS, INIS, AGRIS, etc., deliver the information electronically. Unless the libraries are automated, there is no possibility of accessing the information from these global-level databases. The versatility of an ICT-driven agriculture library that would adequately and efficiently meet the information need of patrons has been widely acknowledged.

ICTs for Agriculture

Many agriculture libraries provide digital data to their users to satisfy their needs in a specific period by searching for information in digital format with help of new ICTs, including computers, Internet, Intranet and other technologies. Now users can place their online demand for the information by mailing or messaging the librarian. Now the user and subscriber also place their information on a global platform. They require access to the latest information, updated information resources, and access to ICT facilities that they could use in their work.

Today, ICT in agriculture will be the need of management to satisfy users. It has many benefits to farmers and other stakeholders. Some of the benefits are:

- Faster and provide easy access to information or data.
- Give remote user access.

- Increasing efficiency, productivity, and sustainability of small-scale farms.
- Information about pest and disease control.
- Early warning system for the new varieties to the user.
- The new way to optimize production and regulation.
- Better markets result from an informed decision about future crops and commodities and the best time and places to sell and buy goods.
- Up to date market information on prices for commodities inputs and consumer trends.
- Reduce soil erosion.
- Open up new business opportunities and allow more accessible contact with friends and relatives.
- Works round-the-clock access to users.
- Give access to unlimited information from different sources and places
- Information flexibility to be used by any user.
- Provides increased flexibility
- Change the information, reformatting and combine data from different network sources.
- Secure access.
- Low economic costs to access some information.

ICTs in Agricultural Library

- ICT helps the users to assemble the information in different stores so that it cannot be lost or removed and kept for a more extended period.
- Users work easier, faster, cheaper, and more effective way.
- It helps to manage information of different subjects, and information overload is removed by the computerized systems using different algorithms methods.

- Remote access is enabled for different users through networked systems.
- Using ICT in agriculture saves space and reduces paper consumption.
- ICT is environment-friendly for users and the nation.

ICT devices used in agriculture

- Wireless technologies - a technology where data can be shared in the air rather than over wire networking between computers would be carried out with the help of a wireless adaptor.
- GPS (global positing system)- is a global navigation satellite system (A device locator that provides location globally)
- Smartphone Mobile Apps
- E-commerce Platform
- Computer-controlled devices(automated system)
- RFID(Radio Frequency Identification)- where digital data is encoded into tag form. It is a similar technology used by bar coder to identify the code or device

Limitation for Using ICT in Agricultural Libraries

- Less funding for ICT infrastructures.
- The initial cost is high.
- Many users find reading printing material easier than reading on the computer screen.
- Updating software and hardware from time to time.
- Less power supply in some places.
- Insufficient bandwidth and poor connectivity
- Lack of technical IT knowledge by library staff and management.

Conclusion

ICTs are very important tools which transform agricultural knowledge and information systems. Agricultural libraries need to adopt new ICTs to provide effective information services to farmers and other stakeholders. Agricultural libraries need to develop knowledge and skills on emerging ICTs for improvising their professionalism.

References

Hussain, A., & N., L. (2014). The impact of ICTs in library and information services at Indus Business Academy, Bangalore. Indian Journal of Knowledge Management, 1, 1-13.

Khan, J. (2016). Impact of information communication technology on library and its services. International Journal of Research -GRANTHAALAYAH, 4(9), 97-100. https://doi.org/10.29121/granthaalayah.v4.i9.2016.2540

Singh, S. (2015). A study of impact of ict on library users and library services. Undefined. https://www.semanticscholar.org/paper/A-STUDY-OF-IMPACT-OF-ICT-ON-LIBRARY-USERS-AND-Singh/ee3731c6f40ea0b4b78dcf4d7b23fb6aebe75b64

A Study on the Growth and Development Agricultural Library of Ministry of Agriculture and Farmers Welfare in India

Kimi[1]

Abstract

In the present study, the author has investigated the status of the library under the Ministry of Agriculture and Farmers Welfare (MoAFW) to know its resources, services, budget, level of automation for the period 2010-19 with the help of a structured questionnaire designed for the purpose. The author has also interviewed the library's Head and practically observed the status of the library. The findings show that the library is on a steady path for its development, as observed through increased collection, services, and library management areas. This study shall be helpful for the library in designing its roadmap for future developmental processes. Simultaneously, it will help the researchers understand these unique libraries due to their type of collection.

Keywords: Agricultural Library, Ministry of Agriculture and Farmers Welfare India, Special Library

Introduction

The policies/schemes of the Government of India relating to agriculture and the welfare of farmers are executed, implemented, and reviewed through the Ministry of Agriculture and Farmers Welfare. The allocation of work relating to the agricultural sector has been assigned/merged/de-merged with other sectors such as food processing, fisheries, rural development, irrigation. In 2015, this vital sector of the Indian economy was allocated and assigned under the Ministry of Agriculture and Farmers Welfare while giving its present name.

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Every Ministry has set up a library that acts as a record house of all important gazettes, policy papers, notes, other documents relating to the functioning of that particular Ministry. Thus, the library associated with the Ministry of Agriculture and Farmers Welfare (MA&FW) plays a vital role in housing all such documents which have shaped the agricultural sector and the farmers engaged with it in the country. The library of MA&FW is situated in Room No. 12, Ground Floor, Krishi Bhawan, New Delhi.

Review of Literature

Gulnaz and Nishat (2019) explored the collection development practices in IIT libraries of Eastern India. Researchers found out that in the newly established IIT Patna library, the library committee is responsible for collection development policy and is the recommender of resource selection.

Whereas, in IIT Guwahati library, the advisory committee is responsible for collection development policy and resource selection on the recommendation of the faculty members. IIT Guwahati library faces problems like lack of funds, information explosion, literature scattered. IIT Patna library is RFID equipped and does not face problems like IIT Guwahati library. Okwu and Mercy (2019) examined the influence of collection development policy and user satisfaction in university libraries in Rivers State, Nigeria. The study revealed a significant influence of collection development policies on users' satisfaction based on knowledge of collection development policy, availability of current resources, and evaluation of collection development policy. While focusing on library and information science services of NIT in the North East region of India, Pachuau (2019), in his studies has suggested improving the collection, infrastructure, networking, automation, institutional repository, and promoting the scholars for better output. Adekoya (2018) investigated sustainable library development, research skills, and ICT application. The study's findings show that sustainable development of libraries is critical to librarians, and librarians should have research skills to perform varying library activities better and raise their research performance as well. The research also highlights that ICT application plays an influential role in achieving sustainable development. The investigator in his study has recommended that a higher level of research skill and ICT application is necessary for sustainable development. Olorunfemi and Deborah (2018) examined academic libraries' marketing and information services. The findings show staff friendliness with users, display of new arrivals, creating a library webpage, employing techniques for marketing library and information services, provision for electronic resources access, organizing user education, and face-to-face user discussion. Library staff should have communication skills, information technology skills, the ability to answer users' queries, sell library services, question and evaluate library services, and interpersonal skills. There are various challenges against this like insufficient funds, lack of market policy, lack of facilities to market library services, lack of media access to academic library services, poor access to information technology, lack of training in marketing, and lack of effective communication between librarian and users.

Research Methodology

For the present research work, the investigator first designed a questionnaire broadly considering the library-specific data such as its collection, services offered to the users, budget provisions, automation stage for utilization of modern-day ICT tools, and others after thoroughly reviewing the available data literature related to the study. After that, to collect relevant data on the structured questionnaire, the investigator interviewed the head of the library. Finally, the collected data was evaluated, analyzed and the same has been depicted and discussed in forthcoming headings.

Scope, Objectives, and Purpose of the Study

The research paper aims to study the Ministry of Agriculture & Farmer Welfare Library, which houses the specific collection related to the agricultural policies and internal publication of different ministry departments to improve efficiency in agriculture and farmers' welfare. The study has been performed to examine the developmental status from 2010 to 2019. The purpose of this research is to

- Know about the library's collection and its growth during 2010- 2019
- Observe the developmental pattern of services of the library during 2010-19
- Know whether the library undertakes the staff developmental activities.
- Bring light on library automation and ICT tools.
- Know the library's budget and its allocation techniques.

Data Analysis and Interpretation

Collection development of Libraries

The library's collection can directly correlate with its development and overall status. It is observed that the library houses a significant collection of books, journals, annual reports, publications relating to agriculture and farmer's welfare. A year-by-year growth was seen in a total collection of libraries from 2010 to 2019. It is shown in Table 1 below:-

Table-1 Collection of Libraries

Years	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Collection	18,000	18,700	20,000	21,000	21,900	22,500	23,700	24,000	25,000	26,200
Yearly growth rate (%)	-	3.89	6.95	5.00	4.29	2.74	5.33	1.27	4.17	4.80

It is also observed that library purchases new books every year. The library has followed the Accession Number List method for stock verification purposes since 2010. The library has been implementing the DDC scheme for stock classification and the AACR-II method for cataloging since 2010.

Library Services

A look at services offered by the library shows that it has been consistently offering an issue return facility, reference service, inter-library loans, new arrival list service, newspaper display to its users since 2010. The library has the facilities of photocopy, scanning, printing, helper for searching and locating documents. There is a proper seating arrangement for the users and drinking and sanitation facilities. Additionally, the library also has an alert and notification facility.

The Library Staff

The total strength of the staff of the library is observed to be four (04) which consisted of three (03) library professionals and one (01) non-professional staff. The staff position has been consistent throughout the period undertaken for the study. It is also observed that the library adopts no staff development policies.

Library Users

It is stated that the library users have been solely the employees of the Ministry since the library has been set up for Ministry-specific purposes. It has also been informed that various research scholars are also utilizing the library for their research purposes/knowledge up-gradation. The library utilizes a passbook system for issuing and returning information resources.

Library Automation and Digitization

The library has been observed to be fully automated since 2010. The core library activities such as library circulation, acquisition, and cataloging are functional through e-Granthalaya software. The library is also installed with modern-day ICT equipment such as computers, photocopiers, scanners. It is pertinent to mention that the library is yet to have its website.

Budget

The budget of a library is a crucial factor for its developmental activities. It has been observed that the library do not have a fixed budget allocation. It varies as per needs and requirements. Furthermore, there is no specific allocation of budget for the library; instead, the expenditure incurred for the library is merged with the other office expenses of the Ministry itself.

Results

It is observed that the library's total collection has been increasing since the year 2010 to best suit the requirements of its users. The library's total collection at present stands at 26000 approx, which is identified to be adequate for its users. The library's services are also user-oriented and hence are sufficient for them. The strength of staff is to meet the requirement of the library, and it may be increased to bring more efficiency. Although the library has adopted ICT equipment since 2010, the library has to introduce advanced automation tools such as RFID, Bar code scanner systems, and OPAC for quick information flow. The library's budget is not a constraint for its developmental activities as it is adequate to meet the present-day requirements.

Conclusion and Suggestion

It may be concluded that although the library is on a steady developmental track with the passing time, there are still some aspects that the library can target to bring more efficiency and user satisfaction. The library should focus on updating the library website, bringing awareness to users, and mentioning the brief of its collection and services. Most importantly, frequently conduct programs/seminars/workshops/induction programs to staff, and make efforts for specific budget provisions so that any needy information seekers could utilize its resources.

References

Adekoya, C. O. (2018). Research Skills, ICT Application, and Sustainable Library Development. Library Philosophy and Practice. Retrieved from https://search.proquest.com/docview/2163342020accountid=10461

Annual Report | Department of Agriculture & Farmers Welfare | Mo A&FW | GoI. (n.d.). Retrieved January 30, 2022, from https://agricoop.nic.in/en/annual-report

Gulnaz, & Nishat, F. (2019). Collection Development Practice in Indian Institute of Technology Libraries of Eastern India: A Study. Collection and Curation, 38(2), 25-31. Retrieved from ProQuest, https://search.proquest.com/docview/2190034076accountid=10461, doi:http://dx.doi.org/10.1108/CC-08-2018-0015.

Okwu, E., & Mercy E. E. (2019). Collection Development Policy and User Satisfaction in University Libraries in Rivers State, Nigeria. Library Philosophy and Practice, 1-17. Retrieved from ProQuest, https://search.proquest.com/docview/2173547777accountid=10461.

Olorunfemi, M., & Deborah A. I. (2018). Marketing Library and Information Services In Selected University Libraries in South West Nigeria. Library Philosophy and Practice. Retrieved from ProQuest, https://search.proquest.com/docview/2164442089accountid=10461.

Pachuau, R. (2019). Library and Information Services of National Institute of Technology in North East Region. Mizoram: University of Mizoram. PhD Thesis. 1-148. Retrieved from http://hdl.handle.net/10603/236032

Mobile Applications in Agriculture: An Overview

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Abstract

Mobile or Smartphone applications, called Apps are gaining importance in agriculture. Farmer can get all solutions and information in just one touch through the Apps. The information is stored in mobile handset for easy access, for example, the details of the package of practices, pest and disease information, and scheme-related information. The majority of Indian farmers are small-scale producers. They are often unable to access the information and technological resources that could increase the yield and get better prices for their crops and products. The widespread network of mobile phones came to the rescue to tackle this problem. Most Apps are helpful only for specific information, while others are multi-informant. This paper reviews the available mobile Apps in agriculture in India meant for farmers and other stakeholders.

Keywords: Agriculture, Mobile Apps

Introduction

We can find that different elements affect agriculture development; however, the essential bottlenecks are the lack of instant information and drudgery involved in farming practices. Access to appropriate information and knowledge for successful agricultural production is essential. Farmers must be aware of the weather forecast for agriculture input applications like fertilizer and pesticides, which might be affected by unforeseen weather disasters. For overcoming these issues, agriculture should be made more alluring and done smartly. There are talks on climate-smart agriculture,

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aiming for a sustainable increase in agricultural productivity and incomes to meet the current and future demands. Various agricultural mobile applications can be used in farming and allied activities as indicated by their source and usage. Its utilization is vital for rapid growth and easy access to Indian agriculturists, farmers, and growers. Information about policies, good agricultural practices, market prices of commodities, current demand of commodities, and various helpful agriculture schemes are helpful to the farmer for reaping good profits. Thus, farmers need to have all such information on their doorsteps. The main advantages of mobile Apps for farmers are easy to access information on farmer's mobile. The information is stored in the mobile handset for easy access, for example, the details of the package of practices, pest and disease information, scheme-related information. Wherever the information is dynamic, for example, weather details, market prices, advisory services, the mobile App requires internet connectivity to fetch the data from the back-end server databases.

Sources of Information

During the past decades, agriculture information and technology transfers have been done mainly by village-level workers, extension personnel, scientists, subject matter specialists of KVKs, Universities, and others.

Later, with the internet's arrival, most of the information was tried to avail by web-based approach (e-based services). However, it has reached only limited users due to the installation cost of the computer devices, for example, e-choupal kiosks. SMSs and voice message delivery systems are easy, but it requires particular types of options or formats to be sent to the system to get the precise information; therefore, ICTs are moving to mobile Apps.

Importance of Mobile Applications in Agriculture

All information is available in the public domain, and it is difficult for the farmer to access it. Mobile or Smartphone applications are called apps, which could avail all such information with changing seasons and climate. Farmer can get all solutions and information in just one touch. According to the statistics, there are two billion smartphone users across the globe in

2016. The majority of the Indian farmers are small-scale producers. They are often unable to access the information and technological resources that could increase the yield and lead to better prices for their crops and products. The widespread network of mobile phones came to the rescue to tackle this problem. Most Apps are helpful only for specific information, while others are multi-informant. Some are just calculative types and for academic usage. Therefore, India's increasing penetration of mobile networks presents an opportunity to make useful information more widely available.

The Ministry of Agriculture, Govt. of India, started various schemes in the interests of the farmers for mobile phones. The emergence of new wireless and satellite-based solutions is positioning the developing countries to take advantage of the benefits derived from ICT applications. Mobile or smartphones are becoming an essential device for all types of users, irrespective of the age group. Information and Communication Technologies (ICTs) in enabling access to and exchange information for farmers is evident. Among ICTs, use of mobile phones, have been changing the agricultural communication process. The introduction of mobile phones has resulted in new services and applications. These include access to market information, weather information, monitoring plant health, education, and other services in the agriculture sector.

Through mobile Apps, farmers are getting agricultural and allied information on time. Many Apps are being utilized for different kinds of functionality regarding the farming activities like cropping information, pesticides, fertilizer, seed, selling of crop, irrigation information, estimation of crop production, weather information, information regarding the best practices of farming, new technologies, dealers and market price. All types of information on crops, soil, weather, climate, rainfall, seeds, animals, and machinery at any point in time and at any number of times are available at the fingertips of farmers (World Bank 2012). The information available is localized, thereby increasing the comfort and precision required. This information is updated regularly and delivered via various applications so that the farmers need not worry about getting the information from different sources.

In the present review paper, we discussed the different apps used for agriculture and agriculture-related activities, which can help agriculture develop faster and hustle-free. Based on the ratings and downloads of the App on the play store following applications were discussed in brief. Ratings will help know the preferences of the farmers /Users. While the downloads of Apps will help know the reach of the App.

1. IFFCO Kisan: The App was developed by Indian Farmers Fertilizer Cooperative Ltd. It has 3.3 ratings and 5L+ downloads. It helps access various modules, including agricultural advisory in text, images, audio, and videos in the selected language. It also connects with Kisan Call Center Services.

2. Crop Insurance: The Ministry of Agriculture and Farmers Welfare, Govt. of India developed this App. It has 3.4 ratings, with 5L+ downloads. It can be used to calculate the Insurance Premium for notified crops based on area, coverage amount, and loan amount in the case of the loanee farmer.

3. Meghdoot: The Ministries of Earth Sciences developed the App and Agriculture, India, with a 3.5 rating and over 1lakh downloads. It will provide weather forecasts relating to temperature, rainfall, humidity, wind speed, and wind direction, which play critical roles in agricultural operations and advisories to the farmers on how to take care of their crops and livestock.

4. e-NAM Mobile App: The Ministry of Agriculture & Farmers Welfare, Govt. of India developed this App. It has a 3.6 rating with 1 lakh downloads. It is to facilitate remote bidding by traders and access to arrivals and price-related information to farmers and other stakeholders on their smartphones

5. Pashu Poshan: National Dairy Development Board (NDDB) developed this App having a 3.6 rating with over 50 thousand downloads. With the help of this balanced App, a ratio can be formulated while optimizing the cost by considering animal profile, i.e., cattle or buffalo, age, milk production, milk fat, feeding regime.

6. Kisan Suvidha: The Ministry of Agriculture and Farmers Welfare, Govt. of India developed the App with a 3.9 rating and 10 thousand plus downloads. It helps farmers by providing relevant information on weather, market prices, dealers, plant protection, IPM practices, seeds, expert advisory, godowns, and cold storage.

7. BharatAgri: It is a Smart farming and agriculture App for farmers. Provides information on innovative satellite mapping, weather forecasting, soil testing, and water testing to enhance farmers' overall income. It has a 4.1 rating with more than ten lakh downloads.

8. Plantix: The App was developed by PEAT, Germany having a 4.3 rating and over one crore downloads. The App will be used for plant disease diagnostics and monitoring. The App provides information concerning best practices, preventive measures, and independent options for action.

9. A Fisher Friend Mobile Application (FFMA): M. S. Swaminathan Research Foundation in partnership with Qualcomm under its wireless reach program developed this App. It has a 4.4 rating with more than 10 thousand downloads. It is a single-window solution to provide easy access to all relevant information related to fishing.

10. Cattle Expert System: TNAU, Coimbatore, and C-DAC, Hyderabad have developed this App with a 4.6 rating and more than 10 thousand downloads. This App covers feeding management for cattle and buffalo, breeding management, diseases, and their control management, production technology, calf management, general care for cattle and buffalo.

Conclusion

Mobile applications in agriculture and allied sectors are more likely to see further integration and dependence. The use of information technology tools that are easily accessible, farmer-friendly, and generally inexpensive in agriculture has dramatically altered the production-consumption interface. With the help of these Apps, farmers can make informed decisions well in advance, which has helped amplify production and made agriculture risk-free to a more significant extent.

References

Bhaskar, G., Murthy, L., and Sharma, V.P. (2017). Mobile Apps Empowering Farmers. Extension Digest. MANAGE.01 (02): 01-35.

Kumar, M., & Agrawal, L. (2020). Empowering Farming Community Through Mobile Applications: Changing Scenarios. International Journal of Scientific & Technology Research, 9(03), 4.

Saravanan, R., (2014) (Ed.). Mobile Phones for Agricultural Extension: Worldwide mAgri Innovations and Promise for Future, New India Publishing Agency, New Delhi.

Sarkar,S., Kumar,B., and Kumar,S. (2021). Mobile Applications for Indian Agriculture and Allied Sector: An Extended Arm for Farmers. Int.J.Curr.Microbiol.App.Sci. 10(03): 1913-1920.

Institutional Repositories and their Role in Knowledge Management: A Study of PAU Repository

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Abstract

Higher educational institutions, particularly agricultural universities, have a tripartite mandate which includes teaching, research, and extension. Open access initiatives have resulted in the growth and development of repositories where researchers can share their work for more visibility and impact. Institutional output can be better preserved and widely shared through institutional repositories. Librarians have better skills in managing knowledge; thus, collaborating with IT professionals can play a crucial role in managing and disseminating an institution's research output. In today's time, librarians have also involved themselves in assisting their organizations in demonstrating researchers and faculty impact of their research using conventional and alternative metrics. This article discusses the concept of knowledge management, institutional repositories, and their role as a green route to publication and disseminating institutional knowledge with particular reference to PAU repositories' structure, growth, and development. It is an exploratory study taking into account the repository's genesis, growth, and development. This study helps understand the concept of knowledge management and institutional repositories.

Keywords: Institutional Repositories, Knowledge Management, PAU Repository, Scholarly Communication, Resource Sharing

Introduction

Knowledge builds on existing knowledge, and past events help generate new knowledge. Higher educational institutions are considered knowledge

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houses where information is exchanged between teachers, scientists, researchers, and students, thus resulting in the development of new knowledge. New knowledge can be generated through human efforts during educational and research activities in any institution. The information generated can be shared through books, journal articles, theses, technical reports, case studies, etc. It has become essential for an institution to compile all the intellectual output in one central place for easy access and dissemination.

Open access initiatives have compelled organizations, particularly universities, to manage their intellectual assets for more visibility and impact. Often, it has been observed that generated information or knowledge is unknown to anyone, and it remains grey literature if not properly recorded and managed. Therefore, an institution or university needs to capture its intellectual knowledge produced as a whole and share it with the broader community. Institutional repositories can be the first choice to showcase the performance of an institution if properly developed and managed.

Knowledge Management

Knowledge management is considered a strategic tool in organizational effectiveness, and it has emerged as a vital resource in building economies. Knowledge has an economic value, the stock of which is never finished by its use; instead, the value of knowledge to an economy comes from its sharing with others (Brinkley, 2006). Knowledge management in higher education refers to managing knowledge assets to improve educational performance for more visibility and impact. It involves several processes that call for continuous changing of organizational efforts in anticipation of future demands and threats (Malhotra, 1998). In other words, it is an effort that "links people with knowledge content" (Hayward, 2000).

Knowledge management is a "Systematic process of identifying, capturing and transferring information and knowledge which people can use to create, improve and compete." According to Duffy (2000), knowledge management is a process that enables individuals of an organization to acquire, share and advantage knowledge to desired objectives collectively. Petrides (2003) defined knowledge management as a "set of practices, which help improve data and information sharing in decision-making." Ramanujan and Kesh (2004) defined knowledge management as "an organizational ability to gather, organize, share and analyze the knowledge of individuals and groups across the institution in ways that directly impact performance."

Technology and Knowledge Management

The Internet has changed the way we display information or access data. Knowledge management involves capturing, organizing, accessing, and using desired information, requiring sophisticated hardware and software tools. The processes will respond best if supported by powerful easy to use technologies. Technological support has enabled organizations to transform knowledge from an abstract concept to a tangible and manageable one. Therefore, information and technology have a strong relationship, which helps develop new processes for designing and developing new information cultures.

Knowledge management involves several processes such as creation, capture, organization, access, and use. Knowledge is created through scientific discovery or discussions, which can be lost or not used if not captured, which is possible through technology by documentation, digitization, representation, and storage. The following necessary process in knowledge management is knowledge sharing which is the major pillar and central component of a successful knowledge management process. Nonanka (1995) added that knowledge sharing gives an overall view of an organization as a living organism where everyone is a knowledge worker rather than a machine for processing information. Kidwell, Vander Linde, and Johnson (2000) conceptualized the potential benefits and application of knowledge management in higher education and advocated for portal-based access.

Further, for research-related knowledge management, they were of the view to create a repository for research outcomes. Collaboration plays an essential role in organizational knowledge management (Serban & Luan, 2002). Sharing of knowledge takes place in everyday life in discussions or other forms of social interactions like sharing experiences that can be personal, economic, political, and social. In a learning institution, sharing knowledge can take a seminar, conference, journals article, report etc. As information sharing has reached unprecedented proportions with the use of information communication technologies, it is now possible for any researcher to share their work with others through the central repository of an institution. In higher learning, knowledge management is at the core of its existence, and effective communication of knowledge, whether explicit or tacit, must be there (Ismail, 2012).

There are four barriers to successfully sharing and transferring knowledge: ignorance, adoption, absorptive capacity, and lack of relationship between giver and receiver. Developing an institutional repository or knowledge base for any academic institution will be helpful and economical. Its open-access features will enhance the accessibility to traditional, grey, and institutional knowledge. Developing countries like India have also made good progress in managing their knowledge resources, resulting in repositories like Shodganga, Krishikosh, TKDL, Vidyanidhi, NISCAIR online periodical repository, etc. Further National Digital Library of India is a great initiative to provide free single window access to a vast amount of knowledge.

So, all knowledge management activities encompass how to create (Learning process), disseminate (Sharing), and measure (Intellectual capital) knowledge related assets (Liao & Wu, 2010)

Open Access Initiatives

Open access movement facilitated by digital and network technologies proposes different access models for accessing scholarly content. It provides end-users with access to the content free of charge and frees most copyright and licensing restrictions. As per the Council of Australian University Librarians (CAUL), open scholarship and FAIR (Findable, Accessible, Interoperable Reusable) scholarly practices result in inefficient dissemination of knowledge which facilitates faster scientific discovery and problem-solving.

It refers to online, free of charge access to literature. As per Budapest Open Access Initiatives (BOAI), open access removes price and permission barriers so that any user can freely read, download, copy, distribute, print, and use the content for lawful purposes. Authors have control over the integrity of their work and the right to be adequately acknowledged. Copyright holders can manifest their consent to open access for using one of the creative commons licenses (fair use) and retain the right to block the distribution of misattributed copies. Thus, the mandate for OA as per BOAI and CAUL (Council of Australian University Librarians) is to build infrastructures, such as institutional repositories. Which help in open access and to promote the access of scholarly information and its availability in the public domain without economic restrictions; to collaborate with researchers, authors, research institutions, and publishers to raise awareness regarding open access initiatives and practices; to work for implementation of policies that facilitate fair use of copyrighted material for educational and research purposes.

Objectives of the study

The present study aims

a. To study the role of academic libraries in the development of IR

b. To discuss the growth and development of PAU repositories

c. To study different types of documents in the PAU repository

d. To study the interface features of the PAU repository

The present study is exploratory and will help understand the concept of knowledge management and the development process of institutional repositories. The basic workflow described will provide a better idea scholarly communication process. The reader will have information about repositories developed in agricultural education.

Methodology

The study has been carried out considering the previous studies done in the relevant context. The role of librarians and academic libraries in the development of institutional repositories has been contextualized. Annual reports and websites of the institution under study have been explored to get the desired information to fulfill the study's objectives.

Institutional Repositories and KM

Open access to the institution's scholarly output contributes to vital academic good, which ultimately determines the prestige and reputation of an Institution. Institutional repositories provide a platform for processing scientific works, which further develops a new dynamic range of knowledge. It further empowers institutes to control their research outputs while ensuring accessibility in open- access. Institutional repositories of any institution provide an opportunity to share its intellectual wealth with a community of scholars and a place for the long-term preservation of scholarly content (Prosser, 2003). Marsolek et al. (2018) further added that I could make a substantial difference in ensuring grey literature's preservation, increasing its reach, and, in many cases, providing a form of legitimacy to these items published outside traditional realms.

Crow (2002) defined institutional repositories as "digital collections that capture and preserve the intellectual output of university communities." It is a new scholarly publishing paradigm that adds more to the visibility and prestige of an institution

Lynch (2003) defined IR as "An institutional repository is an organization-based set of services that the organization offers to the community members to manage and disseminate digital materials created by the institution and its community members. It is most essentially an organizational commitment to the stewardship of these digital materials including long term preservation where appropriate as well as organizational access and distribution". In other words, it is the database of scholarly recorded material for long term preservation using OAI-compliant software to collect, store, preserve and disseminate scholarly material in digital form among the academic communities

It is clear from above that an institutional repository is an excellent platform for knowledge sharing and preservation. Institutional Repositories are being created to manage and preserve digital assets of intellectual output and the cultural heritage of an institution. Faculty, students, and administrators can archive their material for preservation and future access. It may be limited to one department, Institution, or consortia of several institutions. Collaboration through consortium helps in cost reduction and enhanced access to digital content. It may include preprints, post-prints of journal articles, technical reports, theses and dissertations, annual reports, teaching-learning material, works of art, photographs, video recordings, etc. Institutional Repositories have gained acceptance in the academic community by enhancing access to scholarly content. An essential contribution of the IRs is that it preserves traditional scholarly material by empowering faculties to contribute their research articles.

The services of academic libraries have transformed with the application of the Internet and digital technologies. These are not limited to the library's four walls, but anyone from anywhere can access its resources with a click of a button. In his study, Robertson (2010) revealed that librarians could offer better guidance to organizations, researchers, and students as they are occupied in open educational resources through metadata management, resource description, and information literacy and promoting open licensing. They have redefined their role primarily from supporting teaching and learning to increased emphasis on research support services by spreading awareness about research and publication ethics through literacy programs of an institution. Agate et al. (2017) opined that librarians involved in scholarly communications must move beyond the limited set of standard publication types towards a wide range of more complex research output so that grey literature finds a place in library strategies despite its evidence high value to communities. Librarians know about the possibilities of open educational resources and assume their role in promoting the same use. Institutional repositories thus can be one of the services organized by the library to manage and serve digital information created by the community to be served (Oguche, 2018). Digital preservation is the essential purpose of Institutional Repositories, which have gained acceptance in the academic community to enhance access to scholarly content. Libraries can play an essential role in the creation and management of institutional repositories, which contribute significantly to the dissemination of knowledge (Nurdin & Mukhlis, 2019).

The main aspects of the implementation of institutional repositories are (i) Development of scientific work which calls for policy regulation about the mandatory deposition of softcopy of the scholarly work in a desirable format in the library (ii) Processing of scientific work means validation of the work based on technical aspects by the library (iii) Promotion and dissemination of IRs in increasing its visibility and access through library outreach programs and social networking sites. The development of institutional repositories requires good governance, including processing, promoting, and distributing scholarly works.

There are two ways of capturing knowledge in institutional repositories: Self-archiving and mediated archiving. The workflow of IR begins with (a) publishing or presenting of research work by researcher/Staff (b) Submission of research work in prescribed format (c) Verification & checking for completeness as well as the creation of metadata (d) Review by the administrator and addition in the collection.

Institutional Repositories in Agriculture

ICAR has undertaken various digital initiatives in reforming agricultural education and research: CeRA, Krishikosh, Argoweb, e-krishishiksha, etc. Realizing the importance of organizational knowledge for the growth and development of agricultural education E-Granth subproject was initiated under National Agricultural Innovation Project (NAIP) to develop a platform for providing digital access to a vast amount of information available in the National Agricultural Education and Research system (NARES) of India. Under this initiative digital repository has been developed to capture, digitalize and share organizational knowledge to fulfill the needs of the scientific, teaching, and research community. Further, preserving and providing enhanced access to knowledge already available in print form was also digitalized. Punjab Agricultural University contributes university theses to the krishikosh repository and has also developed its institutional repository by digitizing its scholarly print content.

Krishikosh

The Krishikosh is a unique repository of knowledge in agriculture and allied science. It has a collection of theses, old and valuable books, old journals, institutional publications, technical bulletins, project reports, lectures, preprints, reprints, and other grey literature spread all over the country in different state agricultural universities and ICAR institutes. It provides a software platform for implementing open access policy for individual institutions' self-managed repositories with centralized integration. It is collectively managed centrally aggregated with an integrated search facility. Majorly krishikosh repository comprises of thesis collection of participating institutes. Krishikosh has improved the accessibility coupled with the preservation of content. PAU Library is currently receiving one copy of the Thesis in a CD form which is being checked for completeness of the record in the desired format so that it can be uploaded to the repository. After authentication, the record is uploaded for broader dissemination and access. PAU has majorly contributed Theses towards the KRISHIKOSH collection, and some of the newspaper clippings are also part

PAU Repository

In addition to the central repository of agricultural knowledge PAU has also managed to preserve its institutional knowledge available in the form of old print theses, journal articles, research reports, and other valuable publications by digitizing it with the financial support of ICAR received for digitization of library resources under library strengthening scheme of ICAR. The said repository is full-text campus-wide accessible to teachers, students, and university staff. Digital content has been managed and hosted on the E-Quest platform with all technical support provided by Total Library Solutions Pvt Ltd, New Delhi. The main aim was to preserve the content and enhance access to all teachers, researchers, and other stakeholders. The library received a digitization grant, which helped it convert institutional knowledge accumulated over the years in print form to digital format for easy access. Digitization of library resources was a herculean task for which proper planning and implementation were required. Since the digitization of theses of all SAUs from 2000 to 2007 was already undertaken by CCSHAU, Hisar under the KRISHIPRABHA project, it was decided to digitize first the print theses submitted before 2000 followed by institutional journals and other important institutional publications such as package of practices, newsletters, research reports, and PAU archival publications. PAU repository so developed now has in its collection theses submitted before the year 2000 institutional publications namely Journal of Research (now Agricultural Research Journal), Progressive farming, Changi Kheti, Package and Practices, PAU archival collection, research reports, Newsletters, Bulletin, etc. The interface is very user-friendly, as shown below (Fig 1).

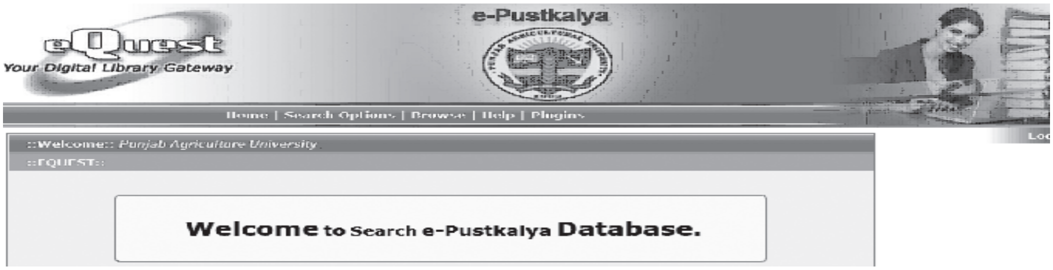

Fig-1 The interface of the PAU Repository

Collection: It has a digitized collection of different types of documents as follows:

- PAU Theses
- Periodicals- Agricultural Research Journal, Progressive farming, Changi Kheti, Horticulture newsletter and Horticulture bulletin.
- The archival collection of PAU such as packages and practices, Handwritten notes, Dr. Randhawa collection and research reports

Search facility: 24449 records are available in the repository, full text searchable in PDF format. PAU repository can be searched collection-wise. Further, Users can browse the theses collection author wise, title wise, and college wise using primary as well as advanced search options (Fig 2)

Fig-2 Search facility

Fig-3 Agricultural research Journal

Full-text digital record: With a single click user can have access to a full-text record (Fig 4)

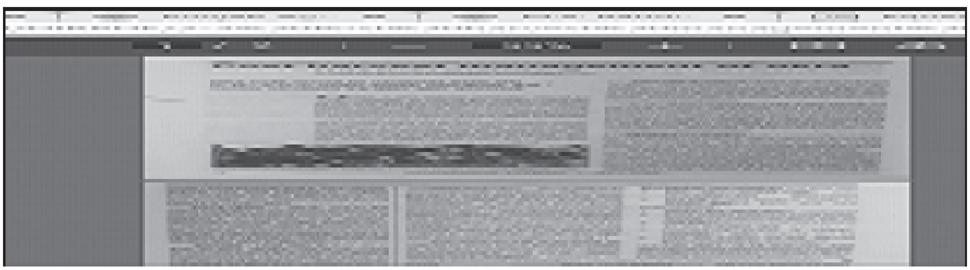

Fig-4 PAU publication full-text record

Conclusion

Institutional repositories contribute immensely to disseminating scholarly knowledge, thus playing a significant role in scholarly communication in the open era. They help preserve and disseminate institutional knowledge. Therefore, proper planning and management of Institutional repositories are necessary for effective knowledge management in institutions of higher learning. Academic libraries are becoming critical players in developing and successfully implementing institutional repositories. Librarians with expertise in publishing and copyright issues collaborate with teachers and researchers for more visibility and impact. They have redefined their role from supporting teaching and learning to increased emphasis on research support services by spreading awareness about research and publication ethics through literacy programs of an institution. Every institution should work towards the growth and development of the repository, be it content type or its promotion and dissemination, so that no one should be deprived of the required information

References

Agate, N., Clement, G., Kingsley, D., Searle, S., Vanderjagt, L., Waller, J., Schlosser, M., & Newton, M. (2017). From the Ground Up: A Group Editorial on the Most Pressing Issues in Scholarly Communication. Journal of Librarianship and Scholarly Communication, 5(1). https://doi.org/10.7710/2162-3309.2196

Crow, R. (2002). The Case for Institutional Repositories: A SPARC Position Paper. https://rc.library.uta.edu/uta-ir/handle/10106/24350

Brinkley, I. (2006). Defining the knowledge economy. The Work Foundation, London.

Duffy, J. (2000). The KM Technology Infrastructure. Information Management Journal, 34(2), 62-62.

Hayward, S. (2000). Choosing Wisely: Technology for Knowledge Management. The Gartner Symposium ITXPO, Orlando.

Ismail, N. A. M. (2012). Key determinants of research-knowledge sharing in UK higher education institutions [University of Portsmouth]. https://researchportal.port.ac.uk/en/studentTheses/key-determinants-of-research-knowledge-sharing-in-uk-higher-educa

Kidwell, J., Linde, K., & Johnson, S. (2000). Applying Corporate Knowledge Management Practices in Higher Education. Educause Quarterly, 23.

Krishikosh: Home. (n.d.). Retrieved January 30, 2022, from https://krishikosh.egranth.ac.in/

Liao, S., & Wu, C. (2009). The relationship among knowledge management, organizational learning, and organizational performance. International Journal of Business and Management, 4(4), 64-76.

Lynch, C. A. (2003). Institutional Repositories: Essential Infrastructure For Scholarship In The Digital Age. Portal: Libraries and the Academy, 3(2), 327-336. https://doi.org/10.1353/pla.2003.0039

Malhotra, Y. (1998). Knowledge management, knowledge organizations & knowledge workers: A view from the front lines. Maeil Business Newspaper, 1-5.

Marsolek, W. R., Cooper, K., Farrell, S. L., & Kelly, J. A. (2018). The Types, Frequencies, and Findability of Disciplinary Grey Literature within Prominent Subject Databases and Academic Institutional Repositories. Journal of Librarianship and Scholarly Communication, 6(1), Article 1. https://doi.org/10.7710/2162-3309.2200

M.S. Randhawa Library. (n.d.). Retrieved January 30, 2022, from https://www.pau.edu/msrlibrary/

Nonaka, J. & Takeuchi, H. (1995). The Knowledge-Creating Company, Oxford University Press,New York, USA, 1995

Nurdin, L., & Mukhlis, S. (2019). Institutional repository as an information infrastructure for scholarly communication: An exploratory study in Indonesia. Malaysian Journal of Library & Information Science, 24(3), 101-114.

Oguche, D. (2018). The state of institutional repositories and scholarly communication in Nigeria. Global Knowledge, Memory, and Communication, 67(1/2), 19-33. https://doi.org/10.1108/GKMC-04-2017-0033

Petrides, L. A., & Nodine, T. R. (2003). Knowledge management in education: defining the landscape. Available at https://eric.ed.gov/?id=ED477349

Prosser, D. (2003). Institutional repositories and open access: The future of scholarly communication. Information Services and Use, 23 (2-3), 167-170

Ramanujan, S., & Kesh, S. (2004). Comparison of knowledge management and CMM/CMMI implementation. Journal of American Academy of business, 4(1/2), 271-275

Roberston, R.J. What do academic libraries have to do with open educational resources Theme: Long term sustainability of open education projects. In Open Ed 2010 Proceedings. Barcelona:UOC, OU, BYU. November 2010, 2-4

Salmon, F. and Smart, C.A. 2012. The role of the academic library in facilitating scholarly communication. Caribbean Quarterly, Vol. 58, no. 2/3: 67-78

Serban, A. M., & Luan, J. (2002). Overview of knowledge management. New directions for institutional research, 2002(113), 5-16 https://www.caul.edu.au/programs-projects/advancing-open-scholarship-fair

Effectiveness of Agricultural Knowledge Disseminated on Social Media

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Abstract

Knowledge is a primary invisible input in the agriculture production process. Knowledge helps farmers in deciding on a wide range of farm activities, i.e., selecting the crop for production to final selling the produce. The agriculture research and extension institutes constitute a significant source of agricultural knowledge and information. They are using all information dissemination methods to bridge the information gap among farmers. Social media platforms are dominating agricultural information dissemination platforms at the field level. The present study is conducted to study the effect of agricultural information on farmers' knowledge levels. The Ex-post facto research design was adopted for the study with a sample of 120 respondents, covering all three erstwhile districts from the Southern Telangana Zone of Telangana state.

Keywords: Social Media, Agricultural Knowledge Management, Agricultural Information.

Introduction

The present age is termed as Information age, where information is treated as a vital and powerful tool of socio-economic development, no less important than land, labor, and capital towards the empowerment of people towards attaining sustainable development. Sustainable development depends on attitude towards information, information sharing, and proper

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information consumption. (Sinha, 2018). ICAR institutes, SAU's, the Ministry of Agriculture and Farmers Welfare, GOI, state departments of agriculture, Ministry of Rural Development, state development departments, and voluntary organizations are the institutes that carry out first-line extension work in India. The extension worker to farmer ratio is low in India, which may be one of the main reasons for the delay in reaching the latest farm information.

Therefore, the information delivered by extension agents should be need-based. It is impossible with the traditional extension system, as farmers are spread in large areas and located in distant locations. Traditionally, agricultural information dissemination was dominated by mass media channels, i.e., newspapers, radio, television, and farm magazines, to reach many farmers. The way of communication is changing day by day, and the advancement in Information Communication Technologies (ICTs) revolutionized communication. However, technology awareness and digital literacy have been increasing among farming communities in all demographics in recent years. Various forms of social media are being used more and more by farmers searching for news, education, and other information in day-to-day life for agricultural development.

Social media is one of the latest ICT technologies that revolutionized the way of communication in the 21st century. Its usage is inevitable in the current decade, and agriculture is not an exception. Social media usage made communication faster, cheaper, and timely information to receivers. WhatsApp, Facebook and YouTube are more familiar at the field level among all social media platforms; extension personnel should develop content accordingly to reach farmers more effectively through these social media platforms (Sandeep et al.).Social media platforms like WhatsApp were familiar in the field level to connect farmers with other farmers and local extension personnel. Networking platforms like Facebook are familiar with connecting farmers' networks, and YouTube channels disseminate significant amounts of farm information in video format to benefit the farm community. With this brief background, the research is taken to study the effectiveness of agricultural information disseminated through social media platforms regarding the extent of knowledge on agricultural technologies disseminated through selective social media platforms.

Methodology

Ex-post-facto research design was adopted for the investigation, and data was collected in 2020. The Southern Telangana Zone (STZ) was selected purposively based on the teledensity. The Southern Telangana Zone was purposively selected based on the pre-research visit, teledensity, and farmer population. All three districts of the Southern Telangana Zone were selected purposively for the study. All three viz., Mahaboobnagar, Nalgonda, and Rangareddy (Erstwhile districts), were selected for the study. Two mandals from each district were selected randomly, and two villages from each Mandal were selected using a simple random sampling procedure. For the last three years, ten farmers were selected purposively from each village based on having active accounts on selected social media platforms (YouTube, Facebook, and WhatsApp).

Thus, the total sample constitutes the sample size of one hundred and twenty (120) farmers. Knowledge is generally understood as an intimate acquittance of an individual with facts. Knowledge is a body of understood information possessed by an individual or culture. Knowledge plays a vital role in an individual's covert and overt behavior. (English and English). In the present study, the extent of knowledge was operationalized as the degree of production technologies of agriculture (Crop production, crop protection, agriculture marketing, climate-resilient agriculture, post-harvest management, and government policies) known to respondents using social media as a source for an agriculture information source. The extent of knowledge level data was collected with the help of personnel interviews conducted during 2020. The respondents were categorized into low, medium, and high by their respective score percentages. Based on the scores obtained on 35 items of five different categories of agricultural production technologies, knowledge percentages (obtained score/total score X 100) were calculated, and ranks were given accordingly.

Distribution of respondents based on their extent of knowledge of agriculture technologies

From Table 1, it can be observed that the majority of the respondent's levels of the extent of knowledge before intervention with social media is found to be low (72.50%), followed by medium (26.67%) and high (0.83). In comparison, the majority (51.70%) of the respondents had a low level of extent of knowledge followed by medium (42.50%) and high (5.80%) after the intervention to social media.

Table-1 Distribution of Respondents According to their Extent of Knowledge

S. No	Extent of knowledge	Before intervention (n = 120)		After intervention (n = 120)	
		F	%	F	%
1.	Low (Up to 33.33%)	87	72.50	62	51.70
2.	Medium (33.33 - 66.66%)	32	26.67	51	42.50
3.	High (Above 66.66%)	1	0.83	7	5.80
	Total	120	100.00	120	100.00

Difference between the extent of knowledge of respondents before and after the intervention to social media

It was evident from Table 2 that the calculated 'Z' value (8.76) was more significant than the table 'Z' value at 0.01 level of probability. It could be concluded that there exists a difference between the extent of knowledge on agriculture technologies before and after the intervention on social media platforms. It can be depicted that farmers using social media gained knowledge of agriculture technologies by using social media. The results are in agreement with Madan (2017).

Table-2 Difference between the extent of knowledge of respondents before and after intervention to social media (n = 120)

S.No	Category	Size of sample	Mean	S.D.	'Z' Value
1.	After intervention	120	60.39	9.05	8.76**
2.	Before intervention	120	49.96	9.40	

Distribution of respondents according to their extent of knowledge in each category before intervention with social media

To determine the extent of knowledge had by respondents, knowledge is divided into five categories. In each category, the respondents were grouped into low, medium, and high levels of the extent of knowledge groups based on the percentages in each group by using the class interval technique. The analyzed data contained in Table 3 revealed that (50.84%) of the respondents had medium-level knowledge of production technologies and practices, followed by low levels (48.33%) and high (0.83%). The knowledge percentage attained was 35.21; hence this category was accorded the first position in the order. The results further indicate that (65.00%) of the respondents had low-level knowledge of post-harvest, schemes, and modern concepts, followed by medium (34.17%) and high (0.83%). The knowledge percentage attained was 25.83; hence this category was accorded the second position.

Regarding the protection technologies and practices, it was observed that (80.00%) of respondents have a low level of extent of knowledge followed by a medium (20.00%). The knowledge percentage obtained was 13.10; this category was ranked third in the order. Regarding the extent of knowledge on climate-resilient agriculture technologies and practices, it was observed that the majority (85.84%) of respondents were had a low level of knowledge followed by medium (13.33%) and high (0.83%). The obtained knowledge percentage was 12.92; Hence, this category was the fourth position. The study further indicated that (84.20%) of the respondents had insufficient knowledge of the agriculture market, followed by medium (15.80%). The knowledge percentage obtained was 10.24; hence this category was accorded the fifth position in the order. Therefore, it can be concluded that nearly three by four of the respondents had a low level of the extent of knowledge, and one by fourth had a medium level before intervention with social media. The possible reason could be that most of the respondents were young and had low farming experience.

Table-3 Distribution of respondents according to their extent of knowledge before intervention with social media (n = 120)

S. No	Categories	Groups	C.I.	F	%	Knowledge percentage	Rank
1.	Crop Production technologies (Items-10)	Low	<33.33%	58	48.33	35.21	I
		Medium	33.33-66.66%	61	50.84		
		High	>66.66%	1	00.83		
2.	Crop protection (Items-7)	Low	<33.33%	96	80.00	13.10	III
		Medium	33.33-66.66%	24	20.00		
		High	>66.66%	00	00.00		
3.	Agriculture marketing (Items-7)	Low	<33.33%	101	84.20	10.24	V
		Medium	33.33-66.66%	19	15.80		
		High	>66.66%	00	00.00		
4.	Climate resilient agriculture practices (Items-4)	Low	<33.33%	103	85.84	12.92	IV
		Medium	33.33-66.66%	16	13.33		
		High	>66.66%	1	00.83		
5.	Post-harvest management and government policies (Items-7)	Low	<33.33%	78	65.00	25.83	II
		Medium	33.33-66.66%	41	34.17		
		High	>66.66%	1	00.83		

Distribution of respondents according to their extent of knowledge in each category after the intervention to social media

The analyzed data contained in Table 4 indicates that 72.50 percent of the respondents had medium-level knowledge of post-harvest, schemes, and modern concepts, followed by low (25.00%) and high (2.50%). The knowledge percentage attained was 43.69; hence this category was accorded the first position. The study further revealed that 85.00 percent of the respondents have medium-level knowledge of production technologies and practices, followed by low (11.70%) and high (3.30%). The knowledge percentage attained was 42.50; hence this category was accorded the second position in the order. Regarding the protection technologies and practices, it was observed that 58.40 percent of respondents have a low level of extent of knowledge, followed by medium (35.80%) and high (5.80%). The knowledge percentage obtained was (35.24%) and hence this category was ranked the third position in the order.

Regarding the extent of knowledge of climate-resilient agriculture technologies and practices, it was observed that the majority (67.50%) of respondents had a low level of knowledge followed by medium (29.20%) and high (3.30%). The obtained knowledge percentage was 26.98; hence this category was the fourth position. The study further indicated that 70.00 percent of the respondents had insufficient knowledge of the agriculture market, followed by medium (28.30%) and high (1.70%). The knowledge percentage obtained was 26.31; hence this category was accorded the fifth position in the order. Therefore, it can be concluded that nearly half of the respondents had medium to high-level knowledge, and the rest half had a low extent of knowledge after the intervention with social media.

Table-4: Distribution of respondents according to their extent of knowledge after the intervention to social media (n = 120)

S. No	Categories	Groups	C.I.	F	%	Knowledge percentage	Rank
1.	Crop Production technologies (Items-10)	Low	<33.33%	14	11.70	42.50%	II
		Medium	33.33-66.66%	99	85.00		
		High	>66.66%	4	3.30		
2.	Crop protection (Items-7)	Low	Below 33.33%	70	58.40	35.24%	III
		Medium	33.33-66.66%	43	35.80		
		High	>66.66%	7	5.80		
3.	Agriculture marketing (Items-7)	Low	<33.33%	84	70.00	26.31%	V
		Medium	33.33-66.66%	34	28.30		
		High	>66.66%	2	1.70		
4.	Climate resilient agriculture practices (Items-4)	Low	<33.33%	81	67.50	26.98%	IV
		Medium	33.33-66.66%	35	29.20		
		High	>66.66%	4	3.30		
5.	Post-harvest management and government policies (Items-7)	Low	<33.33%	30	25.00	43.69%	I
		Medium	33.33-66.66%	87	72.50		
		High	>66.66%	3	2.50		

Conclusion

Hence, from the above results, it could be inferred that there is increase in farmers' knowledge after intervention than before intervention to social media. The extension system of SAUs and the department of agriculture can work on content development and disseminate information to farmers on social media platforms. The probable reason for farmers' low and medium knowledge on agriculture production technologies may be poor knowledge about agriculture marketing and plant protection. Agricultural marketing and plant protection are the primary areas where the farmers lack the knowledge and extension system can focus more on disseminating MSP of different crops, availability of agriculture inputs, and market news for better fetching of price for the produce. Provision of more local weather information about pest and disease incidence, selective plant protection practices with an accurate dosage of application and information on the advantage of soil test-based application to farmers will help better overall management in producing optimum yield from the field.

References

English, H. B., English, A. C., & English, A. H. (Champney). (1958). A Comprehensive Dictionary of Psychological and Psychoanalytical Terms: A Guide to Usage. Longmans, Green.

Madan, M. R. K. (2017). Impact of mobile phone-based advisory services on cotton farmers. Professor Jayashankar Telangana state Agricultural University.

Sandeep, G. P., Prashanth, P., Sreenivasulu, M., & Madhavilata, A. (2020). Social Media in Agriculture - A Profile Analysis. International Journal of Current Microbiology and Applied Sciences, 9(7), 2727-2736. https://doi.org/10.20546/ijcmas.2020.907.322

Sinha, A. K. (2018). Information Seeking Behaviour and Role of Mass Media in Socio-economic Empowerment of the Santals of Birbhum, West Bengal | International Research. International Research Journal of Library and Information Sciences, 8(2). https://irjlis.com/information-seeking-behaviour-and-role-of-mass-media-in-socio-economic-empowerment-of-the-santals-of-birbhum-west-bengal/

Importance of Social Media in Agricultural Outreach Activities

Mayur Verma[1] and Yogesh Sharma[2]

Abstract

The use of social media in information exchange has enormous potential. However, there is considerable skepticism about its use for farm extension education activities; therefore, documentation of its current use for communicating farming-related information is vital. This study outlines social media's current and prospective users in the agricultural and extension sectors.

Keywords: Agriculture Extension, Social Media, Facebook, Twitter.

Introduction

The scale, sustainability, and impact of agricultural extension services in India are restricted. Public extension programs reach only 6.8% of farmers on average. According to the NSSO (2014), 40.6 % of households got extension help, with just 11% of services provided by physical government machinery extension agents, agricultural science facilities, and agricultural universities. There is a need to close this gap by introducing new agricultural extension service delivery modalities with the help of Information and communication technology (ICT) precise, timely, relevant, and high quality information services. A fundamental concern for the country is that sustainable agriculture production necessitates current and relevant information from professionals in this industry.

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Web portals, telecenters, mobile telephony, and hybrid projects are examples of ICT-based agricultural applications (ICTs with traditional extension elements). In India, the mass media, including the internet, is currently the second most important source of relevant information for farming households. Social media is yet another ICT-based instrument that, while primarily used for amusement, has enormous potential for application in information exchange and collaboration, even in agriculture (Goyal, 2011). These ICT devices are generally simple to use and have become increasingly popular in the agricultural sector (Saravanan and Bhattacharjee, 2016). Social media has enormous potential for usage as a tool for communication and networking in the farming sector.

What is Social Media?

Social media refers to internet-based digital tools that allow people to share and discuss information. It refers to user-generated content such as information, opinions, video, audio, and multimedia shared and discussed over digital networks. (Andres and Woodard, 2013). According to Michelle Chmielewski (2011), social media is about what we do or say collectively, globally, to communicate in all directions using whatever digital technologies are available, rather than what we do or say individually.

Table -1: Types of Social Media Platforms and their brief description

Social networking sites	Facebook, Friendster, MySpace, Google+	These platforms are mainly used to build personal profiles and networks with friends, co-workers, and peers. Because of their reach, they are the most popular sort of social media network and have the most reach.
Blogs and vlogs	Blogger, WordPress	They are mainly personal web pages, although corporations are increasingly utilizing them to reach out to their customers. Blogs have a lot of media, but vlogs don't have as much.

Micro-blogs	Twitter, Instagram	They are similar to blogs but have a character limit (240 for Twitter) and let users produce and share information in different formats.

Commonly Used Social Media Tools in Agricultural Extension

In recent years, the usage of social media in the agriculture sector has gained importance, with only prominent platforms such as Facebook, Twitter, and YouTube being used for agriculture and extension-related activity. WhatsApp is another popular tool for extension experts to engage with peer or client farmers.

Facebook

With over 1.87 billion monthly active users, Facebook is the most popular social networking platform globally, which means extension professionals have many opportunities. Individuals, professional networks, and extension organizations use Facebook as an extension tool.

Twitter

With 320 million users, the microblogging service Twitter is one of the world's most popular social media platforms. It has been one of the primary catalysts for forming public attitudes and organizing people into organizations in a social environment. It is also one of the most popular platforms in agriculture.

YouTube

It is a video-sharing platform to give everyone a voice and show them the world. Four values were founded on it: freedom of speech, knowledge, freedom of opportunity, and belongingness. Users can submit and watch videos, and there are options for sharing and commenting on them and the ability to subscribe to other users' subscriptions. Since its acquisition by Google, YouTube has extended beyond the website to include mobile apps, network television, and connecting to other services.

Table - 2: Examples of how Social Media can be used in Agriculture

Facebook By Farmers		
Livestock Information and Marketing Enter (https://www.facebook.com/groups/Livestock.TN/)	Members of this group (farmers, extension employees, scientists, market functionaries, customers, local leaders, and others) communicate information about livestock production, management, and marketing. There is also a Facebook page dedicated solely to livestock marketing.(https://www.facebook.com/Livestock.Market	Agricultural stakeholders involved in livestock.
By Extension centers		
Krishi Vigyan Kendra, Namakkal (https://www.facebook.com/krishi.namakkal)	Through this account, Krishi Vigyan Kendra, Namakkal conveys information about farmer training programs, input availability, etc.	KVK subject matter experts, farmers, and agricultural stakeholders.
Twitter By Farmers		
AgChat (https://twitter.com/agchat)	The AgChat (AgChat Foundation's Twitter online discussion group) was founded in 2009 by a group of American farmers and is widely used in the United States, United Kingdom, Australia, New Zealand, and Ireland to facilitate discussions of industry issues between farmers and agribusinesses.	Farmers, entrepreneurs, Farm product consumers.
YouTube		
Farming First (https://www.youtube.com/user/FarmingFirst/)	This channel showcases the mission of Farming First- a global network of 131 Organisations, prioritizes natural resource protection, information sharing, local infrastructure, harvests, market access, and innovative research.	Policymakers, scholars, agriculturists, and practitioners.

Conclusion

In India, major social media platforms such as Facebook, WhatsApp, and YouTube are used for knowledge delivery and sharing across several agriculture subsectors (crops, horticulture, dairy, and goat husbandry). The majority of them are the result of individual efforts. There is a distinct dearth of structured efforts to exploit social media by the public extension system in India. The Minister of Agriculture in India has a Facebook account and recently used Facebook to answer public questions (Statesman, 2016), a huge step forward in increasing social media usage.

References

Ajay Mamgain, U. J. (2020). Impact of Social Media in Enhancing Agriculture Extension. Agriculture & Food:E- Newsletter, 02(09), 367-370.

Andres, D. and Woodard, J. (2013). Social media handbook for agricultural development practitioners. USAID and FHI.

Bank, W. (2016). World Development Report 2016: Digital Dividends. . Washington, DC.

Chander, D. T. (2018). Use of Social Media in Agricultural Extension: Some Evidences from India. International Journal of Science, Environment, 07(04), 1334 - 1346.

Chmielewski. (2011). 30 social. Retrieved from http://heidicohen.com/social-media-definition.

GFRAS. (2012). Fact Sheet on Extension Services. Position Paper. Global Forum for Rural Advisory Services (GFRAS) June 2012.

Goyal, A. (2011). ICT in Agriculture Sourcebook: Connecting Smallholders knowledge, Networks, and Institutions. Washington D.C.: World Bank.

NSSO. (2014). Key Indicators of Situation of Agricultural Households in India, NSS 70thRound, Ministry of Statistics and Programme. New Delhi.: GOI.

Saravanan, R. a. (2016). Social media policy guidelines for agricultural extension and advisory services GFRAS Interest Group.

Statesman, T. (2016). Future of agriculture in India is great, says Mohan Singh, May 30. New Delhi, India. Retrieved from http://www.thestatesman.com/news/latest-headlines/future-of-agriculture-in-india-is-great-says-mohan-singh/145538.html

Suchiradipta Bhattacharjee, S. R. (2016). Social media: Shaping the future of agricultural extension and advisory services. GFRAS Interest Group on ICT4RAS, (p. 37).

E-Extension / E-Agriculture and Role of Library and Information Centers

Manoj Kumar[1]

Abstract

Information has always been an essential element in all the time in our society. We need information to decide and do the right thing at the right time. Information technology does not have only changed our lifestyle but also the way of dealing with agriculture. As information is affecting agriculture like other sectors, the role of libraries and information centers has increased. Information has become a key instrument to improve and change the course of action. Traditionally, the agriculture sector was full of uncertainty, but with the help of information, we can drastically change the result and impact in modern times. This paper outlined some significant points to describe the role of libraries and information centers and the current developments of technologies, in the context of e-extension or e-agriculture and their impact on the farmers.

Keywords: E-Extension, e-Agriculture, Libraries, Information Centers, ICT, Agricultural Development.

Introduction

In modern society, the role of libraries and information centers has become crucial. Due to the tremendous advancement of information communication technology (ICT) and web-based services, information centers and libraries have drastically changed their course of action, dealing with their holdings and the medium of interaction with the users. They are now user-oriented,

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now they are more accessible in remote areas through internet-based technology.

Library holds books, periodicals, literary materials, newspapers, pamphlets, print-non print materials, audio-visuals, artifacts, and reference sources. Dr. S R Ranganathan described the libraries through his five laws of library science as a public institution with the core of the collection of books and bound the libraries to make them accessible to those who require to use them.

The library's primary purpose is to provide services to society and work as a powerhouse. It collects the information in hard or soft copies, audio-visual, or other forms and disseminates it to promote education, culture, research, and ultimately enlighten society. An information center can be defined as an organization that selects, acquires, stores, and retrieves information in response to requests; prepares abstracts, extracts, indexes of information; disseminates information in anticipation and response to the request.

Information centers are attached to highly specialized research and development organizations. An information center provides various services such as referral service, literature search, translation, bibliographies, abstracting to its user. We know these centers around us as data centers, information analyzing centers, data banks, clearinghouses and others.

E-extension is defined as the extension over cyberspace, using the power of online networks, computer communications, and digital interactions with multi-media to facilitate and disseminate agricultural technology. In general, it includes transferring information, knowledge, and technology from research systems to farmers, advising farm families in their decision-making, educating and empowering farmers to clarify and realize their potential and goals. In this way, we can say that agricultural extension uses modern communication techniques instead of traditional methods.

The e-Extension has various dimensions, and timelines and quickness are among them. As agricultural operations are time-bound and uncertainty is always associated, e-Extensions intervention is the fastest and most reliable means of delivering extension services to farmers. e-Extension can only be a means to seek information that is also valuable agricultural inputs from online agricultural stores. The services of e-Extension cannot overtake the traditional method of agriculture fully, but it can help the farmer make the right decision at the right time to gain much.

Information and communication technology (ICT) in agriculture plays a vital role in e-Extension services; it enhances agricultural activities through ICT application. Information and communication technology includes devices, networks, software, machines, mobile services, and other applications. ICT in agriculture has been developed and tested worldwide to help farmers and agro companies improve agricultural productivity and income, reduce risks, and facilitate mechanized production. It is a global community of practice where people from all over the world exchange information, ideas, and resources related to the use of information and communication technology for sustainable agriculture and rural development.

We know that e-Extension services are vital in the growth of agriculture and for fulfilling the food demand, but at the same time, there are many challenges associated with it. These are Food security, climate change, and sustainable development of agriculture with limited natural resources such as groundwater, energy and land.

When we disseminate knowledge or information through any platform like information centers, mobile Agriculture, agriculture knowledge resources, digital libraries repositories for agricultural knowledge management, ICT at the grassroots level, libraries are playing central role by providing authentic knowledge. e-Extension services can use e-resources to forward practical problems to research institutes and use the same tools to access information from various sources, including libraries and research institutes. Library also provides services and facilities to support training, teaching, research, and consultancy programs through their resources in any organization. They also allow access to various databases according to the user's demand, for example, PROWESS, commodities, and India Stat in the agricultural domain. Current Awareness Services (CAS) and Selective Dissemination of Information (SDI) services are some of the essential services of libraries.

On the other hand, the information center includes various services such as referral services, literature search, translation, bibliographies, abstracting, and literature search services. They are assisting the use of the information resources. At present, libraries and information centers provide services like mobile libraries or libraries on wheels, institutional repositories, Research portals, Kisan Gyan Portal, Agri-tech portals, Weather portals, information kiosks, Kisan podcast.

Nowadays, libraries and information centers are being well equipped with ICT. Thus, the role of these centers is equally important as the IT sector. ICT has become a bridge between user and information and brings user and knowledge together. Now we can access and disseminate information from anywhere, which is also essential in the agricultural sector. E-extension is an emerging field focusing on improving agricultural and rural development through information dissemination. E-extension involves conceptualizing, designing, developing, evaluating, and applying innovative ways to use information and communication in rural areas, focusing primarily on agriculture. (Singh et al., 2015).

Information centers are core participants to provide information on E-extension. Despite the efforts of teaching and training, still, more than 50 to 60 percent of farmers are away from these facilities. Here, the role of information centers is very crucial. ICT-enabled e-Extension initiatives like AGRISNET, AGRI business centers, e-Krishi Vipnan, Kisan Call Centers, Query Redress Services, Decision Support Systems, dissemination of weather warning information, etc., are essential information sources for all formers. The Village Knowledge Centers, successful initiatives like Gyandoot in Madhya Pradesh, Esagu system in Hyderabad, Gyan Ganga

Project in Gujarat, Bhoomi Project in Karnataka, AGMARKNET, and e-Chaupal Project are some examples in the agriculture sector where E-extension services are playing key role synching with libraries and information centers. (Pradhan, 2015)

Libraries are assisting the effort of E-extension by acquiring, processing, storing, and disseminating information. They undertake the dissemination of information and educational knowledge to assist rural farmers, information repackaging, changing the attitude of farmers towards the use of libraries, acquire relevant information in the library and improve information literacy, etc.

It is imperative to know information and communication technology to synch with the current information medium. Nowadays, information can be quickly and easily accessed through the web. Mostly, the farmers have not attended school and cannot read, write, or even speak the universal language like English. Most information is available in English, which becomes a massive hurdle for non-English-speaking communities. In the above background, we need to develop a system which suits us. Currently, Government and private sectors provide the facilities and training through satellite-based services. National agriculture policy also emphasizes the use of information through technology for reaching the goals and development of agriculture.

ICT plays a vital role in agricultural marketing. It can be helpful for farmers to make the correct decision and make more profit. Farmer can be guided about soil health profile, consisting of organic matter, pH value, nitrogen, phosphorous, and other elements. Such information can be obtained from information centers and broadcast through radio, TV, and new ICT tools.

Conclusion

The agricultural sector is facing many challenges like drought, groundwater scarcity, climate change, low-income challenges, inadequate irrigation facilities, land mismanagement, etc. However, the most critical issue is the lack of awareness and information. Agencies like the Ministry of Agriculture, research institutes, autonomous and private bodies are constantly sorting out these issues. The role of libraries and information centers has become crucial in disseminating right information to the doorsteps of farmers.

References

Pradhan, L. M. (2015). E-agriculture: A Golden Opportunity for Indian Farmers. IRD India.

Singh, K. M., Kumar, A., & Singh, R. K. (2015). Role of Information and Communication Technologies in Indian Agriculture: An Overview (SSRN Scholarly Paper ID 2570710). Social Science Research Network. https://doi.org/10.2139/ssrn.2570710

Use of Social Media for Marketing of Agricultural Products Among Agricultural Producers in Lakhimpur District in Assam: A Study

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Abstract

This study aims to know the use, purpose, importance, and problems the farmers face in marketing agricultural products through social media. For this study, 124 farmers are selected as the research sample. The findings of this paper showed that the most preferred social media among farmers are Youtube and WhatsApp. Samples under study use social media to promote agricultural products and share photos and videos relating to agricultural produces. A structured questionnaire was distributed to the respective farmers in the Lakhimpur district.

Keywords: Social Media, Agricultural Marketing, YouTube, WhatsApp, Farmers, Agricultural Products.

Introduction

Agriculture is a significant term associated with our life. Agriculture shapes our life. From the morning till night, we eat Agri products. Without agricultural products, we cannot exist. However, during lockdown, people faced problem to get required agricultural and food products on daily basis. At that crucial time, we continuously search on social media to catch agri-vendors who supply agricultural products at our doorstep. Facebook, Twitter, Whatsapp, Instagram, Youtube, etc., are widely used social media tools for this purpose.

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Agri products growers and vendors also use these social media tools to reach their customers during the lockdown. The Agri products grower and vendors widely use Facebook, Twitter, Whatsapp, Instagram, Youtube, etc., to market their products. The use of social media is getting more popular among agricultural producers and vendors. India's well-established company Bharat Sanchar Nigam Limited(BSNL) launched the "Mahakrishi Plan" to help the farmers. Social media is a tool through which one can communicate with customers directly to sell or market their products. Social media helps agricultural producers to create and share information with their customers.

Social media also create an atmosphere among agricultural producers to get instant feedback about their products. Nowadays most widely used smartphones develop a communication chain between farmers and customers. Social media has achieved increasing popularity day by day and has become a vital tool among all levels and all types of users.

During lockdown, farmers use social media to promote and sell their products door to door. Social media minimizes the geographical distances and help farmer grow their business. Social media provide a better solution to the problem of agricultural marketing. Mainly farmers use social media to create awareness among customers about their agricultural products, each product's price, availability, delivery options, etc. Social media provide a platform for the farmers to create their groups, pages, blogs, vlogs, communities to sell and market their products. The farmers create images, videos, and other links to connect with their customers. These activities facilitate the farmers to market their agricultural commodities and develop a vast network with customers.

What is Social Media

Social media can be defined as a web-based service through which one can create

1) Public or semi Public profile within a bounded environment
2) Communities with whom they can share information.
3) View connections made by the account owner or other friends, review the list, and change the setting within the system.

The nature and setting may vary from Facebook to YouTube, Youtube to Instagram, Instagram to Twitter. Whatever the Social Media tool, the primary purpose of Social Media is to create, publish, collaborate and discuss. There are different Social Media tools available, which can be grouped into the following groups-

Facebook: Facebook provides a platform to create users' groups, page, etc., to communicate with other users.

LinkedIn: LinkedIn generally provides a platform to communicate with professionals with the same interest or diverse interests.

Twitter: Twitter can be used to tweet, retweet, share information.

WhatsApp: WhatsApp is also a viral social media to create groups and share product images, videos, and information.

YouTube: Youtube is also a famous social media to share videos, create polls, and post information in the community tab.

Literature Review

Social media minimizes geographical boundaries and provides a platform to share information among people with a common interest. Rhoades and Hall(2007) state that so many blogs cover topics related to agriculture. The article further explains that gratification and satisfaction encourage users to use social media to fulfill their needs. In his article, Conrad Caine(2012) mentions that social media accelerates agricultural marketing, helps understand the consumers through interaction, and increases the sales of agricultural products. Bite, Deshmukh, & Dresel (2017) in their study among farmers and states that using social media for marketing is very useful.

They further added that it saves time and cost for the farmers to get information. Among farmers, Facebook and WhatsApp are the most preferred social media. The farmers rely on official pages, blogs, and groups to access needed information.

Objectives of the Study

The main objectives of the study are:

- To understand how social media helps in agricultural marketing
- To know the use of popular social media among farmers.
- To know the challenges of social media in agricultural marketing.

Research Methodology

The proposed study is descriptive, so a purposive simple random sampling method is used to collect data. The study was conducted among 167 farmers in the Lakhimpur district in Assam. Only 124 farmers actively participated in the research process and provided their responses to the questionnaire distributed among them. The observation and interview methods were also adopted simultaneously wherever necessary.

Analysis and Results

The data collected by the questionnaire method is analyzed and interpreted, and presented in tables. A total of 167 questionnaires were distributed. However, only 124 filled questionnaires were returned and considered for evaluation.

Age-wise Respondents

Table 1 shows age-wise respondents. Among respondents majority 43% of the respondents are between the age group of 40 to 50 years; followed by 23% of respondents whose age is above 50; 18% of respondents are between the age group of 20-30, and only 16% respondents are between 20-30.

Table-1: Age wise Respondents

Age	Frequency
20-30	20(16%)
30-40	23(18%)
40-50	53(43%)
Above 50	28(23%)

Gender wise Respondents

Table 2 shows the gender-wise responses of the respondent. Among all respondents, 97% are Male, and 3% are female.

Table-2: Gender Wise Respondents

Age	Frequency
Male	120(97%)
Female	4(3%)

Education of the Respondents

Education plays a vital role in upgrading our lives, for farmers who are educated and able to use the latest electronic gadget. Among all respondents, 36% of respondents are matric pass, 29% respondents are Higher Secondary pass, 20% respondents are graduates, and 15% respondents are postgraduates. While interviewing the farmers, it was found that all the farmers can operate social media to market their agricultural produce very effectively.

Table-3: Education of the Respondents

Education	Frequency
Matric	45 (36%)
Higher Secondary	25 (20%)
Graduate	36(29%)
Post Graduate	18(15%)

Types of Social Media used by Farmers

In recent years, it has been seen that Facebook and Twitter are the most used social media among people, but the results shown in Table 4 indicate that most of the respondents 100% are using YouTube and Whatsapp most frequently. The next most widely used social media is Facebook 79%, Twitter is used by 60% of users. Only 19.35% of users use other social media to market agricultural products.

Table-4: Types of Social Media used by the Farmers

Social Media	Frequency
Facebook	98(79%)
Twitter	75(60%)
Youtube	124(100%)
Whatsapp	124(100%)
Other	24(19.35%)

Frequency of using Social Media

Table 5 shows the frequency of using Social media among farmers. Moreover, it is depicted from the table that 44% of respondents use social media daily. Only 9% of respondents sometimes use social media.

Table-5: Frequency of using Social Media

Frequency of using Social Media	Frequency
Daily	54(44%)
Weekly	30 (24%)
Forthnightly	29(23%)
Sometimes	11(9%)

Purpose of using Social Media

The respondents were asked about their reason for using social media. Table 6 reveals that 124(100%) respondents use social media to sell or buy agricultural products. 67(54%) respondents use social media to share videos about their Agri products. It is followed by 34(27%) respondents who use social media to share photos about Agri products and 21(16%)respondents said that searching for information is very fast on social media. 13(10%) respondents use social media to find solutions to problems. 11(9%) respondents use social media to seek information. They reveal that information seeking is very fast on social media; instant messaging is another popular purpose among the respondents and 10(8%) respondents use it for general purpose.

Table-6: Purpose of Using Social Media

Purpose	No. of Respondents	Rank
Instant Message	10	7
To sell or buy agricultural products	124	1
To share information	21	4
Information seeking	11	6
To find a solution to problems	13	5
Sharing Photos of Agri products	67	2
Sharing videos about their Agri products	34	3

Problems faced in using social media

Table 7 depicts various problems the respondents face while using social media marketing. The data reveals that 60(48%) respondents express that poor internet connectivity is a major problem whereas, 30(24%) respondents find the problem in the adoption of social media as a tool for marketing, about 22(18%) respondents stated that lack of technical knowledge is a problem, followed by 12(9%) respondents express that people do not show their trust on e- buying and re-selling of agricultural products.

Table-7: Problems Faced In Using Social Media

Flexibility	No. of Respondents	Percentage (%)
Lack of technical knowledge	22	18
Poor internet speed	60	48
Adoption of social media as a tool for marketing	30	24
People do not show their trust in e- buying and e-selling agricultural products	12	10

Findings, Suggestions & Conclusions

The study found that 97% of respondents are male among all respondents, and 3% of respondents are female. The majority of the respondents (43%) are between forty to fifty years of age. In terms of education, 36% of respondents are matric pass, and 15% have a postgraduate degree. YouTube and WhatsApp are the preferred social media among respondents. The study reveals different problems the farmers face, and "poor internet speed" is the common problem among 48% of respondents, 24% of respondents and state that "adoption of social media as a tool for marketing" is another problem. The respondents express that there are various websites of many institutions through which they found important information related to agriculture. It saves their time and cost of searching for information. Again most of the respondents state that many telecom companies provide data packs at lower prices which is beneficial to market their agricultural commodities. Young farmers show faith in using social media to market agricultural products. By applying social media, farmers can interconnect with the customers and sell their products through online orders. Social media help them promote their Agri products and make them more visible to the broader community.

At present, social media is a prevalent medium to communicate with people. Every person uses social media in their day-to-day life for different activities. So, seeing this wide popularity among people, farmers can use these social media to promote Agri products. Social media is an excellent way to interconnect with the customer community. There are different social media available in the market. Farmers need to be judicious in selecting appropriate social media to market agricultural products. Sometimes farmers find it very difficult to utilize social media for promoting agricultural products. In such a situation, they can take help from various agricultural institutions. Moreover, agricultural and other ICT institutions can arrange short-term training for farmers to use different ICT tools. Again, farmers should show their eagerness to handle the new technology swiftly and efficiently for different agricultural activities.

References

Babu, S. C., Glendenning, C. J., Asenso-Okyere, K., & Govindarajan, S. K. (n.d.). Farmers' information needs and search behaviors: Case study in Tamil Nadu, India. IFPRI Discussion Paper 1165, 48. Retrieved February 1, 2022, from https://www.ifpri.org/publication/farmers%E2%80%99-information-needs-and-search-behaviors-case-study-tamil-nadu-india

Bite, B & Deshmukh, A & Dresel, H. (2017). A study on role of social media in agriculture marketing and its scope. Global Journal of Management and Business Research. 17.

Boyd, D. M., & Ellison, N. B. (2007). Social Network Sites: Definition, History, and Scholarship. Journal of Computer-Mediated Communication, 13(1), 210-230. https://doi.org/10.1111/j.1083-6101.2007.00393.x

Conrad Caine (2012). Social Media Excellence 12. University of St. Gallen und Conrad Caine GmbH

Corcoran, Cate T.; Feugere, Stephane (2009), Brands aim to adapt to social media world'. Women's Wear Daily, Vol. 198 Issue 66, p20

Gakuru, M., Winters, K., & Stepman, F. (2009). Innovative farmer advisory services using ICT. The Forum for Agricultural Research in Africa.

Mangold, W. G., & Faulds, D. J. (2009). Social media: The new hybrid element of the promotion mix. Business Horizons, 52(4), 357-365. https://doi.org/10.1016/j.bushor.2009.03.002

Rhoades, E., & Hall, K. (2007). The Agricultural Blogosphere: A Snapshot of New Agricultural Communicators Online. Journal of Applied Communications, 91(3). https://doi.org/10.4148/1051-0834.1247

Use of Social Media in Agricultural Outreach Activities: A Study at CCS Haryana Agricultural University, Hisar

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Abstract

Social media plays a crucial role in this digital era in every human endeavor. The present study aims to evaluate the use of social media and its impact in agricultural outreach activities at Chaudhary Charan Singh Haryana Agricultural University, Hisar. The study found that more than ninety percent of the extension specialists were aware of the social media applications and their use in sharing agricultural information and outreach activities. Further, it was also found that WhatsApp was the most preferred medium of communication among the extension specialists. Social media was used by 36% of the respondents for sharing agricultural information with the farmers' community. It was also suggested that proper awareness and training programs be organized frequently for extension specialists and the farmers' community.

Keywords: Social Media, Agricultural Universities, Agricultural Extension.

Introduction

Agriculture plays a significant role in the growing economy of India. The agriculture sector has also created the highest employment opportunities compared to other sectors. There is a need to share current, relevant, and timely information with the farmers' community for sustainable agricultural development. In this digital era, Information Communication Technology (ICT) plays a crucial role in disseminating information accurately at a greater speed in less cost. Another side, social media, which is a part of the digital revolution, can be used as a communication and social tool to benefit any sector of society. The farmers' community is no exception to it.

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Social media is an ICT or Internet-based platform that helps create and exchange user-generated content, an interactive way of communication. Mayfield (2008) defined social media as "a cluster of new online media having the following characteristic, i.e., Participation, Openness, Conversation, Community, and Connectedness." Thus, it can be said that social media is a collective and online communication channel, which can be used for personal interaction and or content sharing. Similarly, social media has become the main channel of communication in the agricultural sector worldwide. Agricultural information is the backbone of agricultural productivity in various ways, and it acts as an essential source for farming practices.

Agricultural information includes land, labor, Government policies, capital, livestock, new technology, market conditions, supply chain management, transportation channels, etc. Apart from traditional information dissemination channels such as newspapers, television, magazines, public notices, radio, etc., ICT-based information sharing channels are becoming the necessity of the day among the farmers' community. Social media is one of the main media for creating content or sharing information among peers or farmer's communities in this digital era.

Agricultural information sources like extension services, research, and educational institutions disseminate useful information to the farming community to fully utilize the information for better decision-making, take advantage of the market opportunities, and cope with the continuous changes in their production systems. Information is critical in agriculture development because it acts as a tool between stakeholders and serves as a channel for accessing trends and shaping decisions" (Kalusopa, 2005).

ICT applications have tremendously changed the overall scenario of information and dissemination patterns among the agricultural scientists, teachers, students, and farmer's community. Nowadays, social media applications have widely being used by all agricultural stakeholders. Chaudhary Charan Singh Haryana Agricultural University, Hisar is one of

India and Asia's most prominent agricultural universities and has played a significant role in imparting agricultural education, research, and extension activities. A study was planned to know the use of social media in agricultural outreach activities at Chaudhary Charan Singh Haryana Agricultural University, Hisar.

Social Media

In Merriam Webster Dictionary (2017), it is defined that "social media is a form of electronic communication (such as websites for social networking and microblogging) through which users create online communities to share information, ideas, personal messages, and other content (such as videos)."

Social media can be defined as a collection of online communication channels based on the principle of Web 2.0 and is mainly meant for community-based input, social networking, interaction, and content and media sharing. Social media comprises of all the social networking sites like Facebook, Whatsapp, Twitter, Tumbler, Academia.Edu, Wikipedia, Skype, Viber, Hangouts, WeChat, YouTube, Pinterest, Instagram, Hike, Telegram, Blogs, and other communication tools within virtual worlds (Soni, 2016).

Social media is the most recent and emerging form of digital communication in this digital era, and it is a great place to start a conversation, connect with both the young and old generation alike, and get people excited. It has changed the topography of personal communication and taken on the world of professional communication as well. In other words, the creation of social media has revolutionized the way people communicate worldwide. Aided by smartphones, social media is spreading fast across the world. Social networking sites, blogs, socially integrated messaging platforms, forums, discussion boards, and groups are different social media platforms. Social media sites gained their popularity not only because they connected friends and family, but their huge potential of communication was rapidly realized, and it started finding its use in professional communication" (Pal, 2018).

Role of Social Media in Agriculture

Social media is playing an essential role in personal and professional lives. Similarly, social media is becoming an essential medium for sharing information in the farming sector. Social media is now being used in the farming sector because social media have the utility to connect farmers, agri-entrepreneurs, agri-scientists around the world. Social media can help all the agricultural stakeholders such as farmers, students, teachers, scientists, agri-innovators, agri-entrepreneurs, etc., by providing the platform for the easy and quick flow of information and services. Agricultural research, education, and extension establish connections with one-to-one and many to many in sharing and exchange of information. It can be summarised that with the help of social media, any farmer can get farming-related information quickly and easily such as plant diseases, plant pathology, farming system, pesticides, new breeds, innovations in farming machinery, soil-related, water-related, climate-related, market-related and government policies, etc. Thus, social media are helping to improve farmers' welfare and the rate of information exchange.

Review of Literature

Gurdeep Singh et al. (2021) conducted a study to assess the role of social media in enhancing agricultural growth in the Punjab state of India. This study revealed that only six percent of the young farmers were using radio as a source of information for agriculture. The majority of young farmers preferred social media viz. YouTube, WhatsApp, and Facebook as a source of agricultural information. In contrast, it was also revealed that young farmers observed that social media significantly impacted crop management practices. Idu et al. (2021) noticed that most of the respondents (30.0%) indicated that social media had helped to engage youths in agriculture through extension services, while age, education, farm experience, income, and gender of the respondents significantly influence the usage of social media in agriculture. A study was conducted by Inegbedion, et al. (2021) on the use of social media in the marketing of agricultural products and farmers' turnover in South-South Nigeria explored the use of social media (WhatsApp and Instagram) in the marketing of agricultural products and found that use of social media enhances efficiency and turnover of farmers. In contrast, the researchers concluded that the use of social media channels (WhatsApp and Instagram) in the marketing of agricultural products significantly influences cost reduction and hence efficiency in marketing and enhances turnover of farmers through increased demand for agricultural products. Similarly, a study on social media in agricultural extension services from the perspective of farmers and extension agents was conducted by Kumar Ghosh et al. (2021)

Thakur and Chander (2018) conducted a study to know the use of social media in agricultural extension in India. They found that the potential of social media channels like Facebook, WhatsApp, and YouTube, among others, was not yet fully exploited by agricultural extension and development departments to reach out to farmers in India. There is a definite lack of organized efforts to use social media from the public extension system in India.

A study on role of social media in agriculture marketing and its scope was conducted by Balkrishna and Deshmukh (2017) and found that social media was very useful tool in agricultural marketing because it saves time and cost of the farmers for getting information. Facebook, YouTube, WhatsApp, Twitter and LinkedIn were the most popular social media in agricultural marketing. The researchers also found that the role of social media in agricultural marketing was dominated by males. On the other hand, Kipkurgat et al. (2016) conducted a study to explore the impact of social media on agricultural extension in Kesses District of Kenya and revealed that farmers in Kesses District have diverse source of agricultural information for example the Internet, social media and extension services, and majority of farmers prefer social media in agricultural information seeking with a positive attitude, pointing to the assumption that social media is largely beneficial and convenient as a source of agricultural information, while poor network access, power outages, and costly charges when accessing the Internet were identified the most common challenges faced by the farmers.

It can be said that social media can play a vital role in agricultural information sharing and other outreach activities. Social media can fill the gap between extension specialists, agricultural scientists, and farmers. Many studies were conducted in western countries, but not many studies have been conducted from an Indian perspective. Therefore, the present study has been planned to fill this gap.

About CCS HAU, Hisar

After the division of Punjab State, the first established university in Haryana State in 1970 is Haryana Agricultural University, which is one of Asia's biggest agricultural universities. In 1991, it was renamed after India's seventh Prime Minister, Chaudhary Charan Singh. Thus, now it is known as Chaudhary Charan Singh Haryana Agricultural University, Hisar. The university covers an area of 8645 acres, out of which 7219 acres are on the main campus and 1426 acres at sub-campuses. The university has five colleges on its main campus with different departments, i.e., College of Agriculture (COA), College of Home Science (COHS), College of Agriculture Engineering & Technology (COAE&T), College of Basic Science & Humanities (COBS&H), and College of Fisheries Science (COFS). The university has two more colleges on its outstation campuses i.e., College of Agriculture, Kaul (COAK), and College of Agriculture, Bawal (COAB). The university is affiliated with the Indian Council of Agricultural Research (ICAR) (CCS HAU, 2022).

Statement of the Problem

The application of Information and Communication Technology (ICT) has widely impacted all spheres of human life. Social media is now becoming an inseparable part of human beings' personal and professional lives. Similarly, ICT applications and social media have also significantly impacted the farming sector. Now, the farming community wants their desired information quickly and in an accessible mode of communication. Social media is now playing an essential role in sharing agriculture-related information and the welfare of the farming community. During the Covid-19 pandemic, the farming community was also affected. They could not visit the agricultural research centers, universities, and Kissan Seva Kendras to get their desired information and solutions related to farming. In this situation, social media applications were being used by the District's Extension Specialists (DEE) to share the agri-information among the innovative farmers and try to resolve the issues related to the crops and other farming issues. Therefore, it was decided to assess the use of social media in agricultural outreach activities at CCS Haryana Agricultural University, Hisar.

Objectives of the Study

The present study was undertaken with the following objectives:

- To assess the awareness of extension specialists toward the use of social media
- To find out the opinion of extension specialists towards the adoption level of social media for sharing agricultural information or outreach activities
- To ascertain the social media preference for sharing information
- To explore the importance level of social media among the extension specialists
- To identify the constraints faced by the extension specialists in the adoption of social media

Scope of the Study

The present study was undertaken with the primary objective to study the use of social media in agricultural outreach activities at CCS Haryana Agricultural University, Hisar. The present study aimed to highlight the awareness level, adoption level, and constraints faced by the District Extension Specialists (DES) towards the use of social media in agricultural outreach activities. The study was limited to getting the opinion only from the extension specialists working for the welfare of the farmers' community of Haryana state of India. The findings from the present study would be beneficial for agricultural students, scientists, teachers, extension specialists, library science professionals, etc., to understand the current state of the use of social media in agricultural outreach activities.

Material and Methods

The present study is an online exploratory study assessing the use of social media in agricultural extension activities by the District Extension Specialists (DES). An online questionnaire (Google form) has been prepared and shared among the extension specialists of CCS Haryana Agricultural University, Hisar, through e-mail and WhatsApp to collect the data or opinions. The telephonic conversation was also made in some cases to seek further clarification. A total of 75 District Extension Specialists (DES) were approached, out of which 59 were responded positively; thus, a 78.66% response rate has been achieved. Data were then analyzed and interpreted as the study's objectives using simple percentage analysis.

Data Analysis and Interpretation

The collected data are analyzed, interpreted, and presented under the following sections:

Table-1: Gender-wise Distribution of District Extension Specialists

Gender	No. of Respondents	Percentage
Male	38	64.40
Female	21	35.60
Total	**59**	**100**

Table 1 shows the gender-wise distribution of District Extension Specialists

(DEE)/respondents. They were positively offered their opinion on the study on the use of social media in agricultural outreach activities at CCS HAU, Hisar. Out of 59 respondents, 38 respondents were male, and 21 were female respondents who participated in the study.

Table-2: Awareness of using Social Media

S. No.	Awareness	Frequency	Percentage
1.	Fully aware	36	61.02
2.	Aware	18	30.50
3.	Somewhat aware	05	08.48
4.	Not- aware	0	0
	Total	**59**	**100**

The data regarding awareness about using social media among the respondents is presented in Table 2. It is revealed that 61.02% of the respondents were fully aware of social media and its use. In comparison, 30.50% of respondents were aware of the use of social media. On the other hand, 8.48% of the respondents were reported that they are somewhat aware of the use of social media in sharing agricultural information and other outreach activities.

Table-3: Adoption level of Social Media among Extension Specialists for sharing Agricultural Information or for Outreach Activities

S.No.	The adoption level of social media	Frequency	Percentage
1.	Always	15	25.42
2.	Sometimes	12	20.34
3.	Situation based	23	38.98
4.	In combination with manually sharing info.	09	15.26
	Total	**59**	**100**

The adoption level of social media among extension specialists for sharing agricultural information and other outreach activities is highlighted by the data given in Table 3. It is apparent from the data presented in Table 3 that 38.98% of the respondents were tried to use social media on a situation basis for sharing agricultural information, whereas 25.42% of the respondents were opined that they always try to use social media applications for agricultural outreach activities. On the other hand, 20.34% of the extension specialists sometimes used social media. In comparison, 15.26% of the respondents opined that they tried to use social media to share information among the farmers' community manually.

Table - 4: Social Media Preferences

S. No.	Social media preferences	Frequency	Percentage
1.	WhatsApp	44	74.58
2.	Facebook	08	13.56
3.	YouTube	05	08.47
4.	Others	02	03.39
	Total	**59**	**100**

Table 4 reveals the preferences of District Extension Specialists (DES) towards adopting various social media applications for sharing agricultural-related information. It is evident from the data that the majority of the respondents (74.58 %) preferred to use WhatsApp. In comparison, 13.56 % of the respondents preferred to use Facebook, followed by YouTube (8.47 %) and other applications (3.39 %), respectively. From the results, it can be interpreted that WhatsApp is the most preferred social media channel among the extension specialists of CCS HAU, Hisar, for sharing agricultural-related information to farmer's and other outreach activities.

Table- 5: Constraints Faced by the Extension Specialists in the Adoption of Social Media

S. No.	Constraints in the adoption of social media*	Frequency (n= 59)	Percentage
1.	Poor Internet connectivity/network in rural areas	50	84.75
2.	Institutional obligations in some cases	22	37.29
3.	Lack of interest	27	45.76
4.	Restricted use of social media	20	33.90
5.	Financially not supported by authority	33	55.93
6.	Fear of Internet addiction, and other reasons	40	67.80

**Multiple choices were permitted*

The data regarding various constraints faced by the extension specialists in the adoption of social media for sharing agricultural information with the farmers' community are presented in Table 5. It is clear from the data that the majority of the respondents, i.e., 84.75%, reported that poor Internet connectivity and network in rural areas was the primary constraint, which was faced during the sharing of agricultural-related information to the farmers via social media. In comparison, 67.80% of the respondents have reported the fear of Internet addiction and other reasons. On the other hand, 55.93% of the respondents reported that they were not supported financially by the authority to pay high Internet/data charges. In contrast, lack of interest in social media was the primary constraint for 45.76% of the extension specialists. Similarly, 37.29% of the respondents opined that there are institutional obligations in some cases, followed by restricted use of social media respondents during office hours by 33.90% respondents.

Table - 6: Importance of Social Media in sharing Agri-information/ Outreach

S.No.	Importance of social media	Frequency	Percentage
1.	To a great extent	21	35.60
2.	To some extent	27	45.76
3.	Neutral	08	13.56
4.	Not at all	03	05.08
	Total	**59**	**100**

The data given in Table 6 reveals the opinion of District Extension Specialists (DES) towards the importance of social media in sharing agricultural information and outreach activities. It is clear from the data in Table 6 that 45.76 % of the respondents opined that social media is essential to some extent for them in sharing agricultural information with the farmers' community. In contrast, social media is vital to a great extent for 35.60 percent of the respondents. On the other hand, 13.56 % of the respondents were neutral. In comparison, 5.08 % of the respondents opined that social media is not essential for sharing agricultural information and outreach activities. The data interpretation shows that more than 80% of the extension specialists feel the importance of social media for sharing agricultural information in this digital era.

Major Findings

Some of the significant findings may be summarized as follows:

- The study illustrated that more than 90 % of the respondents were aware of the social media applications and their use in sharing agricultural information and outreach activities.
- About 39 % of the respondents were using social media for sharing agricultural information on a situation basis. In comparison, 25.42% of the respondents opined that they always tried to use social media applications for agricultural outreach activities.

- The Majority of the respondents (74.58%) preferred to use WhatsApp, while 13.56% preferred to use Facebook.
- The Majority of the respondents (84.75%) reported that poor Internet connectivity and network in rural areas was the primary constraint for sharing agricultural-related information with the farmers via social media, while 67.80 % of the respondents reported the fear of Internet addiction and other reasons as constraints.
- 45.76 % of the respondents opined that social media is vital to sharing agricultural information with the farmer's. In contrast, social media is vital to a great extent for 35.60 % of the respondents.

Conclusion

Social media is an integral part of our personal and professional life in this digital era. Everyone now expect every type of information in digital form. The information in digital format can save the stakeholders' space, time, and efforts. In agricultural sector, teachers, students, scientists, extension specialists and farmers also need right information in right time in digital format through user friendly social media platforms. In this study, some interesting findings have been found about the usage and utility of social media in sharing agricultural information and other outreach activities among the extension specialists of Chaudhary Charan Singh Haryana Agricultural University, Hisar. Based on the opinion obtained from District Extension Specialists (DES), it can be concluded that more than ninety percent of the extension specialists are aware of social media applications and their use in sharing agricultural information and outreach activities. However, during the study, the respondents raised some critical issues. Hence, it is suggested that Internet/mobile network issues must be resolved in rural areas by the government, and fundamental awareness and training on ICT applications and social media must be frequently provided to the extension professional and farmers. Furthermore, it is also suggested that the Authority of the University must promote the official use of social media in sharing agricultural information and for other outreach activities for the welfare of the farming community.

References

Anil Kumar (2018). Role of social media in dissemination of agricultural innovations in Haryana. M.Sc. thesis. https://krishikosh.egranth.ac.in/displaybitstream handle=1/ 5810094992&fileid=4c659df4-93ac-47bf-b38a-26e7bf1c7d7e

Balkrishna, Bite Bhalchandra, & Deshmukh, Anand A. (2017). A study on role of social media in agriculture marketing and its scope. Global Journal of Management and Business Research: E Marketing, 17(1). https://globaljournals.org/GJMBR_Volume17/5-A-Study-on-Role-of-Social-Media.pdf

CCS Haryana Agricultural University, Hisar (2022). http://hau.ernet.in/about/history.php.

Gurdeep Singh, Pritpal Singh, Tiwari, Devinder, & Kulwant Singh (2021). Role of social media in enhancing agricultural growth. Indian Journal of Extension Education, 57(2), 69-72.

Idu, E. E., Ajah, A., Alabi., T., & Nnaji, J. N. (2021). Determinants of social media usage in agriculture among youths in the Federal Capital Territory. Direct Research Journal of Agriculture and Food Science, 9, 36-41. DOI: https://doi.org/10.26765/DRJAFS49278624

Inegbedion, H., Inegbedion, E., Asaleye, A., Obadiaru, E., & Asamu, F. (2021). Use of social media in the marketing of agricultural products and farmers' turnover in South-South Nigeria. F1000Research, 9, 1220. https://doi.org/10.12688/f1000research.26353.2

Kalusopa, T. (2005). The challenges of utilizing Information Communication Technologies (ICTs) for the small scale farmers in Zambia. Library Hi-Tech, 23(3), 414-424.

Kipkurgat, Thomas, Onyiego, Michael, & Chemwaina, Silahs (2016). Impact of social media on agricultural extension in Kenya: A case of Kesses District. International Journal of Agricultural Extension and Rural Development Studies, 3(1), 30-36. https://www.eajournals.org/wp-content/uploads/Impact-of-Social-Media-on-Agricultural-Extension-in-Kenya-A-Case-of-Kesses-District.pdf

Kumar Ghosh, M., Hasan, S. S., Maria, U., Akon, S., Ali, H., Moheuddin, M., & Al Noman, A. (2021). Social media in agricultural extension services: Farmers and extension agents' perspective. European Journal of Humanities and Social Sciences, 1(5), 36-43. https://doi.org/10.24018/ejsocial.2021.1.5.143

Mayfield, Anthony (2008). What is social media. E-book from I-crossing, UK.

Pal, Ayushi (2018). Perception of farmers towards use of social media for seeking agricultural information: a study in Udham Singh Nagar district of Uttarakhand. M.Sc. thesis. https://krishikosh.egranth.ac.in/handle/1/5810089169

Soni, Jyoti (2016). Utilization pattern of social media by the students for education: a study at G.B.Pant University of Agriculture and Technology, Pantnagar. M.Sc. thesis. https://krishikosh.egranth.ac.in/displaybitstream?handle=1/5810044496&fileid=9913c61a-2c5a-4b11-b704-157354caf9b4

Thakur, Devesh, & Chander, Mahesh (2018). Use of social media in agricultural extension: some evidences from India. International Journal of Science, Environment and Technology, 7(4), 1334-1346. https://www.researchgate.net/publication/326802477_USE_OF_SOCIAL_MEDIA_IN_A GRICULTURAL_EXTENSION_SOME_EVIDENCES_FROM_INDIA

Need for Internet of Things in Agriculture for Smart Farming

L. S. R. C. V. Ramesh[1], A. Krishna Murthy[2] and A. V. S. S. Naga Raju[3]

Abstract

The Internet of Things (IoT) is about making "dumb" things "smart" by connecting them and the internet. It enables physical objects to be sensed and controlled remotely, allowing for more direct integration between the physical world and computer-based systems. IoT enables devices embedded with sensors to connect to and interact via the internet. Devices can be remotely monitored and controlled in real-time, including pumps, sheds, and tractors to weather stations and computers. This papers examine the need for IoT in agriculture and identify areas of application to transform agriculture into smart farming.

Keywords: Internet of Things, IoT, Smart Farming, Smart Agriculture, Sensors.

Introduction

Smart farming is a capital-intensive and hi-tech system of growing food cleanly and sustainably for the masses. Application of modern ICT, transform agriculture into smart farming (Information and Communication Technologies) in agriculture. The IoT-based smart farming, which is built to monitor several crop field with the help of sensors light, humidity, temperature, soil moisture, etc. and automate the irrigation system. The farmers can monitor the field conditions from anywhere. IoT-based smart farming is highly efficient when compared with the conventional approach.

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The applications of IoT-based smart farming not only target conventional, large farming operations but could also support trends in agriculture like organic farming, family farming, nutri-sensitive agriculture, climate-resilient agriculture etc.

IoT-based smart farming can provide significant benefits for environmental issues, including more efficient water usage or optimizing inputs and treatments.

IoT Opportunities

IoT is about the power of data. Our world is digitally connected, and data is a critical asset. Data from devices can guide farmer's decisions, helping them farm smarter and safer and adapt more quickly to changing conditions. The ability to monitor farm conditions and infrastructure remotely can free up time, labor, and capital to invest, allowing farmers to focus on other things.

Important opportunities of IoT in Agriculture are as follows:

- Remote monitoring of farm conditions and infrastructure, saving time and labor on routine farm checks
- Improving farmer's decision making through data analytics
- Faster and quicker insights from real-time data across the value chain, helping farmers respond to what the market wants
- Efficiency in how we produce food to ensure less wastage, expediency to market, and enhanced traceability to demonstrate safe and sustainable food to our customers
- Building the capabilities to respond to new and emerging technologies and investing in research and development to contribute to ongoing innovation and improved productivity.

Smart farming based on IoT technologies enables growers and farmers to reduce waste and enhance productivity ranging from the quantity of fertilizer utilized to the number of journeys the farm vehicles have made and enabling efficient utilization of resources such as water, electricity, etc. IoT innovative farming solutions is a system that is built for monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, crop health, etc.) and automating the irrigation system. The farmers can monitor the field conditions from anywhere. They can also select manual and automated options for taking necessary actions based on this data. For example, the farmer can deploy sensors to start the irrigation if the soil moisture level decreases. Smart farming is highly efficient when compared with the conventional approach. IoT can transform agriculture in many aspects.

Sensors: Data collected by smart agriculture sensors are vital component. Sensors, control systems, robotics, autonomous vehicles, automated hardware, variable rate technology, motion detectors, button camera, and wearable devices are used for data collection. This data can be used to track the state of the business in general and staff performance and equipment efficiency. The ability to foresee the output of production allows planning for better product distribution.

Agricultural Drones: Ground-based and aerial-based drones are being used in agriculture to enhance various agricultural practices which included crop health assessment, irrigation, crop monitoring, crop spraying, planting, and soil and field analysis.

Livestock Tracking and Geofencing: Farm owners can utilize wireless IoT applications to collect data regarding their cattle's location, well-being, and health. This information helps prevent the spread of disease and lowers labor costs.

Smart Greenhouse: An innovative greenhouse designed with the help of IoT intelligently monitors and controls the climate, eliminating the need for manual intervention.

Predictive Analytics for Smart Farming: Crop prediction plays a key role; it helps the farmer decide crop production, storage, marketing techniques, and risk management plans. This information includes soil, temperature, pressure, rainfall, and humidity parameters. The farmers can get accurate soil data through the dashboard or a customized mobile application.

Industrial Internet of Things

The IoT technology has realized the smart wearable's, connected devices, automated machines, and driverless cars. However, in agriculture, the IoT has brought the most significant impact.

Recent statistics reveal that the global population will reach 9.6 billion by 2050. Moreover, to feed this massive population, the agriculture industry is bounded to adopt the Internet of Things. Amongst the challenges like extreme weather conditions, climatic changes, environmental impact, IoT is addressing these challenges and helping us to meet the demand for more food.

Throughout the world, mechanical innovations such as tractors and harvesters were brought into agriculture operations in the late 20th century. Furthermore, the agriculture industry relies heavily on innovative ideas because of the steadily growing demand for food.

The Industrial IoT has been a driving force behind increased agricultural production at a lower cost. In the next several years, intelligent solutions powered by IoT will increase in agriculture operations. Few recent reports tell that the IoT device installation will see a compound annual growth rate of 20% in the agriculture industry. Furthermore, the number of connected devices in agricultural will grow from 13 million in 2014 to 225 million by 2024.

Due to a lack of constant and reliable communication network infrastructure, IoT solutions providers and business owners have faced implementation challenges in remote or less developed regions. Nevertheless, many network providers are making it possible by introducing satellite connectivity and expanding cellular networks.

IoT in Agriculture

It has been a long since sensors were introduced in agriculture operations. Nevertheless, the traditional approach to utilizing sensor technology was that we could not get the live data from the sensors. The sensors were used for logging the data into their attached memory, and later on, we were able to use them. With the introduction of Industrial IoT in Agriculture, far more advanced sensors are being utilized. The sensors are now connected to the cloud via a cellular/satellite network. This lets us know the real-time data from the sensors, making decision-making effective.

The applications of IoT in the agriculture industry have helped farmers monitor the water tank levels in real-time, which makes the irrigation process more efficient. The advancement of IoT technology in agriculture operations has brought sensors in every step of the farming process, like how much time and resources a seed takes to become a fully-grown vegetable.

Internet of Things in Agriculture has come up as a second wave of the green revolution. The benefits that the farmers are getting by adapting IoT are twofold. It has helped farmers decrease their costs and increase yields simultaneously by improving farmers' decision-making with accurate data.

Application of IoT in Agriculture

Smart Farming is hi-tech and effective and ensures sustainably food system. It is an application of integrating connected devices and innovative technologies in agriculture. Smart Farming majorly depends on IoT, thus eliminating the need for physical work of farmers and growers and thus increasing productivity in every possible manner.

The Internet of Things has brought huge benefits like an efficient use of water, optimization of inputs, and many more.

IoT-based Smart Farming improves the entire Agriculture system by monitoring the field in real-time. With the help of sensors and interconnectivity, the Internet of Things in Agriculture has saved the farmers' time. However, it has also reduced the extravagant use of water and electricity resources. It keeps various factors like humidity, temperature, soil, etc., under check and gives a crystal precise real-time observation.

The following are the benefits of adopting new technology - Internet of Things in Agriculture:

1. Climate Conditions

Climate plays a very critical role in farming. Furthermore, having improper knowledge about climate heavily deteriorates the quantity and quality of crop production. IoT solutions enable to know the real-time weather conditions. Sensors are placed inside and outside of the agriculture fields. They collect data from the environment used to choose the suitable crops that can grow and sustain in particular climatic conditions. The whole IoT ecosystem is made up of sensors that can detect real-time weather conditions like humidity, rainfall, temperature, and more very accurately. Numerous sensors detect all these parameters and configure them according to your intelligent farming requirements. These sensors monitor the condition of the crops and the weather surrounding them. If any disturbing weather conditions are found, then an alert is sent. What gets eliminated is the need for physical presence during disturbing climatic conditions, which eventually increases productivity and helps farmers to reap more agricultural benefits.

2. Precision Farming

Precision Agriculture/Precision Farming is one of the most famous applications of IoT in Agriculture. It makes the farming practice more precise and controlled by realizing innovative farming applications such as livestock monitoring, vehicle tracking, field observation, and inventory monitoring. Precision farming aims to analyze the data generated via sensors to react accordingly. Precision farming helps farmers to generate data with the help of sensors and analyze that information to make intelligent and quick decisions. There are numerous precision farming techniques like irrigation management, livestock management, vehicle tracking, and many more which play a vital role in increasing efficiency and effectiveness. With the help of precision farming, one can analyze soil conditions and other related parameters to increase operational efficiency. It can also detect the real-time working conditions of the connected devices to detect water and nutrient levels.

3. Smart Greenhouse

IoT has enabled weather stations to automatically adjust the climate conditions according to a particular set of instructions to make our greenhouses smart. The adoption of IoT in Greenhouses has eliminated human intervention, thus making the entire process cost-effective and increasing accuracy at the same time. For example, using solar-powered IoT sensors builds modern and inexpensive greenhouses. These sensors collect and transmit real-time data, which helps monitor the greenhouse state very precisely in real-time. With the help of the sensors, the water consumption and greenhouse state can be monitored via emails or SMS alerts. Automatic and smart irrigation is carried out with the help of IoT. These sensors help provide information on the pressure, humidity, temperature, and light levels.

4. Data Analytics

The conventional database system does not have enough storage for the data collected from the IoT sensors. Cloud-based data storage and an end-to-end IoT Platform plays a vital role in the smart agriculture system. These systems are estimated to play an essential role in performing better activities. In the IoT world, sensors are the primary source of collecting data on a large scale. The data is analyzed and transformed into meaningful information using analytics tools. Data analytics helps analyze weather conditions, livestock conditions, and crop conditions. The data collected leverages technological innovations and thus makes better decisions. With the help of IoT devices, one can know the real-time status of the crops by capturing the data from sensors. Using predictive analytics, you can get an insight to make better decisions related to harvesting. The trend analysis helps the farmers to know upcoming weather conditions and harvesting of crops. IoT in the Agriculture Industry has helped the farmers to maintain the quality of crops and fertility of the land, thus enhancing the product volume and quality.

5. Agricultural Drones

Technological advancements have almost revolutionized agricultural operations, and the introduction of agricultural drones is a trending disruption. The Ground and Aerial drones are used to assess crop health, crop monitoring, planting, crop spraying, and field analysis. With proper strategy and planning based on real-time data, drone technology has given the agriculture industry a high rise and makeover. Drones with thermal or multispectral sensors identify the areas that require changes in irrigation. Once the crops start growing, sensors indicate their health and calculate their vegetation index. Eventually, smart drones have reduced the environmental impact. The results have been such that there has been a massive reduction and much lower chemicals reaching the groundwater.

Conclusion

IoT-enabled agriculture has helped implement modern technological solutions to time-tested knowledge. This has helped bridge the gap between production and quality and quantity yield. Data ingestion by obtaining and importing information from the multiple sensors for real-time use or storage in a database ensures swift action and minor damage to the crops. With seamless end-to-end intelligent operations and improved business process execution, produce gets processed faster and reaches supermarkets in the fastest time possible.

References

Ayaz, M., Ammad-Uddin, M., Sharif, Z., Mansour, A., & Aggoune, E.-H. M. (2019). Internet-of-Things (IoT)-based smart agriculture: Toward making the fields talk. IEEE Access, 7, 129551-129583.

Bamigboye, F. O., & Ademola, E. O. (2016). Internet of Things (Iot): It's application for sustainable agricultural productivity in Nigeria. Proceedings of the ISTEAMS Multidisciplinary Cross-Border Conference University of Professional Studies, 309-312.

López-Morales, J. A., Martínez, J. A., & Skarmeta, A. F. (2021). Improving Energy Efficiency of Irrigation Wells by Using an IoT-Based Platform. Electronics, 10(3), 250. https://doi.org/10.3390/electronics10030250

Ravindra, S. (2020, June 30). IoT Applications in Agriculture. IoT For All. https://www.iotforall.com/iot-applications-in-agriculture/

Sadiku, M. N. O., Wang, Y., Cui, S., & Musa, S. M. (2018). Precision agriculture: An introduction. International Journal of Advanced Engineering and Technology, 2(2), 31-32.

Sadiku, M. N., Ashaolu, T. J., Ajayi-Majebi, A., & Musa, S. M. (2020). Smart Farming. International Journal of Scientific Advances, 1(3), 133-134.

Saini, R. K., & Prakash, C. (2020). Internet of Things (IoT) for Agriculture growth using Wireless Sensor Networks. Global Journal of Computer Science and Technology, 20(2). https://globaljournals.org/GJCST_Volume20/4-Internet-of-Things-IoT-for-Agriculture.pdf

Use of Digital Information Resources in S.V. Agriculture College, Tirupati: A User Study

E. Sudhakar[1] **and A. Krishna Murthy**[2]

Abstract

This study attempts to describe the use of digital resources and services by the library users of S.V. Agricultural University Library. The library and information professionals must acquire latest knowledge and skills as the library is transforming into a highly IT-influenced service center. This paper gives an overview of current trends in digital library research consisting of advantages, disadvantages, functions and the impact of information technology on the traditional library. This study attempts to know the utilization and usage of information resources and services by S.V. Agricultural College (ANGRAU), Tirupati.

Keywords: Digital Resources, Digital Library, Agricultural library, e-Books, e-Journals.

Introduction

S.V. Agricultural College Library was started functioning on 07-8-1963. In the beginning, 533 books were purchased by several Departments of the College formed part of the Library. Some books were transferred from Agricultural College, Bapatla for immediate use by the students and staff.

Since the formation of APAU in 1964, the library has grown in leaps and bounds. Accordingly, the libraries of S.V. Agricultural College and College of Veterinary Science were merged on 11-08-1982, raising the library holdings to 34,488 and now separated into S.V. Veterinary University library and ANGRAU Regional Library in the year 2007. It has now 32,196 volumes of

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collection. The library has created a database of Books, Journals, Thesis, Reports, and Reference sources and made it available through 'OPAC.'

The library has also created databases of current periodicals, CDs, Online-Journals subscribed, and digitized databases of Theses available in the Library. It has also contributed to the project on Strengthening of Digital Library and Information Management under NARS (e-Granth) by setting up a workstation to digitize old resources before 1960 housed in the library building. Recently the library has implemented KOHA Library Management System. The library has implemented new technologies to keep pace with the growing information needs of the community to provide better information services.

Objectives

- To find out the category of users of digital resources
- To find out the purpose and utilization of digital resources by the library users
- To find out the preference for digital resources by the library users
- To find out the problems faced by library users in searching for information through digital resources
- To suggest the measures for improving access to digital resources in libraries

Research Methodology

To achieve the study's objectives, a survey method was adopted. A structured questionnaire was designed and used to collect data from the S.V. Agriculture Library users, Tirupati. One hundred questionnaires were distributed among the library users randomly, out of which 84 users responded to the questionnaire.

Scope and Limitation

The scope of the present study is confined only to the library users visiting S.V Agriculture Regional Library Students, Faculty Members, Research Scholars. The study population is limited to 84 S.V. Agricultural Regional Library users.

Analysis and Interpretation

The analysis and interpretation of data and results have been presented in the following tables and figures:

Table-1 : Category-wise Distribution of Respondents

Category	Respondents	Percentage
UG students	58	69.04
PG students	26	30.95
Total	**84**	**100**

The Library has all types of members, including Under Graduate, Post Graduate. Respondents of this research study are described in table 1. which shows that the majority of respondents, i.e., 69.04 % are UG students, and the remaining PG students are 30.95%. Respondents are categorized according to a period of use of the university library as described in Table 2.

Table-2 : Use of Library Services

Time Duration in Years	Respondents	Percentage
Below 1 year	10	11.9
1-2 years	46	54.76
3-4 years	23	27.38
More than 4 years	05	5.96
Total	**84**	**100**

Table 2 shows the years of use of library services by the respondents. Data shows that most users, 54.76%, use library services for 1-2 years, followed by 27.38% of users who have been using the library services for 3-4 years. There is a negligible 11.9% of users use library services from below one year, and the remaining 5.96% use library services for more than 4 years.

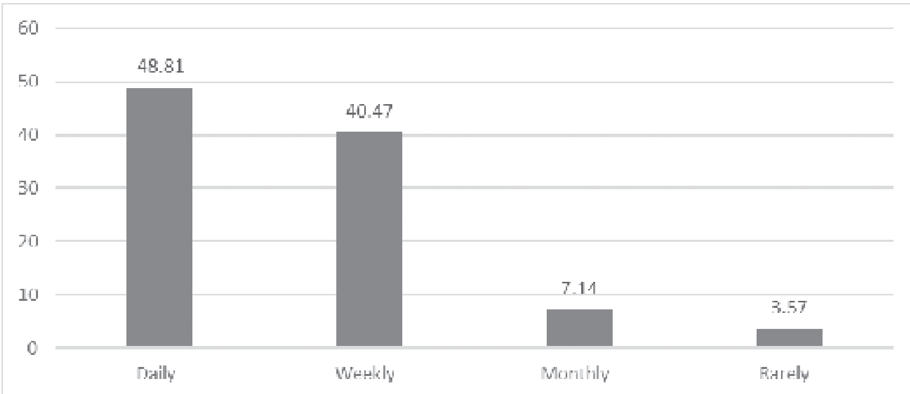

Figure: 1 Frequency of Internet Use

Fig. 1 shows the frequency of use of internet by the users. It is found that the majority of respondents, 48.81% are using the internet daily, followed by 40.47% weekly, 7.14%of the respondents use it monthly, and the remaining uses internet rarely.

Table-3 : Awareness of Digital Resources

Awareness of Digital Resources	**Respondents**	**Percentage**
Yes	84	100
No	-	-
Total	**84**	**100**

Table 3 shows the awareness of digital resources among the respondents. The table shows that 100% of respondents are aware of the available digital resources of the library.

Table-4 : Uses of Digital Resources

Uses of Digital Resources	Respondents	Percentage
e-books	54	64.28
e-journals	36	42.85
e-databases	30	35.71
Internet	48	57.14

**Multiple responses*

Table 4 shows the use of digital resources by the respondents. It is revealed that there is a maximum of 64.28% of respondents use E-books, followed by the Internet 57.14%. E-journals are used by only 42.85% of respondents, and E-databases are used by only 35.71%.

Table-5: Purpose of Using Digital Resources

Purpose of Using Digital Resources	Respondents	Percentage
Seminars/conference	10	11.9
Preparing notes	20	23.8
Updating knowledge	38	45.23
Writing Projects/Assignment	16	19.04
Total	**84**	**100**

Table 5 shows the purpose of the respondents for using digital resources. The majority of respondents 45.23% use digital resources to update their knowledge, followed by 23.8% for preparing notes, 19.04% for Writing Projects/Assignments, and only 11.9% uses digital resources to prepare papers for seminars/conference.

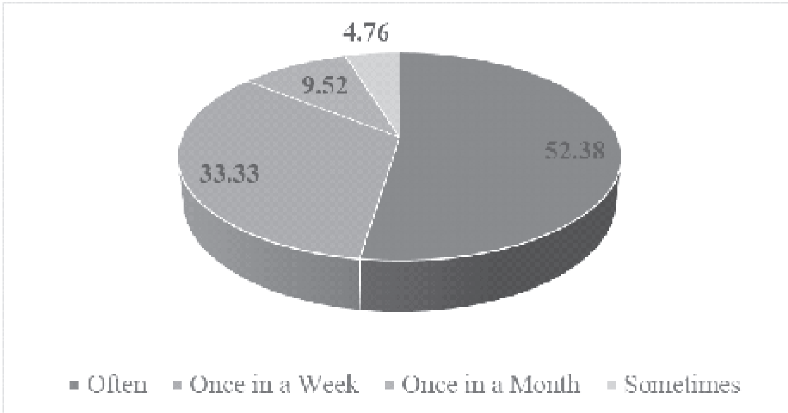

Fig-2 Frequency of Using Digital Resources

Figure 2 shows the frequency of use of digital resources by the respondents. The figure shows that 52.38% of respondents often use digital resources, which means that they use them in their daily routine, followed by 33.33% of respondents who use them once a week, 9.52% of respondents who use them once in a month and the remaining 4.76% of respondents use digital resources sometimes.

Library users face some problems while using digital resources. These problems may be due to the non-familiarity of the users with the available digital resources or may be due to not getting proper support from the library staff or maybe insufficient resources available in the library.

Table- 6: Difficulties in Using Digital Resources

Difficulties in Using Digital Resources	**Respondents**	**Percentage**
Don't Know How to Use	34	40.47
Can't Find Proper Information	23	27.38
Support from Library Staff	16	19.04
Insufficient Resources in the Library	11	13.09
Total	**84**	**100**

Table-6 shows the difficulties in using digital resources by library users. It shows that 40.47% of users don't know how to use the library's digital resources. 27.38% believe that they can find out the required/pertinent information from the available resources. 19.04% say that they get proper support from the library staff and 13.09% opinion that digital resources are insufficient in the library.

Suggestions

From the above findings, there is no proper use of digital resources even though there are sufficient resources available in the library and most users are also aware of these resources. Nevertheless, according to the finding, it can be suggested that libraries should organize orientation programs to increase awareness and the importance of digital resources. The library is also needed to increase the accessibility of these resources by increasing computer terminal's WiFi facility and increasing the budget for the digital collection. The library should conduct a users' survey to know the users' needs from time to time.

Conclusion

Most users visit the library daily to, borrow books, read newspapers, prepare for competitive examinations, and access the Internet for related digital information. Therefore, it is suggested that latest books, periodicals/ magazines, and other printed and nonprinted material should be added to the library to meet the users' requirements. Most of the users are not aware of the services provided in the library. Thus, it is suggested that proper user education or library orientation programs should be provided to the users. Users surveys may also be carried out to know the needs of users, the current status, and the strength and weaknesses of library services to improve the existing situation and provide better services to users.

References

Aderibigbe, N. A., & Emmanuel, S. O. (2012). Use of Library Information Technology Resources by Graduate Students of University of Agriculture, Abeokuta. Library Philosophy and Practice, 1-10.

Akobi, E.I. (2007). The impact and use of TEEAL (The Essential Electronic Agricultural Library) on researchers of agriculture, Ahmadu Bello University Samaru, Zaria. Continental Journal of Information Technology. https://www.academia.edu/661416/The_impact_and_use_of_TEEAL_The_Essential_Electronic_Agricultural_Library_on_researchers_of_agriculture_Ahmadu_Bello_University_Samaru_Zaria

Ansari, M., & Zuberi, B. (2010). Use of Electronic Resources among Academics at the University of Karachi. Library Philosophy and Practice (e-Journal). https://digitalcommons.unl.edu/libphilprac/385

Okello-Obura, C., & Magara, E. (2008). Electronic information access and utilization by Makerere University students in Uganda. Evidence Based library and information practice, 3(3), 39-56.

Okorie, C. N., & Agboola, I. O. (2012). Availability and use of electronic resources in agricultural university libraries. PNLA Quarterly, 76(3), 40-48.

Patil, Y. M., & Kumar, P. S. G. (n.d.). Agricultural Information Systems and Services: Restrospect's and Prospects. Library Science with a Slant to Documentation and Information Studies, 35(1), 37-46.

Salaam, M. O., Ajiboye, B. A., & Bankole, O. M. (2013). The use of library electronic information resources by academic staff at Federal University of Agriculture, Abeokuta, Ogun State, Nigeria. PNLA Quarterly, 77(2), 1-15.

Tamrakar, R., & Verrna, N. (2010). Use of information sources and services by the research scholars of CDRI Library. 413-422.

Webometric Analysis of Websites of Digital Repositories of Agricultural Sciences in Asia on a Global Scale

Sanjib Ghosh[1] and Bijan Kumar Roy[2]

Abstract

This study investigates 88 open-access digital repositories of agricultural sciences in Asia. The webometric methods are used to assess the web performance of these repositories as represented by worldwide visibility and highlights the diverse link architectures and online presence using webometric indicators via the Google search engine. According to the results, the Fundamental Science Library of the NAS, Armenia is ranked first with 391000 web pages, 149000000 In-Link web pages, and 381.0741688 RWIF. Regarding the WISER index value of IDR websites, Taiwan Agricultural Research Institution occupied the first rank with 20.56, followed by the Science and Technology Development Center of the Ministry of Education of the People's Republic of China and the Tea Research Institute Repository, Sri Lanka. This study also shows a comparative study between IDRs regarding their Application Data Management values and mapping these IDS with a WebCrawler, i.e., SocScibot4. As a result of this study, information professionals, researchers, and students will better understand the high-quality websites of agricultural repositories in Asia that meet their information demands.

Keywords: Digital Repository, Web Impact Factor, Agricultural Repositories, Open Access

Introduction

The Agricultural Revolution began in Great Britain in the 18th century. It spread throughout Europe and America by the 19th century, with new

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farming techniques and inventions in Europe increasing crop productivity and labor and land productivity, resulting in a massive increase in food production.

Therefore, agriculture is the backbone of the economic system and plays a critical role in economic growth in many nations throughout the world, providing food and raw materials and job possibilities to a considerable number of the people. In this sense, agricultural output in Asia has held an important place globally for its national development; information about the agricultural sector plays a vital transferable and reusable function. Through digital repositories, ICT has facilitated world wide access to these information resources. The Open Access (OA) movement began in the twenty-first century with the Budapest Open Access Initiative (BOAI) further promoted opening of agricultural knowledge to all.

All academic institutions and research organizations made their research output available for anyone to access through their institutional digital repository websites. Several research organizations play a critical role in distributing their research output throughout the world in this context.

According to open Directory of Open Access repositories (DOAR) and Registry of Open Access Repositories (ROAR), a total of 88 agricultural research institutes provide their research output via digital repositories based on their websites. As a result, the web presence of these digital archives was evaluated and analyzed using various webometric indicators with different search engines. The impact of websites of agricultural digital repositories may be measured using webometric indicators. Furthermore, different web impact factors of their websites fall under webometric study. It can assist in monitoring different users' activities and helping to redesign the repositories' websites. The goal of this study is to investigate and assess the present situation of open access digital repositories in agricultural sciences in Asian countries to measure worldwide exposure and web presence, which may lead to the provision of effect on the organization's research ranking. Most of the repositories have developed in Europe, North

America, and Asian countries. Furthermore, Europe emerges as the first most significant contributor (Open DOAR and ROAR, 2019) in the world in the agricultural field.

Scope and Limitations of the Study

The present study investigates agricultural repository websites that have been selected from ROAR and Open DOAR. After removing all similar repositories, a total of 88 different agricultural repositories have been selected. Agriculture is described in the Open DOOR and ROAR as "agriculture, food, and veterinary science, plant culture, forestry, animal culture, aquaculture, fisheries, fishing, and hunting.

Literature Review

The quantitative study of the web is known as webometrics. Webometrics Development, Web Content Analysis, Web Link Analysis, Web Technology Analysis, and Web Impact Factor are only a few examples of Webometric Analysis, including Web measurements and Web-effects analysis. Various authors have undertaken several studies (Bjorneborn & Ingwersen, 2001, 2004; Thelwall et al., 2002 and 2008) to establish the idea of the webometric study. Jalal, Biswas, and Mukhopadhyay (2009) examined the websites of 13 Indian Institutes of Technology (IITs) and Indian Institutes of Management (IIMs) to determine the progress of Webometrics from bibliometrics. They discussed the application areas of Webometrics research, the methods used for data gathering, web analytic methodologies and tools, and issues faced in web research. Web Content Analysis is one of the parameters of webometric analysis, and several writers (Thelwall, 2003 & 2004a) have used it in many fields. Thanuskodi (2012) examined the websites of important national libraries in Indian institutions and used bibliometric methods to evaluate the contents, link structures, and another study topics. Web Link Analysis is another basic method for webometric research, and many authors use it (Rousseau, 1997a; Thelwall, 2001a; Aguillo, 2007; Jalal, Biswas, & Mukhopadhyay, 2010a; Shukla & Poluru, 2012).

According to a study by Sujithai, Maria, Jayshankar, and Jayasankar (2013), external link web pages are more important than other link pages. Web Technology Analysis is another key component of webometric research, and several writers (Vaughan, 2004b; Vaughan & Zhang, 2007; Bar-Ilan, 2008; Thelwall, 2008b) analyzed the APIs of Google, Live Search, and Yahoo to determine the consistency and inconsistency of these three search engines. The web Impact Factor is a quantitative indicator invented by Peter Ingwersen in 1998, and other writers have examined the web Impact Factor of websites in various fields. Islam and Alam (2011) performed research on 44 private institutions in Bangladesh to determine the influence of websites and their Webometrics indicator.

Objectives

The main objectives of this study is to:

- To analyze the selected open accesses digital repositories of agricultural sciences in Asia based on their websites' activity;
- To explore the web presence and calculate various web impact factors of websites of the selected digital repositories of agricultural sciences;
- To use WISER (Web Indicators for Science, Technology and Innovation Research) ranking method to know the visibility and connectivity of the open access digital repositories of agricultural sciences on the web;
- To identify the web linking between the open access digital repositories of agricultural sciences based on the ADM count summary and generates link network diagrams of the open access agricultural repositories in Asia.

Research Methodology

In this present study, survey and observation methods have been used. Data were collected from selected open access digital repositories of agricultural sciences using Google. Personal web crawler SocSciBot4 (available at http://socscibot.wlv.ac.uk) has been used for creating network diagrams of agricultural repositories websites to extract key summary statistics.

Data Collection through searching:

Google's search engine was used for an approximate number of different link pages from the websites of selected agricultural repositories of Asia during 01-20 December 2020. The following search statements or syntax are used to collect data:

- ***Site: url-***this will extract the total number of WebPages to the websites under the url.
- ***Link: url-*** this will retrieve the total number of WebPages linking to the websites i.e. hyperlink pages.
- ***Link: url*** AND NOT site: abc - it will provide a complete report of several web pages not under the websites which provide links from the other websites i.e, External-Link pages.
- ***Link: url*** NOT site: abc - For a complete report of several links incoming from other websites.

The calculation of WIF is as follows

1. Simple-link WIF (SLWIF) = $\dfrac{\text{Total number of Simple-link web pages}}{\text{Total number of web pages (NWP)}}$

2. External-link WIF (ELWIF) = $\dfrac{\text{Total number of external-link web pages}}{\text{Total number of web pages (NWP)}}$

3. InLink / Revised WIF (ILWIF / RWIF) = $\dfrac{\text{Total number of in-link web pages}}{\text{Total number of web pages (NWP)}}$

Where A=Total no of WebPages of a given site; B=Total no of external backlinks to a given site; C=Total no of self-link of a given site; D=total no of links to a given site.

Calculation of WISER Index Value

The activity of agricultural digital repositories is multi-dimensional, which is reflected in its web presence. The WISER Ranking value is calculated through the combination of these four indicators i.e. the number of links or external links, the number of WebPages, the number of rich files in a web domain, and the number of publications in the Google scholar database based on the following formula where each one has a different weight:

Aguillo, et al. (2008) has given the formula for WISER ranking as:

WISER ranking = log (Visibility 50%) + log (Size 20%) + log (Rich files 15%) + log (Scholars 15%).

Data Analysis and Interpretation

The WIF for each agricultural digital repository is calculated based on a formula given in three different ways. These are Simple Link WIF, External Link WIF, and In-Link WIF, which reflect the level of influence of domain spaces in WWW. A matrix can represent the calculation of WIF of different web spaces as shown in Table 1.

Table-1: Different Web Link Impact Factors of Agricultural Repositories Websites

S. No.	ASIAN Repositories	NWP (A)	NLP (B)	SIMLF (B/A)	External LP (D)	Ext IF (D/A)	No of IN-P(E)	RWIF (E/A)
1	Academia Sinica IR	618000	550000	0.88996764	1040000	1.682848	652000	1.055016
2	AHKRC Digital Library	1800	971	0.53944444	1220	0.677778	939	0.521667
3	Baskent University Open Access System	34100	41200	1.20821114	51100	1.498534	49700	1.457478
4	Bogor Agricultural University Repository	218000	185000	0.84862385	435000	1.995413	389000	1.784404
5	CapSU Tapaz Aklatan Repository	5	5	1	6	1.2	5	1
6	ChungNam Institute	614000	490000	0.7980456	981000	1.59772	993000	1.617264
7	Coconut Research IR	782000	536000	0.685422	615000	0.786445	673000	0.860614
8	DR of Warmadewa University	9010	5340	0.59267481	114000	2.516556	76600	1.690949
9	Diponegoro University | IR (UNDIP-IR)	45300	34700	0.76600442	5660	0.628191	4870	0.540511
10	DSpace at IRRI	17400	9	0.00051724	32600	1.873563	32700	1.87931
11	DSpace@GIPE	55900	15600	0.27906977	16900	0.302326	16700	0.298748
12	DSpace@GOP	10200	9700	0.95098039	9700	0.95098	8530	0.836275
13	E-Library Universitas Brawijaya	99900	143000	1.43143143	161000	1.611612	135000	1.351351
14	ePrints Sriwijaya University - UNSRI Online IR	12200	9580	0.7852459	14100	1.155738	9490	0.777869
15	ePrints Sriwijaya University - UNSRI Online Repo	13200	9370	0.70984849	14900	1.128788	9110	0.690152
16	ePrints@Bangalore University	20300	9780	0.4817734	1280	0.063054	220000	1.896552
17	ePrints@CFTRI	27400	47300	1.72627737	17000	0.620438	948	0.0467
18	Eprints@CMFRI	39600	15700	0.39646465	4010	0.101263	16300	0.594891
19	Eprints@IARI (Indian Agricultural Research Inst.)	29100	14100	0.48453608	15900	0.546392	3710	0.093687

20	eprints@NAARM	28400	28700	1.01056338	39200	1.380282	3710	0.127491
21	EPRINTS@UNAIR - REPOSITORY UNAIR	116000	205000	1.76724138	253000	2.181034	28400	1
22	ETD of UAS Dharwad	13200	5790	0.43863636	4940	0.374242	3880	0.293939
23	FÄ±rat University Instit. OA	68300	72900	1.06734993	98900	1.448023	107000	1.566618
24	Hasanuddin Univ. Rep.	109000	94100	0.86330275	107000	0.981651	76900	0.705505
25	Hector Kobbekaduwa Agrarian Res. & Training IR	35900	39000	1.08635098	35000	0.97493	35800	0.997214
26	HF-IR (the Library of Hefei Ins.of Physical Science)	89900	4290	0.04771969	1860	0.02069	1310	0.014572
27	Igdir Universitesi Acik Erisim Sistemi	9840	8230	0.83638211	11600	1.178862	9000	0.914634
28	IR @VSL	349000	224000	0.64183381	223000	0.638968	195000	0.558739
29	IR of Chengdu Institute of Biology, CAS	2300	928	0.40347826	84	0.036522	549	0.238696
30	IR of Inst. for the Hist. of Natural Sci. (IHNS OIR)	14100	33100	2.34751773	1850	0.131206	6080	0.431206
31	IR of Institute of Geographic Sciences and Natural Resources Research, CAS	180	304	1.68888889	281	1.561111	98	0.544444
32	IR of Research Center for Eco-Env. Sciences, CAS	188	441	2.34574468	414	2.202128	143	0.760638
33	IR of the Chittagong Vete. and Animal Scie. Univ.	3880	73	0.01881443	228	0.037134	5320	0.86645
34	IR@NEERI - IR@NEERI	6140	6550	1.06677524	6000	0.911854	5360	0.81459
35	IR@NEIST OAIR	6580	5490	0.83434651	7	0.001804	5	0.001289
36	Kagoshima Academic Repository Network	240000	184000	0.76666667	242000	1.008333	230000	0.958333
37	KNOWLEDGE REPO. OPEN NETWORK (KNooR)	33000	33800	1.02424242	36800	1.115152	40800	1.236364
38	Knowledge@FSL | Fundamental Sci. Lib of the NAS	391000	44900	0.11483376	14400000	36.82864	1.5E+08	381.074

39	Koya University Eprints - Koya University Eprints	5340	5130	0.96067416	5120	0.958801	5070	0.949438
40	KREi Repository	76500	38400	0.50196078	941000	12.30065	33300	0.435294
41	KRIBB Repository	11400	11100	0.97368421	18600	1.631579	20500	1.798246
42	KRISHI Publications and Data Repository	215000	322000	1.49767442	451000	2.097674	290000	1.348837
43	Krishikosh	351000	147000	0.41880342	129000	0.367521	86700	0.247009
44	Madan Puraskar Pustakalaya	55900	19500	0.34883721	12400	0.221825	12700	0.227191
45	MB IPB Repository - MB IPB Repository	109000	92000	0.8440367	113000	1.036697	95000	0.87156
46	Mugla Sitki Kocman University Open Archive Repo.	36000000	21200000	0.58888889	95900000	2.663889	1.26E+08	3.5
47	NARO Institutional Repository	70700	87800	1.24186704	270000	3.818953	180000	2.545969
48	National Science Digital Library at NISCAIR	6550	14200	2.16793893	4300	0.656489	4440	0.677863
49	NIPGR Digital Knowledge Repository (NDKR)	70700	45000	0.63649222	64500	0.912306	42900	0.606789
50	OA Repository of ICRISAT - OAR@ICRISAT	28400	33000	1.16197183	28700	1.010563	6600	0.232394
51	Obihiro Uni. of Agriculture and Veterinary Medi. AR	7840	6720	0.85714286	10400	1.326531	9630	1.228316
52	Open Access E-Repository @ IIHR	15800	11500	0.7278481	18100	1.14557	15300	0.968354
53	Open Access: Agriculture Research Rep.	29200	26500	0.90753425	54200	1.856164	27100	0.928082
54	openagri	41300	32400	0.78450363	32200	0.779661	31100	0.753027
55	ORION	117000	101000	0.86324786	115000	0.982906	85200	0.728205
56	POLNEP Repository	6350	2940	0.46299213	3000	0.472441	2330	0.366929
57	PSNZIR: Perpustakaan Sultanah Nur Zahirah IR	2000000	1190000	0.595	1430000	0.715	1590000	0.795
58	Rep. University Muhammadiyah Jember - Test Repo.	10800	3990	0.36944444	4690	0.434259	4530000	91.8864

59	Repository of Medan Area University	49300	1290000	26.166329	4050000	82.1501	2950	0.273148
60	Rice Knowledge Management Portal	43700	14900	0.3409611	17500	0.400458	16200	0.370709
61	R-Space, Korea Rural Economic Institute	20000	16700	0.835	8990000	449.5	239000	11.95
62	Rubber Research Institute Repository	198000	120000	0.60606061	174000	0.878788	170000	0.858586
63	SAUL Archive	5890	4060	0.68930391	3570	0.606112	3460	0.587436
64	Scholarly publications from Indian Institute of Spices Research, Kozhikode (Calicut), INDIA	161	128	0.79503106	100	0.621118	276	1.714286
65	Science paper OST Development Center of ME of the People's Re. of China	221000	1.6E+08	723.9819	5760	0.026063	4090	0.018507
66	SEAFDEC/AQD IR	30100	18600	0.6179402	17500	0.581395	14600	0.48505
67	Sirnak University Institutional Repository	4350	19900	4.5747126	4980	1.144828	8080	1.857471
68	TAGEM Open Access System	64100	226000	3.525741	21300	0.332293	18200	0.283931
69	Taiwan Agricultural History Digital Archives	31300	31300	1	33400	1.067093	4490000	0.485931
70	Taiwan Agricultural Research Institute Inst. Repo.	9240000	3570000	0.38636364	6330000	0.685065	30100	0.961661
71	Tea Research Institute Repository	2370000	2110000	0.89029536	3210000	1.35443	2550000	1.075949
72	Thai Agricultural Research Repository:	35800	30800	0.8603352	33700	0.941341	31800	0.888268
73	Tokyo Seiei College Repositories	81700	83600	1.02325581	9	0.00011	75900	0.929009
74	Tokyo University of Agriculture and Tech. Repo.	1590000	966000	0.60754717	1130000	0.710692	1300000	0.81761
75	Tottori University Research Result Repository	59000	36000	0.61016949	33700	0.571186	31500	0.533898
76	Toyama Science Museum Repository	44600	8	0.00017937	25300	0.567265	25100	0.56278
77	Ubaya Repository	12600	15200	1.20634921	27200	2.15873	20500	1.626984
78	UM Research Repository	406000	457000	1.12561576	597000	1.470443	400000	0.985222

79	UMS Institutional Repository	43300	51100	1.18013857	85200	1.967667	55100	1.272517
80	Unika Repository	101000	96800	0.95841584	139000	1.376238	124000	1.227723
81	Unitri Repository - Unitri Repository	5480	4750	0.86678832	5570	1.016423	5190	0.94708
82	Univ. HKBP Nommensen	15200	17300	1.1381579	463000	30.46053	404000	26.5789
83	Universitas Muhammadiyah Sidoarjo	11600	1070	0.09224138	1700	0.146552	1430	0.123276
84	Universiti Malaysia Kelantan Intitutional Repository	10200	9540	0.93529412	9540	0.935294	5420	0.531373
85	UPN JATIM DIGITAL LIBRARY	68400	23600	0.34502924	32300	0.472222	1430	0.020906
86	UPN JATIM REPOSITORY	14900	5360	0.35973154	6620	0.444295	3850	0.258389
87	Western Mindanao State University Repository	54600	45800	0.83882784	454000	8.315018	199000	3.64469
88	Yamagata Univ. Academic Rep.	27900	24500	0.8781362	61700	2.21147	36900	1.322581

Note: NWP=No. of Web Page, IWLP=In-Link Web Page, RWIF=Revised Web Impact Factor

Impact Factor

Table1 exhibits the rank distribution of the 88 Open Access Agricultural digital Repositories. Based on their Simple Link IF Science paper Online @ Sci. and Tech. Development Center of Ministry of Education of PRC ranked the first position with 723.9819005 SIMIF, followed by Repository of Medan Area University (26.166 SIMIF) and IR of Sirnak University (4.574 SIMIF). According to their External Link IF R-Space, Korea Rural Economic Inst. (449.5 EXTL IF) ranked the first position, followed by Repository of Medan Area University (82.1501 EXTL IF) and Fundamental Scientific Library of the NAS, i.e., Knowledge@FSL (36.82864). Based on their revised or In-Link web impact factor (RWIF), calculated by putting the following formula i.e., Revised Web Impact Factor=E/A, where E=Internal Link Web Page and A=Number of Web Page. Fundamental Scientific Library of the NAS i.e., Knowledge@FSL, ranked first with 391000 Web Pages and 149000000 in-link web pages and 381.074 RWIF; followed by Repository of Medan Area University with 49300 Web Pages and 4530000 InLink Web Pages and 91.88 RWIF. University HKBP (Huria Kristen Batak Protestant) Nommensen Institutional Repository (Indonesia) occupied 3rd position with 26.57 RWIF. Though Mugla Sitki Kocman University Open Access Repository and Taiwan Agricultural Research Institutional Repository have a maximum number of InLink Pages (i.e. 126000000 & 4490000) compared to all Digital Repositories, stood at 6th and 66th position due to their less impact factor.

WISER Ranking

To determine the visibility and connectivity of Asia's open access agricultural repositories throughout the world, the WISER Ranking Method is employed, which is derived using the following formula as recommended by the World Webometrics Group for ranking academic institutions:

WISER Rank = log (Visibility 50%) + log (Size 20%) + log (Rich Files 15%) + log (Scholar 15%),.

Table-2: Ranking of Agricultural Repositories based on WISER INDICATOR

Name of Asian Repositories	NWP	ELP	Rich Files					GS	WISER	RANK
	(S)	(V)	No of	No of	No of	No of	Total		VALUE	
	50%	20%	PDF	PPT	DOC	PS	15%	15%		
Taiwan Agricultural Research Inst.IR	9240000	6330000	1070000	6	1640	82	1071728	2580	20.560962	1
SP Online at STDCME of the PRC	221000	5760	16500000	719	18800	3	16519522	55600	18.42007	2
Tea Research Institute Repository	2370000	3210000	255000	8	2030	211	257249	275	18.083122	3
Perpustakaan Sultanah Nur Zahirah IR	2000000	1430000	236000	138	701	58	236897	379	17.761747	4
REPOSITORY UNIVERSITAS MEDAN AREA	49300	4050000	149000	65	648	146	149859	2300	17.189895	5
Coconut Research IR	782000	615000	186000	108	756	806	187670	747	17.18098	6
Bogor Agricultural Univ. Repo.	218000	435000	29900	59	205	224	30388	16100	17.018656	7
UM Research Repository	406000	597000	85900	54	208	74	86236	1510	16.851348	8
Mugla Sitki Kocman University Open Archive Repository	36000000	95900000	59	30	952	55	1096	0	16.754023	9
KRISHI Pub.and Data Repo.	215000	451000	39900	39	366	1	40306	1770	16.19214	10
Krishikosh: Home	351000	129000	4810	0	5	1	4816	28800	16.150158	11
KREi Repository	76500	941000	9290	1	22	2	9315	3370	15.706246	12
EPRINTS@UNAIR - REPOSITORY UNAIR	116000	253000	8600	2	87	1	8690	7960	15.659694	13
Knowledge@FSL | Fundamental Scientific Library of the NAS	3,91,000	14400000	4430	4	42	0	4476	70	15.59871	14
Tokyo Univ. of Agri. And Tech. Repo.	1590000	1130000	268000	62	130	129	268321	3	15.512434	15

Diponegoro University (UNDIP-IR)	45300	114000	14100	5	64	0	14169	12600	15.316895	16
The Academia Sinica IR	618000	1040000	119000	71	521	250	119842	7	15.083911	17
Rubber Research IR	198000	174000	41000	72	105	45	41222	326	15.017744	18
Hasanuddin University Repository	109000	107000	6200	4	98	1	6303	5960	14.993786	19
Unika Repository	101000	139000	6580	1	7	2	6590	4000	14.920464	20
Institutional Repository @VSL	349000	223000	68400	16	163	40	68619	48	14.760998	21
E-Library Univ. Brawijaya	99900	161000	15800	9	307	8	16124	261	14.182687	22
UPN JATIM DIGITAL LIBRARY	68400	32300	13000	9	114	1	13124	2190	14.154951	23
Chung Nam Institute	614000	981000	54300	35	151	19	54505	1	13.868456	24
OAR@ICRISAT	28400	39200	4790	0	7	0	4797	1930	13.365314	25
ePrints@CFTRI	27400	17000	3810	0	21	0	3831	5720	13.36109	26
Ubaya Repository	12600	27200	947	0	3	0	950	25700	13.274779	27
Kagoshima Academic Repo. Network	240000	242000	21200	3	43	16	21262	0	13.267722	28
UMS Institutional Repository	43300	85200	15800	4	23	5	15832	123	13.208551	29
SEAFDEC/AQD IR	30100	17500	9170	1	29	1	9201	1270	13.141426	30
NIPGR Digital Knowledge Repository	70700	64500	3460	0	28	0	3488	386	13.140325	31
Eprints@CMFRI	39600	4010	14000	1	6	0	14007	2480	13.093819	32
Tottori Univ. Research Result Repo.	59000	33700	7300	4	65	1	7370	220	12.860555	33
MB IPB Repository	109000	113000	6760	6	104	23	6893	32	12.786246	34
ORION	117000	115000	8040	1	22	0	8063	23	12.749291	35
FÄ±rat Univ. Inst. OA	68300	98900	15000	1	63	0	15064	22	12.702163	36
UPN JATIM REPOSITORY	14900	6620	11000	0	5	1	11006	1400	12.533984	37
Hector Kobbekaduwa Agrarian Research and Training IR	35900	35000	3990	0	7	3	4000	243	12.439011	38

Western Mindanao State Univ.y Repo.	54600	454000	1850	7	20	0	1877	23	12.381623	39
DSpace@GIPE	55900	12400	28600	1	0	0	28601	45	12.30261	40
TAGEM Open Access System	64100	21300	45600	1	41	1	45643	13	12.260738	41
R-Space, Korea Rural Economic Institute	20000	8990000	4480	0	6	0	4486	1	12.258831	42
ePrints Sriwijaya University - UNSRI Online Repository	13200	14900	1810	0	8	0	1818	1660	12.125645	43
HF-IR (the Library of Hefei Institutes of Physical Science)	89900	1860	5860	6	8	6	5880	603	12.12515	44
UNSRI Online IR	12200	14100	1810	0	58	0	1868	1660	12.079246	45
Univ. Malaysia Kelantan IR	10200	9540	894	1	2	0	897	5900	12.063976	46
Rice Knowledge Management Portal	43700	17500	1310	2	6	0	1318	378	11.933109	47
OPENAGRI	41300	32200	2560	590	64	0	3214	35	11.527102	48
Baskent Univ. Open Access Sys.	34100	51100	6040	0	33	0	6073	14	11.522889	49
NARO IR	70700	270000	7510	2	42	3	7557	1	11.511315	50
DSpace at IRRI	17400	32600	4520	0	5	1	4526	48	11.442905	51
SAUL Archive	5890	3570	2390	1760	0	8	4158	1230	11.383756	52
Open Access: Agriculture Research Repository	29200	54200	2480	10	119	0	2609	20	11.269069	53
National Chung Hsing University Library-Taiwan Agricultural History Digital Archives During the Japanese Colonial Period	31300	33400	390	0	3	0	393	196	11.258122	54
KNOWLEDGE REPOSITORY OPEN NETWORK)	33000	36800	7970	1	110	20	8101	6	11.123234	55

Muhammadiyah University of Sidoarjo	11600	1700	2190	0	4	0	2194	1140	11.045231	56
NSDL@ NISCAIR, India	6550	4300	3350	12	28	0	3390	467	11.001409	57
Thai Agricultural Research Repo.	35800	33700	1130	0	3	3	0	5130	10.967722	58
Univ. HKBP Nommensen	15200	463000	189	0	3	0	192	24	10.86312	59
Yamagata University Academic Repository	27900	61700	7530	1	3	0	7534	2	10.766128	60
ePrints@Bangalore Univ.	20300	1280	1300	3	2	1	1306	525	10.602991	61
Eprints@IARI	29100	15900	1350	1	2	0	1353	22	10.491193	62
Madan Puraskar Pustakalaya	55900	16900	1520	5	16	0	1541	9	10.469526	63
Toyama Science Museum Repository	44600	25300	1620	0	2	2	1624	0	10.439133	64
POLNEP Repository	6350	3000	1600	0	0	0	1600	218	10.174654	65
Digital Repo. Warmadewa Univ.	9010	5660	1510	1	4	0	1515	86	10.174635	66
UNITRI Repository	5480	5570	1240	0	6	1	1247	146	10.097038	67
Open Access E-Repository @ IIHRH	15800	18100	1080	0	3	0	1083	16	10.047267	68
Repository University Muhammadiyah Jember - Test Repository	10800	4690	314	0	1	0	315	272	9.9896586	69
KRIBB Repository	11400	18600	2590	1	1	0	2592	0	9.9161441	70
E-Theses and Dissertations of UAS Dharwad	13200	4940	371	0	3	0	374	134	9.8664598	71
eprints@NAARM	28400	28700	284	0	1	0	285	14	9.8643556	72
Obihiro University of Agriculture and Veterinary Medicine Academic Repo.	7840	10400	4950	0	2	0	4952	0	9.7822213	73
Igdir Universitesi Acik Erisim Sistemi	9840	11600	1680	0	5	0	1685	0	9.4601442	74
CSIR North East Institute of Science and Technology OAIR	6580	6000	916	1	1	0	918	5	8.6103723	75

Sirnak University IR	4350	4980	861	0	2	0	863	0	8.4478207	76
DSpace@GOP	10200	9700	176	0	0	0	176	5	8.2920371	77
IR@NEERI - IR@NEERI	6140	228	346	1	0	1	348	105	8.0610543	78
Tokyo Seiei College Repo.	81700	9	6420	0	24	6	6450	0	7.8521155	79
IR of Inst. for the History of Natural Sciences, Chinese Academy of Sciences	14100	1850	148	2	32	4	186	5	7.7370563	80
Koya University Eprints	5340	5120	159	0	0	0	159	2	7.2914209	81
AHKRC Digital Library	1800	1220	184	1	0	0	185	3	6.4381078	82
IR of Chengdu Ins. of Biology, CAS	2300	84	117	5	4	0	126	34	6.2700391	83
SP of I I SR, Kozhikode, INDIA	161	100	45	0	1	0	46	24	4.6019775	84
IR of Research Center for Eco-Environmental Sciences, CAS	188	414	38	1	0	0	39	5	4.5333753	85
Repsitory of the Chittagong Veterinary and Animal Sci. Univ.	3880	7	5	0	0	0	5	57	4.2409571	86
IR of Institute of Geographic Sciences and Natural Resources Research, CAS	180	281	1	5	1	0	7	3	3.3783806	87
CapSU Tapaz Aklatan Repository	5	6	0	0	0	0	0	0	0.4771213	88

An attempt has been made to rank the Webpages and the links of Asian Agricultural Repositories using appropriate webometric indicators. In addition to the WISER ranking, which was explained in the research methodology. Table 2 highlights the status of the Asian agricultural repositories' websites based on their WISER value. The Taiwan Agricultural Research Institutional Repositories website occupied the highest rank with 20.56 WISER value scored the topmost position, and had the third position with regards to the number of Webpages and had fourth position in-links, and it was the website of SP Online at STDCME of the PRC with 18.42 WISER values that came in the second position, followed by Tea Research Institute Repository of Sri Lanka (18.08). At the bottom, the website of the CapSU Tapaz Aklatan Repository of Capiz State University Tapaz Satellite College of Philippines came with 0.477121256 WISER values. It also had the least number of in-links in the Asian Continent which shows that the WISER method brings out a more representative and reliable picture than the web impact factor which is biased towards a minor number of Webpages and in-links.

Alternative Document Model for Interlinking between Agricultural Repositories in Asia

ADMs are a method of combining web content into units for computational purposes. It works on web pages, directories, domains, etc. Alternative Document Model (ADM) is used for data collection for open access to digital repositories of agricultural science in Asia. Raw data is collected using web crawlers, such as SocSciBot4 for agricultural digital repositories in Asia. In this data, the UPN Veteran Jakarta (upnjatim.ac.id, eprints.upnjatim.ac.id) University repository shows Page in links-20, Directory in links-18 and Domain in links-2 and Site in links-1 and remaining showed nil in data.

Interlinking between Digital Repositories of Agricultural Sciences in Asia

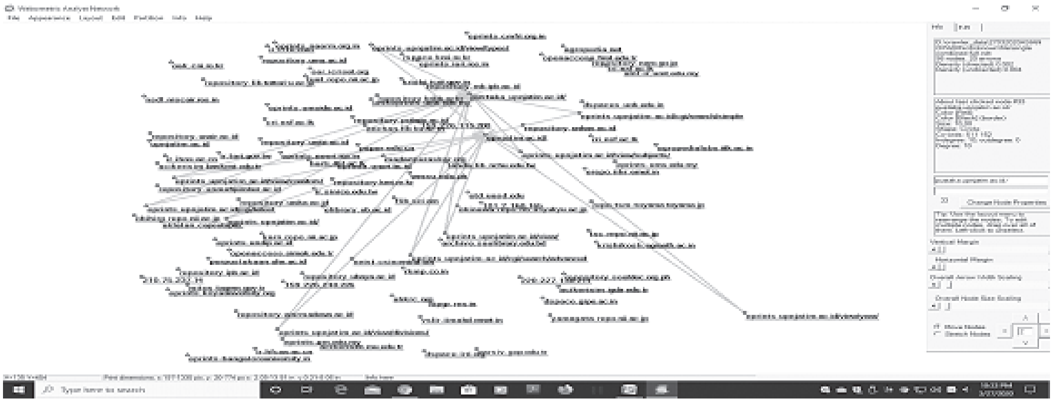

Figure: 1 Network diagram of Repositories

Network topology was built based on the ADM count summary data at the different levels (i.e., page, directory, and file) after crawling the data through the web crawler, SocSciBot (developed by Mike Thelwall). Fig. 1 shows the micro-link topology of Open Access Digital Repositories of Agricultural Sciences in Asia. Such link topologies can be generated to similarly show the network diagram of Repositories of Agricultural Sciences (combined) and other Repositories. The combined network diagram is shown because of its complicated network structure and visibility issues due to huge links that help to know which Open Access Digital Repositories of Agricultural Sciences provides links to whom. Figure 1 depicts the relationships between 88 IDRs. Few IDRs (i.e., 7 IDRs) throughout Asia are linked to one another, but a large number of IDRs not linked to any other IDR.

Major Findings

- In simple link WIF (SLWIF) the website of Science paper online @ Sci. and Tech. Development Center of Ministry of Education of PRC ranked the first position and have uploaded the highest number of rich content files (i.e., 84.64%), followed by the websites of Taiwan Agricultural Research Institutional Repositories and Tokyo University of

Agriculture and Technology Repository (with 5.49 % and 1.37%) and also has the highest score in Google Scholar (i.e. 26.89%) of this repository.

- As per Simple Link WIF, Ext. Link and In-Link WIF the websites of Repository of Medan Area University ranked second position.
- In Ext. Link WIF the websites of Fundamental Scientific Library of the NAS i.e. Knowledge@FSL, ranked 3rd position. In contrast, in In-Link WIF or RWIF the websites of Fundamental Scientific Library of the NAS i.e., Knowledge@FSL ranked 1st position.
- The website of Taiwan Agricultural Research Institutional Repositories occupied the highest rank with 20.56 WISER value scoring the topmost position followed by the Repository of Science and Technology Development Center of the Ministry of Education of the People's Republic of China and Repository of Tea Research Institute, Sri Lanka regarding the WISER value of IDR websites which shows in the Table6.
- Out of the links among 88 selected websites of IDR, only seven agricultural repositories in Asia are linked to one another. However, most IDRs are not linked to any other IDR.

Suggestions

Based on the findings of the Webometrics study, the following suggestions are recommended:

i. Agricultural Repositories having fewer WebPages should upload comprehensive information and content on their websites, ultimately increasing the number of WebPages. It will also improve the WISER value of a website.

ii. Agricultural Repositories' websites having fewer in-links should build good relations with the external world to increase their in-links. To develop these websites, the webmaster can contact administrators of various research organizations, national and international library associations and other similar institutions.

iii. Full information should be uploaded in rich content files to improve the quality of uploaded information and effective presentation of information.

In this 21st century, the documents produced by Google Scholar have been used as a web indicator for ranking and evaluating a website. So Agricultural Repositories will need to understand the importance of the quality of scholarly literature because the uploaded information on websites can receive number of citations that will help to increase the reputation and impact of these repository websites.

Conclusion

Scholarly communication has improved as a result of open access initiatives and movements. IR has evolved into various educational and research institutions in many nations which have aided in the acquisition and preservation of all academic literature and information resources. Similarly, the growth of ICTs, particularly the WWW, has aided in preserving and disseminating information at any time, in any format, and from any place. IRs all around the globe maintain websites that allow free access to worldwide research findings and agricultural science is no exception. According to the study, Asian countries have 88 agricultural repositories with websites, demonstrating that institutional repositories appreciate the importance of the web and its utility in everyday life. However, continual monitoring of website functionality and usability is essential.

References

Almind, T., Ingwersen, P. (1997). Informetric analyses on the World Wide Web: Mythological approaches to Webometrics. Journal of Documentation, 53 (4) 404-426.

Barjak, F., Li, X., & Thelwall, M. (2006). Which factors explain the Web impact of scientists' personal homepages? Journal of the American Society for Information Science and Technology, 58(2), 200-211. https://doi.org/10.1002/asi.20476

Bjorneborn, L., Ingwersen, P. (2004). Towards a basic framework for webometrics. Journal of the American Society for Information Science and Technology, 514. 1216-1227.

Ingwersen, P. (1998). The calculation of web impact factors. Journal of Documentation, 54 (2), 236-43.

Islam, M. A., Alam, M. S. (2011). Webometric study of private universities in Bangladesh. Malaysian Journal of Library & Information Science, 16. 115-126.

Jalal, S. K., Biswas, S. C., & Mukhopadhyay, P. (2010). Web presence of selected Asian countries: A webometric study. Collnet Journal of Scientometrics and Information Management, 4(2), 57-68. https://doi.org/10.1080/09737766.2010.10700893

Jalal, S., Biswas, S., & Mukhopadhyay, P. (2010). Web impact factor and link analysis of selected Indian universities. Annals of Library and Information Studies, 57(2), 109-121.

Jalal, S.K.; Biswas, S.C. & Mukhopadhyay, P.S. Webometric indicators for ranking of accredited Indian universities: An evaluatory study. In XXVII All India Conference of IASLIC on Library/Information Users in Digital Era, organized by KIIT University, 26-29 December 2009, Bhubaneswar.

Jhamb, G., Ruhela, A. (2017). A Webometric Study of the Websites of Public libraries. International Journal of Library and Information Studies, 7 (4) 83-89.

Larson, R.R. (1996). Bibliometrics of the World Wide Web: An exploratory analysis of the intellectual structure of cyberspace." In Hardin, S. (Ed.), Proceedings of the 59th Annual Meeting, ASIS 96. Baltimore, (1996): 71-79. Web. Oct 22, 2019.

Madhusudhan, M., & Prakash, S. (2013). Websites of Indian Institutes of Technology: A Webometric Study. International Journal of Library and Information Studies, 3(4), 93-107.https://www.researchgate.net/project/Websites-of-Indian-Institutes-of-Technology-A-Webometric-Study

McGregor, H., & Guthrie, K. (2015). Delivering Impact of Scholarly Information: Is Access Enough? The Joural of Electronic Publishing, 8(3), 7. https://doi.org/10.3998/3336451.0018.302

Mukhopadhyay, P.S. Measuring web impact factors: A webometric study based on the analysis of hyperlinks. In National Seminar on Information Support for Rural Development, India. IASLIC, December 2004.

Thelwall, M.; Tang, R. & Price, E. (2003). Linguistic patterns of academic web use in Western Europe. Scientometrics, 56 (3), 417-32.

Verma, M. K., and Brahma, K. (2017). Websites of Central Universities in North East India: A Webometric Analysis. DESIDOC Journal of Library & Information Technology, 37 (3) 389-395.

Verma, M. K., Brahma, K. (2017). A Webometric analysis of National Libraries' websites in South Asia. Annals of Library and Information Studies, 64 (2) 116-124.

Verma, M. K., Brahma, K. (2017). Webometric Analysis of Selected Library Consortium Websites of India: An Evaluative Study. 11th International CALIBER (328-341). Chennai, Tamil Nadu: NFLIBNET. 02-04 August

Vijayakumar, M. (2012). Webometric Analysis of University Websites in Sri Lanka. International Journal of Information Dissemination and Technology, 2 (3) 155-159.

Walia, P. K., Gupta, M. (2012). Web Impact Factor of Select National Libraries' Websites. DESIDOC Journal of Library and Information Technology, 32 (4) 347-352.

AgroNet: A Decentralized Platform for Collaborative Community-Driven Consultancy for Farmers and Agro Vendors

Sayanton Mondal[1], Zack Agar[2], Raj Ray[3], Sreetam Ganguly[4], Rubi Bhowmick[5] and Rithwick Sethi[6]

Abstract

Indian farmers are consistently plagued by age-old practices, which often prove non-productive, counter-productive, and harmful to the environment. In this modern technological era, farmers need to remain updated about technological advancements and government benefits. Timely, accurate consultancy and instant troubleshooting are non-existent in the Indian agricultural landscape. Farmers are forced to turn up to their peers' advice which can be inaccurate or wait for expert advice from domains in KVKs and Extension Departments in Agro-institutions. This article describes a novel decentralized system that combines the low latency of peer-to-peer consulting and the accuracy of expert-based systems and consulting from domain experts as an Android portal. AgroNet harnesses some of the tried-and-tested technologies to effectively provide consultancy and quick assistance to small and mid-level farmers quickly, with an estimated response time between 24 and 48 hours.

Keywords: AgroNet, Agro Vendors, Private Extension, e-Extension, e- Agriculture

Introduction

Agriculture is a crucial part of India's economy, and India is among the highest two farm producers in the world. Agriculture is the only means of living for nearly two-thirds of the employed class in India. There are more than 100-150 million farmers in India, according to the National Statistical

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Office's Situation Assessment of Agricultural Households (SAAH) report for 2018-19.

With this vast number of farmers, only a few government organizations are available as their aid. Every year the government rolls out numerous schemes to benefit the farmers to improve their socio-economic condition. Various farm inputs are being provided at subsidized rates to help them generate a good return. The government uses its machinery like Krishi Vigyan Kendra (KVKs), Agricultural Technology Management Agency (ATMA), and other agricultural extension centers. AgroNet is a friendly platform for users to exchange information and discuss issues concerning agriculture based on experience and knowledge. Sharing accurate information, forming communities, getting feedback from verified domain experts, and the latest news articles are a few features of AgroNet.

The information available on this platform can profit the community of researchers, students, farmers, and many more who ought to access and integrate knowledge on agriculture, governmental agricultural policies, soil testing centers, credit facilities, officers nearby, and other variables associated with it. They can get advice from verified experts and climate model experiments to grasp the ability of agricultural systems to deal with global climate change ever-changing food demands, which can create awareness and motivation for the farmers. Farmers often turn to their peers for help and get inaccurate information. Even the domain experts of KVK's and Extension Departments in agro-institutions failed to give the right advice in time. Here farmers can directly ask questions and query the agriculture experts, getting responses in no time estimated between 24 to 48 hours.

AgroNet will significantly enhance the interaction and information flow from different agricultural sectors involving agriculture domains and people associated with them. We can use the service to increase formal education and improve agricultural knowledge. AgroNet is available in different languages. It will help people from different parts of India converse with each other in their native language.

Previous Works

Xuanli Liu, Mack Nelson, Mohammed Ibrahim (2008) present precision farming, a site-specific farming system that confronts farmers with both opportunity and challenge. It is a successful alternative to traditional agricultural production systems since it allows for more efficient use of natural resources and represents agricultural industrialization. There is a broad method for valuing information, which applies the concept of information evaluation to two types of precision agricultural systems: input-oriented systems and output-oriented systems. The former plant a single crop variety in the field and uses variable fertilizer delivery rates based on site-specific information. The second system cultivates crop types and collects data from crop-based experimental designs. The two precision farming systems acquire information from various sources using distinct methods despite certain similarities.

P.Krishna Reddy (2005) offers a framework for a cost-effective agricultural information dissemination system (AgrIDS) to transmit expert agricultural knowledge to the farming community to boost crop yield via the integration of both agriculture and information technology. It enables the farmer to develop a crop with experience, such as an agricultural specialist's, by spreading individualized and timely expert advice cost-effectively. The lag time between research effort and practice can significantly decrease using AgrIDS. In AgrIDS, agricultural professionals create advice by utilizing both available crop-related agricultural technology and the most recent crop-related information obtained over the Internet in the form of both text and images. AgrIDS contains four parts: Farmers, Coordinators, Agricultural experts, and Agricultural Information System (AIS). All parts are connected through the Internet.

Dishant Jojit James etal. (2020), says that scientists from Krishi Vigyan Kendras take the lead in India in transmitting cutting-edge technology with positive consequences to farmers at the grassroots level. Social media allows people to exchange information and participate in agricultural conversations and debates. It also allows them to be informed of current agricultural innovations and keep up to date.

While precision farming undoubtedly benefits farmers in many ways, farmers are also required to have site-specific information about the land, sophisticated knowledge and skills for handling an extensive body of information, and complex equipment that they may have never used before. Furthermore, gathering information is costly, and no matter how much a farm spends on it, it has no resale value in the market. Obviously, before deciding to use precision farming, farmers must weigh the benefits of information against the expenses. Precision farming begins with information evaluation. This type of information is outside the scope of experience, and collecting it generally incurs substantial costs. A valid issue is whether it is worthwhile to get the knowledge. What is the value of the information? This proves to be a difficult challenge for farmers and academics.

Social Media is not devoid of disadvantages, as mentioned by Aliyu Akilu Barau, Safiul Islam Afrad (2017). For example, social media gave new meaning to communication, interaction, and culture and led to several social movements and revolutions. It can also detach a farmer, extension worker, or any other professional in the line rather than facilitate salient physical interactions, which are indispensable for proper networking and ultimate development. Many farmers are subsistence with little to incur data cost for accessing social media. In addition, there is a high internet cost at internet cafés. This ultimately presents a challenge to social media uses in agricultural extension services. Poor electricity supply and internet connectivity infrastructures are vital challenges to social media use in agricultural extension service delivery, the most affected are rural communities in developing countries. Stakeholders in agricultural extension service delivery, especially farmers and extension workers, are less educated, and using social media requires both educational and technical literacy. The accessible nature of social media in terms of comments and content creation is something that extension services cannot compromise.

Irrelevant posts, privacy concerns, stakeholders' conflicting perceptions, and lack of capacity in using social media act as deterrents to using social media in extension service program delivery. Currently, monitoring and assessing the quality and worth of information shared on social media are unsatisfactory for extension service delivery. As a result of cultural and societal limitations on women, the integration of social media into agricultural extension service delivery needs to take into account a gender-sensitive approach to cater to all regardless of advantage or otherwise.

Even though India has a large pool of agricultural scientists with appropriate expertise, it is not easy to cover all the farmers on a weekly/daily basis due to the cost and time factors. Also, such a system will be expensive to build and maintain. Further, drawbacks of the traditional system exist, such as the irrelevance of the delivered information, the inability of the system to cover all the farmers, the lack of avenues to improve performance, and the unaccountability for the advice given by the system.

Proposed Solution and Technology Stack

To tackle the scenario as mentioned above, we propose a role-based personalized system where each role will be shown personalized feeds. The "actor"i.e user primarily belongs to one of the four categories defined by the system i.e. Farmer, Business, Govt and Expert. The user can start using the platform by simply providing his phone number and verifying the authenticity of the number.

To help the user get started with the platform, the user will be asked a certain set of questions to create a basic profile that will enable the platform to personalize the feed according to the user's category along with their field of specialization (Farming, Harvesting, Waste Management) and other geographical features (state, Pincode, etc).

Depending on the category, the feeds will have four options, i.e., Farmer, Business, Government, and Expert. Based on the category, post priority shall be decided. If the category is Business or Government, the posts seen will be general, or fellow farmers post from the same area. As per the pre-defined priority order, posts from fellow farmers from the same area will be shown more than the general posts. However, suppose the category is Farmer or Expert. In that case, the posts will be seen in different priority order, in which the posts based on the specialization from the same area will be most frequent in the feed followed by posts from fellow farmers from the same area and then posts based on just the specialization.

The second part of the architecture involves the user who will create posts. The user clicks on it to create a post. The post will require a Post Title, Description, Category (Harvesting, Cultivation, Waste Management), and an image option. If the user wants to upload an image, he/she can upload using the system camera/the file system. If the fields are not valid for the post creation, it will go back to the post menu. Else, the post will be created and sent to the feed.

To keep it scalable and maintainable owing to the traffic the platform may have to withstand, we opted for a non-monolithic approach where each feature can be independently maintained and scaled (as per traffic) such that the entire system does not go down for a fault in any of the modules such as authentication, profile creation, image upload, feed and post modules, thereby, having a loosely coupled relationship among them, This enables the user to experience an almost zero downtime scenario from his perspective.

These modules will have separate images to be run in a containerized manner. Containerisation enables capturing logs and error handling for each module separately such that each module can be scaled accordingly as and when need be in an almost independent manner.

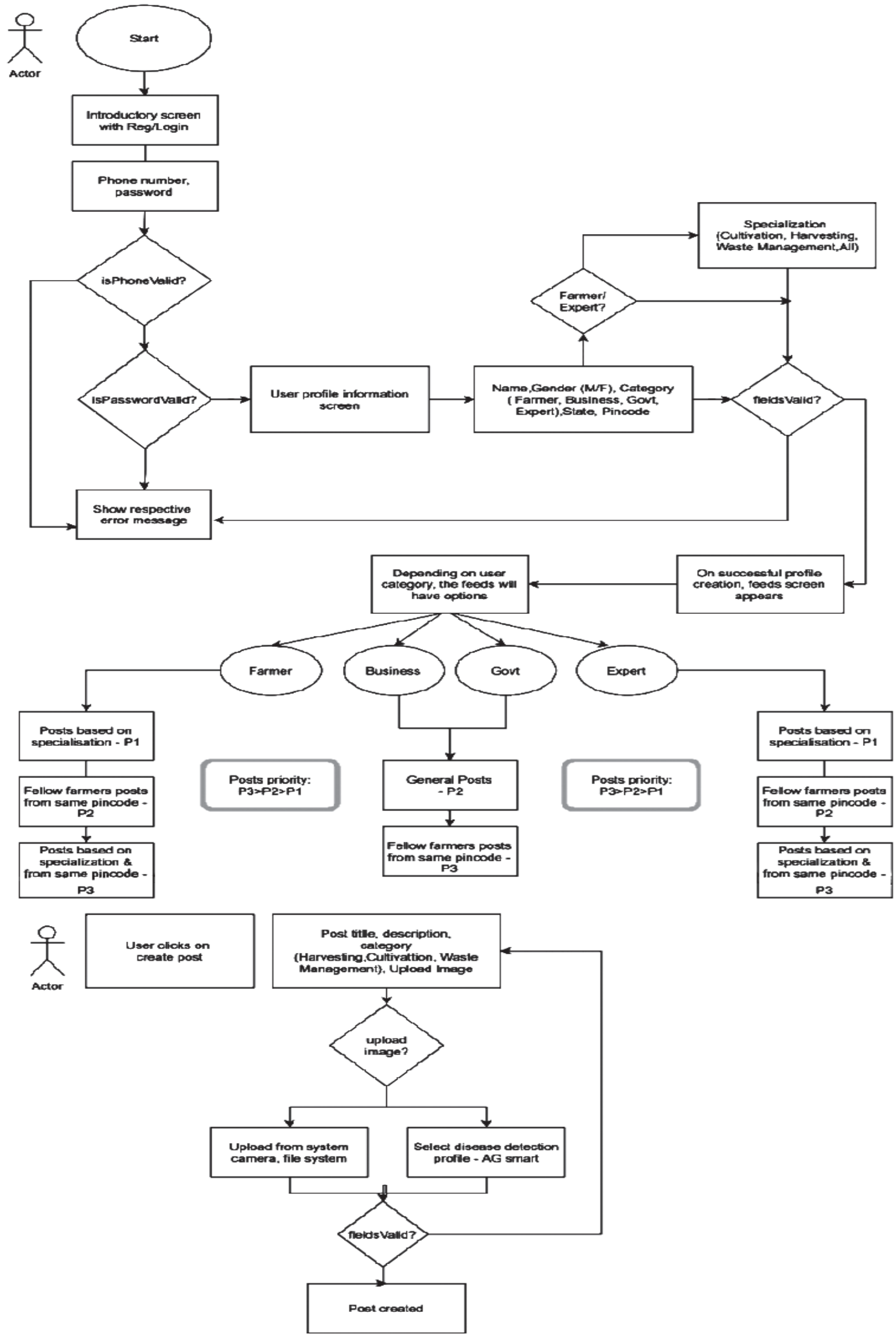

Fig-1: AgroNet Architecture

Possible Socio-Economic Impact

AgroNet is designed to be a platform that would interconnect the people associated with the agriculture and allied services fraternity along with the ones associated with indecision and policymaking. It will link the farmers with different government officials like ADAs, resource persons, subject matter specialists from KVKs, agriculture institutions, researchers, agricultural colleges and universities, agriculture science experts, and fellow progressive farmers. They will remain well informed about the new, modern, and state of the art technologies, methodologies, and facilities. Without going anywhere, they can witness how their fellow farmer is doing wonders with similar kinds of resources. The concept of result demonstration and method demonstration could be readily available for the farmers anywhere. The farmer would remain informed about the current government schemes and subsidies made available to them by the government. AgroNet creates a whole agriculture ecosystem that would generate a colossal agriculture knowledge pool with every sector of the agriculture fraternity. This would make a direct impact on the socio-economic condition of the farmer. It will be like a social media platform for them. With the efficient use of artificial intelligence and machine learning, we can also customize the feed of each farmer according to their needs.

Conclusion

The scenario of Indian agriculture is changing. With the inclusion of new-age startups, the concept of smart and precision agriculture is flourishing. It is becoming more and more technology-driven. After the Covid-19 pandemic, combining agriculture with state-of-the-art technology has become more evident. Indian small and marginal farmers being poor and with little education, will find it challenging to indulge themselves and cope with the present changes. AgroNet, with a user-friendly and straightforward interface clubbed with several regional languages, can become an introductory model for facilitating modern technology into the lives of millions of farmers. AgroNet utilizes tried and tested methods in social engineering and crowd-sourced expert systems to provide quasi-autonomous consultancy to the regular farmer. Ease of integration with current extension infrastructure, scalability due to its modular build, and low maintenance costs make it a sustainable, simple, and elegant solution to enable expert outreach for the modern farmer.

References

Arjun, K. M. (2013). Indian agriculture-status, importance and role in Indian economy. International Journal of Agriculture and Food Science Technology, 4(4), 343-346.

Barau, A. A., & Afrad, S. I. (2017). An overview of social media use in agricultural extension service delivery. Journal of Agricultural Informatics, 8(3), 50-61.

Harish Damodaran. (2021, April 19). The Indian Express. https://indianexpress.com/profile/author/harish-damodaran/

James, D. J., Shivamurthy, M., Lakshminarayan, M. T., & Ganesamoorthi, S. (2020). Social Media Used by Krishi Vigyan Kendra Scientists. Int. J. Curr. Microbiol. App. Sci, 9(6), 2609-2617.

Lerche, J. (2014). Regional patterns of agrarian accumulation in India. Indian capitalism in development, 46-65.

Liu, X., Nelson, M., & Ibrahim, M. (2008). The Value of Information in Precision Farming.

Reddy, P. K., & Ankaiah, R. (2005). A framework of information technology-based agriculture information dissemination system to improve crop productivity. Current Science, 88(12),1905-1913.

Role of Knowledge Management Methods in Agriculture-Need and Approaches

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Abstract

Knowledge Management is the process of collecting, creating, organizing, using and sharing collective knowledge. Knowledge Management mostly refers to tacit or implicit knowledge which is difficult to share in a tangible form. The role of knowledge management in agriculture is critical in addressing the knowledge-intensive farming practices. This paper reviews different knowledge management methods and tools used in agriculture.

Keywords: Knowledge Management, Agricultural Knowledge Management

Introduction

Knowledge is regarded as an important resource in agricultural development. Agriculture organizations realized the importance of managing explicit and implicit knowledge to disseminate right information to the right user at the right time. Adopting suitable knowledge management approach in agriculture is imperative to address the challenges of information explosion on one hand and growing needs of farmers on the other. The innovations in agriculture, food systems and markets demand new information for taking better decisions by farmers.

Challenges to Knowledge Management in Agriculture

The first challenge is the poor mechanisms and infrastructure for sharing and exchanging agriculture knowledge generated from research at national

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and regional levels. Many research activities are repeated due to the lack of such mechanisms and infrastructure at the national level. Researchers can find research papers published in international journals and conferences more quickly than finding research papers published nationally in local journals, conferences, theses, and technical reports. The second challenge is the inefficient mechanisms and infrastructure for transferring technologies produced by research to farmers either directly or through extension system. Although many extension documents are produced by national agricultural research and extension systems to inform farmers about the latest recommendations concerning different agricultural practices, these documents are not disseminated, updated, or managed to respond to the needs of extension workers, advisers and farmers. This is also true for technical reports, books, and research papers related to production. Knowledge is available through experienced farmers and specialists in different commodities. These inherited agricultural knowledge is rarely documented, but they embody a wealth of knowledge that researchers need to examine thoroughly.

Knowledge Management Processes and Tools

Knowledge is a fluid mix of framed experiences. This knowledge should be managed for the better and efficient dissemination of information to the right user at the right time. Various knowledge management tools have been used to help sharing of agricultural knowledge. Some of them are given below.

Word press

The word press is publishing software for easy, speed, and more fabulous user-based community software. It is a blogging tool around the world and is seen by millions of people worldwide. It is licensed under the GPL. It is the official successor of the b2/cafe log. The word press is an open-source project, and there are hundreds of people all over the world working on it. It was started in 2003 with a single bit of code. Since then, it has grown to be the most comprehensive blogging tool globally. It is built on PHP and MySQL and licensed under GPL.

Media-Wiki

A wiki is a type of website that allows the users to add, remove, edit and change the content of the Web Pages. Wiki is regarded as an effective tool to co-create content and share. It is an effective way for share crop-specific knowledge by scientists and innovative farmers.

Videoconferencing

Videoconferencing is two-way synchronous video and audio transmission over the network. It is a valuable tool for applications of many collaborating efforts. It saves time and costs and allows for face to face between individuals and groups. It helps to establish linkage between farmers, extension workers and scientists.

Desktop Videoconferencing

Desktop videoconferencing is a method for individuals to communicate between single users. It is the most basic form that involves two-way voice and video contact. It involves many other activities like screen sharing, media display, chatting, and remote login.

Webcasts

A webcast is a method of broadcasting information via the Web. It is a one-way communication process. Sometimes, in webcasts, the end-user may not have the ability to interact with the presenter. Single users can see it on one computer screen or multiple users through a projector.

Webinars

Webinars are also a method of broadcasting over the web. It requires advanced registration for access to the content, which allows the two ways of communication in text messages. Both single users and multiple users can see it by connecting to the computer. It is a web-based seminar method for information dissemination.

Podcasting

Podcasting is the method for delivering media content. Podcasts allow users to subscribe and automatically receive new content. Podcasts use RSS or XML-based feeds to bring content to users automatically. It is used to subscribe to web-based news, and information feeds.XML code is short, and once it is created once, it does not need to be created again. Podcasts can be played directly on users' computers. Podcasting permit student/ trainees to listen to the lecture without attending classes.

Classroom Capture

Classroom capture technologies allow a presenter to record lectures and make them available via media content such as iTunes U and Management system. Classroom capture is the recordings of classroom-based activities made available for review. Thanks to the improvement in technology and the use of smart classes

Role of Directorate of Knowledge Management in Agriculture

The National Agricultural Research System, and the Indian Council of Agricultural Research (ICAR) have taken a leadership role in promoting of ICTs by developing knowledge management portals on crops, commodities and agrarian practices.

The Directorate of Knowledge Management in Agriculture of ICAR is an ICT-driven technology and information dissemination system for a quick, efficient, and cost-effective delivery system to all the users in agriculture. Keeping in view the current knowledge explosion trends, the Directorate delivers and provides platform to ICAR technologies, policies, and other activities through print, electronic and web approaches. The Directorate is the apex center for planning, preservation, and updating of facilitation of network connectivity across ICAR institutes and KVKs. Moreover, the

Directorate provides public relations and publicity support to the council and its component across the country.

The main areas of knowledge Management in Agriculture are regarded as follows.

1. Dissemination and sharing of agricultural knowledge through value-added information products in print, electronic, and web approach
2. Expansion of e-resources on agricultural knowledge and information for global coverage.
3. Strengthening e-connectivity among ICAR institutes State Agricultural Universities and KVKs.
4. Capacity building for agricultural knowledge management.

Conclusion

Agriculture heavily depends on knowledge to address ever growing challenges. For this there is a need for individuals and institutions in agriculture to adopt better knowledge management approaches and tools.

References

Luen, T. W., & AI-Hawamdeh, S. (2001). Knowledge management in the public sector. Journal of Information Science, 27, 311-318.

Manjunath (ed), L. (2016). ICT for Agriculture and Rural Development. Agri- biovet Press.

Meera, S. N., Jhamtani, A., & Rao, D. U. M. (2004). Information and communication technology in agricultural development: A comparative analysis of three projects from India (p. 14). London: Overseas Development Institute.

Ray, A. C. (n.d.). Knowledge Management in Agriculture and its methods: A study. International Journal of Next Generation Library and Technologies, 3(2), 1-8.

Agricultural Knowledge Management Initiatives by ICAR: An Overview

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Abstract

Agriculture knowledge is a valuable asset for farmers and other stakeholders of any country. It plays a vital role in making them more progressive and helps in transforming society. This paper discusses the agriculture knowledge management initiatives developed by ICAR. The main objective is to raise farmers' understanding of using information and best practices to improve the production system and produce more food. Using these initiatives, farmers can uncover optimum farm practices in tasks that guide them chronologically through the growing season. These abilities can be used in various ways, including conversing with farmhands, tending crops, and fixing machinery. The ICAR has played a significant role in promoting higher education in agriculture excellence. It is engaged in cutting-edge science and technology development and its scientists are internationally acknowledged in their fields. This paper describes agricultural research information system of ICAR and discusses important knowledge management initiatives by ICAR.

Keywords: Knowledge Management, Mobile Apps, Agricultural Portal, Digital Resources, ICAR.

Introduction

Agriculture plays a vital role in the Indian economy by giving a living for more than 70 percent of the provincial families. It has a significant impact on the country's economic and social standing. The Indian agriculture sector has transitioned from traditional practices to newer technologies through the effective deployment of information and communication technologies over the last two decades. The processing and dissemination of knowledge have been critical in this transformation (Zhang et al., 2016).

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To be successful in agriculture, a farmer must not only have a love for the land, practical experience, and plenty of courage and determination, but he/she must also have a thorough grounding in science. Farmers need access to accurate agriculture-based information on a timely basis to make way better choices in their agricultural fields, make continuous and scientific adjustments in their production systems and take advantage of market opportunities (Jain et al., 2015). This is where agriculture knowledge initiatives come into the role.

Keeping pace with the current knowledge diffusion trends in agriculture in India, many public and private organizations are committed to encouraging ICT-driven technology and data distribution system for fast, powerful, and profitable delivery of communications to all the stakeholders in agriculture. In this context, ICAR institutes have played a significant role in disseminating knowledge in agriculture.

About ICAR

The Indian Council of Agricultural Research (ICAR) is an autonomous body in India that coordinates agricultural education and research in India. The world's largest network of agricultural research and education institutes is coming under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers Welfare, Government of India. It was founded on July 16, 1929, as a registered society under the Societies Registration Act, 1860, in response to the Royal Commission on Agriculture's report. The ICAR's headquarters is in New Delhi. This is one of the world's largest national agricultural systems, with 111 ICAR institutes and 71 agricultural universities spread across the country.

The ICAR was a pioneer in ushering in the Green Revolution and subsequent agricultural developments in India, allowing the country to increase the production of foodgrains by 5.6 times, horticultural crops by 10.5 times, fish by 16.8 times, milk by 10.4 times, and eggs by 52.9 times from 1950-51 to 2017-18, thereby having a visible impact on national food and nutritional security.

It has been instrumental in encouraging excellence in agricultural higher education. It is active in cutting-edge scientific and technological development, and its scientists are recognized internationally in their disciplines.

Objectives of ICAR

- Plan, carry out, coordinate, and promote agricultural research and technology development for long-term sustainability.
- Aid, provide and coordinate agricultural education to facilitate quality human resource development.
- Frontline Extension supports, agri-based rural development through the technological application, acceptance, knowledge management, and capacity building.
- Agricultural Research, Education and Extension Policy.

Knowledge Initiatives by ICAR

ICAR has developed a few knowledge initiatives, with each initiative aimed at disseminating information from agricultural research and extension to farmers and other stakeholders and encouraging information sharing across stakeholders.

KVK portals

In 1973, the Indian Council of Agricultural Research (ICAR) formed a committee chaired by Dr. Mohan Singh Mehta of Seva Mandir, Udaypur, to develop the institutional architecture of Krishi Vigyan Kendras (KVK) for vocational agricultural training. The first KVK was laid out in 1974 at Puducherry.

A Krishi Vigyan Kendra (KVK) is a rural extension center in India, typically connected with a nearby agrarian college. KVK is a crucial component of the National Agricultural Research System (NARS). All fall under the ward of one of the 11 Agricultural Technology Application Research Institutes

(ATARIs) throughout India. It serves as agricultural technology knowledge and resource enter, supporting governmental, commercial, and voluntary sector initiatives to improve the district's agricultural economy and connecting the NARS with the extension system and farmers.

The KVK scheme is fully funded by the Indian government, and KVKs are granted to agricultural universities, ICAR institutes, relevant government departments, and Non-Governmental Organizations (NGOs) engaged in agriculture. These institutes will observe the working of respective KVK at the public level and furnishing ideal data and material to the farmers.

Activities of KVK systems

KVK's mandate is to assess technology and demonstrate its use and capacity development.

The following activities are planned for each KVK to carry out the mandate properly.

- On-farm testing to choose the area specificity of the country progresses in a few developing systems.
- On-the-ground demonstrations to demonstrate the productivity potential of technologies on farmers' farms.
- Capacity building for farmers and extension people to keep their knowledge and skills up to speed on contemporary agricultural technologies.
- To serve as a knowledge and resource center for agricultural innovations in order to promote governmental, corporate, and voluntary sector initiatives to enhance the district's agricultural economy.
- Disseminate farm advisories via ICT and other media channels on various topics of relevance to farmers.

Furthermore, KVKs produce high-quality technological products (seed, planting material, bio-agents, livestock, etc.) and make them available to farmers, organize frontline extension activities, identify and document selected farm innovations, and converge with ongoing schemes and programs within the KVK's mandate.

The following table shows the distribution of KVKs among various institutions:

Agricultural Universities	**493**
ICAR Institutes	69
NGOs	102
State Governments	34
Other Educational Institutions	17
Total	**715**

Mobile Apps

A growing number of mobile apps provide access to agricultural and allied sector information. The primary benefits of mobile apps for farmers include easy access to information. Every day, brand new agri-apps, and service are designed and launched, available for download on the Google Play store.

These apps play an essential role in lowering the costs associated with agricultural production. It also enables farmers to cultivate better crops and, as a result, earn more money to improve their living standards. ICAR identifies a total of 113 mobile apps according to different agricultural fields.

Name of the Agricultural field	Name of the Mobile Apps
Crop Science	इक्षु केदार, Farm Tree, CTRI - FCV TOBACCO, CICR Cotton App, Groundnut-IPM, Groundnut-IFC, Fodder Kannada, ICAR IISR Black pepper. Seed Spices Info, Malwa Fasal, VNMKV, Emausamhau Krishi Mausam Seva, Weed Manager, PDKV Weed Manager, Soybean Gyan, Rice-IFC, RKMP Rice Vocs, Rice Expert, ICAR - MUSHROOM, Cane Adviser Tamil, Cane Adviser Hindi, Cane Adviser, Agriculture: FEM@Mobile
Horticultural Sciences	ICAR-Directorate of Onion and Garlic Research, OrchidoPedia, Cashew India, Banana Export and Value Addition, Arka Bagwani, Orchids Farming, Herbal Kisan, Fruit crops, ICAR DMAPR, हळद लागवड VNMKV Parbhani, e-kalpa, Oil Palm Pests English, Oil Palm Nutrients English, Oil Palm Cultivation English, Tomato Cultivation IIHR, CCRI-Citrus, लिंबुवर्गीय फळझाडांची लागवड (Citrus Cultivation), Ripe Mango Products, Aam Ki Suraksha-ICAR Patna, Mango Cultivation IIHR, GrapesDSS, ICAR-NRC L, Solapur Anar, ICAR IIOR Sunflower, ICAR-IIOR Castor, ICAR IIOR Safflower, ICAR IIOR Sesame, ICAR - IISR Black pepper, ICAR - IIOR, CCRI - CITRUS, GrapesDSS, E-Thilhan
Natural Resources Management	Saur Shakti ICAR, Fertilizer Calculator - Goa, VNMKV जलसंवर्धन व जलपुर्नभरण, PIS, GypCal-Sodic Soil Reclamation, Havaamaana- Krishi, LRIS GOA, PCZ Mapper, CAZRI KRISHI
Agricultural Engineering	Food Safety, AgroTech VNMKV

Animal Science	Bufelth, Buffalo Nutrition, Avimitra, Buffalo Reproduction (भैंस जनन एप्प) Dairy Kannada, Indigenous Dairy Products, Training Calendar, Feed Calculator, VetMicro, Hoof Care, Infoequine by ICAR-NRCE, IVRI-Pashu Prajanan (Animal Reproduction) App, Cover art IVRI-Shukar Palan(Pig Farming) App, CGKV APP, IVRI-Shukar Palan(Pig Farming) App, IVRI - Artificial Insemination App, IVRI - Pashu Prajanan (Animal Reproduction) App, Feed Guide: Multilingual App for Scientific Feeding for Dairy Animals
Fisheries Science	CIFT Lab Test, CIFTFISHPRO, mKRISHI Fisheries, Vanami Shrimpapp
Agricultural Education	CIFTraining, ICAR-CRIJAF
Agricultural Extension	Krishi Gyan, Kisan Mitra, KVK online AgriMart, Malda Krishi Vigyan Kendra, UBKV, Ratua, Malda, एकत्मिक तण व्यवस्थापन VNMKV, Kisan Sahayak Fatehgarh Sahib, Kisan Sahayak Ropar, Phule Krishidarshani, Farm Calculators, KhetiSewa, mAgIDS, Kheti-Gyan, Krishi Sparsham, Mobile Farm Solutions (Q&A), Micro Mitra, ICAR-IIOR Biocontrol, Chanamitra, GypCal -Sodic Soil Reclamation, GypCal -Sodic Soil Reclamation (Hindi), Genebank app, Fertilizer Calculator - Goa, e-kalpa, Chana Mitra

Agriculture Education Portal

ICAR's Agricultural Education Division which promotes quality of higher education in India tries innovative teaching, research, and outreach activities. The Agricultural Education Division of the ICAR is concerned with strengthening and streamlining the higher agricultural education system, improving the quality of human resources in the agri-supply chain, and preparing the country's agriculture production for future challenges. Through collaboration and efforts of the ICAR-Agricultural Universities (AUs) system, which includes 62 State Agricultural Universities, 5 Deemed-to-be Universities, two Central Agricultural Universities, and four Central Universities with Agriculture Faculty, the division works to maintain and improve the quality and relevance of higher agricultural education.

Objectives of Portal

- Strengthening and development of higher agricultural education in India.
- Development of human resources for positions of leadership in agricultural sciences.
- Refining the quality of agricultural education via Innovative Teaching, Research, and Outreach Activities.

Caneinfo

CaneInfo is an interactive and user-centerd website on sugarcane production technologies developed for cane growers and cane development personnel, students, and scientists to share information and knowledge on sugarcane by the Sugar Breeding Institute of ICAR. The CaneInfo is a database-driven website that delivers timely information regarding sugarcane to be retrieved free of cost everywhere, anytime, by all involved in sugarcane cultivation.

Compendiums

The ICAR has created a compendium, a condensed collection of information about a specific area of agriculture knowledge. The following collection of compendiums are made available under ICAR Compendiums initiatives for agriculture stakeholders:

- Compendium of Agricultural Technologies
- State-specific Technological Interventions for Higher Agricultural Growth
- Agricultural Transformation through Public-Private Partnership: An Interface
- Selected Agricultural Technologies - A Compendium

Consortium for e-Resources in Agriculture (CeRA)

CeRA is an e-Consortium of agricultural libraries, founded in November 2007, under the Indian Council of Agricultural Research (ICAR) for National Agricultural Research and Education System (NARES) libraries. CeRA is the first of its kind to provide 24 X 7 online access to selected journals in agricultural and allied sciences to all teachers and students, policy planners, officers, and extension specialists in NARS through IP. Currently, scientists in NARS choose CeRA above others for the literature search on web platforms for their professional quest. In short, CeRA catalyzes the NARS institution's agricultural research, education, and extension operations.

Foreign Visit Management System of DARE-ICAR

The DARE-ICAR Foreign Visit Management System (FVMS DARE-ICAR) is an online system developed and implemented at DARE and ICAR to handle all ICAR personnel's foreign visit/training/fellowship activities. By applying the workflow method, this system has been designed to reduce delays in processing foreign visit bids. The FVMS technology allows the employee to apply online, which then goes through the online approval procedure, and the employee is notified of the application status. Email notification of application approval is also automated. Employees and other officials concerned will receive email notifications in their official email accounts.

KRISHI Portal

KRISHI (Knowledge-based Resources Information Systems Hub for Innovations in Agriculture) Portal is an initiative of the Indian Council of Agricultural Research (ICAR) that was designed as an ICAR centralized data repository system consisting of technology. This is a unique form of data inventories repository. The primary goal of this repository is to offer a single Metadata inventory of information relevant to agricultural and allied sectors that is available at multiple ICAR Institutes/SAUs and is to be easily accessible for researchers, farmers, and planners. The KRISHI portal provides access to the photo gallery, audio and video gallery, dashboard, etc.

Knowledge Innovation Repository of Agriculture in the North East (KIRAN)

KIRAN is an initiative on a user platform developed and hosted by the National Informatics Center Content, maintained and updated by ICAR Research Complex for the NEH Region. It is involved in harnessing the power of scientific knowledge and technological innovations to strengthen the agricultural system in the North East region through active partnership and merge with various stakeholders. KIRAN is intended to catalyze building institutional capabilities in the region through effective convergences and networking.

National Innovations on Climate Resilient Agriculture (NICRA)

National Initiative on Climate Resilient Agriculture was launched as a flagship network project by the Indian Council of Agricultural Research (ICAR) in 2011. It intends to conduct a strategic study on adaptation and moderation, demonstrate technologies on farmers' fields, and raise awareness among farmers and other stakeholders about the effects of climate change on agriculture.

The project involves four major components of the initiative, which are Strategic Research, Technology Demonstration, Capacity Building, and

Sponsored/Competitive Grants. Climate change is a major worry for the entire world, including India. To assist the climate change research, ICAR has constructed cutting-edge infrastructural facilities around the country in the National Agricultural Research and Education System (NARES). The NICRA website www.nicra-icar-in offers information on climate - resilient technologies, research and success stories.

The Agricultural Research Management System (ARMS)

The Agricultural Research Management System (ARMS) is a critical tool created and deployed by ICAR to track and evaluate scientific progress. Based on the information given by scientists in this system, this system will be used for information management and evaluation of the Council's scientific research. On completion, achievements are to be uploaded on the system every month. The information given by the scientist will be verified by the Reporting Officer, PME In-charge, and Reviewing Officer at various stages throughout the specified period. Scientists would be able to link their research to the Government, Council, Region, and Institute priorities, which would be mapped by a proposed Standing Committee on Research in the Council. The system includes a technique for scoring individual scientists' performance based on achievements uploaded.

All scientists will be prompted to input data into the system only once, saving the scientist the difficulty of giving data multiple times for different requirements. The system will give a variety of information in report forms (Monthly Division/Institute/SMD progress report/Annual Institute report material). In the future, the information generated by this program will be linked to the many dashboards maintained by the Government of India.

Other Knowledge Initiatives

Apart from these, to highlight the need of imparting knowledge to farmers and other major stakeholders in a comprehensible and manageable manner, the ICAR has initiated the Technologies and Knowledge Resources, under which various digital resources of the agriculture field have been made assessable. The list of other knowledge initiatives initiated (Digital Resources) by ICAR are as follows:

- National Initiative on Climate Resilient Agriculture (NICRA)
- Design of Micro Irrigation Systems (DOMIS)
- Rice Knowledge Management Portal
- Edalhan Gyan Manch
- Knowledge Innovation Repository of Agriculture in the North East
- Rohu Database
- Expert System for Maize
- Expert System on Wheat Crop Management
- Expert System on Seed Spices
- CaneInfo
- Technologies & Products for Commercialization -Animal Science
- Design Resources
- Statistical Computing for NARS

Conclusion

The ICAR Knowledge Initiative on Agricultural Education, Teaching, Research and Service initiated will offer the impetus required to re-energize our long-standing legacy of knowledge exchange. This activity may be a step to empowering farmers and other stakeholders to be self-reliant to create the future we all want to live in.

References

Zhang, Y., Wang, L., & Duan, Y. (2016). Agricultural information dissemination using ICTs: A review and analysis of information dissemination models in China. Information Processing in Agriculture, 3(1), 17-29. https://doi.org/10.1016/j.inpa.2015.11.002

Jain, A. K., Kumar, A., & Kapur, S. (2016). Reference Manual on Krishikosh-A Repository for NARES. ICAR- Indian Agriculture Research Institute.

Chandrasekharan, H., Patle, S., Pandey, P. S., Mishra, A. K., Jain, A. K., Goyal, S., Pandey, A., Khemchandani, U., & Kasrija, R. (2012). CeRA - the e-Journal Consortium for National Agricultural Research System. Current Science, 102(6), 847-851.

Jain, A. K., & Veeranjaneyulu, K. (2013). Repository Of Indian National Agricultural Research & Education System (NARES): Open Access To Institutional Knowledge [Working Paper]. http://oasis.col.org/handle/11599/1830

Welcome to ICAR | भारतीय कृषि अनुसंधान परिषद. (n.d.). Retrieved February 6, 2022, from https://icar.org.in/

National Agricultural Innovation Project | भारतीय कृषि अनुसंधान परिषद. (n.d.). Retrieved January 30, 2022, from https://icar.org.in/node/1890

Mobile Apps | भारतीय कृषि अनुसंधान परिषद. (n.d.). Retrieved February 6, 2022, from https://icar.org.in/mobile-apps

Krishi Vigyan Kendra Knowledge Network. (n.d.). Retrieved February 6, 2022, from https://kvk.icar.gov.in/

LIBRARY 4.0: Application of Augmented Reality in Agricultural Libraries

B. Ravivenkat [1]

Abstract

The Industrial Revolution 4.0 has paved the way for the emergence of Web 4.0, Education 4.0, and Library 4.0. The Cyber-Physical Spaces interaction is the new coinage term used to integrate technology leading for immersive or experiential, oriented service in different sectors. The Internet of Things (IoT), Virtual Reality and Augmented Reality, Big Data, Robotics, and 3D print environment are the popular term now in usage which are altogether called Artificial Intelligence where the reality is mixed with technology to provide more knowledge and economy. The education sector at the elementary level already uses augmented reality for gaming, reading other learning activities; the library being part of the learning system is no exception. The developed countries have successfully implanted this technology for innovative information services. India has to take more steps in this direction. This paper examines the AR usage in different sectors like entertainment, business, medicine, archives, museums, military, science, services, education, including the culture sector, and further how it can be implemented in the academic libraries of agricultural education.

Keywords: Augmented Reality, Virtual Reality, Agricultural, Library, Innovation, Farming

Introduction

Augmented Reality is technology-based, where the natural objects or environment are superimposed digitally in a computing environment that

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provides an interactive experience that includes sensory, visual, and auditory orientation. According to Investopedia, 2020, augmented reality (AR) is an enhanced version of the real physical world that is achieved through digital visual elements, sound, or other sensory stimuli delivered via technology. It is a growing trend among companies involved in mobile computing and business applications. The Pokemon GO 2016 has paved the way for developing gamification using AR has further resulted in using this interactive technology for a different purpose which has helped for more knowledge growth. Augmented reality (AR) technology has been blooming in the past few years, with a growing number of low-cost AR devices becoming available to the general public. AR techniques have demonstrated the capacity to optimize task efficiency in various industries and provide engaging entertainment and education experiences.

Augmented Reality in Agriculture

Agriculture is an area where advanced technology is constantly introduced with a delay. Currently, it appears that new techniques and technologies appear in it very quickly.

Augment reality will probably soon become popular, especially since there are many areas in which its implementation might be advisable. However, the condition is a reduction in the cost of this technology, so its use would be cost-effective.

According to the Food and Agriculture Organization of the United Nations, one of the priorities by 2030 is the following:

- Creation of mechanisms and institutions for the elaboration and expansion of international norms, standards, and data for partnership between countries;
- To increase the exclusivity and stability of production to external influences;

- The development of small farms and the diversification of the workforce, which moves to cities;
- Creating a systems approach: ecosystem and proper education;

Virtual technologies used to develop agricultural science and technology advancement will allow farmers to understand better and master the advanced methods of agricultural land management. Making the learning process more and more intuitive, vivid image, which significantly increases the effectiveness of training and increases their educational interest.

In addition to virtual reality, there are already practical cases of companies with augmented reality. So, the Swedish agricultural machinery brand Väderstad offers one of its applications. The AR in the agriculture market is segmented based on applications and solutions. The applications include outdoor and indoor farming, including hardware, software, and services. The outdoor farming segment of the AR in the agriculture market is further categorized into precision and smart farming, livestock monitoring, simulated training, and weather tracking and forecasting.

The AR in the agriculture market by application is majorly driven by indoor applications, such as vertical farming, hydroponics, aquaponics, and cannabis farming. However, outdoor farming applications have more significant potential, generating more revenue than indoor farming.

Livestock monitoring applications lead the outdoor farming application segment. It is currently one of the most lucrative applications and the most promising segments. This is followed by the precision and smart farming application segment, which is expected to have the second-highest growth rate.

Scientists at the Danforth Plant Science Center in St. Louis Missouri, US has taken the project in 2019 to build AVR Learning Laboratory. It uses sophisticated imaging technologies including X-ray microscopy and CT scanning, combined with data-driven machine learning to improve innovative ways of analysis and visualization of plants in ways that are important to sustainable agriculture and crop improvements. The data generated can be built into engaging 3D and even 4D immersive scientific stories and experiences for students, adults, and life-long learners. This project will collaboratively engage teachers and scientists in establishing a community-accessible, one-of-a-kind Plants and Agriculture AVR Learning Laboratory at the Danforth Center that can be used for teacher professional development and student exploration.

Review of Literature on AR in Libraries

During the last decade, several research articles related to the implementation of VR/ AR and mixed reality in the library and information science domain have come up. Research related to models, apps, surveys, and implementation is done, and a few are discussed below.

The Bavarian State Library experimented with Augmented Reality applications. In the App Ludwig II, the library provided multimedia content on the famous Swan King as an interactive Augmented Reality application, georeferenced at prominent places of the king's life such as Neuschwanstein Castle (Ceynowa, 2011). A model was suggested (Noh, 2015) related to future libraries 4.0 which included intelligence-based, massive data, augmented reality, context-aware, cutting-edge displays, and infinite creative space, intelligence-based agents, connected web, ubiquitous web, intelligence connections, and intelligence-based web.

Augmented reality has been effectively used in the health sector; a study (Chalin & Chan 2018) on applied dietary monitoring related to the self-participatory aspect of AR showed that most of the students achieved learning objectives and were positive with exploring with AR. The study suggested (Huang & et.al, 2016) showed that though the library in the public system has provided the orientation of learning path through signage and location but providing a digital interactive innovative service integrating with virtual technology solve the problems of spatial unawareness and domain awareness in learning in libraries. Karambakhsh et. al, (2019) in their study on deep gesture interaction for augmented anatomy said that augmented reality is helpful in studying anatomy where the students face body organs in the classroom further they suggested that neural networks can be combined with augmented reality as a rising field, and the great potential of augmented reality and neural networks to be employed for medical learning and education systems.

The research done by Shen (2019) investigated the strategic development of a large-scale transdisciplinary area, named intelligent infrastructure for human-centered communities at Virginia Tech. The findings reveal the emerging scenarios around complex adaptive systems, intelligent data infrastructure, and future digital libraries all in the context of building infrastructure for human-centered communities.

The subject Smart Libraries emerging innovation habitat was discussed by Gul & Bano (2019) showed that smart libraries are becoming smarter with the emerging smart technologies, like the Internet of Things, Artificial Intelligence, Blockchain Technology, Augmented Reality which enhances their working capabilities and satisfies the users associated with them. Implementing smart technologies in the libraries has bridged the gap between the services offered by the libraries and the rapidly changing and competing needs of humans.

Effects of an Augmented Reality Library Orientation on Anxiety and Self-Efficacy: An Exploratory Study (Kannegiser, 2021) indicates that academic libraries use scavenger hunt library orientations to engage students and teach them about the library. Libraries are also starting to use augmented reality (AR) technology in orientations, instruction, and programming. The study used both traditional and AR-based orientation for first-year students. The outcome was that both orientations positively impacted students' perceptions of the library; the AR orientation had a significant impact on students' perceptions of librarians' desire to help them. The study made by Saleh et al., (2021) on augmented reality technology in the libraries of universities of medical sciences: a model consisted of strengthening education, promoting users' information literacy, finding resources, user guidance, gamification, educational justice, helping management, enriching resources, providing new services and economic savings. The advantages were library services, sociocultural excellence, educational level, software potential, and helping the librarian. The challenges were technical, economic, and cultural barriers.

Case Studies on Augmented Reality in Libraries

myLibrARy

In 2014 the University of Applied Sciences Potsdam started myLibrARy, a project to evaluate and explore the fields and scope of the application of AR in public libraries (Freyberg & Wolf, 2016). The main goal was the development of a user-oriented app for libraries with significant features related to augmented reality.

Some of these features are related to AR; some are classic features of library apps that could already be found elsewhere. The prototype was developed by Metaio and was a channel in the Junaio app of Metaio (Tonnis, 2010) Media were identified by optical tracking and image recognition of the book cover. The second prototype was implemented as an independent app where media were identified by scanning the ISBN code. The main idea of myLibrARy was the development of Smart Libraries where smart technologies are an integrated part of the user experience. AR might be a critical element that enables new knowledge due to the semantic and visual contextualization of information.

LibrARi

LibrARi is an image-based AR app for mobile devices and AR glasses that supports users in finding their way to the desired book in the bookshelf (Siddappa, 2014). Since the AR app shows the direct way to the book on the display, the library can be explored interactively and users do not have to bother with classification systems anymore. LibrARi offers to search, locate, and navigate physical space using a digital interface on a mobile device (Siddappa, 2014). The University of Illinois Library developed a mobile recommender app with augmented reality features called Topic Space. By embedding optical character recognition software, the augmented reality app can recognize the signature on a book in the library and suggest relevant items that are shelved nearby. Additionally, the app shows users media that are generally shelved at the location, but that is currently checked out. (Hahn & Ryckman, 2015)

ShelvAR

The Miami University in Oxford, Ohio developed an ARbased app called ShelvAR intended to support librarians to identify books located in the wrong place in the bookshelf (Wolf & Buttner, 2015). Using the prototype librarians could aim the mobile device (e.g., smartphone or tablet) at the shelf, and books in the wrong place will be marked accordingly Unfortunately, due to a patent dispute the project was discontinued.

The Bavarian State Library Munich developed the AR app "Ludwig II" that presents location-based services of cultural assets (e.g., unique locations, buildings, monuments) related to King Ludwig II. (Ceynova, 2012). The multimedia content is either displayed on top of a map view or integrated into the live camera video.

DiscoverRoux

Florida Southern College, Roux Library open house event also consists of library orientation that covers students coming to the library, meeting librarians, getting awareness of library resources, and enjoying some pizza. In 2016, the physical event was cut due to some administrative reasons. This left the staff on their terms to get students to the library, reach as many students as possible, and reduce the anxiety of students coming to the library. The Pokemon Go 2016 game inspired incorporating augmented reality in this welcome event using Aurasma AR and Google Card Board for Virtual reality app. With proper advertisement name as" DiscoverRoux"

The Library services, sources related were added. Trigger areas for students were identified, and VR station was set up for the students to use the app; the event become successful with the participation of two-thirds of the strength of the students and their positive feedback, along with offering pizza as food for motivation.

Mysillman AR

Silliman University uses AR for instruction function to enhance the services. The AR has been kept to use through the Mysilliman portal where students have to register through the portal and get access to the resources and services. The tool was used as an aid to reduce anxiety among the students.

Wayfinding and Metadata

Mandal Public Library and Oslo Science Library funded by the Norwegian National Library uses a practical application for Augmented Reality (AR). The two functionalities of this was to develop a prototype app which will have Wayfinding (locating books) and Extra information on books(metadata). The books were located using coded AR lighthouse which is scanned through the mobile and further related to books are guided by enhanced locating guides and further extra information related to the books.

AR in Agricultural Libraries

The artificial intelligence has already been applied in the agriculture sector and is the supporting system and library with its cost-effective plan can implement the AR in the following areas in agricultural libraries, which help meet the vision of digital or virtual library in the future.

Areas for AR implementation in Agricultural Libraries.

- Locating reference books related to agriculture and providing additional print and digital information using 3D and animation. AR can be used to link different types of library holdings and show all media since not everything can be presented in the catalog of the library.

- Providing orientation or information literacy related to agricultural resources and services.
- Enhancing the image of the library with a user-friendly and immersing experience. With the help of AR, the libraries can offer better, and demand actuated service.
- Users are motivated to use the library by providing a personal experience in curiosity, games, puzzles, which improves the discovery of the knowledge.
- Library building navigation, providing additional information on the location of Agri-related cultural and archival collections.
- Creation of additional content and same be incorporated in the AR app for historical agricultural manuals and physical objects related to the agriculture revolution.

Conclusion

The University of Agricultural Sciences GKVK, Bengaluru Library provides one of the e-resources services called Krishichitralaya. The functionality of this video library cum virtual classroom is to provide unique & dynamic real-time online multimedia service to user fraternity. One of the initiatives shows that the library staff can plan innovative services without attracting much cost expenditure and provide value-added services. The same can be incorporated into the AR app medium to become more effective oriented and reach masses through remote access facilities. The IIT Kharagpur Library being the leader in the Digital Library of India, has taken the initiative to provide AR services called a WebAR Based Information Delivery System which consists of an available Web marker that can be scanned through mobile using QR code and it further leads for the Web portal. These are the live examples already been done in India. The AR will be used in all the activities in the future where the next generation is fascinated to it and the agricultural information centers cannot ignore this innovative service and lag behind.

References

BidOn Games Studio. (2021). How Virtual and Augmented Reality technologies improve Agriculture, Retrieved from https://www.bidon-gs.com/virtual-and-augmented-reality-in-agriculture.

Ceynowa, K. (2011). Information Services in the mobile Internet - the Example of the Bavarian State Library, Zeitschrift fur Bibliotheakswesen und Bibliographie, 58(5), 247-255.

Ceynowa, K.(2012). Information "On the Go": Innovative Nutzungsszenarien für digitale Inhalte - Die Augmented-Reality-App "Ludwig II." der Bayerischen Staatsbibliothek". Bibliothek Forschung und Praxis, 36, 64-69.

Chanlin, L.J., & Chan, KC. (2018).Augmented Reality Applied in Dietary Monitoring, Libri-International Journal of Libraries and Information Studies, 68(2), 137-147.

Electronic Resources. (n.d.). Retrieved February 8, 2022, from https://uasbangalore.edu.in/index.php/library-en/electronic-resources-en

Freyberg,I.,&Wolf,S.(2016)."Dienstleistungeneiner SmART Library -Anwendungspotentiale von Augmented Reality in Bibliotheken". Medienproduktion - Online-Zeitschrift für Wissenschaft und Praxis, (9),11-15.

Gul, S., & Bano, S.(2019).Smart libraries: an emerging and innovative technological habitat of 21st century, Electronic Library, 37(5), 764-783.

Hahn, J., Ryckman, B., & Lux, M.(2015).Topic Space: Rapid Prototyping a Mobile Augmented Reality Recommendation App. code{4}. Lib Journal,30

Hornik. J.N., & Wade, S.(2018).Animating an interactive welcome event at an academic library with AR and VR.: Augmenting orientation

Huang, T.C., Shu, Y., Yeh, T.C. & Zeng, P.Y. (2016), Get lost in the library? An innovative application of augmented reality and indoor positioning technologies, The Electronic Library,34 (1), 99-115.

Indian Institute of Technology, Kharagpur. (2022). WebAR Information Service. Retrieved from .https://library.iitkgp.ac.in/pages/con/imlib/ar/index.php

Investopedia.(2020). Definition of Augmented Reality, Retrieved from https://www.investopedia.com/terms/a/augmented-reality.asp.

Kannegiser, S. (2021).Effects of an Augmented Reality Library Orientation on Anxiety and Self-Efficacy: An Exploratory Study, College and Research Libraries, 82(3)852-859.

Karambakhsh, A., Kamel, A., Sheng, B., Li, P., Yang, P., & Feng, D.D.(2019).Deep gesture interaction for augmented anatomy learning, International Journal of Information Management, 45

Market Research.com.(2021). The Increasing Adoption of Augmented Reality (AR) in Agriculture, Retrieved from https://blog.marketresearch.com/the-increasing-adoption-of-augmented-reality-ar-in-agriculture

Noh, Y. (2015).Imagining Library 4.0: Creating a Model for Future Libraries, Journal of Academic Librarianship, 41(6), 786-797.

Saleh, M.D., Salami, M., Soheili, F & Ziaei, S.(2021). Augmented reality technology in the libraries of universities of medical sciences: identifying the application, advantages and challenges and presenting a model, Library Hi-Tech.

ShelvAR. (n.d.). Retrieved February 8, 2022, from http://www.shelvar.com/

Shen, Y. (2019). Emerging scenarios of data infrastructure and novel concepts of digital libraries in intelligent infrastructure for human-enterd communities: A qualitative research, Journal of Information Science, 45(5), 691-704.

Siddappa, P.(2014). librARi. , .http://www.pradeepsiddappa.com/design/librari/

Tönnis,(2010).Augmented Reality - Einblicke in die Erweiterte Realität. Berlin: Springer,

United States, Dept. of Agriculture(2021). Experiential plant science and agriculture education using virtual and augmented reality. Retrieved from https://portal.nifa.usda.gov/web/crisprojectpages/1018302-experiential-plant-science-and-agriculture-education-using-virtual-and-augmented-reality.html.

Welcome to ICAR | भारतीय कृषि अनुसंधान परिषद. (n.d.). Retrieved February 6, 2022, from https://icar.org.in/

ICTs Supported Agricultural Extension Services: A Study on Information Access for Farmers in Barnala District of Punjab

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Abstract

ICTs have enormous potential to improve e-extension advisory services if taken advantage of by the 'extension agents' in the diffusion process of innovations. ICTs can play a crucial role in strengthening the capacity of farmers and the field level extension functionaries and intermediaries. The purpose of the study was to analyze the use of different ICTs in agricultural knowledge pathways, the dissemination pathways, line departments, and socio-economic factors. Data were analyzed manually and using R software (version 3.6.1).

A total of one hundred farmers were interviewed, with a purposively selected sample of 60 farmers, using a pre-formulated questionnaire from all three blocks of Barnala district. The findings indicate that farmers depend on four major ICT applications viz., mobile apps, television, internet browsing and Facebook to access information. The lack of harmonization and weak linkages between line departments in utilizing the existing ICT tools, level of ICT ownership and access to information at the household level were found important challenges for ICT-enabled agricultural extension services.

Keywords: ICT, e-Extension, Agricultural Extension

Introduction

Farming is a critical profession for the livelihood of farmers in the Barnala district of Punjab. Farmers heavily independent on agricultural production activities like crops cultivation and animal rearing. They use both non-ICTs and ICTs means to access information on modern agricultural technologies.

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ICTs play a crucial role in accessing agricultural information for farmers, and the modern ICT tools and services can strengthen the traditional extension services and information provision (Singh et al. 2016). Modern ICT tools and applications offer excellent platforms and services for disseminating knowledge on new agricultural technologies to the farming community. There is a need to study find out the use of different ICTs in agricultural knowledge and dissemination pathways, ownership of ICTs and access to information, and usage of these modern IT technologies by the farmers.

Methodology

The study was conducted in all three blocks i.e. Sehna, Barnala, and Mehel Kalan of Barnala district. A total of 100 farmers were interviewed using a pre-formulated questionnaire with a purposively selected sample of 60 farmers (20 from each block). The sampling method was non-probability sampling, under which convenience sampling technique was used. The collected data was compiled, tabulated, and analyzed manually using R software (version 3.6.1). Frequency and percentage were calculated. A Chi-square test was performed to assess the statistical significance of the sources of information available to respondent farmers and on availability, accessibility, and usage of different sources of information. The study aims to analyze the use of different ICTs in agricultural knowledge pathways that farmers use to access agricultural technologies information, the various dissemination pathways and ownership, access and usage of ICTs at the farmers level.

Results and Discussion

Overview of Knowledge Pathways

Knowledge pathways are the methods and various approaches used to disseminate agricultural technologies and information by the extension service providers. There are many channels to get agricultural knowledge and technologies information in the district.

Major knowledge pathways through which agricultural technologies information reaches the farmers were (1) conventional approaches and (2) ICTs. Table 1 shows that for 95% of farmers (n= 57) ICTs have been the source for information on agricultural technologies. This trend was followed by gathering information from friends and relatives 88.33% (n=53) and extension activities 86.67% (n=52). A significant major proportion of farmers, 83.33% (n=50) acknowledged Krishi Vigyaan Kendra as their reliable source of information. In addition to these sources, 53.33% (n=32) and 40% (n=24) of farmers acquired information through helpline and extension workers, respectively. The most negligible share of farmers recognized government agencies (23.33%) and Farmer Field Schools (21.67%) as their sources of information. Similar observations were also reported by Kameswari et al. 2011 and Singh et al. 2016. It was also observed that there was a lack of harmonization and weak linkages between line departments in utilizing existing ICT tools and performing similar extension activities with the risk of duplication or sending conflicting information to the farmers.

Table - 1: Sources for Information on Agricultural Technologies for Farmers

Source of Information	Yes	No
Krishi Vigyaan Kendra (KVK)	50	10
Farmer Field Schools(FFSs)	13	47
Extension Worker	24	36
ICTs	57	3
Extension Activity	52	8
Government Agencies	14	46
Helpline	32	28
Friends & Relatives	53	7
X2	49.84*	
p-value	0.00	

*Note: * Significant at 5% level of significance*

Availability, Accessibility and Usage of Different ICTs

The data on farmers' availability, accessibility and usage of different ICTs reflected statistically significant differences as mentioned in Table 2. The study revealed that almost all the respondent farmers had accessibility to television and mobile phones. The mobile phone was available and accessible to 95% (n=57) farmers. Television was available to 96.67% (n=58), accessed by 95% (n=57) and used by 90% (n=54) farmers. The use of mobile phones was higher (91.67%) than all other ICT tools, which can be attributed to the fact that it is affordable and portable. Only 65% (n= 39) farmers have availability to internet browsing whereas accessibility and usage of internet browsing was 63.33% (n=38).

Table - 2: Availability, Accessibility and Usage of Different ICTs By The Farmers

Type of ICT's	Availability		Accessibility		Usage	
	Yes	No	Yes	No	Yes	No
Mobile (GADVASU and other Apps)	57	3	57	3	57	5
Television	58	2	57	3	54	6
Radio	1	59	1	59	1	59
Information kiosk	2	58	2	58	2	58
Internet Browsing	39	21	38	22	38	22
Facebook	31	29	27	33	27	33
E-mail	27	33	18	42	18	42
Computer	20	40	18	42	15	45
Youtube	36	24	32	28	30	30
CD/ DVDs	0	60	0	60	0	60
E-books	0	60	0	60	0	60
X2	333.90*		330.50*		316.11*	
p-value	0.00		0.00		0.00	

*Note: * Significant at 5% level of significance*

Almost half of the farmers interviewed had the availability of Facebook, while usage and accessibility of Facebook was 45% (n=27). Availability of e-mail was with 45% (n=27) of farmers, but usage and accessibility of e-mail were limited to 30% (n=18) farmers. The accessibility of YouTube was 60% (n=36), and the usage was 50% (n=30). Radio was accessible, available, and used by only 1 farmer (1.67%), and the information kiosk was accessible, available, and used by 2 farmers (3.33%) only. Accessibility, availability, and usage of CD/DVD and E-Books was 0% each. Some of the farmers were illiterate and were non-ICTs acquiescent, and they could not use these ICT tools and services. So, a skill assessment would indicate what kind of formal training may be conducted for farmers to improve their skills for proper use of modern ICTs technologies to access and adopt new agricultural technologies for increasing their farm income. The study findings are in line with Syiem and Raj (2015).

Conclusion

The study revealed that several knowledge pathways exist through which farmers access farming information in the district. The primary ICT tools and services were mobile, television, internet browsing and Facebook; however, lack of harmonization and weak linkages between line departments in utilizing the existing ICTs. Respondent farmers and a large number of the extension staff also lacked the skills to exploit ICTs to fully access agricultural knowledge from various sources. An ICT intervention that can improve the livelihood of farmers will likely have significant direct and indirect impacts on enhancing agricultural production, post-harvest activities, and marketing. The higher percentage of ownership and accessibility of ICTs among the survey farmers also offers the potential to fully exploit ICTs to improve the agricultural knowledge pathways and information provision. More awareness and training programs for farmers on ICTs to improve their self-confidence, capability, and skills to take the benefits of modern agricultural technologies and increase farm income are recommended.

References

Syiem, R. and Raj, S. (2015). Access and usage of ICTs for Agriculture and Rural Development by tribal farmers in Meghalaya State of North-East India. Journal of Agricultural Informatics, 6(3), 24-41

Singh, A., Sidhu, S., Hundal, J. S. and Chahal, U. S. (2016). Information sources for Indian livestock farmers. Journal of Livestock Science, 7, 150-156

Kameswari, V. L. V., Kishore, D. and Gupta, V. (2011). ICTs for Agricultural Extension: A study in the Indian Himalaya region. The Electronic Journal on Information Systems in Developing Countries, 48(3), 1-12.

KrishiGrow: An Expert System Based Macro and Micronutrient Visualization System for Smart Crop Management

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Abstract

Macro and micronutrient management of agricultural land is a problem that requires constant monitoring and planning, which is absent in the current Indian agricultural landscape. Farmers often balance the risk of biomagnification and nutrient depletion with maximizing profits, which is not done correctly in most cases. Continuous depletion of macro and micronutrients from the farming land would lead to poor soil fertility, reduced crop production, and negatively impact human and animal health. In this article, we propose KrishiGrow, an expert monitored smart system that utilizes open-source data from agricultural extension information outlets and geological surveys across India and presents the farmer with the most accurate and up-to-date advice on the strain and type of crop that should be planted for a particular plot of land. Our solution would also enable the farmers with the most updated data on soil quality and fertility across India. We believe that KrishiGrow and its implementation will aid small and mid-level farmers to obtain the highest possible productivity for their land.

Keywords: Nutrient Management, Macronutrients, Micronutrients, KrishiGrow, Smart Crop Management, Visualization System

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Introduction

Agriculture is the core sector in a developing and emerging country like India. The overall growth of the agricultural sector has faced a recession since the year 1990. Studies have shown that 60% of the Gross Domestic Product (GDP) has been accounted for by the service sector, which further led to the recession of agriculture shares. It is found that India is the second-largest producer of farm output and is the largest producer of milk, major spices, fruits and vegetables, and several other crops such as jute, castor oil seed, and millets (IBEF, 2020). Moreover, it is also the second-largest producer of rice and wheat. Commercial crops can elevate the exports of agricultural commodities, which will result in the rapid growth of agro-based industries. The agricultural sector is known as an inclusive sector as it reduces poverty and provides employment to the majority of the Indian population.

With the increasing population and the growing demands of agricultural commodities, we are placing unprecedented demands on natural resources and agriculture. In this 21st century, the high consumption rate of the growing population is a challenge to farmers and scientists. The world population is estimated to reach 9.5 billion by the year 2050. To cope with the increased demand of this population, current food production will be required to double what it is now. Monocrops of species like wheat, rice, corn, and soybean is cultivated in around 80% of the arable land; this subsides the genetic diversity of global agriculture.

Moreover, climate change has decreased agricultural productivity and increased the number of malnourished people from 40 to 170 million. To alleviate poverty and malnutrition and cope with the growing population's demand, depleting natural resources, and global climate change, the farmers have turned to diverse agricultural practices in India. With the need to feed the growing population came the need to increase the yield and produce quality yield. This increased the need to use fertilizers, pesticides, and fungicides and adopt practices like monocropping, poly cropping, etc.

It produced a green revolution but led to resource degradation in the long run.

In India, the green revolution started around the 1960s; the primary goal was to increase food production and feed the malnourished people; it pioneered the new era of agricultural technology. It employed the use of high-yielding chemical fertilizers and bioengineered seeds. The small farmers who wanted to implement the technologies of the green revolution took out loans and sold lands to afford it but were left impoverished, and many suicides were reported. Farmers were pushed into this vicious cycle, where they were buying large amounts of fertilizers to counteract the effects of monocropping. Moreover, it resulted in low water tables, soils deprived of micro and macronutrients in areas where vast amounts of fertilizers were used, nutrients including boron, zinc, molybdenum, magnesium, etc.

The small farmers in India face lots of obstacles that make cultivation and farming harder for them and push them to commit suicide; they face issues such as the absence of infrastructure in their village, increasing cost of cultivation, the availability of credit for small farmers, little or no financial support by government for the small farmers, the unfair use of natural resources, repugnant international policies, repetitive or monocropping increase the risk of crop failure, lack of funds, etc. Moreover, the small farmers in India allocate the overall or the central part of their land to grow high-value crops, such as fruits and vegetables, wheat, and rice. In this paper, we focus on discussing KrishiGrow, which is an expert system, that will use the available open-source data from agricultural extension information outlets and geological surveys and presents the farmer with the most accurate and up-to-date advice on the strain and type of crop that should be planted for a particular plot of land.

Macro and micronutrient management of agricultural land is a problem that requires constant monitoring and planning, which is absent in the current Indian agricultural landscape. Farmers often balance the risk of bio-magnification and nutrient depletion with maximizing profits, which is not done correctly in most cases.

Currently, farmers face several issues like decreased productivity, decreased profit, rising quality competitiveness due to globalization, the poor link between farms and market, a wide information gap between farmers and analysis practices labs, and insufficient knowledge of agricultural input. Talented human resources in sufficiently giant numbers would be needed to address these challenges adequately. KrishiGrow will help provide information on the weather forecast, farmers-related news, when and how these pesticides, herbicides, and insecticides extra need to be used, according to your location and weather forecast what crop varieties would be most suitable for the respective land.

Previous Works

It presents an automated system that assists farmers in gathering data about their crops through sensors and then growing the crops accordingly. Different soil parameters such as temperature, humidity, climatic condition (rain), and moisture present in the soil are collected and transferred to the cloud known as ThingSpeak Cloud to control and check the scale of fertilizers whether the fertilizers present in the soil are in the right amount or not. In this system, sensors are used to gather these parameters connected to a node MCU microcontroller. That node MCU microcontroller is connected to a cloud storage system, ThingSpeak, through Wi-Fi. The cloud data is reviewed using an Android application, and several Machine Learning algorithms are applied to the obtained data. After this procedure, data stored on ThingSpeak Cloud are analyzed, and conclusions are made on which crops will be ideal for that area where farmers would water the crops. Farmers can use ThingSpeak Applications to analyze and visualize parameter results.

It creates a stand-alone method used to evaluate soil macronutrients in the laboratory. However, photodiodes, light-emitting diodes, analog-to-digital converters (ADC), and FPGAs are used to test the color of the soil. This equipment saves time since fresh soil samples are instantly placed in test tubes, chemicals are added, and the solution color changes. It is also a low-cost solution that farmers can afford. It benefits farmers by saving them time, money, and the hassle of going to a lab and evaluating the soil. Fertilizers are advised to boost production based on the data obtained.

To the best of our knowledge, no studies have experimentally examined these multiple goals simultaneously using micronutrients. No one technology can entirely close the gaps in crop-human nutrition interfaces in nations where they exist. Certain technologies, some new and others improved, can be used to begin closing the gap. Due to the vast regional variations in soil properties, the temporal demands for various nutrients by crops, and the negative nutrient interactions that occur, it would be impossible, if not impossible, to have a balanced composition with all 14 elements in a single fertilizer product. As a result, nutrient omission and addition studies that reveal the relative effect of each nutrient under specific crop and agro-ecological conditions should lead to advancements in fertilizer product design and formulation. This ensures that only the appropriate nutrient combinations are employed for the appropriate crop, in the appropriate location, and at the appropriate time. The introductory lesson is that most farmers' fertilizer use should extend beyond the big three (N, P, K) to include micronutrients, but only on a case-by-case basis.

Problem Statement

Based on our in-depth domain research, landscape exploration, and competitive analysis, we observed an absence of commercially available software that presents small and mid-level farmers with advisory regarding the strain and kind of crop that can be grown in their location, keeping in mind the micronutrient and macronutrient profile of their respective farmland. The advisory provided to farmers using existing extension infrastructure, tele-recommendations, and peer forums, is at best slow, and at worst, grossly inaccurate, leading to mismanagement and severe long-term problems such as loss of nutrients, biomagnification, and crop failure.

Proposed Solution

To provide farmers with timely recommendations regarding cropping cycles, we propose KrishiGrow, a context-aware expert system that aids small and mid-level farmers to view available options on the type and strain of crop to grow and their expected yield versus cost ratio. Unlike traditional solutions currently in use in the agricultural sector, KrishiGrow is fast, accurate, and easy to use, making it easy to integrate across a wide range of linguistic sectors. Due to its inherent autonomous structure, it can seamlessly enhance the current soil testing facilities provided by extension services worldwide by filling in the gaps in human-based soil-testing and crop consultancy services.

KrishiGrow is composed of three major parts:

1. Database: The database comprises Geo-Spatial data as a fully-connected, undirected, acyclic graph G. Graph G can also be interpreted as a tree. In graph G, the root is the central region (country, continent, subcontinent, economic zones, etc.). The various levels below the root represent increasingly finer sub-regions. The tree's leaves represent the smallest subdivision (typically districts, blocks, or sub-divisions). Each leaf li contains three data fields

   a. Key-value of l_i.

   b. Geo-location vector L_i where L_i = [latitude of li, longitude of l_i].

   c.Nutrient vector ni where ni is a matrix that stores the macro and micronutrient and average rainfall received for the region described by l_i. Typically n_i = [N P K S Zn Fe Cu Mn B (Average rainfall)] where the figures are established in kg/ha. Assuming standard temperature and pressure, the average annual rainfall is converted into the same units.

   The Database also has a separate lookup table T with the shape (n, p+1) where n is the number of leaves in G and p is the number of data points in n_i. The additional field is reserved for the critical value of l_i, thus serving as the primary key to aid in faster lookup times.

2. Prediction module for Spatio-temporal data gaps: To accumulate the absent datapoints, the raw 2D representation as described by the graph G and lookup table T subjected to average filling and Gaussian Blurring

$$G(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{x^2}{2\sigma^2}}$$

The Gaussian blurring smoothens out the imperfections and possible noise in the data to provide a more accurate description of real word agricultural lands. The Gaussian blurring is applied to each of the elements in n_i. Since those elements taken together over the complete 2D region of interest creates a p-channel 2D image, the blur can be applied using standard Python libraries. Polynomial regression is used instead of Average filling to accumulate larger data gaps, coupled with the standard Gaussian blurring.

3. Risk to profit factor calculation engine: We define the risk as the average investment a farmer has to make, taking the financial and opportunity cost into account. To represent this, we have estimated the cost of fertilizers to be a linear function of macro and micronutrient deficiencies when expressed in p-dimensional space.

Nutrient requirement matrix r_c for crop c = [N P K S Zn Fe Cu Mn B (Average rainfall)] where the values are the requirements expressed in kg/ha assuming standard temperature and pressure.

Cost matrix D_{ci} for crop c and region i is defined as: $D_{ci} = \text{ReLu}(r_c - n_i)$ Since we accept only the nutrients to be added, we ignore the nutrients already present. ReLu simplifies this function.

The Risk to profit factor Jci for crop c and region i is expressed as:

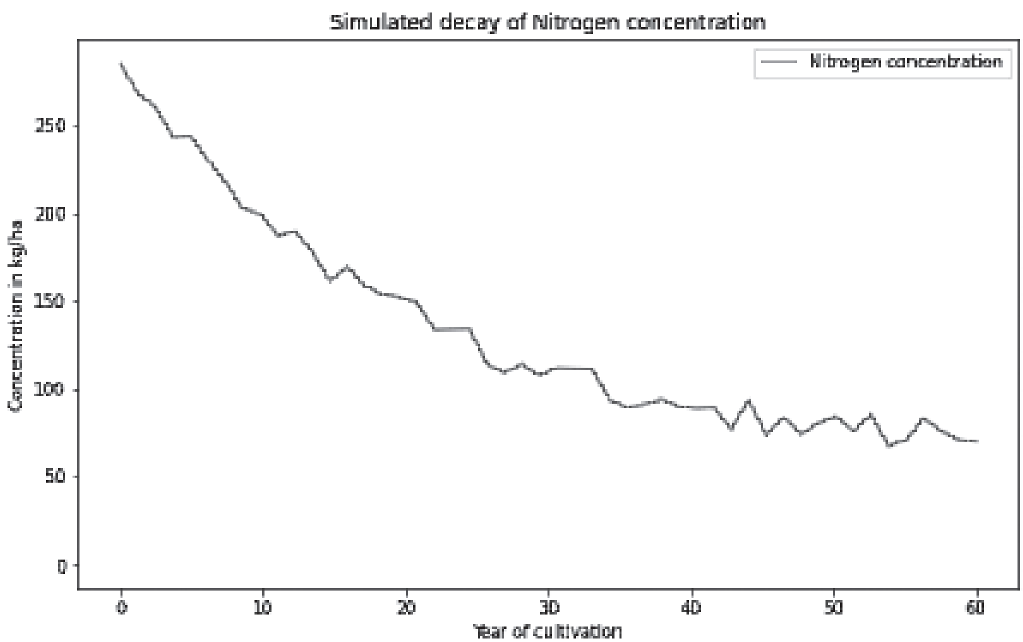
$$J_{ci} = 10 \times \text{sigmoid}(||D_{ci}|| \,/\, ||n_i||)$$

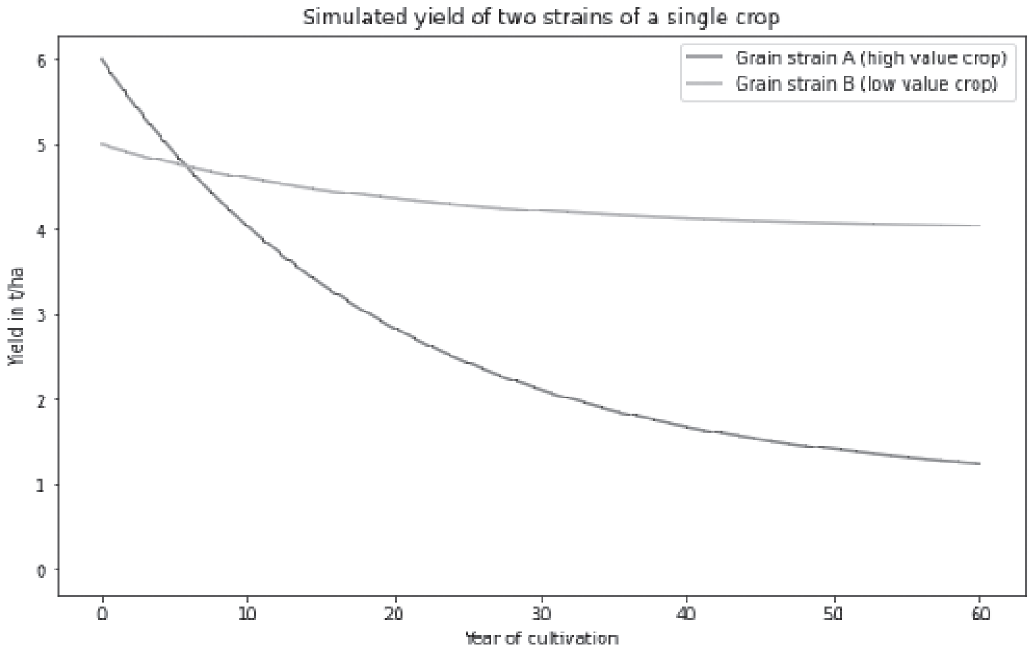
To aid in the comprehensiveness of J, it is expressed in a points or "star" system, providing the most profitable crop with most "stars" and the least profitable crop with least "stars". This ensures that the recommendation will surpass language and educational barriers.

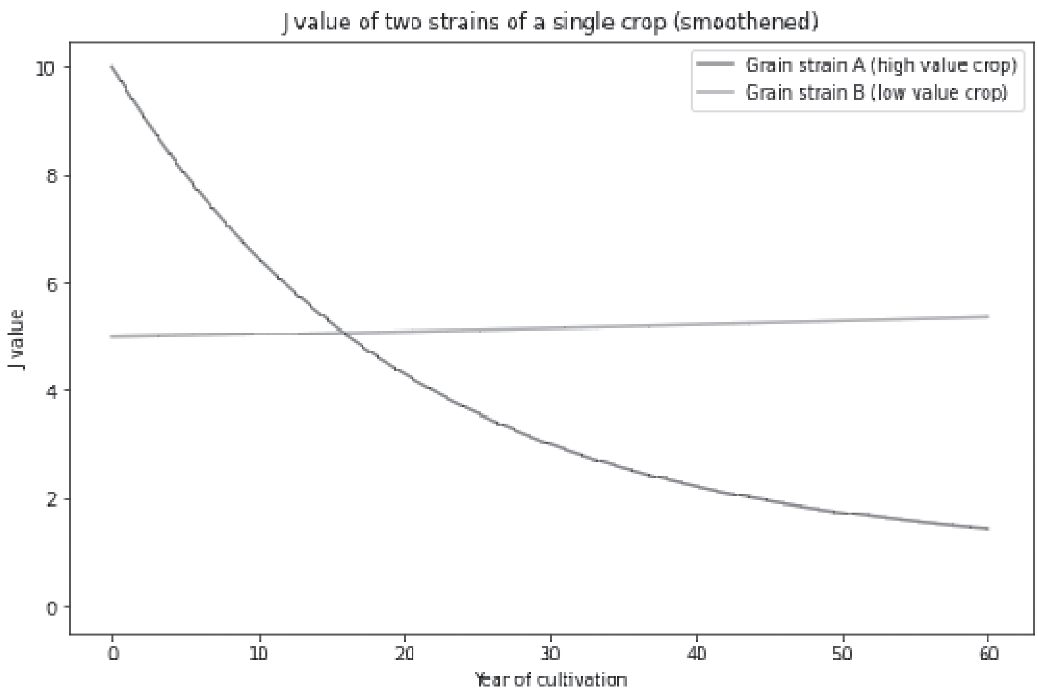
The dataset for the KrishiGrow database is collected from open-source GIS & GPS Based Soil Fertility Maps of 11 states published by The Indian Council of Agricultural Research (ICAR). The data was autonomously tabulated using Python image processing and optical character recognition (OCR) modules. The module continuously scrapes and updates the data from the available sources and is integrated into the technology stack of KrishiGrow. The average rainfall is collected from satellite feeds and updates from India Meteorological Department (IMD) website using automated scrapers and a ReGEX based compiler.

Results and Discussion

We have simulated a scenario where we have varied only the nitrogen concentration and have calculated the J value based on simulated yield.




Simulated yield of two strains of a single crop
Grain strain A (high value crop)
Grain strain B (low value crop)
Yield in t/ha
Year of cultivation
0 1 2 3 4 5 6
0 10 20 30 40 50 60


J value of two strains of a single crop (smoothened)
Grain strain A (high value crop)
Grain strain B (low value crop)
J value
Year of cultivation
0 2 4 6 8 10
0 10 20 30 40 50 60

Based on the above results, despite the low yield on the high-value strain A, the farmer should switch to strain B at around year 16 of cultivation instead of at year 7 if he follows the recommendations of KrishiGrow.

It can help the small farmers by accumulating open-source data from outlets providing agricultural information and providing farmers with accurate data about the strains or type to plant, to increase productivity, it will help reduce expenditure on organic and inorganic fertilizers, irrigation facilities, and agricultural products, help reduce waste production and insurance liabilities, it will implement agricultural practices to reduce environmental pollution and promote the efficient use of natural resources and it will also encourage practices to utilize the agricultural subsidies efficiently. Farmers will be able to meet the demand of the present generation without compromising the demand of the future generations. Moreover, the app will confer a better insight to understand the market. As a result, farmers will be able to increase the annual percentage yield, which will improve soil fertility.

Conclusion

KrishiGrow is an expert system that uses open-source data from agricultural extension information outlets and geological surveys to provide small and medium farmers with accurate and time-sensitive guidance on the type and strain of crops that can be planted with relatively short latency compared to more traditional human-involved systems. Based on simulations, it performed impressively and provided accurate recommendations regarding the type and strain of the crop that needs to be planted. In the future, the system can be tested using real-world data and can be integrated into Edge computing frameworks.

References

Abrol, I. P., & Sangar, S. (2006). Sustaining Indian agriculture-conservation agriculture the way forward. Current Science, 1020-1025.

Adams, M. W., Ellingboe, A. H., & Rossman, E. C. (1971). Biological uniformity and disease epidemics. BioScience, 21(21), 1067-1070.

Altieri, M. A., Nicholls, C. I., Henao, A., & Lana, M. A. (2015). Agroecology and the design of climate change-resilient farming systems. Agronomy for sustainable development, 35(3), 869-890.

Bhan, S., & Behera, U. K. (2014). Conservation agriculture in India-Problems, prospects and policy issues. International Soil and Water Conservation Research, 2(4), 1-12.

Bowonder, B. (1979). Impact analysis of the green revolution in India. Technological Forecasting and Social Change, 15(4), 297-313.

Deshmukh, P. V. (1940). Farmers suicides in India. age, 3450(2140), 2704-2705.

Dhawan, V. (2017). Water and agriculture in India. In Background paper for the South Asia expert panel during the Global Forum for Food and Agriculture (Vol. 28).

Dimkpa, C. O., & Bindraban, P. S. (2016). Fortification of micronutrients for efficient agronomic production: a review. Agronomy for Sustainable Development, 36(1), 1-27.

Foley, J. A., Ramankutty, N., Brauman, K. A., Cassidy, E. S., Gerber, J. S., Johnston, M., & Zaks, D. P. (2011). Solutions for a cultivated planet. Nature, 478(7369), 337-342.

Ghosh, N. (2004). Reducing dependence on chemical fertilizers and its financial implications for farmers in India. Ecological Economics, 49(2), 149-162.

Godfray, H. C. J., Beddington, J. R., Crute, I. R., Haddad, L., Lawrence, D., Muir, J. F., & Toulmin, C. (2010). Food security: the challenge of feeding 9 billion people. science, 327(5967), 812-818.

Ingale, V., Vaidya, R., Phad, A., & Shingare, P. (2016, April). A sensor device for measuring soil macronutrient proportion using FPGA. In 2016 International Conference on Communication and Signal Processing (ICCSP) (pp. 0715-0718). IEEE.

Latha, C. M., & Shanmugam, V. (2014). Growth of service sector in India. Journal of Humanities and Social Science, 19(1), 08-12.

Mahendra Dev, S. (2014). Small farmers in India: Challenges and opportunities.

Mathur, A. S., Das, S., & Sircar, S. (2006). Status of agriculture in India: trends and prospects. Economic and political weekly, 5327-5336.

Sebby, K. (2010). The green revolution of the 1960's and its impact on small farmers in India.

Tian, H., Wang, T., Liu, Y., Qiao, X., & Li, Y. (2020). Computer vision technology in agricultural automation-A review. Information Processing in Agriculture, 7(1), 1-19.

Udapudi, S. S., Sonika, R., Aravind, E. M., Prasad, S., & Anoop, G. L. (n.d.). Automatic soil nutrient detection and fertilizer dispensary system. ResearchGate. https://doi.org/10.1109/RCTFC.2016.7893418

Digitalization of Agriculture-The Future of Indian Agriculture

Amitosh Kumar[1], Anshuman Kumar[2] and M. R. Vineeth[3]

Abstract

Digitization and e-agriculture opens up opportunities for traditional non-players in the agriculture value chain. It provides reliable data for research and policy-making and fills the current information gap. Farmers' income can be increased, and positive effects on agriculture are seen through the emergence of farm technologies and connected robust information communication technology (ICT). Digital transformation will provide access to finance through exposure and awareness due to digitization, forecasts on climate change enable right decisions, for better soil fertility and soil structure, access to markets, access to information, smallholdings utilization and enables predictive analysis. Adopting a holistic ecosystem approach to address challenges faced by the Indian agriculture sector is of national interest to achieve objectives, like doubling farmer incomes and sustainable development. Finally, digitization will change the scène of Indian agriculture in the future and guarantee higher income to farmers and reduce distress. This paper explains the scope of digitization in agriculture and reviews the on-going digital agricultural and e-agriculture initiatives.

Keywords: Digital Agriculture, e-Agriculture, India,

Introduction

In India, high agriculture growth is needed for the overall growth of the economy and to provide employment and food security to the majority population. Growth may be higher during the previous two decades, but

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inclusive focus on agriculture and the allied sector has been missing. The agriculture sector, currently valued at US$370, is one of the major sectors in the Indian economy. According to the Economic survey 2020-21, GDP contribution by the agriculture sector is like to be 19.9% in 2020-21, an increase from 17.8% recorded in 2019-20. Digitization is an essential variable for fast growth in this sector if we want high agricultural growth and rising incomes for farmers.

Dr. A.P.J Kalam quoted that "Enhancing agriculture productivity is key for agro-food processing and related industries, manufacturing, and service sector growth". This requires a great revolution in research, technology development, agricultural extension services, and effective marketing, storage, and distribution networks.

The study is conceptual and based on secondary data collected from company websites, newspapers, and journals. The scope of the study is restricted to the agricultural sector only.

Scope for Digitization in India

Digitization and e-Agriculture opens up opportunities for non-traditional players in the agriculture value chain. Better data will allow government and non-government organizations to design farmer-friendly policies and planned interventions. "E-agriculture is a multi-stakeholder process that involves bringing together many different ministries and departments as well as private sector players such as insurance, banking, and mobile network operators. Countries have been experimenting with technology for agriculture for a long time. Today, the term agricultural digitization refers to the process of integrating advanced digital technology like Artificial Intelligence, Big Data, Robotics, and Communication Networks, all connected through the Internet of Things (IoT), into the farm production system. ICT Development Index (IDI) 2020, published by UN International Telecommunications Union, measures information and communication technology access. It ranked India a low 131 out of 167 nations. This is reflective of the poor access of the population to ICT services.

The Internet penetration rate in India went up to nearly around 45 percent in 2021 from just about four percent in 2007. Although these figures seem relatively low, it meant that nearly half of the population of 1.37 billion people had internet access that year. This also ranked the country second in terms of active internet users.

With a higher level of ICT, services become more efficient, and their productivity increases; as a result, income increases at a high rate. The digitization of the agricultural sector can play a significant role in increasing employment opportunities, improving the standard of living in the agricultural sector, and reducing the risk and uncertainties that our farmers have to deal with presently.

Technology is vital in increasing growth through providing better services and innovative delivery models. Mobile telephony is connected to satellites and data delivered to centralized servers, which are instrumental in converting grain into monetized assets. Crop health can be measured from pest infestation levels to moisture readings of the crop to satellite imagery of the warehouses. This type of high-tech intervention will allow financial institutions to use agri-crop as the primary collateral to promote financial inclusion.

Digital farming provides a real-time data flow from the fields to the company office about day-to-day farming operations. This enables taking care of the entire value chain, from sowing to harvesting through agribusiness. With the help of digital systems, advice can be given to farmers, and field staff attached to them can ensure best practices in their fields. Through digital monitoring, fields are digitally managed by giving the proper course correction advice and taking regular updates on the health of the farm through pictures.

The digitization of agricultural practice provides traceability across the entire supply chain. It also helps farmers connect with the buyers and initiate sales by availing online marketplace, giving farmers more independence and choosing a buyer.

IoT adoption is growing in India, but enterprises struggle with legacy setups, connectivity protocols, and high costs associated with large-scale IoT departments. IoT vendors can help enterprises in their digital transformation. The Indian IoT is expected to expand at a compound annual growth rate of 13.2% from 2020 to 2025.

In the coming decade, India has a growing opportunity in the agriculture sector to improve lives, making India a true leader in agriculture IoT by revolutionizing the way farmers plant, fertilize, and harvest in the next decade. Advancement from chipmakers is making the computer and connectivity hardware and software technologies more affordable. Almost 50 percent of the population is employed in the agricultural sector and it will increase the overall growth of the country this sector should avail the benefits of the huge potential of IoT-driven solutions for improving supply chains and farm practices which will enhance yield and higher monetization of the sector.

Farmers' income can be increased and positive effects on agriculture are seen through the emergence of farm technologies with well-connected robust Information Communication Technology (ICT). Technology in Indian agriculture helps overcome productivity stagnation, strengthen market linkages, and improve farm management. Farming can also be modernized by adopting technology-driven production practices to ensure consistent annual returns, reduced risk of crop failure, and increased yields. Digital technology can be applied in remote sensing via satellites, geographic information systems, crop and soil health monitoring, and livestock and farm management.

Current Initiatives under Digital Agriculture in India

Demand for digitization in Indian agriculture is well understood and acknowledged; likewise, efforts have also been made toward digitizing the prevailing value chain. In 2021, the Union Minister of Agriculture & Farmer Welfare announced the initiation of the Digital Agriculture Mission 2021-2025 while signing five MoUs with CISCO, Ninjacart, Jio, ITC, and

NCDEX e-markets to forward digital agriculture through pilot projects. The Digital Agriculture Mission 2021-2025 aims to support and accelerate projects based on new technologies like AI, Blockchain, Remote sensing and GIS technology and use of Drones and Robots.

Cisco developed in Agricultural Digital infrastructure (ADI) in 2019, enhancing farming and knowledge sharing. This ADI is likely to play a vital role in the Department of Agriculture's data pool under the National Agri Stack. The pilot project for this initiative will take place at Haryana and Madhya Pradesh.

The Jio Agri platform launched in 2020 digitizes the agricultural ecosystem along the entire value chain to empower farmers. The platform's core function uses stand-alone application data to provide advisory; the advanced function uses data from various sources, feeds the data into AI/ ML algorithms, and provides accurately personalized.

ITCs e-Chaupal has proved to be a comprehensive digital knowledge hub for farmers, which has 6,100 installations covering 35,000 villages serving 4 million farmers. It was launched in 2000, benefiting farmers doing business through their network and producing a ripple effect on the public sector managed food grain management system leading to up-gradation.

Tata Consultancy Services (TCS) offers personalized advisory services in voice and visual formats through communication devices such as mobile phones through its mKRISHI platform. With mobiles, farmers can connect with other farmers and traders and utilize their mobile phones for information on input availability or market prices and allow them to get competing prices and choose the best one and availing information about, selecting seed varieties appropriate to a particular farm, adopt best activation practices, bear weather risks and coping with plant diseases.

The ekgaon One Village One World Network is leveraging mobile communication technology to encourage the sustainable development of Self Help Groups (SHG) and small farmers across India. The platform has over 9,00,000 women and 3,00,000 farmers spread across villages in India.

Digital India was launched on July 1, 2015 to create a digital infrastructure for empowering rural communities, enabling digital delivery of services, and promoting digital literacy. Digital agriculture can be defined as ICT and data ecosystems to support the development and delivery of timely, targeted localized information and services for profitable and sustainable agriculture through providing safe, nutritious, and affordable food for all.

In 2021 The Ministry of Agriculture and Farmer Welfare signed with MoU with Microsoft to run a pilot program for 100 villages in 6 states. Under the MoU, Microsoft will create a Unified Farmer Services Interface through its cloud computing services. This is a significant part of the ministry's plan to create 'Agristack.'

Conclusion

Digital transformation will provide access to finance through exposure and awareness due to digitization, forecasts on climate change enable right decisions, for better soil fertility and soil structure, access to markets, access to information, smallholdings utilization and enables predictive analysis. Indian Agriculture and the allied sector are on the verge of adopting modern technologies, such as IoT, AI, and agro-drones for unmanned aerial surveying; Indian and foreign agritech players can play a vital role in supplying these advanced technologies to farmers.

Adopting a holistic ecosystem approach to address challenges faced by the Indian agriculture sector is of national interest to achieve objectives, like doubling farmer incomes and sustainable development. For India, when regional, national and international research institutes have already developed technologies, farmers need motivation and encouragement to adopt this proven yield-enhancing, cost-efficient, and environment-friendly technologies. Thus a multi-stakeholder approach will be required for the wide-scale adoption of digital agriculture in India, with the Government playing a key enabler's role in the ecosystem.

References

Annual Report | Department of Agriculture & Farmers Welfare | Mo A&FW | GoI. (n.d.). Retrieved February 8, 2022, from https://agricoop.nic.in/en/annual-report

Digitisation will turnaround agriculture sector: CropIn Tech-Rural Marketing. (n.d.). Retrieved February 8, 2022, from https://ruralmarketing.in/interviews/digitisation-will-turnaround-agriculture-sector-cropin-tech/?gvas=lilac

ITC's Agri Commodities and Rural Services. (n.d.). Retrieved February 8, 2022, from https://www.itcportal.com/businesses/agri-business/agri-commodities-and-rural-services.aspx

Seeds of decline. (n.d.). Retrieved February 8, 2022, from https://www.downtoearth.org.in/coverage/agriculture/seeds-of-decline-56200

The Economic Times: Business News, Personal Finance, Financial News, India Stock Market Investing, Economy News, SENSEX, NIFTY, NSE, BSE Live, IPO News. (n.d.). Retrieved February 8, 2022, from https://economictimes.indiatimes.com/defaultinterstitial.cms

Green Library Services in the Libraries of Agricultural Universities

Deepak Kumar Namdeo[1] and Rakesh Khare[2]

Abstract

Learning activities need a peaceful, eco-friendly and healthy environment; hence the concept of green building was implemented in the library, and the Concept of Green Library emerged. Green concepts enhanced the library's image and marketing the library services. There is a need to promote Green Library Services in the agricultural institutions and universities. This paper explains the challenges to green libraries, explains various standards available for green libraries and elements and suggests green library services along with changing role of library professionals in green libraries.

Keywords: Green Library, Library Services, Agricultural Libraries, Agricultural Universities

Introduction

Nowadays, there is a growing concern for sustainable development and green concepts to save the environment. Impact of greenhouses effects, climate changes, global warming, and sustainable development trends in society are forced to implement the Green Concept. People perform most of their tasks and activities inside the buildings and desired an eco-friendly atmosphere to enhance the qualities of work; therefore, concepts of green being implemented in the buildings are recognized as Green Buildings. Ecological, energy-saving, waste-reducing, and health-promoting buildings are collectively called as green buildings. The library is a learning hub for intellectuals. Learning activities need a peaceful, eco-friendly and healthy

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environment; hence the concept of green building was implemented in the library, and the Concept of Green Library emerged in the 1980s. In the 21st Century, the Green Library is trendy and commonly accepted by society. United Nations has introduced the Sustainable Development Goals (SDGs) in 2015, which consists of three key aspects, including 'natural resource conservation. In these circumstances, community centers, knowledge hubs, and libraries also play a significant part in saving the environment and conservation of natural resources.

Green Libraries are scaling down the negative impression on the surrounding. These are focused on reducing carbon footprint in collection development, routine activities, and services of the library. The Green Library concept tries to provide a natural environment and eco-friendly atmosphere to their patrons within the library building and its surroundings. These libraries developed and adopted such policies that help save the environment of the earth.

According to the Online Dictionary for Library and Information (ODLIS), Green libraries are "designed to minimize the negative impact on the natural environment and maximize indoor environmental quality employing careful site selection, use of natural construction materials and biodegradable products, conservation of resources (water, energy, paper etc.), and responsible waste disposal (recycling, etc.)." The concept of a paperless library and less paper library system boost-up the green library movement and reduced deforestation to meet the requirements of the papers industry.

Oxford English Dictionary (1989) defined the term green as "about, or supporting environmentalism" (p.811). The term "sustainable "relates to "forms of human economic activity and culture that do not lead to environmental degradation, esp. avoiding the long term depletion of natural resources". Green libraries take all initiatives which save the nature and natural resources i.e., use of solar energy, maximum use of natural light and air, implementation of green building concept, move towards e-resources and reduce the consumption energy therefore clean environment gift for the forthcoming generation. The concept of green is going to the implemented across the globe. Leading library agencies of the world and authorities are planning to save the libraries and nature by the guidelines to move towards Green Library. The library has five organs i.e., Building, Furniture, Books, Human Resources, and learning atmosphere. All these five entities move towards reducing the negative energy, enhancing the positive energy and make eco-friendly environment then a library become a Green Library. Green libraries reduce the negative and enhance the positive effect on the environment, economy, and society.

A library that follows eco-friendly practices in all its activities is called a green library. Eco-friendly practices include Reduce, Reuse and Recycle policy, creating a zero garbage system, creating a paperless work environment, planning for sustainable development, and propaganda of saving nature through library operation and services. The Green library building design is the maximum use of renewable resources, and after optimum utilization, these resources must be reused and recycled. Maximum use of on-site available natural resources i.e., sunlight, fresh air, water, and reuse of waste. Sustainable design of buildings enhances the use and reuse of resources and minimizes building impact on human health and the environment during the lifecycle of the building. It fulfills the requirement of the present without any negative impact on coming generations.

Objectives

The primary objective of the green library is to provide an eco-friendly learning atmosphere to the readers and play a negligible role to save the earth and make it green with the following aims:

1. To study the design aspect of library building which helps Green Concept.
2. Identify the challenges to initiate the green library concept in agricultural universities,

3. To study the role of library professionals towards the greenness of library and its services,
4. To promote the use of natural resources in the library,
5. To save the cost and provide a healthy environment to the readers,
6. To know how libraries can be transformed into Green Libraries.

Review of Literature

Literature review indicates that several studies regarding Green Library and related concepts have been published in print and electronic media during 1990 to 2021, especially on green library buildings and their standards, substitutability of the library building, green library initiatives in University and public libraries. The implementation of Green Library concept in agricultural universities is very important and critical for the spread of the green concept in libraries of other sectors.

Singh, M. P., & Dixit, S. (2021) finds out Sustainable Strategies adopted by the Selected State University Libraries of Lucknow, Uttar Pradesh. The study shows that library professionals are aware of green libraries and sustainable development and are using their guidelines for the library. Yasin Sesena (2020) discussed the report "Our Common Future prepared by the World Commission on Environment and Development (WCED)" and explored the idea for the coming generation to meet their information need in the natural environment. To promote the green library concept and its implementation, IFLA (International Federation of Library Associations and Institutes) started a Green Library Award in 2016. It also points out the user behavior and expectation with the green library.

Walker (2020), in his blog "100 Ways to Make Your Library a Little Greener," gives detailed information in a lucid style. Mahawariya (2019) states the concept of a green library on how to make libraries green, the criteria of LEED, the need for a green library, and the role o library professionals for the eco-friendly library. Vasanthi (2019) discussed the green library building, the importance, the purpose of eco-friendly libraries, and various national and international standards to assess the green library. Attia (2018), in his book, straightforwardly explains Net Zero Energy Buildings. Weerasinghe (2018) has observed that the construction cost of building a green library is 37% higher than that of a similar-natured conventional building. However, the end life overall cost saving is 21% higher in green buildings. Hence it has been stated that green libraries involve initial cost but save cost in the future run.

Meher and Parabhoi (2017) studied green libraries and unique references to Indian libraries and focused on initiatives taken by librarians. Bhattacharya (2017) has explained various standards for green libraries, major green library initiations globally, the role of librarians, how awareness about the green library can be created, etc. Haipeng (2017), in his research, explored the sustainable learning environment at the University of California (UC) Merced Library, showing that the library is built to support active and constructive learning through its sustainable design as an open, collaborative, and welcoming learning environment. Nikam (2017) has highlighted the concept of a green library, its features, and its elements. He has also emphasized the role of the modern librarian in the process and has mentioned some valuable suggestions to implement the green library concept. Sornasundari and Saha (2016) have pointed benefits of green library buildings. They have suggested focusing on the sustainability of resources by greening existing library facilities and providing green library services to users.

Chakraborty (2013) studied on realities of green initiatives of the metro cite libraries i.e., University of Calcutta Library, Mumbai University Library, Madras University Library, and Delhi University Library. Hauke and Werner (2012) focused on sustainability through recycling the old buildings into new libraries. He thinks that "we are ecological interdependent with the whole of the natural environment; we are socially culturally, and economically interdependent with all of humanity; sustainability in the context of this interdependence, requires partnership, equity, and balance among all parties". Antonelli (2008) has explained the benefits of the green library for future generations, the concept of LEED, various green library programs. He has also discussed some green library courses and has provided information about green library associations. Brown (2003) studied the emerging trend of green libraries and proclaimed that libraries have cutting edge green design.

Why the Green Library

The world's population is increasing day by day, and the whole world is facing a lot of environmental problems, i.e., pollution, environment degradation, diminishing of resources, and many more. In this situation, we are focused on conserving natural resources, health & hygiene, an eco-friendly environment, and sustainable development of society. The green library gives quality services in a pleasant atmosphere and homely environment for good mental and physical health. Dr.S.R. Rangamathan gave the fifth law of library science in 1931, i.e., "Library is a growing organism" that says the library is growing like living things. Therefore, libraries also need sustainable development to serve a coming generation with a homely and eco-friendly learning environment. Green Concept and sustainability has reduced the maintenance cost of library activities and services, so the library feels independent. Green library services increase the library's market value and attract more users to the library, therefore enhancing the library footfall.

Challenges of Green Libraries

Sustainable Design for the library is strongly recommended under the green building movement by different authorities across the globe, i.e., USLEED, BREEM, LEED-India, IGBC, GRHA, etc. However, libraries and information centers have some unique challenges to going green.

- Patrons are very much comfortable with traditional reading materials.
- Books still play a significant role in preserving knowledge for future generations.

- Books may damage by extreme temperatures, moisture, and ultra-violet rays of sunlight.
- Reconstruction and modification of Building design
- Financial Constraint
- Lack of Administration Support and staff
- Lack of awareness of users and staff
- Non - availability of a green library policy and plan
- Lack of physical resources and human resources
- Lack of time

Standards for the Green Libraries

We have some standards and certification agencies for standardizing green library buildings at the national and international levels. LEED and BREEM are at the international level, and GRIHA and IGBC are at the national level.

LEED

LEED rating system was developed by the United States Green Building Council (USGBC) in 2000. It stands for Leadership in Energy and Environmental Design (LEED). This is an ecology-oriented building certification program that judged building's sustainability based on six credit categories for new building construction: sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and innovation in design. It is a point-based rating system where projects earn LEED points for meeting green building criteria that certify as Silver, Gold, or Platinum.

BREEAM

BREEAM is the environmental assessment method for the rating of buildings was launched in 1990 by Building Research Establishment, Walford, England. BREEAM (Building Research Establishment Environmental

Assessment Method) measures buildings based on its five sustainable design principles and environmental performance. It considers and observes the building on low carbon technology for heating and cooling, low energy lighting, and water conservation systems. In this method, the building is rated at five BREEAM rating levels: poor, i.e., very good, excellent, and outstanding. BREEAM has been implemented in 93 Countries, and 598729 buildings are certified out of 2322635 worldwide up to Oct 2021.

Chicago Illinois Standards

This standard is developed based on LEED for the Rating of Green Building in Chicago, mainly for the public building to implement the eco-friendly guidelines. It considered the design aspect, materials selection for construction, energy efficiency, and life-cycle analysis of buildings which minimize the harmful impact on the environment.

IGBC

Indian Green building Council (IGBC) was established by the Confederation of Indian Industry (CII) in 2001 to promote and rate Green buildings in India. The council's vision is, "To enable a sustainable built environment for all and facilitate India to be one of the global leaders in the sustainable built environment by 2025". IGBC has licensed the LEED Green Building Standard from the U.S Green Building Council and developed a Gold rating system to promote Green Buildings in India.

GRIHA

Green Rating for Integrated Habitat Assessment Council was jointly set up by the TERI (The Energy and Resources Institute, New Delhi) and Ministry of New and Renewable Energy in 2007. The Government of India has adopted it as the National rating system for Green building which is suitable for all kinds of buildings in different climatic zones of the country. It is an indigenous tool for rating and plays a forefront role in the Green building movement in India.

LEED-India

Leadership in Energy and Environmental Design is the paradigm in the green building rating system. It is a nationally and internationally accepted benchmark for the design, construction, and operation of high-performance green buildings. There are four certification levels (Certified, Silver, Gold, Platinum) awarded according to achievement as evaluated by points using the LEED scorecard. LEED rate on 100 points and certify the buildings on the following criteria:

25-40 points as Certified.

41-50 points as Silver.

51-60 points as Gold.

61-80 points as Platinum.

LEED-India stimulates a whole-building approach to sustainability by acclaiming the performance in the following key areas:

- Site location
- Water conservation
- Energy efficiency
- Materials
- Indoor air quality
- Vegetated Green Roof
- Conserves the energy.

Green Library Activities Services:

1. Maximum use of electronic resources rather than books,
2. Minimum purchase of printed books,
3. Printed books may arrange through Resources Sharing,

4. WebOPAC search facility in place of catalog card,
5. Minimum use of Xerox machine and provide e-copy of the document,
6. Use a maximum of natural light in the reading room and stack,
7. Use Indoor and outdoor to reduce the building temperature,
8. Sensor-based lights must be used in the library,
9. Roof garden to maintain building temperature,
10. User and staff orientation to promote the green concept in the library to enrich our environment.

Elements for Green Library

Support of Administration/Community collaboration

Implementation of the Green library concept is needed to support public administration and people awareness. Community/Public assets are efficiently used and maintained with public support.

Both Daylight and Artificial Light

The library should have large windows and ventilation for the natural lighting, mainly east and west sides of the building. Sensor-based LED or energy-efficient lighting systems may use in place of bulbs or tube lights to save electricity. Use pair daylight with artificial lighting to reduce energy costs

Use of Green Materials

Use renewable, recyclable, and regionally available natural materials to construct and design buildings, i.e., wood, linoleum, bamboo, and cork for eco-friendly buildings.

Green Roof

Green Roof planting or rooftop gardens are an excellent idea to reduce the building temperature and proper rainwater and fresh air. Solar tiles or panels can be used on the roof to generate solar energy. Reflective roofs may use to come down inside the temperature of the building. Green roof systems help to save energy costs.

Natural Ventilation

The library should have large windows and ventilation for the natural and fresh air for an eco-friendly, healthy, and hygienic atmosphere. Insulated windows may use which are maintain inside temperature and resist dust and noise.

Quality of the Indoor Environment

Indoor environmental quality required proper plantation inside the building, providing pure and breathable air and making the library cool. Good ventilation and proper plantation reduce the electricity consumption of the air-conditioning and pleasant and healthy environment. Uses of laptops and LCD monitor in place old computer system to reduce electricity consumption and building temperature.

Raised Floor System

Raise the floor for fresh air and use of paper insulation is also a good trick to make an eco-friendly building. It also protects the wall from insects and fire.

Area / Location

Site selection is a fundamental element of green building; Sustainable building depends on the physical situations of the locality, so the most suitable site to be selected for the green library building allows for maximum utilize local natural resources. Before the construction of the building must be planned and must think about all sides benefit and drawbacks.

Water

The library should plan appropriately for a sound sanitation system that helps the library clean, green, and healthy. A water harvesting system must be implemented in the building to store rainwater properly in sanitation and plantation.

Green Library Collection

Green library collection means reading materials available in the library, which helps to save the environment.

- Promote the maximum use of e-resources.
- Avoid purchasing multiple copies of the book.
- E-books provide under the Book bank facility.
- Provide softcopies of reading material in place of Xerox.
- Digitalization of old and rare books
- Develop institutional repository

Conclusion

The green library concept is widely spreading across the globe, and it is the need of hours and most libraries are moving towards the green library concept. This concept is beneficial to provide modern library services without any harmful impact on nature. Libraries especially in Agricultural Universities should lead the Green Library concept and show the way to libraries in other sectors.

References

Antonelli, M. (2008). The Green Library Movement: An Overview and Beyond. Electronic Green Journal, 1(27).

Attia, S. (2018). Net Zero Energy Buildings (NZEB). Butterworth-Heinemann.

Bhattacharya, A. (2017). Green Library and its utilities in modern day library service: A study. International Journal of Next Generation Library and Technologies, 3(3), 1-11.

Brown, B. (2003). The new green standard. Library Journal, 128, 61-64.

Chakraborty, S. (2013). Going green or not: realities of the Indian metropolis libraries. Retrieved from http://library.ifla.org/113/1/115b-chakraborty-en.pdf

Connel, Virginia (2010) Greening the Library: Collection Development Decisions, The journal of the new member's Round table, 1(1)1-15.

Gundawar, Neeta D. (2017). A survey of green libraries in India available in Shodhganga access link http://hdl.handle.net/10603/276629

Hauke, P., & Werner, K.U. (2012). The second hand library building: Sustainable thinking through recycling old buildings into new libraries. International Federation of Library associations and Institutions, 38(1), 60-67.

Mahawariya, Kimi (2019). Transformation of modern libraries in to green libraries to attain sustainability. Journal of Indian library association. Vol 55(2) pp1-7.

McElrath, Eileen," Environmental Sustainability and Libraries", International Journal Of Humanities & Social Science, Vol.5,No-12;December 2015:P-13-23.

Meher, P. and Parabhoi, L. (2017). Green Library: an overview, issues with special reference to Indian libraries. International Journal of Digital Library Services, 7(2), 62-69. Retrieved from http://www.ijodls.in/uploads/3/6/0/3/3603729/7ijodls217.pdf

Nikam, S. (2017). Green Library: an Emerging Concept. Knowledge Librarian: An International Peer Reviewed Bilingual E- journal of Library and Information Science, 4(6), 190- 198.

Oxford English Dictionary. (2nd ed., Vol. V.). (1989). Oxford ; New York : Oxford University Press.

Shah, L., Kumar, S. & Shah, M.K. (2015).Green Libraries in Academic Institutions: need of the Hour. International Journal of Research- Granthaalayah, 3(9), 1-5.

Singh, M. P., & Dixit, S. (2021). Sustainable strategies towards green libraries: A study of state university libraries of Lucknow, Uttar Pradesh. Library Philosophy and Practice, 2021, 1-21.

Sornasundari, R. & Sara, C. (2016). Green Library: a study. International Journal of Research Instinct, 3(2), 616-621.

Vasanthi (2019). Green libraru trends and development in India: A study. International Journal of advance research and innovative Idea in Education, 5(5), pp475-479.

Walker, M. (2020). 100 Ways to Make Your Library a Little Greener [Blog]. Retrieved from https://www.bachelorsdegreeonline.com/blog/2009/100-ways-to-make-your-library-a-little-greener/

Weerasinghe, A. S. (2018). Economic sustainability of green buildings: a comparative analysis of green vs. non-green. Built Environment Project and Asset management, 8(5), 528-543.

Yasin Sesena, Alpaslan Hamdi Kuzucuoglub (2020). The Importance of Green Libraries in Terms of Sustainability, Journal of Balkan Libraries Union, Vol.7, No.1, pp. 10-16, 2020.

Importance of User Studies for Information Retrieval: A Case Study of Assam Agricultural University, Jorhat

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Abstract

User studies over the years have attempted to explain the information use phenomena, understand and predict information use behavior and improve the information search results by manipulating essential conditions. Librarians are exhorted to develop traits in identifying the distinct groups of users along with their information-seeking habits, sources, and needs. These, in turn, facilitate the successful evaluation of search results in Information Retrieval. The present user study on a sample of 184 users is highlighted as one of the essential tasks that lead to search-oriented query collection from a heterogeneous group of users in the Assam Agricultural University and consider the specific databases for the Information Retrieval process. The users' satisfaction level can judge the attitudinal approach to information search after retrieving information relevant to the queries submitted by the users.

Keywords: User Study, Queries, Information-Seeking Behavior, Information Retrieval, Agricultural Library

Introduction

The continuous monitoring of user behavior determines the degree of library-user interaction during the information retrieval process. The changes in the information search pattern are dependent on factors like information needs and the implementation of new services in the library. In terms of the usage of library resources, user behavior presents many overlapping issues that reflect on the incapability of the users lacking in the specificity of the search queries, consequently ending up with vague

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and general search strategies. Besides implementing services in the library, promotion and publicity of these services to the users must also be emphasized to avoid dispensing non-essential information to the users during information retrieval. Many documents on information retrieval validate that the standard approach to IRS evaluation revolves around the degree of relevancy of documents. As a rule of thumb, a minimum of 50 (fifty) information needs is realized to be the minimum requirement for deciding upon the relevance factor. A document is said to be relevant if it addresses the stated information need not just because it contains almost all the words in the query but due to certain stated statistical measurements applied in the various information retrieval models.

Hence "relevance" is assessed relative to an information need, not a query. Hence when the information need is framed improperly, it is difficult for the IRS to process and produce the relevant result as expected by the user.

Objective of study

The objective is to study the user community of agriculture and allied fields to draw inferences on the taxonomy of different user groups and their information-seeking approaches. To highlight the interdependence between the user profile and query collection and justify the selection of databases i.e., CeRA and DELCON for the Information Retrieval Process.

Scope and limitation of the present study

The study throws light on the attitudinal readiness to information use on which further research can be attempted. Also, the stratification of the user groups of agricultural information in the study can be considered for any research involving the users.

As for the concerned limitations, since the queries collected for the Information Retrieval Process are considered research-oriented queries, so out of the undergraduate and postgraduate students, only the postgraduate students are considered for the study as they are assigned with preparing dissertation a compulsory credit course. Secondly, the Assam Agricultural University constitutes the colleges of Agriculture, Community Science, Sericulture, and Horticulture within its campus. The Colleges of Veterinary Science and Fisheries are located in different districts. Therefore maximum data received comprises users of the in-campus colleges and sparsely from users from Veterinary and Fishery.

Literature Review

Wilson (1981), in his model of factors influencing the needs and information-seeking behavior, opines that the full range of personal human needs is at the root of motivation towards information-seeking behavior. He suggests that as part of the search for the satisfaction of these needs, an individual may engage in information-seeking behavior. However, many factors other than these needs are also recognized to play a part in the information retrieval process. Gwizdka & Lopatovska (2009) defined "subjective aspects of information searching that include all aspects related to users' feelings and perceptions (in contrast to their actions directed towards the system in achieving their goal)." They included studies of searchers' feelings associated with the search stages, searchers' satisfaction, and relevance judgments (Kuhlthau, 1991; Tessier, Crouch, & Atherton, 1977; Su, 2003; Saracevic, 2007 as cited by Gwizdka & Lopatovska, 2009). Their primary goal was to examine searchers' behavior while monitoring changes in their 'subjective' states, specifically the effects of changing search circumstances on their feelings and experiences. Therefore users' information-seeking behavior depends mainly on the types of users. In the present context, the users of agricultural information are discussed in detail to make the base for performing IR nearly appropriate.

The perception of library users happened to be constricted in types, but the approach in seeking information is realized to be unchanged, as witnessed by Ramachandra and Somasekhar (1979) in their work "Bibliographical organization of literature in agricultural sciences" where they stated that the agricultural users form a single user group. Although the subject interests of such users overlap, their information needs have much in common. A significant point was highlighted by Ford (1980), who defined the information needs in terms of conceptual incognitas, the parameters used to correlate the user interests with cognitive, social psychologies. They stated that the satisfaction of such needs is attributed to the access to varying ranges of information sources, from individual learning sources to large-scale databases. Guha (1983) quoted Herbert Menzel, who grouped the user need studies into three main categories.

- Communication behavior studies in which surveys are conducted to investigate the pattern of the overall intention of the user community with the communication system, without reference to any specific information receiving event;
- Use studies in which surveys are conducted to find out the use of any communication medium, such as primary or secondary sources and
- Information pattern studies in which surveys are conducted to find out the pattern of flow of information in the communication system.

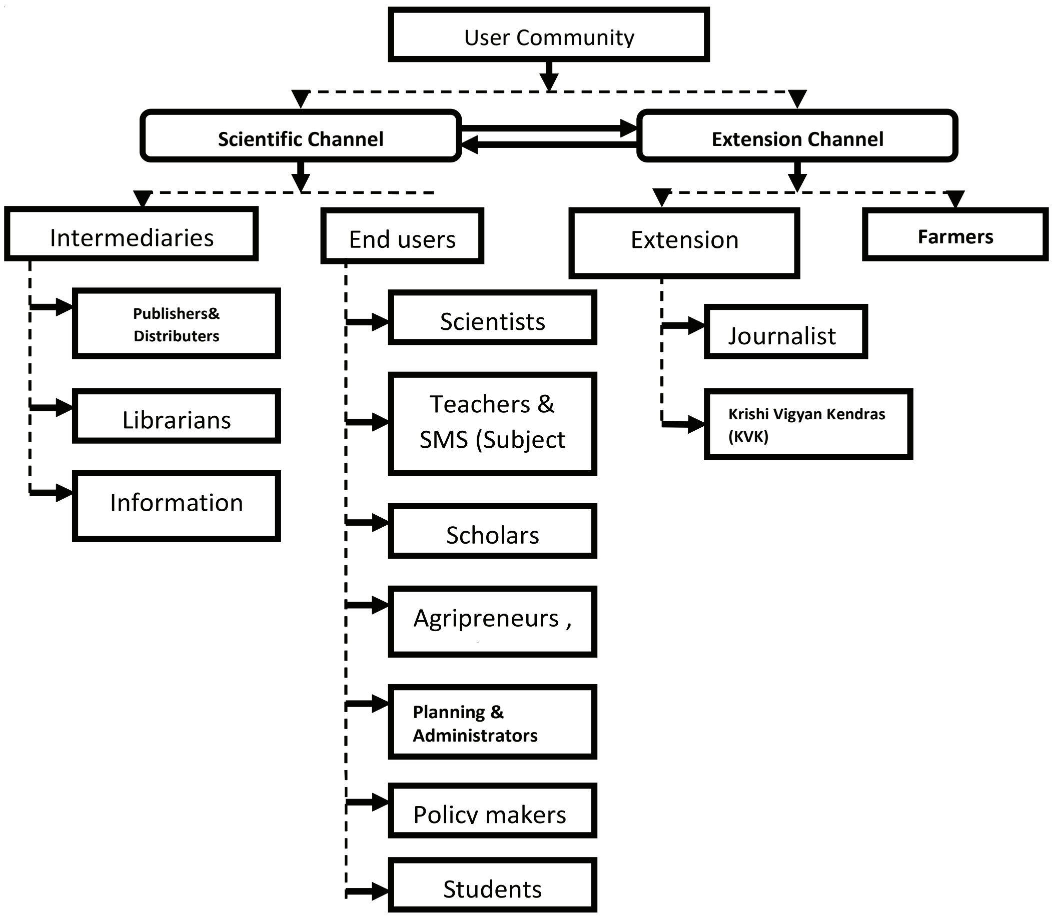
In the book "Agricultural Librarianship in India," Subbaiah, R. (1988) mentioned that the users of agricultural information can be classified as end-users and intermediaries. According to him, the end-users are the various types of persons connected with agriculture in one way or the other such as teachers, students, scholars, extension workers, farmers, entrepreneurs, etc. while the librarians, documentalists, even publishers and distributors act as the intermediaries who make the information available to the end-users. French, B.A. (1990), speaking on the taxonomy of users in "User needs and library services in agricultural sciences," stated that a relative dearth of real knowledge about the users of agricultural information exists, which is further complicated by the expanding scope of agriculture. He mentions Metcalfe's views published in 1981 who proposed eleven categories of users arranged into two groups viz. primary literature users and secondary/tertiary literature users. Based on various studies on the types of users, French classified and explained the users under five categories with some variations and overlap viz. scientists and researchers, extension scientists or researchers, extension advisers, farmers/producers, and others like policymakers, educators, journalists, agribusiness workers, and consumers. According to Gadge, Sane, and Kekre (2015), end-users present additional troubles in the information retrieval process by submitting an unstructured query. The authors stated that the "user's main concern is the methods to procure the pertinent and accurate information from the web. The meticulous conveyance of content is subject to user preferences and interpretation." Some of the numerous reasons for failure to receive relevant documents by the users can be cited from the works of Sahami et al. (2004), Baeze-Yate (2003), and Ravikumar and Singh (2010) as follows:

1. Information needs are frequently imprecisely defined, generating a semantic gap between user needs and their specifications (Sahami et al.; Baeze-Yate).
2. The user queries are limited to a couple of words and the users often do not have the foggiest idea about the best query to retrieve the information they require (Ravikumar and Singh).
3. There are various types of users and they have their perspectives and interpretation. Besides, the user's needs for information change with time. (Baeze-Yate; Ravikumar and Singh).

Al-Maskari and Anderson (2010) considered user satisfaction as a subjective variable that can be influenced by several factors such as system effectiveness, user effectiveness, user effort, user characteristics, and expectations. They suggested that information retrieval evaluators should consider all these factors in obtaining user satisfaction. They validated that most studies are done before theirs have conflicting conclusions on the relationship between user satisfaction and system effectiveness. This study has substantiated this relationship and supports using user satisfaction as a criterion of system effectiveness.

Stratification of the User Community of Agricultural Information

The agricultural universities that span across many disciplines viz agriculture, veterinary, sericulture, fisheries, horticulture, and community sciences apart from imparting agri-based education play important roles in extension services to the common man specifically to farmers and are also involved in government schemes and projects. The Krishi Vigyan Kendras (KVKs) under the administration of the universities are involved in conducting training programs for the farmers and producers, extension activities like field days, field visits, diagnostic field visits, and rural exhibitions as well as work in collaboration with the departments and NGOs. The user community classified as end-users and intermediaries forms an integral part of disseminating agricultural information.



The methodology adopted for the user study in the present work

A survey-based study with a questionnaire as the tool for user data simply does not fulfill the purpose of determining the user information needs. A questionnaire can only be considered one of the many methods of data collection involved in the user study. Rocio Herrera C. et al. (1987) suggested that developing appropriate techniques and methodologies for user studies is necessary because most libraries hitherto have not been fully conversant with the problems and techniques associated with such studies. Moreover, such studies often result in a considerable collection of disparagingly interpreted data, more likely from inadequate and poorly chosen samples. The questionnaire is supplemented with an interview because a small sub-sample should be interviewed to check the validity of the answers given to the questionnaire.

(a) Hypothesis

H_0 =There exist no significant difference in the approach of the different categories of users w.r.t.

1. Usage, fulfilment of the purpose of their use, and their satisfaction level from the different types of library services and facilities. Their primary interest in using the services is acquiring the appropriate information based upon their need during information search.
2. Usage of the different e-resources subscribed and purchased by the library

H_1 =There exist a significant difference in the approach of the different categories of users w.r.t.

1. Usage, fulfilment of the purpose of their use, and their satisfaction level.
2. Usage of the different e-resources subscribed and purchased by the library.

(b) User Categories

From the researcher's perspective, the possible user groups in the agricultural university can be categorized as

- Scientists and researchers
- Extension scientists and subject matter specialists (SMS)
- Faculties and scholars
- Students (PG)

These four categories of users are considered for query collection mainly because they are the constant users of the library and fulfill the first criteria of the scope i.e., taking into account the digital collection in the library that serves the purpose of the title of this study. The study was conducted by adopting the purposive sampling method and data collected through a survey-based questionnaire containing several closed-ended, open-ended, and multiple-choice questions designed to collect the relevant research data from the registered users of the Central Library of Assam Agricultural University. "Google forms" are used to prepare the questionnaire, and the interaction and conversation are jotted down later to derive the conclusion. Likert's five-point scale was used in designing the questionnaire.

Data Collection

The sampling done was purely purposive as the primary goal was to evaluate the respondents' awareness about the e-content the library has subscribed, purchased, and available through CeRA; their knowledge about the databases viz Krishikosh DelCON, India Agristat. The variables in this study are measured using a 5 point Likert scale with the following variations: agreement, quality, and likelihood to allow for correlations. In this regard, five different factors are proposed with the following parameters and their respective items:

Factors	Parameters	No. of items
1	Library visit	8
2	Library infrastructure, ambiance & ICT facility	12
3	Library services (usage)	8
4	Users & information seeking pattern (purpose & satisfaction)	8
5	e-resources & database	6

(c) Response Trend

A sample of 184 users depending on the class attendance was considered. The following findings are drawn from 161 respondents, out of which 13 responses for missing data and 9 responses for being casual and identical are removed. The final datasets decided to be used for analysis are 139 (161-13-9=139) categorized as

1. Post Graduate Students = 73
2. PhD Scholars = 35
3. Faculties (teachers/ scientists/SMS etc) = 31

Table-1: Demographic data

Variables	Number	Percentage
Questionnaire distributed	184	100
Questionnaire returned	161	87.5
Usable questionnaire	139	75.54
Categories of respondents		
PG Students	73	52.51
Research Scholars	35	25.17
Teachers/Scientists/SMS	31	22.3
Total respondents	139	100

The collected data from the users was organized, tabulated, analyzed, and interpreted using the following tools and techniques: frequency distribution, percentages, summated mean scores through the weighted index and ranking techniques, MS-Excel, and the chi-square test with a significance level of 0.05 i.e., ∞ =0.05 for which we accept the null hypothesis (H_0) framed for this study when (x^2)tabulated > (x^2)calculated

Result and Analysis

The collected data was analyzed and interpreted to draw the results and test hypotheses framed for this study.

Visit the Library

a. No. of regular visitors: 63 (students and scholars); Reason for visit expressed as $\mathbf{R_1>R_2>R_3>R_4}$ where

   R1= Preparation of notes for class, assignment, research activities, articles for subject-related magazines, daily agriculture-based newspaper articles, self-help groups, etc

   R2= Spending time in the e-resource section

   R3= Preparation for competitive exams in the banking sector, agricultural officer, NET-JRF, Ph.D. entrance, etc

   R4= Regular newspaper reading

b. No. of frequent visitors: 27 (faculties, extension scientists, and scientists); Reason for visit expressed as $\mathbf{F_1>F_2>F_3>F_4}$ where

   F1=Newspaper reading (interest and liking)

   F2= Gaining awareness with the recent trends, changes, and implementation in the agricultural and allied sectors) through the newsletter, reports, and other updated records

   F3= Class preparation in digital mode (prefer the e-resource and computer laboratory section)

   F4= Group discussion (faculty and a few of his/her students) and other queries

Usage, the purpose of use, and satisfaction level w.r.t the library services

From table 2, it is evaluated that under the "usage" criterion, it is seen that 80% and above users of all the three categories use the circulation service, DDS, photocopy service and the online service as all the users are always in need of prompt information; students are focused in preparing class notes, assignments, literature search for their dissertation topics as well as photocopying of the reference collection and fractions of dissertations that are not for loan; research scholars are more occupied and concentrated with their research and investigation as well as cracking of competitive exams due to which it can be ascertained from the above table that online service, DDS, CAS, reference service, CD ROM service and photocopying service are in high demand; Faculties for whom teaching, supervising and research are part and parcel of their academic pursuit have additional responsibilities of projects, agricultural camps, extension service to the other categories of users involved in agriculture viz. farmers, entrepreneurs etc. and therefore their usage statistic of online service, reference service and CAS are in high demand. Regarding "purpose," when compared among the three user categories based on the allotted ranks, it is seen that the circulation service and online service have best served the purpose of use. Furthermore, it can again be analyzed from the ranking that reference service, CAS, DDS, etc. are towards the decreasing mode in terms of the purpose served. When the "satisfaction level" of all the three user categories is compared based on the ranks, online service hits the top of the ranking list. In contrast, other services show the minimum difference in meeting the satisfaction of all the users. Therefore, it can be interpreted that all the three categories of users do have very much common in the services when usage, purpose served, and satisfaction level is taken into account, differing only in the degree of importance in information seeking level. Hence it can be assumed there is no significant difference in the approach for seeking information, and therefore, the null hypothesis is accepted.

Table - 2: Usage, the purpose of use, and satisfaction level w.r.t the library services

Services	Usage			Purpose			Satisfaction		
	P.G. students	Research Scholars	Faculties	PG	Research Scholars	Faculties	PG	Research Scholars	Faculties
	F (%)	F (%)	F(%)	mean(rank)	mean(rank)	mean(rank)	mean(rank)	mean(rank)	mean(rank)
Circulation service	69(94.52)	35(100)	25(80.64)	4.203(1)	4.17(1)	4.08(3)	3.94(4)	3.91(3)	3.4(7)
Reference service	46(63.01)	31(88.57)	27(87.09)	3.07(7)	3.22(8)	3.11(8)	3.52(7)	3.33(8)	3.26(8)
CAS	53(72.60)	33(94.28)	30(96.77)	3.6(5)	3.75(5)	3.8(6)	3.96(3)	3.9(4)	3.63(5)
DDS	61(83.56)	33(94.28)	25(80.64)	3.44(6)	3.69(6)	3.84(5)	3.81(5)	3.63(6)	4.08(2)
Photocopy service	73(100)	35(100)	23(74.19)	4.03(3)	3.91(4)	4.34(1)	4.01(2)	3.88(5)	3.56(6)
Catalogueue service	53(72.60)	29(82.85)	17(54.83)	2.9(8)	3.55(7)	3.58(7)	3.71(6)	3.48(7)	3.76(4)
CD-ROM database service	35(47.94)	31(88.57)	13(41.93)	3.8(4)	4.06(2)	3.92(4)	3.42(8)	4.06(2)	3.92(3)
Online service	64(87.67)	35(100)	31(100)	4.06(2)	4(3)	4.19(2)	4.96(1)	4.91(1)	4.77(1)
Chi-square calculated value	13.98			0.12			0.2		
Degree of freedom	14			14			14		
Significance level	0.05			0.05			0.05		
Chi-square table value	23.68			23.68			23.68		
H_0 accepted/ rejected	Accepted			Accepted			Accepted		

Use of e-resource collection

The interpretation that can be drawn from the analysis in Table 3 below is that the mean frequency of usage of e-resources and the ranks suggest that CeRA is most effective in catering to the information needs of the three user categories. The PG and scholars use Krishikosh, but they almost wind up their search in the Theses and Dissertation section because the library has held a strong collection since its inception. On the other hand, the faculties suggest the above two user categories to browse Krishikosh. Also, from the data collected, it was found that scholars and faculties have introduced themselves to all the e-resources mentioned above and databases as compared to PG students. As CeRA and DelCON have nearly fulfilled their search, IndianJournals.com is hardly used by the users. In this case, the null hypothesis is accepted as has been derived from the "x^2-test" that there exists no significant difference in the use of e-resources by all the three categories of users.

Use of e-resources & databases

e-resources/database	PG mean(rank)	Research Scholar mean(rank)	Faculty mean(rank)
e-books	3.93(2)	4.06(2)	4.65(2)
CeRA	4.58(1)	4.86(1)	4.74(1)
DelCON	2.88(5)	3.89(3)	4.06(4)
Krishikosh	3.18(3)	3.74(4)	3.32(5)
IndiaAgriStats	2.95(4)	3.57(5)	4.26(3)
IndianJournals.com	1.47(6)	2.26(6)	2.97(6)
Chi-square calculated value	0.5		
Degree of freedom	10		
Significance level	0.05		
Chi-square table value	18.307		
H_0 accepted/rejected	Accepted		

I. Information gathered from oral communication

Although it may be realized that it is not judgmental to include the oral communication between the researcher and the user group "extension scientists of KVKs" in a study purely based on query-document effectiveness in Information Retrieval, it has, however been felt necessary to state that focus on research on the ground level issues will prepare a strong base for an efficient Information System. Following issues that show scope for necessary initiatives to be undertaken are

- The present agricultural trend demands high competition in the agricultural market, and hence agriculture has become an information-intensive occupation. It is, however, understood from the conversation with the extension scientists that the farmers they work with,
- Lack of confidence in the accuracy and reliability of the information because they like being stuck to the age-old traditional methods of agriculture and financial and climatic issues sometimes create serious barriers. The KVKs thus provide their central source of information.
- A significant setback for the extension scientists and the farmers is linguistic communication, both verbal and nonverbal, which is otherwise the benefit of lingua franca enjoyed by the scientists and researchers
- Translating information to local languages and successfully disseminating and applying information is another time-consuming impediment faced.
- The collection of information in the local language is way far less than the ratio of the information available in English. Adding up is the wave of e-resources, both national and international, posing a more significant technological challenge.
- This focuses on the need for selective translation and dissemination services. To improve users' quality of information-seeking nature as

one of the highly considered visibility indicators, various innovative steps need to be adopted. In this regard a few obstacles identified are:

- The imbalance between document delivery capabilities and bibliographic capabilities. Bibliographic capabilities being more developed proves that the accessibility to agriculture outreach the other branches of sciences. However, from interactions with the users, they report difficulties obtaining the information when needed.
- Examining bibliographic information retrieval as an approach to measure user satisfaction. In this regard, two principles need to be adopted, viz., the selection of the data sources and the precision of the automatically extracted resources. Precision in this context means the relevance of displayed resources must be of the same subject coverage as the article selected by the user.
- The users' online information search tends to focus on precision and recall and the purpose of the request rather than on the structure and content of a particular database.

II. Interpretation

Following were the interpretations that are drawn from the data gathered with regards to users' approach to accessing information

- Most users start their search with a search engine and not preferably with the library portal
- Prefers to browse and read online
- Purchased and subscription-based e-resources of the library are equally accessed

From table 3 "Use of e-resource collection", it is decided that for e-resource retrieval, CeRA and DelCON databases will be taken into account for Information Retrieval Process for query-document pairs.

The outcome of the study

1. The search factor "Usage of the online databases" from the questionnaire acts as the criteria in selecting the databases from which documents are to be retrieved based on the frequency of use by the users.
2. The criteria viz. usage, purpose, and satisfaction from library services and the use of different e-resources are intentionally taken into account to make the selection of databases for retrieval of documents based on the queries collected from the users much easier time-saving. This is hoped to make the central theme of the present research study on "The application of document similarity measures for e-resource collection in Agriculture and its allied fields" comprehensive.

Conclusion

An exhaustive user study based on the pattern of search strategy, search platform, and search techniques makes most of the retrieval successful, decreasing the probability of search failures. At any point of information search, the user community should realize the demand for the librarian's guidance. Tonta (1992) has concluded in his study that "user input should be sought when analyzing search failures with retrieval effectiveness measures such as precision and recall. The same can be said for failure analysis studies that are based on user satisfaction measures. We should strive for full-scale user involvement as much as possible in every stage of analysis of search failures. Despite user participation in the evaluation process, search failures in document retrieval systems are unlikely to be eliminated altogether

The present study is a section followed by the query classification and preparing the search process to be accurately implemented with the application of the Vector space model of Information Retrieval, the main topic of doctoral research undertaken by the researcher.

References

Al-Maskari, A. and Sanderson, M. (2010). A review of factors influencing user satisfaction in information retrieval. Journal of the Association for Information Science & Technology, Association for Information Science & Technology, vol. 61(5), pages 859-868, May.

Baeze-Yate, Ricardo. (2003). Information Retrieval in the Web: Beyond Current Search Engines. International Journal of Approximate Ranking. Vol 34 pp 97-104.

Ford, N. (1980). Relating information needs to learner characteristics in higher education. Journal of Documentation, 36(2). Pp. 99-114.

French, B.A. (1990). User needs and library services in agricultural sciences. Library Trends, vol.38 no. 3 pp. 415-41

Gadge, Jayant, Sane, Suneeta, Kekre, H.B. (2015). "Performance Analysis of Layered Vector Space Model in Web Information Retrieval". International Journal of Applied Information Systems. Foundation of Computer Science. New York, USA, Vol 8 no. 5 feb.2015. ISSN 2249-0868

Guha, B. (1983).Documentation and information. Calcutta, World Press, pp.61

Gwizdka, J., & Lopatovska, I. (2009). The role of subjective factors in the information search process. Journal of the American Society for Information Science and Technology. 60(12). (doi:10.1002/asi.21183)

Hensley, C.B., Sowarby, A.J. and Resnick, A. (1962). Selective Dissemination of Information. IRE Transactions of the Professional Group on Engineering Management, EM-9:2.

Herrera C.,Rocio, Lotero M. , Libia and Rua R., Ivan (1987). User studies in university libraries. International Reader in the Management of Library, Information and Archive Services.

Ramchandra, H.R & Somasekhar, K.T. (1979). Bibliographical organization of literature in agricultural science. AALDI Bulletin, 7: 24

Ravikumar, P. & Singh, Ashutosh K. (2010). Web Structure Mining: Exploring Hyperlinks and Algorithms for Information Retrieval. American Journal of Applied Science. Vol 7(6), pp 840-845.

Sahami, Mehran et al. (2004). The Happy Searcher: Challenges in Web Information Retrieval. PRICAI 2004: Trends in Artificial Intelligence pp 3-12.

Subbaiah, R. (1988).Agricultural Librarianship in India: An overview. New Delhi

Tonta, Yasar (1992). Analysis of Search Failures in Document Retrieval Systems: A Review. The Public-Access Computer Systems Review 3, no. 1 pp 4-53.

Wilson, T.D. (1981). On user studies and information needs. Journal of Documentation. Vol. 37, pp.3-15.

Role of Agricultural Libraries in Digital Environment

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Abstract

Indian Council of Agricultural Research (ICAR) encourages e-Learning to promote the use of e-Resource in the Agriculture Sector. The financial aid provided by the Indian Council of Agricultural Research (ICAR) is a good initiative for strengthening and developing Agricultural Libraries. Agricultural Libraries play a vital role in disseminating information and knowledge to researchers, extension workers and farmers to increase crop productivity and self-sufficiency in the agriculture sector. In the Digital Age, the advances digital technologies offer immense opportunities for Agricultural Libraries to expand their networking and services to reach out to their targeted group effectively. This paper examines the different initiatives made by ICAR and other organizations and suggests recommendations to strengthen Agricultural Libraries in the digital environment.

Keywords: Agricultural Library, Digital Library, CeRA, Krishikosh, IDEAL

Introduction

The Agricultural Library and Information Centers in Agricultural Universities and Research Institutions are important learning centers which provides Agricultural Information to people engaged in the Agricultural Sector. They play a vital role in the transmission of agricultural technologies and knowledge to farmers, scientists, extension workers, administrators and many others who involve in agricultural development. In the digital era, the Agricultural Libraries have transformed into Digital Libraries and Online Libraries to provide information services to different stakeholders efficiently. These modern libraries with the power of advances in ICTs

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adopted innovative methods digitized the rich agricultural information and knowledge for easy access and use by all. The Agricultural Libraries have added several e-resources in the form of e-books, online journals, online databases, institutional repositories etc.

Objectives

This paper states the role of Agricultural Libraries in Digital Era and explains the initiative of ICAR for strengthening of Agricultural Libraries in the country. It also discusses the major constraints for Agricultural Libraries and Librarians Professionals in the digital era.

Agricultural Libraries in India

Indian Council of Agricultural Research - ICAR is an extensive network for agricultural education, research, and extension in agriculture and allied subjects. In this network more than 200 libraries exists under the ICAR umbrella. These included 4 Deemed University Libraries declared as National Libraries, 3 Central University Libraries, 64 State Agricultural, Horticulture and Veterinary University Libraries, 65 Central Institute Libraries, 14 National Research Center Libraries. More than 200 college libraries in agriculture, horticulture, agricultural engineering, veterinary and animal husbandry, fisheries are also providing library services in-country.

Important Services of Agricultural Libraries

1. Loan Privilege: Books, References, Periodicals, Thesis, Reports and reading materials.
2. Documentation Services Abstracting Services, Indexing Services, Bibliography Services, Translation Services, Reprint Photocopy services, etc.,
3. Current Awareness Services (CAS) and Selective Dissemination Information (SDI) Services

4. Internet Surfing:

   a) Web Surfing for study Purpose

   b) For Research

   c) For Recreation

5. E-Services

   a) E-Journals through CeRA

   b) Through Open Access sites

   c) Though subscribed resources e-Books, e-Resources e-Journals, online journals Database Access, Elsevier, CABI

6. Web OPAC: Networked OPAC Show Everywhere
7. Library Services 24X7 and available on Mobile Apps, Email alerts, New Arrivals
8. Circulation check anywhere- RFID
9. Krishikosh Repository
10. In-house Local Repository
11. Video Conferencing, Wi-Fi Facility
12. Resource Sharing, Data sharing, Information sharing through network
13. Internet-Based Library Information Services
14. Guidance and Counselling, Awareness and Orientation/ Training Programs.
15. Competitive Corner

Agricultural Libraries in Digital Era

In the Digital era, Libraries and Information Centers are known as Digital Libraries, Online Libraries, Virtual Libraries etc. In these digital libraries, the agricultural knowledge, study materials and information resources mostly available as digital or e-content and made available and accessible through websites, portals or institutional repositories. Since the information is digitized and available through online mode, the agricultural libraries have increased their access to users anywhere.

Agricultural Libraries also play a prominent role in disseminating information through their services, i.e., loan privilege, e-resources, e-services etc. Online service like Krishikosh, an institutional repository is an excellent example of collection development and e-resource sharing in the digital agricultural libraries. The establishment of library consortia is also observed as an important development in maximising the sharing of digital resources among agricultural libraries. Internet and IP-based networked technology play a significant role in accessing online databases, e-journals and other digital contents. Similarly, cloud computing and remote access software plays a tremendous role in providing library services in remote areas.

Role of Agricultural Libraries

Agricultural libraries play an essential role in education, research, and extension activities. They provide the following services to agricultural faculty, researchers, extension professionals and farmers:

1. The agricultural library's prominent role is to increase the use of agricultural information resources in teaching, research, and extension services.
2. Support to improve the quality of education, research, and extension services of the agricultural institutions.
3. Current Awareness Service (CAS) and Selective Dissemination of Information (SDI) services in hard and soft copy form to agricultural scientists, research workers, professors, students, farmers, and those involved in the agriculture sector.
4. Cooperation with other agricultural institutions to use the information resources.

5. Awareness programs, exhibitions, displays of the latest agricultural research, varieties related publications for farmers in rural areas.

The Changing Role of Agricultural Libraries in Digital Environment

1. Agricultural Libraries should provide information resources for their users and allow implement IT tools and techniques for seamless access to information creating a learning environment.
2. Agricultural libraries should create a networked-based digital environment for sharing resources from institutions for teaching and learning process.
3. Agricultural libraries should provide access to e-resources such as e-books, online journals, electronic databases, and software by a community of users.
4. Agricultural librarians should provide reference services questions, provide access to audio-video books, and teach users how to use e-resources.
5. Agricultural libraries should provide selective dissemination of information to students, faculty, and agricultural workers through electronic or online means.
6. Agricultural library professionals should act as instructors to guide users on use of new technologies and techniques to access different types of digital information
7. Agricultural libraries should preserve and organize agricultural research, ideas, knowledge resources, experiences for the future in digital format
8. Agricultural libraries should focus on building information databases on agriculture techniques, innovations, methods, experiments, practices, cultivation, and new research in order to provide learning opportunities to agriculture workers for global and local levels.

9. Agricultural libraries should ensure accessibility to their digital information resources to the users who operate from classroom, lab and field. They need to create facilities like video conferencing, virtual classroom, online classroom etc., to organise face-to-face meetings with resource persons and farmers
10. Agricultural libraries should take leadership in promoting the concept of resource sharing, inter-library collaboration and consortium initiative

ICAR Initiatives for Strengthening Agricultural Libraries

The Indian Council of Agricultural Research (ICAR) is an autonomous apex body responsible for co-coordinating agricultural education, research, and extension in India. Indian Council of Agricultural Research also supports agricultural education and research and extension activities. Under agricultural education for strengthening and developing agricultural libraries,

The ICAR has contributed a lot toward strengthening and modernizing agricultural libraries via modern Information Technological (IT) tools. ICAR had sanctioned network project 'Library Information System Project' under the National Agricultural Technology Project for effective execution of the project for developing better human resources. In this regard, the National Agriculture Innovation Project (NAIP) is also launched to develop this sector. ICAR launched Consortium for e-Resources in Agriculture in (CeRA) and e-Granth for an agricultural community under NAIP. The main objective of this consortia is to bring together several libraries in the group to develop the existing research and development information resource base of ICAR institutes/universities etc. Comparable to that existing in the world's leading institutions/organizations and to subscribe to e-journals and certain and e-access culture among scientists/teachers and students in ICAR institutes and agricultural universities. Important initiatives by ICAR are given below:

eGranth

eGranth is a subproject of the National Agricultural Innovation Project (NAIP) of the Indian Council of Agricultural Research (ICAR). Under the umbrella of ICAR, Indian Agricultural Research Institute (IARI) continues to be the leading institution for agricultural research, education, and extension in the country. The project aims to provide digital access to research institutes and agricultural universities' library resources, including OPAC, important institutional repository, rare books and periodicals, old journals, and make them publicly accessible over the internet under NARS with Online Computer Library Enter (OCLC) partnership. KOHA is selected as the standard software for this purpose.

Integrated Digital Ensemble of Agricultural Libraries (IDEAL)

http://ideal.egranth.ac.in/

IDEAL is a platform for Agricultural Libraries of Indian National Agricultural Research & Education System (NARES), enabling them to adopt an Integrated Library Management System for their operations of all their library functions. It is a software platform built on the 'Software as a Service (SaaS) concept to provide a hassle-free, ready to use, international standards-based platform for sharing library holdings through a union catalog (AgriCat). An integrated digital library delivered at the desk of researchers, faculty, and students of NARES can boost the quality of research output and save time. A robust set of servers and failover servers operational at the data center of ICAR-Indian Agricultural Research Institute (IARI), Pusa, New Delhi, provide hosting facilities for customized Koha open source software running independent instances for each library. Any library under NARES willing to be part of IDEAL needs to bring their catalogue data to a standard format and learn how to use Koha ILMS for library functioning.

Consortium for e-Resources in Agriculture (CeRA):

https://jgateplus.com/search/login/

Consortium for e-Resources in Agriculture is an online consortium known as CeRA. Its mandate is providing online accessibility of all essential journals related to agriculture and its allied field to researchers and students of the Consortium members. Improvement in the quality of scientific publications, teaching, and research. The main objective is to upscale the existing R & D information resource base of ICAR Institutions/Universities comparable to the world's leading institutions/organizations, subscribe to e-journals, and create an e-access culture among scientists/ faculty in ICAR Institutes/ Agricultural Universities. Presently CeRA provides 24 x 7 online accessibility of 3300 + scientific journals and 1174 e-books to 152 NARES Institutes and State Agricultural Universities through IP authentication. In CeRA, Specific articles, not accessible through CeRA, made available through Document Delivery Request (DDR) System to members. This consortium also provides remote Access Facility to select Institutes for accessing CeRA off Campus.

E-Courses Krishi Siksha

http://ecourses.iasri.res.in/Home1.aspx

Under ICAR support, all the e-Course contents available on this website have been developed by subject matter specialists of the respective disciplines at State Agricultural Universities in India and Deemed Universities of ICAR. The course material is prepared as per ICAR approved syllabus for undergraduate students already enrolled in Indian Agricultural Universities.

IndiaAgristat

https://www.indiaagristat.com/

Provide Indian agricultural statistics i.e., Area/Land Use Agricultural Education Agricultural Export Agricultural Implements and Machinery Agricultural Imports Agricultural etc. https://www.indiaagristat.com/

Indian Agriculture Research Journal

http://epubs.icar.org.in/ejournal/

ICAR provides more than forty online Indian agricultural research journals for its users.

Suggestions for Improvement

Agricultural Libraries should promote and help in agricultural education, training, extension, and research activities. Libraries should be working as an advanced learning center.

- Emphasis should be given to the promotion of networked-based communication and dissemination.
- Concentration should be given on global information sharing.
- Need concentration on evolving effective information sharing mechanisms.
- Emphasis should be given on the Networking of Agricultural Libraries.
- Coordination should be created for sharing agricultural information in various ICAR institutes and agricultural Universities.
- Importance should be given to library computerization and automation should work in all the in-house operations of the library.
- Need uniformity in using automation software. Programming language should be platform-independent. Common Library Management Software should be implemented in all the agricultural libraries.
- Library services should be accessed all the time (24X7) for users, need increase satellite linkage of agricultural libraries.
- Needed high bandwidth connectivity for high speed internet to improve access to information resources.

- Agricultural library should increase access to digital literacy, increase e-resources, digital and online resources, digital content, online content, course materials.
- Implement cloud computing for storing data for future development.
- The agricultural library should organize user awareness orientation programs, lecture series related to library and technical services.
- Regular awareness and training should be essential for library staff of agricultural libraries.
- Learning materials like books, journals, databases, and other relevant information sources should be digitized and made them readily available for use with the help of IT tools in digital platforms.
- Agricultural libraries should provide online Current Awareness Service, Database Service, Indexing and Abstracting, Reprographic Service, Selective Dissemination of Information, Technical Enquiry Service, and Union Catalogue of Periodic Resources.
- Agricultural libraries should introduce the use of electronic resources and e-services i.e., web services, e-mail, internet browsing, database and multimedia, new arrivals, etc.
- Agricultural library should also provide translation services, translation of resources in local language for transforming library services
- A mobile app for library services should be developed. These apps will be highly beneficial to the user for accessing library resources like Krishikosh apps, Library apps and eBooks apps.
- Promotion should be given for mobile applications and QR Code.
- Emphasis should be given for use of learning tools in library services like computers, mobiles, kindle, laptops and e-book readers..
- Agricultural library should promote use of remote access software for providing access to rural and remote areas. Latest software and

hardware systems should be established for remote access to libraries resource in rural areas.

- Emphasis should be given to initiatives that promote collaboration, networking, consortium and resource sharing among agricultural libraries.
- Agricultural libraries should concentrate on Massive Open Online Courses: (MOOCs) for free online courses.
- Preference should be given for integrating agricultural apps for weather, disease prevention, and agronomical practices for farmers like crop doctors in library services.
- The library professionals in the digital libraries should have required skills on managing and operating latest ICT tools and techniques. They should have good working knowledge on accessing information through online databases, e-journals and knowledge portals. They should have good communication skills to orient and train the users.

Challenges

Besides several advantages, agricultural libraries in the digital environment face different challenges related to collection development, capacity of library professionals and financial support. Some of the important challenges are given below:

- Privacy, security and copyright issues related digital content in the libraries
- Lack of required bandwidth to get high-speed internet connectivity.
- Inadequate capacities of library professions on the use of new ICTs and software applications in libraries
- Most of the website of libraries are not updated with latest information.
- Many library need to harvest the power of social media platforms like Facebook and Twitter to disseminate information directly to the users
- Meagre financial support to procure e-resources in the libraries

Conclusion

The role of agricultural libraries and information centers and the library professionals associated has been gaining importance in agricultural development. The advances in ICTs and software applications further empowered agricultural libraries to be able to provide relevant information to the doorsteps of farmers, scientists and extension workers through a variety of online information services, websites, databases, information repositories etc. However, the agricultural libraries need to initiate efforts to digitize content, integrate their services with the on-going efforts of the Governments or ICAR like library consortia and networking to share information resources optimally. There is a need also to build capacities of library and information professionals to manage digital agricultural libraries and reach out users through innovative approaches.

Reference

J-Gate: Home. (n.d.). Retrieved February 8, 2022, from https://jgateplus.com/search/index/

IASRI. (n.d.). Retrieved February 8, 2022, from https://ecourses.iasri.res.in/Home1.aspx

CAB Direct. (n.d.). Retrieved February 8, 2022, from https://www.cabdirect.org/

Implementation of Internet of Things (IoT) in Libraries: Challenges and Opportunities

Gohil Prakashsinh[1]

Abstract

Agriculture forms a significant part of our Indian economy. Agriculture and irrigation are the essential and foremost sectors in the current world. It is a mandatory need to apply information and communication technology in our agricultural industries to aid agriculturalists and farmers in improving all stages of crop cultivation and post-harvest activities. This paper highlights the modern technologies deployed to agriculture, and discusses the challenges and possible solutions and implementations. It proposes an implementation framework for using Internet of Things (IoT) to renovate the conventional library systems to become smart online library schemes. The IoT enables the connectivity of a physical object (such as a book or other text typologies) with real-time communication technology by using RFID tags and tiny sensors. The Internet of Things can also provide a global linking of a considerable number of libraries and universities in real-time, all the time. It is concluded that the IoT-based library management systems will be a good structure that can play a vital role in human data organization and knowledge access by helping researchers, farmers, agriculturalists more efficiently and smartly.

Keywords: Internet of Things (IoT), library Management System, Cloud System, Information and Communication Technology (ICT)

Introduction

The IoT is a prevalent phenomenon in which many smart objects can connect and plot a smart map of the devices deployed over a field. Based on the ISOC (Internet Society), the IoT refers to the scenarios of the advanced

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connectivity of the devices' physical objects without human intervention (ISOC, 2015). This extraordinary evolution was possible due to the progress in information science and technologies such as cloud systems, wireless communication, WSN, RDIFs that drive IoT (Höller et al., 2014; Bayani et al., 2010).

The librarians also face innovative challenges, concerns, and opportunities for development regarding the emergent technologies such as the IoT.

The Internet of Things will be overlaid with many IP-based objects that can connect physical and virtual embedded devices shortly. As an emergent technology, IoT uses the RFID to interconnect unique identifiable devices within the existing configuration, creating smart infrastructures.

Although the traditional library management systems have used the RFID barcodes in the various administrative processes, these systems are not considered smart systems. Nowadays, many systems need to provide connections between virtual and physical objects to make a detailed map related to the situations and decisions based on the obtained data. Furthermore, with the assistance of the IoT, the objects will become smart devices that can facilitate the supply administrating chain, the tracking, monitoring, and controls of the products in an efficient manner.

A library management system should incorporate the more innovative elements in its processes to cope with the efficiency limitations, converting it into an intelligent system. This paper contains a brief explanation of the Internet of Things and proposes a theoretical model design related to the IoT-based automation library system for providing a proper awareness to the library system designs to incorporate the IoT's innovative elements into the structure of this kind of system

Literature Review

Building the smart library and its related issues, such as monitoring, registering, establishing security, managing, tagging, tracking, self-servicing, and detecting users, is subject of interest and concern for the researchers.

While some issues remain, including privacy safeguards, data interoperability standards, and cybersecurity measures, we can say that the various technologies needed to support the IoT can and will be integrated to realize the IoT's full potential. Among the enabling technologies are some that should be familiar to librarians: Radio Frequency Identification (RFID), machine-to-machine (M2M) communications protocols, and semantic search capabilities, including metadata and discovery tools (Vermesan and Friess 2013).

A worldwide internet-connected library system makes the global research process possible for users: Locally, by employing the RFID, WSN, and cloud technologies in the IoT architecture, and by the process of identification checking of the users and books, object tracking, and self-checking in/ out, which create an innovative and secure library management platform. Connecting the physical objects to the Internet builds an effective structure named Web of Things (Guinard and Trifa, 2016). The Web of Things (WoT) provides an efficient interface to search and data mining to discover patterns and multiple-dimension categorizations of the books. With WoT, books or documents can be classified by many attributes such as the type, author, editor, subject, location, publishing place, weight, size, volume, price, ranking, history, e-copy, updated, etc. Creating a direct link between everything and multiple physical and virtual attributes was impossible before the release of IoT in our real world. The WoT (by using IoT) can generate both centralized and non-centralized networks of the books as living objects connected to an extensive database. This can facilitate collecting large volumes of data related to each element in a real-time mode.

Furthermore, the emergence of a prevalent technology, such as the Internet of Things, with lots of benefits, as it offers, has its limitations in the implementation phase at the initial point.

Discussion

Most of the libraries in the world, especially those in third world countries, are managed traditionally for many reasons, such as cost-benefit analysis or because there are unknown related technologies for making decisions. One of the main advantages of the IoT library management implantation is the automation of the process. The benefits for an automated system are technically likely and expected; although, sometimes politically, it is not the concern of the people or administration system.

Moreover, the speed to access the information and objects (books), low energy consumption, decrease in latency, cheaper maintenance cost, and smart automated system implementations are advantages of robotizing the processes.

Using the prevalent technology such as the Internet of Things pervades the intelligence into the structure and processes (Hamm, 2013), making the system more efficient. Therefore, using a technology such as IoT converts a library management structure from a traditional to a smart system that can inherit all attributes of an intelligent infrastructure, such as linking many objects.

Because there are different time zones, many people are always active, and others are slept or inactive. The IoT can provide a global linking between the huge number of Universities, people, and research centers' libraries in real-time 24/7 (Bayani & Vilchez, 2017). Building such a long connection provides a big opportunity for researchers worldwide or inside a country (local linking), to access the online resources and projects.

Besides, establishing local and global links is possible through the Internet, facilitating access to the unknown valuable historic and scientific resources around the world. Furthermore, creating a global library link among other collections leads to building an open online global library that enables global access to the big treasure of knowledge in human history. Thus, a novel phenomenon called "the IoT-based World Library Network" is formed. Libraries have been affected by all developments in IT. They have benefited from IT tools-including hardware, software applications, communication networks, and electronic sources of information-to provide better library services and broader access to the user community. Since libraries are sources of culture, they can create change in the user community's culture, specifically by shaping their information collections, improving resource availability, and helping users access the collection through communication and training efforts.

New IT concepts have appeared in recent years, including digital transformation, cloud computing, Artificial Intelligence, Big Data, Machine Learning, and the Internet of Things (IoT). They have impacted the population, and therefore libraries can benefit from them too. Libraries may save a lot of their IT budget by adopting these new approaches because they provide technology in accessible ways, often at lower costs, and to the benefit of users. This paper will cover the IoT and its applications in libraries.

The IoT Concept

In recent years, several new IT concepts have emerged around the IoT.

- The IoT refers to physical devices connected to and exists as internet entities. The devices may be in appliances or security systems in cars, trucks, and construction or farming equipment and the sensors in traffic signals and street lighting, the smart tags on items in stores; and the mobile devices that many users wear or carry with them at all times. The data streaming over internet connections may serve various business purposes, including equipment performance monitoring, system updating, and inventory control.
- The Internet of Things (IoT) is a scenario in which objects, animals or people are provided with unique identifiers and the ability to transfer data over a network without requiring human interaction (TechTarget 2018).
- The importance of the IoT is evident in that it allows the connection of things anytime, anywhere, with everyone and everything connected to the network. The potential of the IoT is best shown in smart cities where continuously monitoring the data generated from sensors can result inefficiencies in managing resources.

The first existing constraint is related to the hardware design for the particular purpose of a global or local library system. It is required to create a customized design to adapt to the overall conditions of the library systems. Producing the colossal small-size and low-cost number of WSN sensors and the exact numbers of the RFID tags is needed to paste them to the library objects such as books or other kinds of documents. On the other side, the objects (books) should possess the appropriate physical conditions to take the sensors or tags.

The internal communication system is another issue that the project managers or designers will confront because of technical, administrative, or financial limitations. One of the main elements in an IoT infrastructure is the storage capacity.

Another type of preparation is needed to connect the local libraries: A well-designed telecommunication and Internet system and a public cloud system can guarantee the interconnection between the libraries in a country or region. The employed devices in this infrastructure should perceive the IoT signal and messages by using the IoT applications. As mentioned before, the applications of the IoT in many areas such as the library management system are still in progress. The IoT comprises a wide range of devices and is driving a particular market segment in application development. In addition to the popular operating desktop systems hosting the IoT interfaces, using mobile applications is a trend.

People are spending high percentages of their time using their smartphones and mobile apps, then applying a library mobile application can increase the users' library usage rate. It is ubiquitous to use smartphones to connect to the Internet, buy a product, pay for a service, watch a video, and get access to numerous online services. One of the advantages related to the library service management that the IoT can offer is that once the users download and install the library application, they can access all online services prepared by the system.

The IoT is considered a complex environment, and many times the implementation of an innovative process and even the development of an application is a big challenge. As a library system provides specific services to the users, customized IoT mobile applications in the library field are facing a lot of unavoidable challenges; such as the IoT's hardware compatibility with the different operating systems like Android, iPhone OS (iOS), and Windows, the application's licensing costs and the speed of technology changing.

Applications for Libraries

It is difficult to imagine all possible IoT applications in the future, but all IoT applications depend on communication tools, including the internet, Wi-Fi, and RFID.

Here are some practical use cases for libraries:

- You could discover the smartphones located in a particular library area via Wi-Fi or Bluetooth and send targeted communications (such as announcing an event currently taking place inside the library).
- Alternatively, you could track Wi-Fi devices to show traffic patterns and identify popular shelves to make better-informed space-usage decisions.
- Many libraries already tag the items in their collections with RFID tags to help check out and check-in materials. Libraries can also benefit from smart tagging in other ways: finding lost or misplaced items in the collection or tracking items as they move through the library and possibly deciding to relocate underused resources to increase their visibility.

Just imagine the improvements that could result from adopting smart city technologies:

- You might install smart lighting inside and outside your library. The library could then use the internet to monitor and control the lighting (and its costs) via the library's Wi-Fi network to turn the lighting on and off.

- The same goes for installing a smart energy system in which energy consumption can be controlled according to need-and not just made available all the time-thus saving a lot on expenses.
- Using fire sensors connected to the internet, the advent and progress of a potentially disastrous fire could be followed and dealt with safely from outside the library, pinpointing the danger areas and remotely dealing with them.

As we have witnessed book-based libraries' evolution into electronic, digital, and virtual libraries, we will no doubt soon see smart libraries.

Challenges

While the IoT promises to make an extraordinary change in our entire way of life and work-not just for libraries and librarians-realizing the IoT's potential presents challenges to IT leadership inside and outside libraries. In some cases, there needs to be a change in business culture, the structure of projects, and leadership strategy to focus on innovation, cooperation, and integration.

The Current Scenarios

The most important reasons for not adopting technology are as follows:

- Not all librarians have the skills to deal with new technology.
- Administrative and bureaucratic procedures in the libraries have negatively affected the development of technology infrastructure; therefore, the technology in place is often obsolete and possibly not even being used.
- Users are not playing their part in demanding that the libraries provide a distinguished service. Users should urge libraries to pay more attention to services based on IT.

However, the following is clear:

- The IoT, digital transformation, and cloud computing are three concepts that should be of interest to those serving in the library field and governments worldwide. These concepts depend on three key elements: the technology itself and its components, the central importance of data, and the imperative for community awareness.
- IoT advantages include cost savings and increased work efficiency. But realizing these goals depends on reliable infrastructure, including the existence and persistence of good internet connections. In the era of the IoT, ISPs have become VIPs.
- IoT applications can and will be applied and adapted by libraries, even as the IoT expands to what some have called the Internet of Everything.

Recommendations

- The Ministry of Communications and Information ought to advance participation among libraries, setting a genuine model by further developing the IT framework inside the public authority libraries it manages. A reasonable approach to exhibiting its significance is to update PCs and programming in those libraries.
- The Ministry of Culture should consider fostering libraries, simultaneously advancing client consciousness of the job and significance of IT.
- Libraries need to comprehend and apply the new ideas, giving specific consideration to offering the best types of assistance by further developing the IT foundation, particularly the speed of their web associations.

If we genuinely care about the user community, libraries will provide the best current services to them by applying the concepts of IoT, digital transformation, and cloud computing. The goal will be achieved when all libraries and library associations do their best to advocate for change and work together to implement solutions.

Conclusion

At present, information technology and related topics such as the Internet, communication technology, smart mobiles' connections, and online services significantly impact all aspects of human beings' lives. The libraries are also affected directly, facing growth, advancement, and challenges for development. The library atmosphere is a complicated environment in terms of the high volume of the elements, customer attending quickness, continuous growing of the objects and demands, and a good supply chain management system. The IoT enables the connectivity of a physical item like a book to real-time communication technology. This characteristic of connecting all things to the Internet allows implementing an online library supply chain, integrating it with diverse technologies such as wireless and Internet technology, database, data acquisition, and cloud systems. By integrating the mentioned systems, many online services can be generated. Connecting similar IoT library systems makes possible the biggest online supply chains and services in the world, a massive number of the objects, including books and users, and a huge number of the data depository research universally will be connected through the Internet.

In rundown, one might say that applying the IoT's innovation in the library, the board frameworks' execution is promising for the forthcoming future. It can assume a critical part in the human's worldwide information access and information engendering in a quick, more effective, and brilliant way.

References

The Internet of Things (IoT): An Overview. (2015). Internet Society. Retrieved February 5, 2022, from https://www.internetsociety.org/resources/doc/2015/iot-overview/

Chang, A. (2016). Building an Internet of Things environment in the Library. The VALA201618thBiennial Conference and Exhibition, Melbourne Convention and Exhibition Enter, Melbourne, Australia from 9 - 11 February 2016.

Coyle, K. (2005). Management of RFID in libraries. Journal of Academic Librarianship, 31(5), 486-489.

Guinard, D., & Trifa, V. (2016). Building the Web of Things: With examples in Node.js and Raspberry Pi (1st ed.). Manning Publications Co.

Nag, A., & Nikam, K. (2016). Internet of things applications in academic libraries. International Journal of information technology and library science, 5(1), 1-7.

Library Resources and Services in Agricultural Universities in India

P. Mohanathan[1] and G. Krishnasamy[2]

Abstract

The Agricultural Universities are identified as premier institutes of higher education and research in Agricultural Technology in India. Having a common goal, there is a need for cooperation among the libraries of the Agricultural Universities. To achieve this kind of co-operation, there is a need to design and develop a unique type of library portals containing resources and services of their libraries and providing links to other University libraries. Further, there is also a need to form an educational network specialized among the Agricultural University libraries. This paper comprehensively studies the availability of electronic information resources and the services of major Agricultural Universities in India.

Keywords: Agriculture University, Agricultural Library, Electronic Resources, DOAJ, CeRA

Introduction

The agriculture sector has an important place in the Indian economy. The economic transformation of a developing country like India crucially depends on the performance of its agriculture and its allied sector. The proportion of the Indian population depending directly or indirectly on agriculture for employment opportunities is more than that of any sector in India as high as 70 % of its rural household still depends primarily on agriculture for their livelihood, with 82 % of the farmer being small and marginal. In this context, the agricultural universities in India are playing a key role in imparting agricultural education, research and also developing

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new technologies. There are 63 leading state agricultural and allied universities, 4 deemed to be agricultural universities and 3 central agricultural universities with agriculture departments in the country. Table 1 gives the list of agricultural universities. The libraries attached to agricultural universities have been identified as information centers for sharing information and disseminating new technologies. This paper will look into the availability of electronic information resources and services in three important Agricultural Universities in India.

Table1. List of Agricultural Universities in India

Andhra Pradesh

1 Acharya NG Ranga Agricultural University, Guntur

2 Dr. YSRHU (APHU), Venkataramannagudem

3 Sri Venkateswara Veterinary University, Tirupati

Assam

4 Assam Agricultural University, Jorhat

Bihar

5 Bihar Agricultural University, Sabour, Bhagalpur

6 Bihar Animal Sciences University, Patna

Chhattisgarh

7 Indira Gandhi Krishi Viswa Vidhyalaya, Raipur

8 Chhattisgarh Kamdhenu Visvavidyalaya, Durg

Gujarat

9 Sardar Krushinagar Dantiwada Agricultural University, Dantiwada

10 Anand Agricultural University, Anand

11 Navsari Agricultural University, Navsari

12 Junagarh Agricultural University, Junagarh

13 Kamdhenu University, Gandhinagar

Haryana

14 Chaudhary Charan Singh Haryana Agricultural University, Hisar

15 Lala Lajpat Rai University of Veterinary & Animal Sciences, Hisar

16 Haryana State University of Horticultural Sciences, Karnal

Himachal Pradesh

17 Ch. Sarwan Kumar Himachal Pradesh Krishi Viswavidyalaya, Palampur

18 Dr. Yaswant Singh Parmar University of Horticulture & Forestry, Solan

Jharkhand

19 Birsa Agricultural University, Ranchi

Jammu & Kashmir

20 Sher-e-Kashmir University of Agricultural Science & Technology, Srinagar

21 Sher-e-Kashmir University of Agricultural Science & Technology, Jammu

Karnataka

22 University of Agricultural Sciences, Bangalore

23 Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar

24 University of Agricultural Sciences, Raichur

25 University of Agricultural Sciences, Dharwad

26 University of Horticulture Science, Bagalkot

27 University of Agriculture & Horticulture Sciences, Shimoga

Kerala

28 Kerala Agricultural University, Thrissur

29 Kerala University of Fisheries and Ocean Studies, Panangad, Kochi

30 Kerala Veterinary and Animal Sciences University, Pookode, Wayanand, Kerala

Madhya Pradesh

31 Rajmata Vijayaraje Scindia Krishi VishwaVidyalaya, Gwalior

32 Nanaji Deshmukh Pashu ChikitsaVisvaVidyalaya, Jabalpur

33 Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur

Maharashtra

34 Dr. Balaesahib Sawant Kokan KrishiVidyapeeth, Dapoli

35 Maharastra Animal & Fisheries. Sciences University, Nagpur

36 Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani

37 Mahatma Phule Krishi Vidyapeeth, Rahuri

38 Dr. Punjabrao Deshmukh KrishiViswaVidyalaya, Akola

Orissa

39 Orissa University of Agricultural & Technology, Bhubaneswar

Punjab

40 Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana

41 Punjab Agricultural University, Ludhiana

Rajasthan

42 Maharana Pratap University of Agriculture & Technology, Udaipur

43 Swami Keshwanand Rajasthan Agricultural University, Bikaner

44 Rajasthan University of Veterinary & Animal Sciences, Bikaner

45 SKN Agriculture University, Jobner

46 Agriculture University, Kota

47 Agriculture University, Jodhpur

Tamil Nadu

48 Tamil Nadu Agricultural University, Coimbatore

49 Tamil Nadu Veterinary & Animal Sciences University, Chennai

50 Tamil Nadu Fisheries University, Nagapattinam

Telangana

51 Sri Konda Laxman Telangana State Horticultural University, Hyderabad

52 Sri PV Narsimha Rao Telangana Veterinary University, Hyderabad

53 Professor Jayashankar Telangana State Agricultural University, Hyderabad

UttraKhand

54 G.B. Pant University of Agriculture & Technology, Pantnagar

55 VCSG Uttarakhand University of Horticulture & Forestry, Bharsar

Uttar Pradesh

56 Chandra Shekhar Azad University of Agricultural & Technology, Kanpur

57 Narendra Deva University of Agriculture & Technology, Faizabad

58 Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut

59 U.P. Pt. Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwa Vidhyalaya Evem Go Anusandhan Sansthan, Mathura

60 Banda University of Agricultural and Technology, Banda

West Bengal

61 Bidhan Chandra Krishi Viswa Vidhyalaya, Mohanpur

62 West Bengal University of Animal & Fishery Sciences, Kolkata

63 Uttar Banga Krishi Viswavidhyalaya, Cooch Behar

Deemed Universities

1. ICAR-Indian Agricultural Research Institute, New Delhi
2. ICAR-National Dairy Research Institute, Karnal
3. ICAR-Indian Veterinary Research Institute, Izatnagar
4. ICAR-Central Institute on Fisheries Education, Mumbai

Central Agricultural Universities

1 Central Agricultural University, Manipur

2 Rani Laxmi Bai Central Agricultural University,Jhansi, Uttar Pradesh

3 Dr. Rajendra Prasad Central Agricultural University,Pusa (Samastipur)

Tamil Nadu Agricultural University (TNAU)

The Tamil Nadu Agricultural University (TNAU) had its genesis from establishing an Agricultural School at Saidapet, Madras, Tamil Nadu, as early as 1868, and it was later relocated at Coimbatore. In 1920 it was affiliated with Madras University. TNAU assumed full Agricultural Education and Research responsibilities and supported the State Agricultural Department by delivering research products. Till 1946, the Agricultural College and Research Institute, Coimbatore, was the only Institute for Agricultural Education for the whole of South India. In 1958, it was recognized as a Post-graduate Centre leading to Masters and Doctoral degrees. The Agricultural College and Research Institute, Madurai, was established in 1965. These two colleges formed the nucleus of the Tamil Nadu Agricultural University while it was established in 1971.

1. Tamil Nadu Agricultural University Library Resources

The TNAU Library System comprises a University Library and 10 constitutional college libraries that collectively support the university's teaching, research, and extension programs. The University Library houses a total collection of over two lakh documents comprising books, theses, journals, and compact discs in Agricultural Sciences. All in-house operations in the library are fully computerized using the Koha software, which provides web-based access to the online catalogue of the Library. The benefit of a consortia-based subscription to electronic resources is confined to its core members and extended to all Constitutional Colleges, Research Stations &KVKs through remote access.

Electronic Information Sources and Service of TNAU

E-Books

- CABI e-books
- Astral e-book
- Taylor & Francis e- books
- Elsevier -Science Direct
- Springer e-books
- Wiley -e-books

E-Journals

- CeRA (Consortium for e-Resource in Agriculture)
- Indianjournals.com
- Directory of Open Access Journal (DOAJ)

E-Database

- Web of Science
- Scopus
- Indiastat.com
- Commodity India
- DELNET

- Endnote
- iThenticate

E-Theses of M.Sc./Ph.D.

- Krishikosh
- Shodhganga

2. Mahatma Phule Krishi Vidyapeeth

The Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri is the premier Agricultural University in Maharashtra that provides farmers with Education, Research, and Extension Education. In pursuance of the Maharashtra Agricultural University (Krishi Vidyapeeth) Act 1967, the Maharashtra Agricultural University (Krishi Vidyapeeth) was initially established for the entire Maharashtra State started functioning in March 1968 with its office at Mumbai.

Electronic Information Sources and Service of Mahatma Phule Krishi Vidyapeeth

E-Books

- Astral ebooks - astralebooks.com
- CABI ebooks -
- Arts and Science Publisher - www.asapglobe.com
- Taylor & Francis
- Kart online - https://www.cambridge.org/core/what-we-publish/books
- New India Publishing Agency https://www.nipaers.com/univebooks/dashboard

E-journals

- CeRA (jgateplus.com) http://jgateplus.com/search
- Indian journals.

Statistical Data

- http://www.indiaagristat.com (LINK is given on Jgateplus portal https://jgateplus.com/search/?spage=authorfinder#authorfinder)
- http://www.fao.org
- Govt. of Maharashtra (Agril.Dept.)
- http://krishi.maharashtra.gov.in/1250/Taluka-Level
- JRF /SRF Online Test Series - https://www.nipaers.com/univhome

Krishikosh (Institutional Repository) of ICAR, MPKV Theses of M.Sc./Ph.D. uploaded

- Krishikosh - http://krishikosh.egranth.ac.in (Books, Journals, Reports, Articles, Theses, etc.(full text) are available) e-Books (Full Text)
- Egranth - http://www.egranth.ac.in(Option krishikosh)
- E- Krishishiksha (e-courses) https://ecourses.icar.gov.in/
- IDEAL (A platform of Indian Agricultural Libraries) http://agricat.egranth.ac.in

3. Punjab Agricultural University

Punjab Agricultural University was established in 1962 to serve the state of erstwhile Punjab. It was inaugurated by Pt. Jawahar Lal Nehru, Prime Minister of India on July 8, 1963, and in February 1970, Haryana Agricultural University carved out by an Act of Parliament. In July 1970, HP Krishi Vishvavidalya was established at the Palampur campus. In 2006, the College of Veterinary Sciences was upgraded as Guru Angad Dev Veterinary and

Animal Science University at Ludhiana, modelled on the pattern of land grant colleges in the US. PAU has played a vital role in increasing food production in Punjab state and ushering in an era of Green Revolution in India and made a notable contributions in increasing livestock and poultry production in the state. In 1995, it was adjudged as the Best Agricultural University in India.

Electronic Information Sources and Service of Punjab Agricultural University

Punjab Agricultural University Library was established with a meagre collection of 200 books in 1959 in the College of Agriculture. The Foundation stone for the present building was laid in February 1969 by Dr. M. S. Randhawa. The library was shifted to the new building in 1972. However, at present, this temple of learning, with its beautiful five-story building, with a covered area of 93,320 sq. ft., centrally air-conditioned and surrounded by lush green lawns, dotted with beautiful ornamental trees and a pollution-free environment, has grown into one of the best libraries of the region - a place of pilgrimage for scholars and faculty members from all over the country. This library has 760 seating capacity in its Five Reading Halls. The library aims to provide rich knowledge to its users and to extend it further through information technology, automation, and networking

Online Databases Subscribed

- (CeRA) Consortium for e-Resources in Agriculture
- E-Books
- EBSCO Management Collection
- e-Journals
- Indiastat.com
- ISO Standards on Food Products
- Krishikosh (An Institutional Repository of Indian National Agricultural Research System)

- PAU Repository
- Other e-Resources
- Directory of PAU Faculty
- Bibliotheca Alexendrina: Royal Tropical Institute
- Dictionary
- Encyclopedia
- ICSSR Statistical Data Repository of Socio-economic and Industrial Data
- ICSSR Data Analytic Tool
- Motivational Lectures
- National Digital Library
- Open Access e-Resources
- Free Trial Access
- E-KrishiShiksha

Conclusion:

This paper has focused on the availability of electronic resources and services in three important Agricultural Universities in India. It has been observed that electronic resources and services in Tamil Nadu Agricultural University, Mahatma Phule Krishi Vidyapeeth (Agriculture University) and Punjab Agricultural University are reasonably advanced with lots of digitization activities going on in these universities. It seems that digital Library Initiatives in these universities are being run as per planned guidance. It was found that most of the Agricultural University libraries are offering the services of CeRA (Consortium for e-Resource in Agriculture), Astral e-book, Elsevier -Science, and Taylor & Francis. It is suggested that networking of Agricultural University Libraries is very essential for improving access to electronic information sources and services to agricultural scientists, academia and extension professionals across the country.

References:

Ali, N. (2005). The use of electronic resources at IIT Delhi Library: a study of search behaviours. The electronic library.

Bhattacharya, P., & Choudhary, P. K. (1980). Digital library initiatives in IITs: an overview. Indian Library Association, 6, 5.

Jotwani, D. (2013). Library resources and services in Indian Institutes of Technology.

Jadhav, M. N., & Bamane, N. (2006, June). Enhancing digital repository of scholarly publications at Indian Institute of Technology, Bombay (IITB) India. In 9th International Symposium on Electronic Theses and Dissertations.

Kaur, B., & Verma, R. (2009). Use and impact of electronic journals in the Indian Institute of Technology, Delhi, India. The Electronic Library.

Pal, M., & Pathak, S. K. (2008). Proper Content Management to the Library Web Site: Evaluation of all IIT's Library Websites.

Singh, S. P. (2001). Computer applications in Indian Institutes of Technology libraries. The Electronic Library.

Sutradhar, B. (2006). Design and development of an institutional repository at the Indian Institute of Technology Kharagpur.

Kannappanavar, B. U., & Mestri, M. (2009). Content Analysis of Indian Institutes of Technology Libraries Web Portals: A Study. DESIDOC Journal of Library &Information Technology, 29(1).

Bangladesh Agricultural Research Council Marching Towards Digital Bangladesh

Susmita Das[1]

Abstract

The Bangladesh Agricultural Research Council, in collaboration with other national agricultural research institutes, is working tirelessly to make Bangabandhu's Sonar Bangla an upper-middle-income country by 2030 and a developed country by 2041 by achieving the Sustainable Development Goals. This paper presents the activities of the Bangladesh Agricultural Research Council, which are following the vision of Digital Bangladesh in opening up all the data and information related to agricultural research outputs for all the farmers and the stakeholders of the National Agricultural Research System of Bangladesh.

Keywords: Agriculture, Knowledge Management, Digital Library

Introduction

Established in 1973 by the Father of Nation, Bangabandhu Sheikh Mujibur Rahman, the Bangladesh Agricultural Research Council (BARC) had transformed into an Apex body of the National Agricultural Research System (NARS). It is working for the nutritional security of the nation with active collaboration of constituents of NARS, the national agricultural research institutes in the country viz., Bangladesh Agricultural Research Institute, Bangladesh Rice Research Institute, Bangladesh Sugar crop Research Institute, Bangladesh Jute Research Institute, Bangladesh Atomic Agriculture Research Institute, Soil Resources Development Institute, Bangladesh Livestock Research Institute, Bangladesh Fisheries Research Institute, Bangladesh Forest Research Institute, Bangladesh Tea Research

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Institute, Cotton Development Board and Silk Research Institute, Bangladesh Wheat and Maize Research Institute. The agricultural research in Bangladesh transformed from subsistence agriculture to commercial agriculture. The Bangladesh Agricultural Research Council, in collaboration with other national agricultural research institutes, is working tirelessly to make Bangabandhu's Sonar Bangla an upper-middle-income country by 2030 and a developed country by 2041 by achieving the Sustainable Development Goals.

Strength to Bangladesh Agriculture

The country is on the path of development under Hon'ble Prime Minister Sheikh Hasina, the worthy daughter of Bangabandhu. In a speech on the occasion of Krishibid Diwas on February 12, 2021, Prime Minister Sheikh Hasina said, "The present government's policy on agriculture is conducive to agriculture and agronomists".

It is a matter of pride to the BARC that the Independence Award 2021 was awarded to BARC in the research and training category for its continuous success in agricultural research and training. This achievement in the 50th anniversary of Bangladesh's Independence has set the BARC in a different direction in a great height. This achievement of the Council under the dynamic leadership of the present Executive Chairman, Dr Shaikh Mohammad Bakhtiar, is highly appreciated at home and abroad.

Digital Bangladesh

The foundation for Digital Bangladesh was laid in 2008 and had defined various goals for 2021, the year marking the 50th anniversary of Bangladesh's Independence. The vision of Digital Bangladesh is to be ready with Technology Driven Talents to meet the global demands. Moreover, to be one of the top 10 growth markets for tech devices offering rapid technology adoption, consumer base has been built on Four Pillars which are as follows:

1. Digital Government,
2. Human Resource Development,
3. IT Industry Promotion and
4. Connecting Citizen

Access to Data, Information and Knowledge in the NARS

The new knowledge needs real-time or immediate access to the data and information. The prominent research outputs are the publications made by various researchers in peer-reviewed publications. The constitutes of NARS are publishing various research journals in agriculture and allied sciences.

Open Access Journals in NARS of Bangladesh

The Bangladesh Journals Online (BanglaJOL) was established by the INASP in 2007 and managed by the Bangladesh Academy of Sciences to provide online publications of Bangladeshi journals. There are about 19 journals related to agriculture and allied sciences published by the universities or by scholarly societies (Table 1). Some of these journals and others are indexed in the Directory of Open Access Journals (DOAJ), a quality-controlled authoritative Open Access journals indexing platform (Table 2.) The journals indexed in DOAJ explicitly make all the articles under Creative Commons licensing.

Table 1. Agricultural Journals hosted by BanglaJOL

S.No.	Name of the Journal	Name of the Publisher
1.	Annals of Bangladesh Agriculture	Bangabandhu Sheikh Mujibur Rahman Agricultural University
2.	Bangladesh Agronomy Journal	Bangladesh Society of Agronomy
3.	Bangladesh Journal of Agricultural Research	Bangladesh Agricultural Research Institutes
4.	Bangladesh Journal of Animal Science	Bangladesh Animal Husbandry Association, Bangladesh Agricultural University

5.	Bangladesh Journal of Livestock Research	Bangladesh Livestock Research Institute
6.	Bangladesh Journal of Plant Breeding and Genetics	Plant Breeding and Genetics Society of Bangladesh
7.	Bangladesh Journal of Veterinary Medicine	Bangladesh Society for Veterinary Medicine
8.	Bangladesh Rice Journal	Bangladesh Rice Research Institute
9.	Bangladesh Veterinarian	Bangladesh Animal Health Society
10.	International Journal of Agricultural Research, Innovation and Technology	IJARIT Research Foundation
11.	Journal of Advanced Veterinary and Animal Research	Network for the Veterinarians of Bangladesh
12.	Journal of the Bangladesh Agricultural University	Bangladesh Agricultural University Research System, Bangladesh Agricultural University
13.	Microbes and Health	Bangladesh Society for Veterinary Microbiology and Public Health
14.	Progressive Agriculture	Progressive Agriculturists
15.	Rajshahi University Journal of Life & Earth and Agricultural Sciences	Rajshahi University
16.	Research in Agriculture Livestock and Fisheries	AgroAID Foundation
17.	SAARC Journal of Agriculture	SAARC Agriculture Centre, Bangladesh
18.	South Asian Journal of Agriculture	Agrotechnology Discipline, Khulna University, Khulna
19.	The Agriculturists	Krishi Foundation

Source: https://www.banglajol.info/

Table-2 Agricultural Journals indexed in DOAJ

Sl. No.	Journal	Publisher	APCs	Creative Commons License
1.	Bangladesh Agronomy Journal	Bangladesh Society of Agronomy	APCs: 20 (USD), 500 (BDT)	CC BY-NC-ND
2.	Bangladesh Journal of Scientific and Industrial Research	Bangladesh Council of Scientific and Industrial	No charges	CC BY-NC
3.	Fundamental and Applied Agriculture	Farm to Fork Foundation	APCs: 4000 (BDT)	CC BY-NC
4.	International Journal of Agricultural Research, Innovation and Technology	IJARIT Research Foundation	APCs: 100 (USD)	CC BY
5.	Journal of Advanced Veterinary and Animal Research	Network for the Veterinarians of Bangladesh	APCs: 12000 (BDT), 250 (USD)	CC BY
6.	Journal of Fisheries	BdFISH, University of Rajshahi	No charges	CC BY-NC-SA
7.	Journal of the Bangladesh Agricultural University	Bangladesh Agricultural University Research	APCs: 1500 (BDT)	CC BY
8.	Research in Agriculture, Livestock and Fisheries	AgroAid Foundation	APCs: 100 (USD)	CC BY

Source: https://doaj.org/

Digital Services of the BARC

Going forward with the vision of Digital Bangladesh, the BARC has built various websites for agriculture. Some of the unique websites offering digital agricultural services (data, information and knowledge) are as follows:

Agri-advisory Portal http://cropzoning.gov.bd:82/

The Agri-advisory portal developed under the Crop Zoning Project of BARC is an on-demand information portal available bi-lingual. Through the portal, advisory services in agriculture and allied disciplines viz., crop suitability, soil health & fertility status, climate, crop economics information etc., are shared to all stakeholders of NARS.

Mobile Applications - Khamari

The BARC had developed a mobile app called "Khamari" for sustainable agricultural development. The app is available at Google Play Store. Furthermore, it provides information on crop season-wise land specific suitable crop, crop-wise fertiliser recommendation based on the soil fertility status, crop varieties, yield & duration of the crop, good cropping pattern, and crop production technology.

Agricultural Research Management Information System (ARMIS)

Nearly 37600 project information records are being made available via ARMIS http://armis.barcapps.gov.bd/. All the possible search facilities to learn about the ongoing and completed projects as per the organisation, subject/theme or funders can be searched and accessed. When the project related information and its outputs are publicly shared, work duplication can be avoided, and resource optimisation can be achieved.

Land Suitability Assessment and Crop Zoning of Bangladesh

Another flagship project of the BARC is the 'Land Suitability Assessment and Crop Zoning of Bangladesh http://cropzoning.barcapps.gov.bd/.

Using the Geo-Information System software, the data and information are visualised to know if their regions (lands) are suitable for a particular crop. The suitability information is available for the cereals, pulses, oilseeds, spices, tuber crops, fibres and sugarcane.

Climate Information Management System (CIMS) http://climate.barcapps.gov.bd/

Access to climate information is crucial as the entire operations of agriculture are linked with the weather. When the historical data is available, forecasts can be made, and management practices can be adopted. The CIMS makes the data available for the following parameters to all the registered users.

- Cloud Coverage
- Humidity
- Moisture Regime
- PET
- Rainfall
- Solar Radiation
- Sunshine
- Temperature
- Thermal Regime
- Wind Speed

In addition to this, The Govt. of Bangladesh, made services for the citizens, are on the doorstep as e-services https://bangladesh.gov.bd/. Some of the e-Service lists available for agriculture, fisheries and livestock are as follows:

- Agriculture Call Center
- Agriculture Information Service
- Bangladesh Rice Knowledge Bank

- BARC Archive Database
- Climate Database/Weather information
- E-Livestock
- E-marketing
- Fish Advise System
- Fisheries Food License
- Jute Seed Management Software
- Land Resource Database
- Livestock SMS service
- Online Crop Calendar
- Online training registration
- PGRFA Database
- PMIS (BADC)
- Seed storage and distribution software
- Venue Booking Database

Conclusion

The country of Bangladesh is marching rapidly towards Digital Bangladesh, and all the citizen services and all the information services related to agriculture and allied sciences are available at doorsteps (view mobile SMS, apps and websites). It is envisaged that shortly the Digital Agriculture in Digital Bangladesh will bring more efficiency by providing the correct information at the right time to the end-users.

Reference:

Agri Portal. (n.d.). Retrieved February 07, 2022, from http://cropzoning.gov.bd:82/

ARMIS:: Welcome. (n.d.). Retrieved February 7, 2022, from http://armis.barcapps.gov.bd/

Bangladesh Agricultural Research Council (BARC). (n.d.). Retrieved February 7, 2022, from http://cropzoning.barcapps.gov.bd/

Bangladesh Journals Online. (n.d.). Retrieved February 07, 2022, from https://www.banglajol.info/

Climate Information Management System. (n.d.). Retrieved February 7, 2022, from http://climate.barcapps.gov.bd/

Digital Bangladesh & Vision 2021 Invest in Digital Bangladesh. (n.d.). Retrieved February 7, 2022, from https://investindigitalbd.gov.bd/page/digital-bangladesh-vision-2021

Directory of Open Access Journals. (n.d.). Retrieved February 7, 2022, from https://doaj.org/

ডিজিটাল বাংলাদেশ. (n.d.). Retrieved February 7, 2022, from https://www.digitalbangladesh.gov.bd/

বাংলাদেশ (Bangladesh) জাতীয় তথ্য বাতায়ন | গণপ্রজাতন্ত্রী বাংলাদেশ সরকার | People's Republic of Bangladesh. (n.d.). Retrieved February 7, 2022, from https://bangladesh.gov.bd/index.php

Pathways to Opening Access to Agricultural Research Knowledge in India

Sridhar Gutam[1] and Srinivasacharyulu Attaluri[2]

Abstract

New knowledge is created by analysing and processing data and information. Having access to data and information promotes the generation of science, the communication of science, and the creation and adoption of new knowledge. All Sustainable Development Goals (SDGs) include agriculture as an integral component, and agriculture should be prosperous and sustainable to achieve any SDG. Besides developing skilled and talented human resources, the Indian Agricultural Research System seeks to offer quality data and information to stakeholders to improve agricultural production, processing, and exports. However, access remains restricted despite the availability of data and information, making it impossible to achieve desired results. The purpose of this paper is to summarise how data, information and knowledge of NARS are available and accessible to various stakeholders during various phases of World Bank-supported projects and how the availability and accessibility to data and information exist in NARS.

Keywords: Open Access, Agricultural Research Information, Agricultural Knowledge Management, Open Access Policy, NARS

Introduction

The Agri-food sector is becoming more knowledge-intensive due to market-oriented Agri-food systems. Researchers and scientists are integrating Agri-food systems and ICTs innovations to meet the demands of a wide range of actors and stakeholders, ranging from government departments,

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researchers, scientists, agripreneurs, input suppliers, NGO functionaries and farmers to consumers.

In agricultural research systems, information technology and knowledge management are crucial for collecting, managing, sharing, and disseminating information for awareness, problem-solving, and making informed decisions. Organisations and governments are being forced to open up Access to Agricultural Information and Knowledge in the public domain thanks to the Open Access Movement and Linked Open Data Initiatives. Currently, the private sector is shifting its focus to providing value-added specific information around technologies, products, commodities, services, problem solving, financial, marketing, and information intermediation roles. Increasingly, farmer organisations, cooperatives, and NGOs provide data, manage locally relevant information, manage local networks, and enable effective use of information, knowledge, and skills.

India's National Agricultural Research System (NARS) is the World's most extensive system. It comprises the Indian Council of Agricultural Research (ICAR) established institutes, State Agricultural Universities (SAUs), faculties at Central Universities, and other establishments (Mruthyunjaya & Ranjitha, 1998). This largest network produces a tremendous wealth of data, information, and knowledge that contribute to knowledge discovery. Consortium projects funded by the World Bank continue to generate new knowledge and manage it. Access to NARS libraries' knowledge is possible through repository and catalogue software. The library collections viz., data, published books, journals, theses, and other materials are now being made available.

The Open Access movement is growing worldwide and in India. In recent months, UNESCO has made recommendations on Open Science (UNESCO, 2021). Before that, the Government of India has developed a draft policy of Science Technology and Innovation Policy [STIP2020] for Open Science Frameworks (Office of the Principal Scientific Adviser, 2020). Different initiatives have been started in the NARS, opening access to agricultural research information and knowledge through different projects. This paper summarises how data, information and knowledge of NARS are available and accessible to various stakeholders during various phases of World Bank-supported projects and how the availability and accessibility to data and information exist in NARS.

National Agricultural Technology Project (NATP)

From 1998 to 2005, the National Agricultural Technology Project (ICAR, 2004) was in operation. Several ICT initiatives were undertaken during this project period at the ICAR institutes, including institutionalising Prioritisation, Monitoring, and Evaluation (PME), using computer-assisted instruction modules, redesigning the ICAR website, and developing crop databases expert systems, and spatial information systems. The intranet and internet connectivity in the NARS was improved during this period. The PME cells served as clearinghouses for information generated by the institutes and made the information available through their websites.

National Agricultural Innovation Project (NAIP)

As part of the National Agricultural Innovation Project, several consortium-based agricultural knowledge management projects were undertaken from 2005 to 2014 (NAIP, 2005). A great deal of emphasis was placed on ICT applications during the change of management (Component 1). As part of the project, a thesis repository was created at a centralised data centre, and access to peer-reviewed publications in journals was made available.

For all websites of NARS constituents, a uniform design using Content Management System (CMS) was recommended only to ensure smooth dissemination of information. AgroPedia was envisaged and hosted using CMS Drupal on similar lines to Wikipedia. ASHOKA, a supercomputer and data centre was built to meet the needs of scientists and knowledge management. In addition to flipping the ICAR journals online and hosting various other journals, the dialogue was started on opening data and information. ICAR adopted its landmark Open Access Policy in September 2013 (Shah et al., 2016).

National Agricultural Higher Education Project (NAHEP)

The National Agricultural Higher Education Project (ICAR, 2017) has been under implementation since 2017. The emphasis made during NAIP on computer-based instruction modules is now being taken up more significantly, reaching out to all the students online and offline under NARS. Apart from physical infrastructure, huge ICT based infrastructure is also made available to the institutes & universities to continue the teaching even during the pandemic. New undergraduate and postgraduate education syllabuses were designed under the New Education Policy.

ICAR Open Access Policy

During the late phase of the NAIP, the ICAR had adopted an Open Access policy for all its research publications (ICAR, 2013). The policy states that each institute shall have its own repository and a central harvester would harvest the meta-data and would be the one stop portal to access the published literature by the ICAR institutes. However, instead of establishing institutional repositories for various ICAR institutes, a repository (KRISHI) was established to host all the institutes' research and scholarly outputs at the central repository. Before the ICAR Open Access Policy and KRISHI, there were attempts made to establish institutes' repositories at Indian Agricultural Research Institute (IARI), Central Marine Fisheries (CMFRI), Indian Institute of Spices Research (IISR), and Indian Institute of Horticultural Research (IIHR). However, only the CMFRI could successfully build and populate its repository. It stands now as the world's most prominent publications repository on marine fisheries. In addition to the ICAR Open Access Policy, the KRISHI repository has adopted the ICAR data licence.

Krishikosh

Krishikosh is a thesis repository for the NARS system (Gutam, 2013). It was initially hosted by the Haryana Agricultural University under the NAIP project and was merged with the e-Granth project hosted at the IARI. As a mandatory policy adopted for NARS by the ICAR, the thesis produced by the universities are digitised (scanned), and along with the born, the librarians deposit digital copies of the thesis in the Krishikosh repository. In addition to the thesis, annual reports, rare books & journals, monographs, and many more are available within the library and deposited into the repository. Even during NAHEP, support is extended to all the NARS libraries to populate the repository and share the collections openly via AgriCart using Koha software. As the thesis repository is hosted with DSpace repository software, its content's meta-data is made available to various harvesters to harvest following the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH). The National Digital Library of India harvests the meta-data and makes the records to be fetched from the source repository.

ICAR e-Publication Platform

The ICAR e-Publication platform built on the Open Journal Systems of Public Knowledge Project is hosting its flagship peer-review journals and other journals published by the Universities and Societies in NARS (ICAR, 2013b). All the journal's meta-data is harvested into FAO AGRIS. With the software upgrade from OJS 2.0 to OJS 3.0, another beta version of the ICAR e-publication platform is under testing.

Consortium for e-Resources in Agriculture

The Consortium for e-Resources in Agriculture (CeRA) is the project intended to bring access to published literature in the world's peer-reviewed journals related to agriculture and its allied sciences. Under Internet Protocol address authentication and or with remote login, the access to commercial databases of full-text availability is made available to the NARS constituents (ICAR, 2014).

KRISHI

The KRISHI - Agricultural Knowledge Resources and Information System Hub for Innovations , is an initiative of ICAR aimed at making the research & scholarly outputs of ICAR institutes available publicly (KRISHI Project Team, 2015). However, with the adoption of the ICAR data licence, sharing the deposits under Open Access is limited and restricted. The KRISHI portal houses scholarly works and is a repository of all data, information, and research outputs. Moreover, ICAR Interportal Harvester harvests various other sources' meta-data related to agriculture and makes it available for the users. The contents of KRISHI are available under the ICAR Data licence.

Conclusions

Several of NARS' knowledge management initiatives are powered by open-source software. However, these initiatives are more conservatism-based rather than openness-based. For instance, many outputs have an 'All Rights Reserved' licence. The repositories claim their content is openly available, but not all can be accessed, downloaded, saved, read, or shared. Users are only allowed to use the resource for personal use and are not encouraged to save and share with others; therefore, it does not qualify as Open Access. Content built and shared under Creative Commons licensing would be archived, re-used, and shared by a large audience and machines. Because search engines can filter content according to a creative commons licence, licensing repositories and their contents under Creative Commons licensing is highly recommended.

Additionally, efforts should be made to make journals hosted by the ICAR e-Publication platform open access (Guttikonda & Gutam, 2009). They would benefit from inclusion in the Directory of Open Access Journals. The repository content should be open to Data Mining to explore the vast treasure of knowledge in new ways. Under the NAHEP, there should be increased focus and effort on building Open Educational Resources in Agriculture. NARS Agriculture Knowledge Portal should be established similarly to the ICAR Interportal Harvester, which would serve as a one-stop shop for agriculture data, information, and knowledge.

References

Agropedia /. (n.d.). Retrieved February 1, 2022, from http://agropedia.iitk.ac.in/

Consortium for e-Resources in Agriculture (CeRA) | भारतीय कृषि अनुसंधान परिषद. (n.d.). Retrieved February 1, 2022, from https://www.icar.org.in/content/consortium-e-resources-agriculture-cera

Gutam, S. (2013). KrishiKosh - An institutional repository under national agricultural research system. AIMS; FAO. http://aims.fao.org/news/krishikosh-institutional-repository-under-national-agricultural-research

Guttikonda, A., & Gutam, S. (2009). Prospects of open access to Indian agricultural research: A case study of ICAR. First Monday, 14(7). https://doi.org/10.5210/fm.v14i7.2488

Home-NAIP. (n.d.). Retrieved February 2, 2022, from https://naip.icar.gov.in/index.htm

ICAR adopts Open Access Policy | भारतीय कृषि अनुसंधान परिषद. (n.d.). Retrieved February 1, 2022, from https://icar.org.in/node/5542

ICAR Research Data Repository For Knowledge Management. (n.d.). Retrieved February 1, 2022, from https://krishi.icar.gov.in/

ICAR. (2004). Annual Report DARE/ICAR (pp. 1-261). Indian Council of Agricultural Research.

ICAR. (2013). ICAR adopts Open Access Policy. Indian Council of Agricultural Research. https://icar.org.in/node/5542

ICAR. (2013b). Indian Agricultural Research Journals. Indian Council of Agricultural Research. https://epubs.icar.org.in/ejournal/

ICAR. (2014). Consortium for e-Resources in Agriculture (CeRA). Indian Council of Agricultural Research. https://www.icar.org.in/content/consortium-e-resources-agriculture-cera

ICAR. (2017). National Agricultural Higher Education Project. https://nahep.icar.gov.in/

KRISHI Project Team. (2015). ICAR research data repository for knowledge management. KRISHI ; Indian Council of Agricultural Research. https://krishi.icar.gov.in/

Mruthyunjaya, & Ranjitha, P. (1998). The Indian agricultural research system: Structure, current policy issues, and future orientation. World Development, 26(6), 1089-1101. https://doi.org/10.1016/s0305-750x(98)00051-5

NAIP. (2005). National Agricultural Innovation Project. Indian Council of Agricultural Research. https://www.naip.icar.gov.in/index.htm

National Agricultural Higher Education Project. (n.d.). National Agricultural Higher Education Project. Retrieved February 1, 2022, from https://nahep.icar.gov.in/

Office of the Principal Scientific Adviser. (2020). Science, Technology and Innovation Policy 2020. https://www.psa.gov.in/stip

Shah, L., Dandawate, V., & Gutam, S. (2016). The Changing Landscape and Future of Open Access in India , Pallavi Shukla and N Deepa. In International Conference on Digital Libraries (ICDL) 2016: Smart Future: Knowledge Trends that will Change the World (pp. 1-1072). TERI Press.

UNESCO. (2021). UNESCO Recommendation on Open Science. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000379949.locale=en

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