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## Oral Presentation

# ICDL 2019

INTERNATIONAL CONFERENCE ON DIGITAL LANDSCAPE

## DIGITAL TRANSFORMATION FOR AN AGILE ENVIRONMENT

November 6–8, 2019 | New Delhi



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ISBN : 978-81-7993-698-6



### Published by

TERI  
Darbari Seth Block  
IHC Complex, Lodhi Road  
New Delhi – 110 003  
India

### For copies, please contact

TERI Press  
The Energy and Resources Institute  
Darbari Seth Block  
IHC Complex, Lodhi Road  
New Delhi – 110 003  
India

**Tel.** 2468 2100 or 2468 2111  
**E-mail** teripress@teri.res.in  
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**Web** www.teriin.org  
India +91 • Delhi (0) 11

Printed in India

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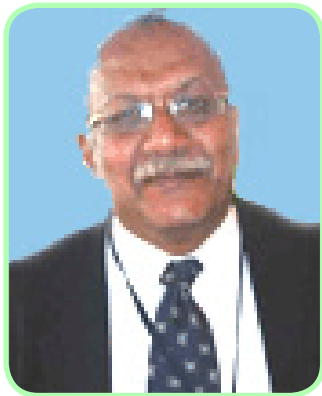
# ICDL 2019

International Conference on Digital Landscape

**Digital Transformation for an Agile Environment**

**November 6-8, 2019 | New Delhi**

## Foreword



**W**ith the Digital Transformation (DT), the era of trotting from one place to another for services, processes, business decisions, knowledge access have become a story of the past. Virtual world has conquered the world of knowledge and information so much so that by the click of a button a gateway of wider avenues gets opened like a wonder world. DTI in all sectors across the world has taken over the process of accumulation, transactions, decision making, marketing and dissemination of knowledge with ease and accuracy. Today, DT is no more a concept in incubating stage, but a reality with cutting edge precision. Digitization and the digital transformation have taken proactive steps to transform economy into digital domain bringing revolution into business decisions, policy making and become iconic in accelerating the on-going global processes of change in society.

Digital transformation can involve many different technologies but the hottest topics right now are the Internet of Things, cloud computing, big data, and artificial intelligence. Digitization – going paperless -- can save money, boost productivity, save space, make documentation and information sharing easier, keep personal information more secure, and also help environment.

ICDL 2019: Digital Transformation for an Agile Environment, the Sixth in the series conducted in every 3-years, is about revolutionizing internal operations and functions of organizations and institutions in addressing the needs of their various stakeholders by embracing new trends and technologies in a sustainable way. An agile approach shall roll-out new initiatives across the organization to strengthen coordination between all stakeholders to adapt and deliver key product and service innovations in a rapidly developing digital world.

The success stories of ICDL conferences in provide knowledge access, innovative content, developing partnerships and creating learning opportunities for participants speaks of the enthusiasm generated in the knowledge dissemination arenas across the globe. Here scholars speak, share and carry home ideas values and technological updates and continue enriching the vast repository of bits and dots of great thoughts, facts and figures. I am sure that your participation would add value to the event and surely would be fruitful to your future endeavours.

**Mr Nitin Desai**  
Chairman, TERI







# ICDL 2019

International Conference on Digital Landscape

Digital Transformation for an Agile Environment

November 6-8, 2019 | New Delhi

## Message from Director General



ICDL 2019 conference is being organized this year on the broader theme on Digital Transformation for an Agile Environment. It has envisaged holding discussions on cross-cutting areas in sustainability, access to information and digital transformation in various sectors.

In September 2015, the UN Sustainable Development Summit adopted the 2030 agenda which is the key document guiding international efforts for sustainable development until 2030 through 17 goals in key areas such as poverty, water, energy, education, gender equality, economy, biodiversity, climate action, and many more. While the targets set by the UN for different countries are far from achieved, major improvements have been seen in SDG achievements using digital disruption and innovative technology adoption. In recent years rapid developments in the fields of internet of things, big data, robotics, block chain technology, sensors, artificial intelligence, augmented reality, 3D printing etc have noticeably changed the processes of manufacturing industry. Digitization is fundamentally transforming the way goods are developed, produced and consumed, and galvanize the development of new business models, services, and behaviours. However, its potential can be realized

only in the presence of “digital inclusion” of stakeholders. Skill development in these areas and sectors are gaining prime importance.

Under this perspective, one part of the ICDL 2019 conference is addressing an important issue of need to develop new business models and innovative products to leverage digital transformation to realize the SDG targets through smart industrial growth and intelligent business processes in water, agriculture and smart industrial sectors.

Besides, ICDL 2019 will also focus on the recent digital technology trends and developments in data and information access, collaborative learning and knowledge research. As the demand for anytime, anywhere access to information grows, technology is disrupting all areas of global enterprise in organizations, industries and academia. Organizations are increasingly capitalizing enormous opportunities of digital transformation more than ever through increased use of digitization, knowledge management, data analytics and connected devices.

In recent years, most important developments in modern information societies are data-driven research, use of social media for collaborative research and learning and use of mobile technologies for knowledge access. The explosion of Social Media in the form of user-generated content on blogs, twitter, discussion forums, product reviews, and multimedia sharing sites presents many new opportunities and challenges to both producers and consumers of information. Further to this, enterprise knowledge access using social collaboration models have changed the organization decision making and social collaboration pattern substantially. The Government intervention in these areas is phenomenal through its Digital India and Make in India programmes to manage societal knowledge.

TERI being a research institute working for sustainable tomorrow, understand the value of digital transformation (DT) towards achieving SDG targets and also believes in collaborative learning through innovative research. Under the present era of transition in knowledge, technology disruption in business, the theme of the event is topical and I hope would generate huge knowledge base, which will then be shared among the stakeholders for achieving key benefits. With this understanding, TERI in collaboration with a number of Government, Multilateral and Private bodies, is organizing the International Conference on Digital Landscape (ICDL) 2019 to prepare us for new challenges and opportunities. I hope that the event will create a collaborative platform and initiate discussions to build new partnerships, so that knowledge can be used for collaborative learning to handle future challenges.

Dr Ajay Mathur

Chair, ICDL 2019

Director General, TERI





# ICDL 2019

International Conference on Digital Landscape

Digital Transformation for an Agile Environment

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## Preface



Digital transformation is about revolutionising the way organisation and institutions are continuously changing internal operations and activities, addressing need of various stakeholders, and embracing new trends and technologies. Whereas an agile approach is to roll out new initiatives across the organisation, which will ensure all team members to quickly adapt and deliver key product and service innovations and survive in a rapidly developing digital world. It has been estimated that by 2030, India will have 50% share of digital economy in GDP. So there is a dire need to grow a digitally fluent workforce, with capabilities and competencies to use, understand and adapt digital technologies; working collaboratively, solving problems and improving services. By sharing digital skills, and learning from professional colleagues, we need to take collective responsibility for digital evolution. The digital ecology is to create digital inclusion for people across various domain to lead digital initiatives and digital technologies evolution. The broader goal of Digital Transformation outlines four major objectives:

- To increase *opportunities to share innovative practices* and concepts across the profession, nationally and internationally.
- To increase *recognition of and support for experimentation* with innovative and transformational ideas.
- To *assist and make use of new and emerging technologies* by promoting and supporting technological experimentation and innovation.
- To increase *leadership development and training opportunities* designed to support the on-going transformation of organisation and institutions.



Digital transformation is a continuously changing process that represents a fundamental change in how organizations should operate in a digital world. It modernizes an organization or community with digital technology at its core — one that uses the power of today's technologies to create new forms of organisations/communities value chain for the future.

Today, ICDL is a global acronym and also one of the flagship events organized in every three years' interval by The Energy and Resources Institute (TERI). It has become one of the premier international platforms to facilitate the exchange of knowledge on all dimensions of digital libraries. The entire ICDL was started in 2004, but today in the sixth edition of this conference and research it has evinced a paradigm shift from *Digital Libraries to Digital Landscape*. This shift is due to continuous penetration and emergence of Digital Technologies to transform the 17 Sustainable Development Goals identified by United Nations. The ICDL 2019 with the theme “**Digital Transformation for an Agile Environment**”, which will not only create a roadmap to guide us through what will come next, but also help us prepare ourselves for new challenges and opportunities. The event will address emerging trends and issues that accelerate Digital Transformation in institutions across countries to address SDGs. ICDL 2019 has identified industry – particularly manufacturing and business processes - as one of the key areas where digital transformation is undergoing a paradigm shift, called Industry 4.0. In order to achieve Sustainable Development Goals (SDGs), digital disruptions, application of analytics, artificial intelligence and IoT applications are taking place in manufacturing and service oriented industries in many processes.

The event will bring together leaders spearheading digital disruptions in their organizations to offer insights, knowledge, and case studies on contemporary issues and challenges of digital transformation. This conference will comprise an educative mix of events like:

- Plenary Sessions and Thematic Tracks highlighting recent digital library research across the globe by the luminaries
- Workshops addressing contemporary issues to a focused group of stakeholders
- Thematic Events in select niche areas for business houses and academics Exhibition by national and international knowledge vendors and publishers
- Stakeholders engagement in digital platform using online collaborating tools

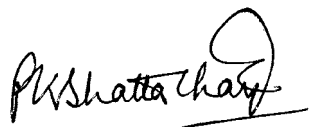
Every year ICDL, tries to bring in a sea change in the conference format. One of the major breakthroughs is Digital Engagement Platform, where we have bridge the knowledge gap on contemporary issues using Webinars, Virtual Classroom and Storytelling. A large number of audiences from across the globe participated and stay tuned during pre- and post-ICDL.

The ICDL 2019 has received 115 papers, which underwent a rigorous blind-review process and finally 74 papers have been selected for oral and 17 papers have been selected for poster presentation. These papers will be presented in different sessions during the event.

The ICDL 2019 organizers are also thankful to the experts, resource persons, committee members, delegates and sponsors for their overwhelming response to make this event a grand success.

We welcome you all and hope that you will all gain intellectually from this event.

Regards



**Dr P K Bhattacharya**  
Organising Secretary, 2019  
Associate Director`  
Knowledge Resource Centre,  
TERI



**Dr Shantanu Ganguly**  
Organising Secretary, 2019  
Fellow  
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# ICDL 2019

International Conference on Digital Landscape

**Digital Transformation for an Agile Environment**

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**November 6-8, 2019 | New Delhi**

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# ICDL 2019

International Conference on Digital Landscape  
Digital Transformation for an Agile Environment

November 6-8, 2019 | New Delhi

## KEYNOTE SPEECH



Organizer



The Energy and Resources Institute





**6 November 2019**

**Keynote speech at the ICDL 2019 Conference:**

# **Digital Transformation leading to a low carbon footprint and achieving the SDGs**

**Nikhil Seth**

## **PART I**

### **Agenda 2030 and its significance**

1. It is a special privilege for me to be in Delhi, invited by my “guru” Nitin Desai and TERI. Thank you organizers for putting this together.
2. 2030 Agenda and the SDG’s were adopted in September 2015 in the presence of over 169 Heads of State and Government. The Climate Change agreement in Paris came soon thereafter.
  - The adoption came after two years of intense negotiations with the robust engagement of governments, business, academia, UN System and civil society.
  - The agenda was built on the ideas and approaches contained in the Millennium Summit, in the UN Summits of the 1990’s and in the outcome of the Rio+20 conference “The future we want”.
  - The themes and the process of deep engagement makes the 2030 Agenda one of the most significant. And it is passing the test of time. It continues to be the agenda with the greatest political traction.
  - The Climate Change outcome in Paris was equally significant. They are twins conjoined at the hip.
3. The special significance of the agenda is:
  - Its universality and relevance to all countries
  - Its bringing together, as never before, economic, social, environmental issues as also issues around the creation of peaceful and just societies.
  - Its focus on an integrated approach to solving contemporary problems.
  - Its focus on individual rights, hopes, aspirations and fears.
  - Its focus on reaching the furthest, the poorest and most vulnerable first.
  - Its emphasis on actions by all – governments, business, academia and civil society.
  - SDG’s define goals, targets and indicators to help reach its ambition mostly by 2030.
  - Its primarily focus on ending poverty in all its forms, on reducing inequality within and between countries, ending corruption, enhancing the delivery of justice and ensuring better institutions.
  - Its orientation, in implementation, or ensuring that we safeguard our planet for present and future generations.
4. The integration vision is best understood by viewing the SDG’s and targets as an interrelated matrix e.g. girls’ education target will contribute to the goals on poverty, health, food security, gender empowerment, water, energy, etc. this vision will help smarter planning and better budgeting.

## **PART II**

### **Global Assessment**

5. I have been at the SDGs Summit in New York this year. Overall, progress is being made with some favorable trends:
  - Extreme poverty and child mortality rates are falling
  - Progress in some diseases such as hepatitis
  - Electricity access is increasing
  - Unemployment levels are back to pre-crisis levels
  - Urban population living in slums falling
  - Marine protected areas increasing
  - Governments integrating SDGs in national plans increasing
  - Near universal response and country ownership
  - Local governments, business, civil society, academia, youth engaging UN system in deep reform.
6. However, while the situation varies amongst regions:
  - Progress not fast enough to transform our world by 2030
  - Extreme poverty will not be eradicated by 2030
  - Hunger has risen in the last three years
  - Biodiversity loss is alarming
  - GHG emissions reaching record highs since 2015
  - Institutions not strong enough or effective enough
  - All categories of those left behind remain largely excluded.
  - Gender inequalities and violence against women continue unaltered.
7. Moreover:
  - Political environment has changed dramatically. Multilateral cooperation is suffering especially from the all-time highs of 2015
  - Conflicts and instability have intensified. 68.5 million displaced persons, 85% living in the developing world.
  - Disaster losses have increased 150% in last 20 years.
  - Global economic growth slow, volatile and trade prospects cloudy
  - Rising income and wealth inequalities threatening social cohesion
  - Rising intolerance threatening fundamental human rights and progress
  - Growing lack of trust in governments and institutions
8. The tasks for the next 11 years included:
  - Special focus on the most vulnerable
  - Well directed financing
  - Strengthening institutions
  - Strengthen local actions especially at municipal levels
  - Strengthen data systems for better evidence-based decisions everywhere
  - Harnessing science technology and innovation with a greater focus on digital transformation.
9. But in my view we have the greatest challenge in awareness, attitudinal and behavioral skills which are the bedrock of change. And we need to reach people in the millions and not in the thousands.

### **PART III**

## **Digital Transformation leading to a low carbon footprint and achieving the SDGs**

10. In the past years, digital technologies have spread and began to transform virtually all sectors. The educational sector has benefitted largely. And while face-to-face learning will continue to play a role, it is clear that online and blended learning offerings will continue to grow. The promises are immense when we think of the fact that information is a public good, ie everyone can use it (non-exclusion) without reducing the benefit of others (non-rivalry). However, there are also challenges in developing effective online learning platforms. Let me outline some lessons based on the experience at UNITAR. While we have numerous platforms on the Divisions of our on Planet, People, Peace and Prosperity, Diplomatic Training and Satellite Applications, I will eventually draw on the SDG platform and the Climate Change learning platforms.
11. We have developed two digital platforms with the aim of training and encouraging millions of people to work toward a low carbon footprint and the promises of the SDGs. These platforms are the UN Climate Change Learn platform, or UN CC:Learn, and the UN:SDG Learn platforms, respectively.
12. **Platform and partnership approach**
  - The UNCC: Learn e-learning platform provides learners credible and free content as well as certification that can help them to progress in their careers or become innovators/champions in their professional careers. At this time most learners are public sector or university graduated, although increasingly teachers are signing up to our courses as a basis for becoming climate change teachers within the general education system.
  - The main added value of UNCC:Learn is that the content is backed by the relevant expertise within the UN system. 38 UN entities have joined together. UNITAR does not generate the content; it works with the relevant agencies to pull it together and package it as an e-learning product. Examples include working with UNICEF on climate change and children, or with WHO on climate change and health. There are many more examples of this. These agencies get an excellent deal because their content is associated with the UNCC:Learn platform which is growing and already has 250,000 registrants, and is seen as an implementing mechanism of Article 6 of the UNFCCC on education and training.
  - UN SDG: Learn, which was just recently launched in July, follows a similar logic but goes a step further with the collaborative efforts of the United Nations, multilateral organizations, and sustainable development partners from universities, civil society, academia and the private sector, UN SDG: Learn provides a unique gateway for a wealth of SDG-related learning products and services that are currently available. UN SDG: Learn currently has over 40 members.
  - UN SDG: Learn is helps facilitate access to Agenda 2030 learning products. These have been very scattered making it difficult to get an overview of the offers out there. Hence SDG learn gathers information on accessing such solutions in one place, while giving direct links to the individual member's training material.
  - So my first message is that in developing platforms build partnerships for content, feedback and constant refinement. Ownership in all forms builds trust and improves usage.
13. **Reaching thousands of learners worldwide**
  - UNCC: Learn is the single largest provider of online courses on climate change and green economy globally, with a total of 250,000 registrants to date and currently issuing more than 30,000 certificates of completion a year. There are about 25 different courses currently available

in multiple languages. We expect the content to continue to grow. The feedback is positive from learners as evidenced by the numbers that are not only starting the courses but completing them.

- **SDG: Learn** was just recently launched and so only preliminary feedback has been gathered from members. It is too early to feature statistics on courses. The initial feedback was positive from the members, in particular in view of search functions, mobile phone compatibility and visibility for course providers.
- In general, we can see in our number of beneficiaries, that online platforms contribute the biggest share of new learners per year, from 38.000 in 2017, to 60.000 and 85.000 in 2018 and 2019, respectively.

#### 14. **Limitations to scaling numbers of beneficiaries:**

- Customizing to local realities and language: While these two platforms can be scaled up, this does not mean that coverage is equal. For example CC:Learn does not have much traction in Francophone sub-saharan Africa even though most of our courses are in French. The challenge we face is that scaling up in this region requires both reframing of content to regional realities and a better understanding of how knowledge is transferred, which tends not to be via traditional computer based interfaces. Societies are more mobile based and capacities to download high density files are also limited.
- **SDG:Learn** faces challenges related to course languages. Although it features courses in multiple languages and allows to search on specific languages, there is a pre-dominance of English language courses. Efforts to have the platform on all six UN languages are being discussed, with increased focus on diversity in language offer.
- My second message is the necessity of customization, based on an in-depth needs assessment. Customization can be national, sub-national, local sectoral and relevant to the socio-economic and cultural context.
- Blended learning: There is little excuse now for providing foundational learning content via expensive face to face approaches. UNCC:Learn can issue a certificate of completion on the basics of climate change, for example, at less than USD 20. By contrast, more advanced and applied content still requires a face to face approach, potential backed by on the job coaching. E-learning can significantly increase the cost effectiveness of this latter approach but blended learning is the optimal approach in our estimate.
- **SDG:Learn** features search functions for blended learning that lists the available blended learning courses within the users preferred interest areas. We foresee an increase in the blended learning courses offered.
- My third message is that in UNITAR's experience blended learning works best to reinforce knowledge transfer. In the case of Indian diplomats we have a three module e-learning course followed by face to face training following a case-study approach.

#### 15. **Innovation in design**

- Learning from social media: UNCC:Learn has active social media accounts but the impact in this area is relatively weak. It is hard to measure the effectiveness of social media in advancing UNCC:Learn objectives and the programme is constantly re-evaluating its strategy. One lesson learned appears to be that all visible global programmes need to have social media in order to have credibility. But whether social media achieves something more tangible beyond this remains a key question.
- Incorporating best practice: **SDG:Learn** has made efforts to design the platform to be mindful of people with colour-blindness and also made sure to keep a design that is well suited for mobile phones.

- Instructional design: Digital learning platforms need to learn from social media and the gaming industry. Interactivity, simulation and entertainment are crucial ingredients for effective platforms. Quizzes, tests and evaluation are equally important. Maintaining, reviewing, and constant updating is required to keep the digital platforms topical.

#### 16. **Business models**

- Free vs. fee based approaches: Both platforms are free to the learner but is relatively high cost to maintain and to create content. We still depend on traditional donor contributions and UN co-financing. Private sector funding has been obtained in developing specific courses that are of interest to clients, but getting seed funding to support the overall efforts of the platform has been more difficult. We foresee that the traditional donors will continue to be needed for this with the argument being that we can leverage this funding significantly. At this time we do not think that a direct payment model would work. However we intend to implement a voluntary payment system by the end of the year to offset maintenance costs.
- My fourth message: There are numerous business opportunities and business models, e.g. charging a small fee for certification and fees for curated and face to face training. They need to be explored in the relevant context.
- In conclusion, I am convinced that digital platforms will be key for the future success of UNITAR and any organization in the educational sector. They will increasingly be relevant for the attitudinal and behavioral changes that are required by millions for achieving the goals layed out in the 2030 Agenda. But challenges remain which I have outlined based on the two platforms we have developed.

- Thank you.



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## INVITED PAPERS



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# Smart Machines

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## Abstract

Smart Machines encapsulates technologies that allow them to adapt their behavior on experience, are not totally dependent on instructions from people and are capable of coming up with unanticipated results. This talk presents how we are helping our businesses succeed in the era of Smart Machines by Providing Platforms & Engineered Intellectual property.

# Facilitating FAIR data sharing in Dataverse Repositories

**Sonia Barbosa**

Manager of Data Curation, IQSS Harvard University, USA

## Abstract

The Dataverse Project is an open source web application to share, preserve, cite, explore, and analyze research data, and is developed at Harvard University. Dataverse software strives to support FAIR data sharing standards and automates much of the job of the professional archivist. This strength enables organizations and institutions to provide self-curated data sharing capabilities to their research communities.

Unfortunately, much of the self-curated content within the Harvard Dataverse Repository falls below accepted FAIR standard. One reason for this state of affairs: the time commitment required to curate a dataset for discoverability and accessibility. In response, the Harvard Dataverse repository, in collaboration with the Harvard Library, has implemented data curation services, along with new features and integrations, to help move Harvard Dataverse datasets towards FAIR data sharing standards.

This presentation will describe collaborative data curation services that will help to improve curation of newly deposited datasets, and to provide education and training to the research community on meeting FAIR standards in Dataverse

# **Evolving Roles of Libraries and Librarians to meet the 21<sup>st</sup> Century Challenges**

**Dilara Begum**

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## **Abstract**

The 21<sup>st</sup> century comes up with the blessings of advanced Information and Communication Technologies (ICTs). Due to the rapid transformation of the ICTs the roles, responsibilities and activities are also being changed with time. It is quite obvious that to cope up with this flow of modern technologies the libraries and librarians need to reshape and rethink regarding their role and as well as they need to establish these roles in the society strongly. The libraries and librarians need to understand the importance of different modern tools for better service providing as well as should have the ability to implement and use these. In this regard, awareness regarding different modern tools and techniques used in providing information services throughout the world also needed to be known by the libraries and librarians. In 21<sup>st</sup> century, generally the users don't have the time to receive services. It is the responsibility of the libraries and librarians to redesign the services to reach at the door of the users. The libraries and librarians should also promote innovations among themselves to meet 21<sup>st</sup> century challenges. The library and information professionals should not limit themselves within the boundary of the library. They need to take active part in global issues as well. Sustainable Development Goals (SDGs) is one of the burning issues of recent times. The libraries and librarians need to come up with specific plans and strategies to assist in achieving SDGs. They need to actively take part in this issue with a combined efforts. It is the high time to show the world the capabilities of libraries and librarians in promoting SDGs and also in achieving this. The librarians will only able to do so if they get a standard education and continuous hands on training. The librarians can only play a significant role if they become competent enough on modern tools, technologies and techniques. The libraries also need to build themselves as an advisory center which will actively work with the government in promoting and achieving SDGs.

# Open Data Behind Bars – Does the Unfamiliarity with Data Protection Regulations Prevent the Publication of Research Data?

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## Keywords

Research Integrity, Open Data, Research Data, Research Transparency, Data Protection, GDPR

## Abstract

Imagining a case study: A researcher from the field of psychology published an article in a reputable journal. In his work he presents the results of a qualitative study about the gender identity of his probands. He didn't publish the underlying data as he was afraid of breaking the law and endanger his volunteers. To make sure he complies with the privacy laws in his country and with the corresponding expectations of his probands, he deleted the data completely.

Another scientist was reading the paper and suspects to have found a mistake in the research design and the evaluation of the data. As the data is not published and not available, it is not possible to reproduce or validate the given results.

How could this be avoided? Was it necessary to destroy all the data? Would it even have been possible to publish the research data?

Research integrity is imperative to excellent science and research. The principles of reliability, honesty, respect and accountability should guide researchers in their work. Thus, a basic ethical attitude and an overarching culture of transparency must be promoted (Deutsche Forschungsgemeinschaft 2019: 16 - 17). This can be achieved by disclosing intentions (with preregistrations) and research design, as well as by Open Research Data.

Research data form the basis of the scientific knowledge process and are part of a scientist's work from data acquisition to data processing and through analysis to publication. In the case of new technologies, a large amount of digital data in a very short time is produced. Therefore, good management of it (research data management) became a vital part of the research itself and of research integrity too. Ideally, research data should be open and made available (ALLEA 2017: 6) in terms of Open Science.

The most common, yet informal, definition of Open Science comes from Michael Nielsen: 'Open science is the idea that scientific knowledge of all kinds should be openly shared as early

as is practical in the discovery process' (Gezelter 2011). It includes practices of Open Access to scientific articles, science communication, and publishing of research data. Open Data Open Knowledge Foundation as one of the four pillars of Open Science (Masuzzo 2017: 3 - 4) can help to reduce misconduct, facilitate replication (i.e. reproducibility), and support further research (e.g. meta-analyses). Fraud in research, such as those highlighted in a discussion of reproducibility issues by Ince (2011) can be avoided. Open (Research) Data allows researchers to enhance, review and build on the given research results, and answer new research questions. Several scientific articles already show the advantages of Open Data besides the benefit to the general scientific community, e.g. increased the citation rate (Piwowar 2007, Piwowar 2013). Furthermore, an increasing number of funders, publishers and research organizations are demanding data sharing (European Commission 2016, Jones 2019).

Each discipline often makes its own demands on the management of its data, including publishing. The general research data management will be only of little help here. For instance; microscopic observations need a different handling than the digitization of handwritten diary entries of a missionary in South Africa even though both will be considered as digital research data. One reason is the high diversity of affected legal areas and their respective legal complexity (Hartmann 2019: 6). The most common denominator, however, is the data protection law that requires 'de-identification' to protect privacy. The General Data Protection Regulation (GDPR) from May 2018 seems to open up the gap between research opportunities on the one hand and data privacy on the other even more. Furthermore, national legislation or related EU measures have to be considered too. There is an undisputed recommendation to inform the participants about the limits of anonymity and confidentiality. However, the extent to which principles and standards apply to research data with varying degrees of person-related information remains largely unclear. It requires new reflection on the compatibility of good research and good data protection.

Data protection is both a central theme of research ethics and a fundamental human right, and thus has to be consistently applied by the research community. Nevertheless, scientists are often uncertain what they are allowed to do. A profound understanding of the meaning of openness and its legal implications is usually lacking. Most of the researchers are concerned about whether to publish their data, as the lack of protection of personal data against loss or misuse can have serious reputational, financial, and legal consequences. As shown in an interdisciplinary survey in 2013 on research data management at the Humboldt-Universität zu Berlin, Germany, 51% of the surveyed researchers stated that they would need legal advice from their university (Simukovic 2013: 4). In a survey at the Leibniz Universität Hannover in 2016 the percentage of respondents was 67% (Hauck 2016: 59). There are several attempts in and outside Germany to generalize the legal advices which may not always be applicable to all disciplines (European Commission 2018, forschungsdaten.info 2019, Kreutzer 2019, Lauber-Rönsbreg 2018, OpenAIRE 2013).

According to the European Code of Conduct for Research Integrity (ALLEA 2017: 6) the researchers, research institutions and organizations must ensure that access to data is as 'open as possible and as closed as necessary'. However, if limited accessibility, for example due to data protection, prevents the open publication of data, it does not contradict the FAIR Data Principles

(Wilkinson 2016). The main objective of the FAIR principles is to optimally prepare research data to facilitate knowledge discovery by humans and machines. With appropriate data management planning much sensitive and proprietary data can still be shared by making it Findable, Accessible, Interoperable and Re-usable (FAIR). It is almost always possible to share the metadata at least.

In the presumed conflict between handling of research data and the issues of data protection, it is important not only to adapt the concrete design of protection standards to the realities practiced, but also to anticipate developments in order to withstand scientific competition. In the research presented here (Biernacka 2019) this conflict will be investigated, considering both differences between disciplines (i.e. learning analytics, medicine and climate impact research) and between cultural perspectives (i.e. Germany, China, India and Peru). The considered disciplines show large variations in the type of research data in terms of data sensitivity. Furthermore, different legal regulations and cultural factors lead to different starting situations. Under these aspects the data openness will be analysed.

## Reference list:

1. ALLEA. 2017  
The European Code of Conduct for Research Integrity  
Berlin: ALLEA - All European Academies. 15.
2. Biernacka, K. 2019  
Research Integrity and Privacy  
<https://headt.eu/Research-Integrity-Technology-and-GDPR> (accessed on 17.07.2019)
3. Deutsche Forschungsgemeinschaft. 2019  
Leitlinien zur Sicherung guter wissenschaftlicher Praxis  
Bonn: Deutsche Forschungsgemeinschaft. 29.
4. European Commission. 2016  
H2020 Programme. Guidelines on FAIR Data Management in Horizon 2020.  
European Commission. 12.
5. European Commission. 2018  
Ethics and Data Protection  
European Commission. 21.
6. forschungsdaten.info. 2019  
Forschungsdaten veröffentlichen? Die wichtigsten rechtlichen Aspekte
7. Gezelter, D. 2011  
An informal definition of Open Science.  
<http://openscience.org/an-informal-definition-of-openscience> (accessed on 25.07.2019)
8. Hartmann, T. 2019  
Rechtsfragen. Institutioneller Rahmen und Handlungsopitonen für universtiäres FDM  
Frankfurt (Oder): Europa-Universität Viadrina Frankfurt (Oder). DOI: 10.5281/zenodo.2654306
9. Hauck, R., et al. 2016

Der Umgang mit Forschungsdaten an der Leibniz Universität Hannover. Auswertung einer Umfrage und ergänzender Interviews 2015/16  
Hannover: Institutionelles Repositorium der Leibniz Universität Hannover. 71. DOI: 10.15488/265

10. Ince, D. 2011  
The Duke University scandal - what can be done?  
*significance*
11. Jones, L., et al. 2019  
Implementing publisher policies that inform, support and encourage authors to share data: two case studies  
*Insights the UKSG journal* 32
12. Kreutzer, T. and Lahmann H. 2019  
*Rechtsfragen bei Open Science*  
Hamburg: Hamburg University Press.
13. Lauber-Rönsbreg, A., et al. 2018  
Gutachten zu den rechtlichen Rahmenbedingungen des Forschungsdatenmanagements  
Dresden: DataJus. 20.
14. Masuzzo, P. and Martens L. 2017  
Do You Speak Open Science? Resources and Tips to Learn the Language  
*PeerJPreprints*  
Open Knowledge Foundation.  
Open Data Handbook
15. OpenAIRE. 2013  
*Safe to be open. Study on the protection of research data and recommendations for access and usage*  
Göttingen: Universitätsverlag Göttingen.
16. Piwowar, H. A., et al. 2007  
Sharing detailed research data is associated with increased citation rate  
*PLoS One* 2 (3)
17. Piwowar, H. A. and Vision T. J. 2013  
Data reuse and the open data citation advantage  
*PeerJ* (1:e175)
18. Simukovic, E., et al. 2013  
Ergebnisse der Umfrage zum Umgang mit digitalen Forschungsdaten an der Humboldt-Universität zu Berlin.  
Zenodo. DOI: 10.5281/zenodo.7446
19. Wilkinson, M. D., et al. 2016  
The FAIR Guiding Principles for scientific data management and stewardship  
*Scientific Data* 3

# **Libraries Unlimited Supporting the SDG's in Bangladesh**

**Kristy Crawford**

Ministry of Cultural Affairs, British Council

## **Abstract**

Libraries Unlimited seeks to improve public access to information and knowledge and has been designed based on the findings of the Library Landscape Assessment of Bangladesh study (June 2015). Developed in close partnership with the Government of Bangladesh, LU aims to develop the public library network, build the capacity of government officers, train library staff, and build public awareness of and access to library and information services. The British Council is implementing this project in partnership with the Ministry of Cultural Affairs and is supported by the Department of Public Libraries. LU will give millions more people in Bangladesh more control over their own lives thus supporting them to achieve their potential through access to a range of user-driven services.

As we know, libraries can support all of the SDG's one way or another. From access to information, resources and new skills to lift people out of poverty, to supplying weighing machines in libraries for Health and Wellbeing, to creative play with toy bricks to improve 21st century skills in children's education, Libraries Unlimited is innovating, developing, and bringing new services to the government public libraries in Bangladesh. With 64 of these libraries across the country, that means only 1 public library for over 2 million people. Our strategy therefore also needs to include digital access. We will be supplying free high-speed customer Wi-Fi in all libraries and are looking at ways to lend Wi-Fi hotspots so people can take it home with them too. We are bringing coding workshops to all 64 government public libraries in Bangladesh using micro:bits and Kano computers, and starting coding classes using the equipment donated wherever possible.

Gender and accessibility issues are very important to the project, and we're bringing as many girls as boys to the coding workshops. In our redeveloped "model library" in Munshiganj we're making sure that wheelchair users can access the library despite the steps up and down through the public park outside.

The Ministry of Cultural Affairs of the Government of Bangladesh is tasked with achieving goal 11.4. We believe that not only should the libraries preserve the cultural heritage of the nation in terms of its literature, but also in support for cultural industries and cultural expression and are working on cultural development in libraries.

Our 25 district, 2 day festival, outreach "Public Library Campaign" is introducing community members all over the country to the benefits of libraries, and introducing them to the new



services and programmes. The project is not only supporting the SGD's, but the libraries communities too.

# GDPR Readiness: The TCS Information Resource Centre (IRC) Approach and Experience

**Dhanashree Date**

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## Abstract

Data is the most valuable currency for businesses today. Emerging terms such as ‘data economy’ and ‘infonomics’ only suggest that data is traded for bits and bytes of wealth. Businesses are on a constant lookout to mine information and turn it into value-added services. Technology has undoubtedly helped amplify business opportunities, but on the flip side has also proven to be a big threat to data privacy. General Data Protection Regulation (GDPR) arises out of this need to arrest risk.

Giant global organisations like TCS have diverse stakeholders and perpetually handle huge amount of cross-border data, personal and confidential amongst other. Uptake of GDPR framework by TCS to ensure data protection compliance across all TCS units globally, has also mobilised the Information Resource Centre (IRC) of TCS to embrace it.

The first anniversary of GDPR has passed during which the IRC has charted a four-step approach towards compliance by working closely with the GDPR supervisory authorities. Beginning with in-depth assessments of tools, platforms and content, the areas of high-impact privacy risks are identified for remediation. Ancillary, but equally important measure includes education, sensitisation, and preparedness of the IRC team and its stakeholders about risks of privacy breach.

TCS IRC experiences will help address the lingering concerns of information professionals on whether GDPR and other privacy regulations impact our processes, stifle information services, or, provoke us to re-think the future of our service strategies in supporting our organisations to build trust and brand value in the digital milieu.

# **Libraries in Disaster Management of Bangladesh: A role model for reducing vulnerabilities**

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## **Abstract**

The traditional role of the library and information centre is mainly to collect, organize, disseminate and preserve information. Besides these traditional roles the libraries may have some alternative uses to improve the knowledge relating to face the risks of disaster prone areas. The study thus attempts to explore how an innovative approach of a Library and Information Centre has contributed to improve the skill and knowledge of the extreme poor people in the areas vulnerable to disasters. The study extricates the clue why large number of people in costal belts is not early informed about the disaster? Why they don't have any preparation to face the disasters? What initiatives have been taken by the libraries to reduce these? It will also explain how Disaster and Environment Management Library and Information Centre (DEMLIC) has turned into integral part in the lives of the extreme poor people in the costal as well as flood prone areas of Bangladesh. Based on data collected by survey and supplemented by some case studies the present paper shares the author's experience on how major risks of the disasters have been reduced through DEMLIC.

## **Keywords**

DRR; Innovative Approach; Libraries; Information Centres; Disaster Management

## **Introduction**

Dramatic changes have taken place in the mode of storage and transmission of information across the globe during the post second world war years. These changes have been caused mainly by the developments in computer and communication technologies and their application in the storage and dissemination of information. Libraries and information centres are the prime institutions which are adopting new technology as soon as it appears into the world. In this digital era, libraries and information centres have to provide information in every single second. Library professionals have been facing new challenges to keep pace with the rapid growing technologies. Librarian/information officer has to play a very dynamic role in the universal diffusion and advancement of knowledge and society. In most cases librarian has to work as an information scientist, researcher, educator, knowledge manager, documentation or

communication officer, psychologist and mentor. Out of many responsibilities, a librarian has to work as a safeguard of the library as well and need to play a role to protect the library from various disasters and risks (Hossain, 2015). Similarly, the librarian has to play role to save the lives and livelihoods of the community people. In this paper emphasis has been given on role of libraries and information centres in managing disasters and emergencies. Besides the routine job of the librarian, the study tries to identify the social voluntary role during, before and after the disaster for the affected people in the community.

Traditional role of the librarian is mainly to collect, organize, disseminate and preserve information. Besides the traditional role, the study discovered that in the disaster prone areas DEMLIC (Disaster and Environment Management Library and Information Centre) plays a very extraordinary role to attract the community people as its user. The question may be raised how DEMLIC succeeded to attract the people? The research team explored some good reasons for it. Firstly, DEMLIC played role as training centre where all sorts of disaster related training were organized. Secondly, it worked as a learning centre through which it operates learning activities for its beneficiaries and other stakeholders of the community and Thirdly DEMLIC is known as an Information dissemination centre where right information at the right time related to disaster management would be disseminated in the right way. The details of these 3 roles of DEMLICs have been discussed at the findings of this study.

Within 147, 000 sq-km land areas in Bangladesh there are 170 million people. So, no doubt that it is one of the overpopulated countries in the world. Annual seasonal flooding is a way of life in many parts of the country but many communities, particularly poorer, are not yet well prepared to mitigate and respond to this resulting in a constant erosion of their household and livelihood assets (UNFPA 2016). Annual seasonal flooding is a way of life in many parts of the country but many communities, particularly poorer, are not yet well prepared to mitigate and respond to this resulting in a constant erosion of their household and livelihood assets. Cyclones affect particularly the coastal and southern part of the country and a major geological fault line runs through the country and includes the capital Dhaka (MoDM Report, 2017).

Bangladesh has a number of policies and legal instruments in place to address these threats including the National Climate Change Strategic Plan, the National Adaptation Plan and the Disaster Management Act with its associated Standing Orders (Khan&Jonsson, 2013). These suggest that the Government of Bangladesh is serious about meeting its obligations to disaster reduction and response as a signatory to the Hyogo Declaration which is the protocol governing the international strategy for disaster reduction (IRIN News, 2009). It is clear that within these national frameworks, NGOs have been playing a very meaningful role.

Bangladesh became independent in 1971 and since then many organizations involved in DRR in different ways. But nothing was new in their intervention. Therefore, no significant changes found in the Disaster Risk Reduction in Bangladesh. The idea of the DEMLIC Project was first come from the affected people of the coastal zone who were used to visit the local NGO libraries frequently. Some NGOs like BRAC, Action AID, ASA, Ahsania Mission etc. have been working in most of the flood affected areas since long. Mainly they provide need-based information and training services for the people of the coastal communities. The idea of the DEMLIC has been

generated from it. The research team thought that the role of library and librarians has a great impact in the lives and livelihoods of the costal people. So, they started thinking on it. Basically the research team was very curios to work with the affected people installing libraries and information centres as a training, learning and information centre. Thus, the concept of DEMLIC becomes very popular among the community people in the disaster porn areas.

## **Description**

The role of the DEMLIC in Disaster Management was really innovative and successful. It's a special library which was established for providing support towards vulnerable and affected people. Funded by Government of Bangladesh and Irish Aid, its collections were mainly of disaster management related books and non-books materials including but not limited to need-based training modules on how to cope with disaster, how to face flood, earthquake, landslides, droughts, capacity building modules, training equipment of facing disaster-like life- buoy, first aid, rope, torch, bicycle, boat with engine, umbrella, torch-light, resources of CDMP (Comprehensive Disaster Management Programmes), reading materials, disaster-related posters, AVMs (Audio-Visual Materials), community radios, hand-mike or sound-amplifiers, illustrated books, inspirational tailor-based videos, trampoline etc. Computer with internet connection was the main inspirational tools for the extreme poor people and children. Often the librarian encouraged them to watch the disaster-related documentaries and movies; so that they could gather some knowledge for facing the challenges. DEMLIC operated its activities in three major phases. Firstly: It supplied dry food immediate after the disaster to the affected people of the disaster prone areas; Secondly: It donated cloth among the affected men and women and; thirdly: It disseminated disaster-related information among the community people. It involved with local NGOs/Local Government, CBO leaders, DMC members and other related bodies for long term rehabilitations. DEMLIC managed fund from the donors for housing project for long-term rehabilitation as well.

### ***DEMLIC in 7 Upazillas***

Funded by the GoB (Government of Bangladesh) and Irish Aid the research team began implementing a-3 year 'DEMLIC for DRR (Disaster Risk Reduction)' project in 2013. It was a 3-year project. The research team selected seven Upazillas based on the frequency of the disaster, availability of data and the accessibility of the research team. Out of 7, two are high risk areas in Bangladesh for flash-flood namely Dharmapasha in Sunamgonj and Khaliazuri in Netrokona; two are for seasonal flood namely Kazipur in Sirajgong and Daulatpur in Kustia; the remaining three upazillas are Burguna, Patharghata and Teknaf for tropical cyclone. One may ask why the research team has chosen these seven upazillas only out of 493? The study has some good reasons for it. Firstly:, these seven upazillas have been identified as disaster- prone areas in Bangladesh. Secondly: During the baseline survey at the end of 2012, the research team found these areas mostly vulnerable and thirdly: considering the availability and the accessibility of information, these have been chosen. After selecting the areas the research team started installing DEMLIC outlets in 7 Upazilas. The project has been launched in the seven said areas and the Terms of Reference (ToR) for librarians and project staffs have been prepared. A Memorandum

of Understanding (MoU) with Ministry of Disaster Management has been signed as well on December 30, 2012. Accordingly as a strategic partner of MoDM, the research team initiated DEMLIC project in January 30, 2013 with a view to reduce the risks to the vulnerable communities and improve their livelihoods protecting them from flash- floods, seasonal floods and tropical cyclones.

## **Specific objective**

The main objective of the study was to reduce the risks from flash floods, seasonal floods and tropical cyclones to vulnerable communities through an innovative approach of a Library and Information Centre.

## **Overall Objectives**

The study has also revealed how DEMLIC has increased the coping mechanisms of the affected people, saved wealth and livestock's from the disasters. It has extricated the cause why community people have identified the library as a very useful and rare learning centre? Besides these, the study has explained how at the end of the project, it has been increased capacities of the local NGOs, DMCs (Disaster Management Committees) and community people to face the disaster.

## **The Purpose of the Study**

Sharing the achieved outcomes with the relevant bodies of the government is one of the important mottos of the study. Its' best practices should be used in developing strategy for DRR in Bangladesh. Introduce this innovative idea with other organizations who are working for saving lives and livelihoods of the vulnerable people in the coastal belt of Bangladesh.

## **Baseline**

As per record of the Disaster Management Ministry, it has been found that during flood in 2014 and 2016, the DEMLIC worked like a shelter centre to the affected people and the library staffs played role like a rescue team in the community. Using the mechanisms of the library project, people could early inform about any upcoming disaster. Accordingly, they could take precaution to protect their lives and livestock's instantly. Experienced from the early projects of different NGOs and Government Organizations, it has been found that installation of library in seven vulnerable areas can contribute a lot instead of other programmes.

## **Beneficiary selection criteria and deliverables**

Research team worked first for selecting the beneficiaries of the 7 upazilas. They selected the people who live in highly vulnerable zones to climatic hazards and disaster. They also selected most vulnerable and extreme poor households (average 35% of total population) including female-headed households, individuals with disabilities, ethnic minorities, landless etc. in highly vulnerable areas to disasters.

## **Deliverables**

DEMLIC built capacity on Knowledge and skill through community based session. It ensured assess into community risk to identify local risk, risk factor and risk reduction plan. With an innovative approach of library it has promoted viable options at local level for learning and dissemination of technologies. To create awareness through reading habits, folk songs, drama, visual aids, different interesting collections and motivational short documentaries were the prime responsibility of the DEMLIC. Finally it has started the advocacy for citizen movement to protect the people from disaster.

## **Methodology**

The study has applied mixed (quantitative and qualitative) method for collecting data. Analyzing the livelihoods of the people in the research area, different techniques such as KII (Key Informants Information); FGD (Focus Group Discussion); AI (Appreciative Inquiry); PI (Personal Interviews) etc. were used based on the best suit application process. Secondary data has been collected through pin-pointed review of the documentation related with the project. In secondary data analysis, special emphasis has been given on project objectives, outputs, activities and the plan of action not only the DEMLIC but also other relevant projects implemented by different NGOs. Data have also been collected from the Bangladesh Bureau of Statistics (BBS). Its beneficiary selection process was completed through a participatory way. Besides these, consultations with the disaster experts in different NGOs who are working in the coastal belt have also been taken into account to select the beneficiaries. Some organizations who work there since long, their need assessment report have been scrutinized carefully to select the targeted people as well. With a view to make the research more authentic, 20 enumerators have collected primary data from January to June 2013 through field visit, direct personal interview, focus group discussion and yard meeting (meeting at the open space of the beneficiaries' residence).

Table-1: Checklists for extricating the major findings during FGD with the affected people especially with the fishermen. Total 35 fishermen were asked and gathered the responses:

Questions	Responses
What kinds of disaster you are facing frequently?	1). Seasonal floods and super cyclones;
What kinds of challenges you face in most of the cases?	2) Crops and walking ways gone under water; no sufficient boat so we cannot move for work; houses are water logged; closed small trading; unclean drinking water; sanitation problem; belongings go wet; shelter problem; cattle and goats die; children cannot go to school.
What kinds of support DEMLIC provides for you before, during and after disaster?	3. DEMLIC prepares small bamboo pool for children's schooling; It organizes campaign for creating awareness; It provides information support in our community people; it circulates weather forecasting through hand-mike; It gives us knowledge about water and sanitation; Provides training on DRR.

## Findings

Research team has gathered primary data from various sources that have been considered to achieve the findings. With a view to extricate the targeted results, DEMLIC staffs responses have been tabulated. All answers have been marked in “yes and “no” respectively except for question-3 (Category of Disaster). Please see table-2. Thus the study forms its basis of the findings through tabulating the respondent's responses. Not only used the structured questionnaire and set checklist for FGDs, the researcher also has taken into account different techniques to get proper findings of the study.

Table-2: Data analysis and outline of the findings

Q 1.Name of the Lib./Info. Centre	DEMLIC-1 Dharma pasha in Sunamgonj	DEMLIC-2 Khaliyazuri in Netrokona	DEMLIC-3 Kazipur in Sirajgonj	DEMLIC-4 Daulatpur in Kustia	DEMLI C- 5 Burgun a Sadar	DEMLIC-6 Patharghata in Burguna	DEMLIC-7 Satkhira Sadar	
Q2.Faced Disaster	Y	N	Y	Y	Y	N	N	Y=43% N=57%
Q3.Category of disaster	seasonal floods and water logging	Flash flood	Seasona l floods	Tidal floods	Super cyclone sidr	Super cyclone sidr	Super cyclone Aila	
Q4.Disaster Plan	N/R	N	Y	Y	N/R	N	N/R	Y=29% N=29%
Q5.Librarians Knowledge about disaster	Y	N	Y	Y	Y	N	Y	Y=7 1% N=2 9%
Q6.Budget	Y	N	Y	Y	Y	Y	N	Y=71% N=29%
Q7.Training for library staffs	Y	N	Y	Y	N	N	N	Y=43% N=57%



Q8.working attitude during disaster	N	N	N	N	N	N	N	Y=0% N=100%
Q9.Support parent institute	N	N	N	N	N	N	N	Y=0% N=100%
Q10 .Protect collections & Restore services	N	N	N	N	N	N	N	Y=0% N=100%
Q11. Rescue & co worker	N	N	N	N	N	N	N	Y=0% N=100%
Q12. Disburse aid, find shelter Work with local admin.	N	N	N	N	N	Y	N	Y=14% N=86%
Q13. Restoration of water etc.	Y	Y	Y	N	N	N	N	Y=43% N=57%
Q14. Spread Awareness	Y	N	N	N	N	N	N	Y=86% N=14%
Q15. Act as focal agency To share information	Y	Y	Y	Y	Y	Y	Y	Y=100% N=0%
Q16. Prepare Documentations	Y	Y	Y	Y	Y	Y	Y	N=100% Y=0%
Q17. Prepare knowledge base	N	Y	Y	Y	N	Y	Y	N=14% Y=86%

## Analysis-2

It has been found that 43% (3 DEMLICs) faced disasters in the form of tidal cyclone and seasonal floods where as 57% did not face any such problems. 2 of these 3 DEMLICs faced seasonal floods which percentages are 67. 1 DEMLIC (33%) encountered flood because of heavy rains. However, out of 7 DEMLICs 29% faced floods and 14% centres encountered tropical cyclone and flashfloods making it to 43% DEMLICs which have faced disasters.

## Analysis-4-6

4. It has been found in the analysis 4-6 that only 29% (2 DEMLICs) have their own disaster management plan but their community people are not aware about this plan at all.
5. It is needed to mention here that significant number of DEMLIC staffs (42%) of the total Respondents skipped the question of having any disaster management plan. On the other hand, the staff of 2 DEMLICs (29%) responded that they have disaster management plan and community people are aware about it. Another 29% responded negatively for having any disaster plan.
6. Positive responses have been received from 2 DEMLICs about the availability of budget to meet any disaster which makes only 29% where as 71% of the total DEMLICs didn't

have any budget to encounter the challenges. One centre responded that it has little allocation to control flash flood only.

If there is any huge fund needed, DEMLIC then assess the need of the people and send proposal to the local government and other GO/s and NGOs for sanction the budget. Finally with the approval of the Ministry of Disaster Management, the budget allocation comes through DEMLIC.

7. In order to counter any disaster, 57% agreed that DEMLICs provide special training with proper instructions and briefing frequently. One centre provides first aid training to its staff. However, 43% respondent's opinion differed that there is no training and demonstration to face any disaster and make them alert through sending the common messages.
8. 100% DEMLICs agreed to perform any kinds of extra role during any emergency in spite of having their regular job.
9. All DEMLICs have given positive opinion to assist their core organization where they work. They were promptly gather and provide the information on their website or internal notice board either electronically or manually with a view to keep update their members of the DEMLICs.
10. All staffs of 100 DEMLICs are capable to save their resources and restore their services for the convenient of the community people.
11. At the time of emergency, 100% DEMLICs are ready to exchange information in order to protect self and community people as well.
12. 100% respondents agree to work as volunteer with the community people.
13. The disaster management unit in each upazilla under Local Government division comes forward to help the disaster victims. They are disbursing aid/relief, medicine, cloths and find them shelter. They are also providing right information to the genuine disaster victims about various facilities and schemes introduced by GOs and NGOs. 86% of the respondents have given opinion that they are ready to work with local administration. On the other hand, 14% of the respondents not agree to perform this kind of responsibility.
14. 57% respondents (who are maximum in number) have no any objection to work with local government, agricultural and public health department to protect the plants, livestock's and the crops as well. It helps in controlling disease by means of distributing medicines and supplying pure drinking water whereas 43% were not ready to take up this duty.
15. 86% respondents shown positive attitude on creating awareness among the people of the disaster affected community through boat/mobile library services. Most of them preferred to create awareness delivering lectures, presentations and workshops. It has been found that through proper information dissemination, the damaged occurred by the disaster reduced significantly. A very few number of respondents (14%) have differed with it.

16. 100% respondents agreed that DEMLIC acts as a focal point for networking and dissemination information with other allied organizations and helps them in restoring their services.
17. 100 % responded to prepare timely reports for the government departments and complete need assessment of damage with the help of an expert where he/she will clearly mention what kind of relief and aid would be required in the affected area.
18. 86% respondents have given emphasis on creating a knowledge-base society regarding any emergency which need to be shared on the web for quick consultation with a greater interest of the community people while a few number of respondent (only 14%) showed negative attitude with this kind of voluntary task during any disaster.

## Findings of the individual Training Need Assessment (TNA) through Questionnaires

### *DEMLIC Staff:*

A total of 59 DEMLIC staff members were interviewed through physical visits and individual questionnaire at their locations. Among the interview many of the questions were to check their knowledge base or understanding level of different DRR aspects. Other questions were to determine their disaster related understanding level by self assessment and recommendations/ suggestions as well. Table-3 reflects their level of understanding about natural disasters.

Table-3: Findings from the knowledge base/understanding level checking were as follows:

Understanding	Cannot say/ wrong answer	Poor answer	Partially correct	Correct answer	Total (n)
Natural disaster	5%	39%	38%	18%	59
Disaster risk	31%	21%	10%	38%	59
Disaster risk reduction	26%	21%	38%	15%	59
Disaster vulnerability	38%	21%	21%	20%	59
Effect of disaster	18%	31%	26%	25%	59
Disaster driving forces	72%	15%	13%	0%	59
Community mobilization	28%	34%	33%	5%	59
Early warning system	18%	31%	46%	5%	59
Climate change	44%	31%	18%	7%	59
UDMC's (Upazilla Disaster Management Committee) responsibilities	46%	8%	28%	18%	59

DEMLIC staff suggested training topics including but not limited to: disaster, different type of disaster, climate & disaster, disaster impact, disaster risk reduction and management, activities before disaster, activities during disaster, activities after disaster, UDMC responsibilities, UZDMC responsibilities, coordination & communication disaster risk reduction, disaster preparedness, gender and disaster, disaster signals, child marriage, dowry, human rights, disaster mitigation planning, food preservation during disaster, food preservation for lean season, crop diversification, primary health care during disaster.

***Other recommendation and suggestion related to training were:***

- 38% of the participants from DEMLIC reported that they have had disaster related training
- 79% participants from DEMLIC and Local NGOs stands on participatory training methodology that to be incorporated in the training module

## **Findings Interpretation**

Installation of DEMLICs in each disaster-prone areas of Bangladesh was good initiative. No doubt that it has been working for the wellbeing of the community people. From the above analysis, it is found that 100% of the respondents are getting ready to work dedicatedly to help their parent organizations. They have no any objection to disseminate the disaster related information to local media. Around 86% (majority in number) respondents interest to work with Upazila Disaster Management committees to assist the long-term relief, rehabilitation and recovery project from emergency. Special budgetary provisions are mandatory for helping the disaster affected people. Without finance, immediate action to tackle the emergency is impossible. Apart from these, provision of training and demonstrations are essential for the working professionals to save themselves, their resources and the community people as well. It is evident from the analysis that only 29% of the respondents interested to have a disaster plan in their DEMLICs whereas majority (71%) of the respondents are not even aware about it.

## **Collaboration with Government Organizations**

***DEMLIC worked with the local government as a training centre***

It facilitates short-term and long term training program on disaster related issues regularly. It increases the efficiency of the Union and Pourashava DMCs by disseminating local warning signals, risk reduction techniques, rescue and recovery strategies and so on. DEMLIC also maintains liaise among the development agencies and local service providers. It takes decision about implementation of the action plan for DRR as well as review the progress of the implementation. Finally, DEMLICs become more popular to the community people as a capacity building organizations. As a result, the community people can forecast warnings related to any natural hazards in the right time and also can inform vulnerable people about their roles and responsibilities for saving their lives and livelihoods from disaster. Table-4 indicated how DEMLICs provided training in association with GOs/NGOs.

Table-4: Upazila-wise DEMLIC trained-up the following local NGOs within the project period:

Upazila	Organization/s	No of Beneficiaries	Training provided	Duration of the training
DEMLIC-1 Dharmapasha	ASOD (Assistance for Social Organization and Development) <a href="http://www.ngof.org/nrc/wdb/ngodetail.php?id=004">http://www.ngof.org/nrc/wdb/ngodetail.php?id=004</a>	150 community people including religious leaders and CBO leaders	<ul style="list-style-type: none"> <li>Contingency plan during disaster</li> <li>Awareness training on DRR</li> <li>Staff development training</li> </ul>	2 weeks and 20 people per batch
DEMLIC-2 Khaliazuri	BOSS (NGO)	70 extreme poor people of Haor	<ul style="list-style-type: none"> <li>Protecting from flashfloods</li> <li>Preparing protection wall</li> <li>Awareness about early warning systems</li> </ul>	01 week and 35 people per batch
DEMLIC-3 Kazipur	JSKS <a href="http://jsksbd.org/about/">http://jsksbd.org/about/</a>	50 people including 12 Union DMCs and some volunteers	<ul style="list-style-type: none"> <li>Awareness on seasonal floods</li> <li>Knowledge sharing about River erosion and safety measures</li> </ul>	Two weeks and 25 people per batch
DEMLIC-4 Daulatpur	OVA(Own Village Advancement)	50 people Including pourishova leaders	<ul style="list-style-type: none"> <li>Awareness on protecting livestock from river erosion</li> <li>Training on chaining livelihood option during flood</li> <li>Training on distribution of relief</li> <li>Training on women rights and gender issue</li> </ul>	Two weeks and 25 people per batch
DEMLIC-5 Burguna	Songram <a href="https://www.sangramngo.org/">https://www.sangramngo.org/</a>	30 people including CBOs (community based organizations) women	<ul style="list-style-type: none"> <li>Training on food security during disaster</li> <li>Awareness on reducing risk through early warning systems</li> </ul>	01 week
DEMLIC-6 Patharghata	Shushilan <a href="https://shushilan.org/">https://shushilan.org/</a>	100 people including fishermen and farmers	<ul style="list-style-type: none"> <li>Training on early warning systems</li> <li>Training on protecting boats and nets before disaster</li> <li>Training on working in a group</li> </ul>	4 weeks and 25 people per batch
DEMLIC-7 Satkhira	JJS Jagrata Juba Shangha <a href="http://www.jjsbangladesh.org/">http://www.jjsbangladesh.org/</a>	100 people including community women and local government staffs	<ul style="list-style-type: none"> <li>Training on Knowledge sharing with AILA affected people</li> <li>Training on increasing IGAs (Income generating Activities)</li> </ul>	4 weeks and 25 people per batch

Table-4 shows that DEMLIC worked with 7 local NGOs and trained up 550 people including Government bodies. It also reveals the topic of the training programs including duration. All training has been done within the project period. Besides these, DEMLIC arranged many need-based emergency training for the community people as well. Out of 7 local NGOs, 5 had their own websites. Two NGOs namely OVA and BOSS had no website on that time.

### ***DEMLIC worked as a Learning Centre***

Through DEMLIC learning section, community people could learn to determine specific safe centre/shelter where they should go at the time of need. This section of the library helped to design plans with a view to rescue the affected people and started quick response with primary

relief operation. DEMLIC also arranged the different learning rehearsals on the dissemination techniques of warning signals/forecasts.

Last but not the least; DEMLIC arranged an experience sharing session with the participation of relevant institutions and individuals on their learning from risks and after risks.

### ***DEMLIC as an Information Dissemination centre***

The prime objective of the information dissemination centre is to deliver right information at the right time to the right way to its right user. DEMLIC follows this objective by disseminating warning and security alert when needed for its community people. It helps vulnerable people to evacuate them quickly from the risky zone based on the evacuate plan. DEMLIC engages different organizations, volunteers and the community people in the early warning systems providing training and other demonstrative activities. Even it provides data and statistics to the other workers who are working on disaster management.

### **Other findings collected from the experience of the affected people during direct personal interview DRR (Disaster Risk Reduction)**

There is a lack of ICT-based disaster management organizations and a very poor level of awareness is the main factors for rising death tolls and increasing vulnerability. Unawareness among the coastal people about the cyclone and the huge water surge is very common. Even after informing about the early warning, it is a common belief among the people that nothing will be happened. As consequences, casualty and damage increased a lot. Out of 7 Upazillas there were 03 cyclone shelter centres available for the three Lacs vulnerable people. In response to a question during KII, UNO (Upazilla Executive Officer) of Teknaf said that the existing number of shelter centres are very insufficient and government have plan to build more cyclone centres considering the population of the coastal zone. Local elites, NGOs, Community leaders and the donors can also come forward to build the shelter centres for the convenient of the vulnerable people.

During interview with the local people, the research team could know that there is only one committee namely UDMC (Union Disaster Management Committee) formed by the Local Government in each upazilla who are working for disaster management. But it is basically exists in pen and paper only practically it is not active.

Preparedness effects water situation a lot. The research team found that there is no pure drinking water plant even in the district level. Whereas access to pure drinking water is the right of the citizen and during emergency it is mandatory for protecting people from various diseases. Some of the affected people noticed that the embankment works like a life-saver to them but as these have built very poorly and maintained improperly, so question arises about its sustainability. These are the causes of high fatality rate, damage and losses as well.

## Progress

### ***Increased capacity of 7 local NGOs and 20 Disaster Management Committees (7 Upazila level and 49 Union Parishad level) on disaster risk reduction measures***

DEMLIC was the focal point that facilitated initial training on Disaster Risk Reduction (DRR) to ensure common understanding of the approach, concepts and tools for this specific action to all community people involved in the programme. As a part of the awareness programme ‘disseminating general information’ and ‘information for lives’ session were conducted. The Disaster Management Committees have been re- activated and assisted to conduct hazard and risk analysis of their areas and trained to carry out their roles and responsibilities as DMC members. These included followings:

- increased awareness about risks and provide information to the community on survival during disasters
- ensured disaster risk reduction following plans;
- prepared Local Disaster Management Actions Plans for protecting people & their assets and increase their capacities to cope, withstand and recover from impacts; and
- treated Information Centre as Control Room for coordination of activities related to evacuation, rescue and relief.

### ***Increased capacities of the target communities to withstand, respond to, and recover from the impact of climate related hazards by a number of preparedness measures***

DEMLIC has enhanced the communities’ capacity to withstand, respond and recover from the impact of climatic hazards through increased awareness on disaster risk reduction measures, improved Early Warning Systems at local level and improved access to social protection schemes. DMCs and local NGOs have motivated community representatives/volunteers and influential leaders including imams, teachers, women’s, micro credit group leaders and local elites to support the project and help in awareness raising activities.

DMCs with participation of the community have been guided by DEMLIC with view to plan for establishing appropriate preparedness interventions for specific hazards. The preparedness measures identified as priority during the field assessments in 2014 were i) improved the Early Warning Systems at community level and ii) improved access to social protection programmes for the extreme poor and the highly vulnerable people.

### ***Assessment of the existing mitigation measures and identification of most appropriate technology for specific hazards***

The study has examined the information on local knowledge and practices with respect to existing mitigation measures. It also assessed how existing practices can be improved or strengthened to ensure that recommended mitigation technologies are appropriate to local needs and resources available. Special focus have been given on flash flood protection measures,

cropping pattern in flash and seasonal floods, tree species in flash and seasonal floods and shelters in flash and seasonal floods and cyclones.

***Community-based DRR initiatives are documented and lessons learnt are disseminated at local, national and international forum for advocacy***

The project experiences have been shared with other relevant organizations at local level. The documentation has been included in the baseline study, mid-term review and final evaluation as well as training modules, communications materials, institutional capacity assessments and progress reports technical reviews.

## **Results Achieved**

Considering the geographical context of Bangladesh, the findings of this study is very inevitable. Before developing the concept note of the project, the research team had initiated a baseline survey to assess the capacity of the community people. They found that most of the people were not aware about DRR but after the inception of DEMLIC, countrywide awareness has been created amongst the people on disaster management. Besides these, the information literacy rate particularly on disaster risk reduction issues has been increased. Connecting with DEMLIC, the confidence level of the vulnerable people in the coastal zone has been increased in a very significant way. In comparison with past, coastal people are now very conscious about DRR. No doubt, these are the impact of DEMLIC.

## **Case Study**

***Saleha Determined Not to Ignore Cyclone Warning Again***

Both Saleha and her husband Abdul Huq are engaged in sweeper's profession. In fact, many of the poorest people of *Malipara sluice ghat* area of *Taltoli bondor* earn their livelihood by this profession. Saleha is among the poorest inhabitants who received training from DEMLIC after the cyclone Sidr.



Before Sidr, Saleha and her husband Abdul Huq ignore the signal as they had an assumption that there will be no storm at the date when signal is declared. Their house was in a vulnerable area, near the canal which was struck by great blow of cyclone. The canal has a direct connection with the river. She had a terrible experience during the storm. She stated, "We will never ignore the warning signal again."

Saleha has a great mental satisfaction as she received proper training on DRR from DEMIC



Saleha had two daughters but no son. That's why her husband always blamed her. After receiving the gender training from DEMLIC, her husband becomes more tolerant to her. One of her daughter study at grade V and another has already got married. She was unable to properly educate her children due to poverty. After receiving the training she has a great mental satisfaction. She can peacefully plan for her future. She has a plan to possess some cow and goats, although she does not have enough money to buy them. She also envisioned her husband to having his own shop. DEMLIC was the basic foundation to attain her dreams.

## Conclusion

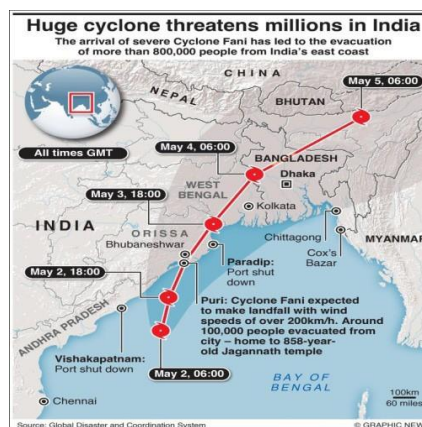
The study has focused the influences of DEMLIC to manage natural disasters. DEMLIC explores that besides the routine job, library and information professionals can play a vital role for disaster risk reduction. It can manage the emergencies disseminating early information/warning to the community people using various components of ICTs. Due to its achieved outcomes, the study becomes very popular to the coastal people. DEMLICs were highly regarded to its all stakeholders because of its innovative approach. It has created an example to the people of Bangladesh that libraries can change the lives and livelihoods of the coastal people. In spite of having many challenges, the study has achieved significant progress. The extreme poor people in the disaster prone areas think themselves as marginalised people in terms of their livelihoods, health and rights. They are discriminated in various ways. But DEMLIC brought them back towards the mainstreaming by establishing their rights and entitlements as a citizen of Bangladesh. Through its realistic approach, DEMLIC becomes successful to change the attitude of the people. In future, if the study gets the opportunity to share its best practices to the relevant bodies at national level, it would be an example for developing a comprehensive disaster management strategy in Bangladesh.

## Special Note

On 3rd May 2019, while writing the first draft of this paper, the tropical cyclonic storm named 'Fani' is roaring in the Bay of Bengal. See below a short note about it.

Fani has set to hit Bangladesh at the evening on 3rd May, 2019. Already it has attacked Odisha, India. There are 13 districts with a population of approximately 10 lacs are guessed to be affected by its attack. Government started evacuation process to keep them in safer places to reduce the casualties. It is likely to be stricken Bangladesh hitting 13000 sq-km coastal belts with a population of 18 millions. Please see the path of the cyclone (Dhaka Tribune, 2019).

It is needed to mention here that right now DEMLICs and other voluntary organizations are working together for DRR in their upazillas. Over phone the author has collected



updated data from them. The library staffs are now very busy to warn the people and bring them back to the shelter centre. They are disseminating right information to the vulnerable people about ‘what should be done and what shouldn’t be done’ during and after attacks. In response to a question, 7 DEMLIC authorities has shown their confidence to reduce the risks. Therefore, people of Bangladesh lives in coastal belt are not scared at all if ‘Fani’ hits them. DEMLIC taught them the techniques to face this sort of disaster.

## References

1. Hossain, A., *Expectations of new generation satellites for hazards monitoring*, BMD (Bangladesh Meteorological Department) Proceedings of the 6<sup>th</sup> Asia/Oceania Metrological Satellite Conference held in 9-13 November, 2015, Tokyo, Japan, 81-88p.
2. Khan, A. & Jonsson, G., *Functionality Assessment of Union Disaster Management*. A Report of the Comprehensive Disaster Management Programme (CDMP II), 2013. UNDP-Bangladesh, pp-17-29.
3. IRIN News, *Bangladesh: Cyclone AILA victims still in need*. A need assessment report by IRIN News Agency on 6 July 2009. Retrieve from the site: [www.reliefweb.int/report/bangladesh](http://www.reliefweb.int/report/bangladesh) Retrieved date: 20 August, 2018.
4. MoDM Report, *Climate Protection and Development: Budget Report, 2017-18*. Report published by the Ministry of Disaster Management. Website: <https://reliefweb.int/report/bangladesh/climate-protection-and-development-budget-report-2017-18>. Retrieved dated: 3 July, 2018.
5. The Dhaka Tribune. Cyclone Fani now 445km southwest off Mongla port. A weather updated report written by Mizanur Rahman and Bilkis Irani on 3<sup>rd</sup> May 2019. Published in The Dhaka Tribute. Retrieved from the site:<https://www.dhakatribune.com> on 3<sup>rd</sup> May, 2019.
6. UNFPA Report, *Disaster Risk Reduction in Bangladesh: The Ways and Means*. An Annual report, published by UNFPA, Dhaka, Bangladesh, pp-. 33-46, May, 2017.

# Ontology-Based Process Planning for Manufacturing, Production, and Assembly

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## Keywords

Ontology, Upper Ontology, Domain Ontology, Production Planning, Manufacturing, Production, Assembly, Planning

## Abstract

In currently emerging **Intelligent Production Environments (IPE)** and **Industry 4.0** the manufacturing of new products takes place in several steps and locations, possibly distributed all over over the world. Companies involved in such productions act in highly competitive global markets and always have to find new ways to, e.g., cut costs by changing to the best providers, or enabling, e.g., tax savings, to stay competitive. This can only be achieved by using the fastest, most effective, efficient, and flexible distributed collaborative production processes. In this context, a **Collaborative Adaptive Production Process Planning (CAPP)** can be supported by semantic product data management approaches enabling production-knowledge representation; utilization, curation, and archival as well as knowledge sharing, access, and reuse in many flexible and efficient ways. To support such scenarios, semantic representations of production knowledge integrated into a machine-readable process formalization is a key enabling factor for sharing such explicit knowledge resources in cloud-based knowledge repositories. We will introduce such a method and provide a corresponding prototypical Proof-of-Concept implementation called **Knowledge-Based Production Planning (KPP)**.

KPP is based on so-called **Function Block (FB)** Production Knowledge Domain Models, serving as a high-level planning-process knowledge-resource template and the representation of knowledge. Web- and Cloud-based tool suites which are based on process-oriented semantic knowledge-representation methodologies, such as, e.g., **Process-oriented Knowledge-based Innovation Management** (German: Wissens-basiertes Prozess-orientiertes Innovations Management, **WPIM**) can satisfy the requirements of semantic representation, integration, and processing. This means, WPIM can represent such planning processes and their knowledge resources in a machine-readable semantic representation based on ontologies. In this way, it can

not only be used in production planning but also, e.g., in *Collaborative Manufacturing Change Management (CMCM)* as well as, e.g., *Collaborative Assembly-, Logistics- and Layout Planning (CALLP)* both building on the results of CAPP. Therefore, a collaborative planning and optimization from mass to lot-size one production in a machine readable and processable representation will be possible. On the other hand, KPP knowledge can be shared to support other types of innovation, collaboration, and co-creation within a cloud-based semantic knowledge repository.

We will also demonstrate the usefulness and interoperability of ontologies within a prototypical Proof-of-Concept implementation of KPP. This includes an integrated visually direct-manipulative production process editor representing production processes semantically and based on manufacturing ontologies. Moreover, we will illustrate the features of this prototype and outline the underlying KPP Mediator Architecture including a user-friendly production knowledge query library based on KPP and its ontologies.

## Introduction, Motivation and Problem Statement

*'Product Lifecycle Planning (PLP)* deals with *Process Planning for Products and Production (PP4PP)* as well as *Product and Production Knowledge (PPK)* for the whole Product Lifecycle even before and after the product exists.' [Tobias Vogel, 2018].

Aiming at supporting CAPP, CMCM, CALLP, PLP, PP4PP, and PPK our semantic process representation approach is building on applying the *WPIM Ontology* [2] as an *Upper Process and Resources Ontology*. Initially the WPIM ontology was rolled out in the knowledge domain of innovation processes and extended by a first innovation knowledge domain ontology. Using WPIM as an upper ontology for representing manufacturing processes in relevant industrial knowledge domains will now continuously be further extended, first of all to support production and production planning as part of Industry 4.0 applications. For these new process types, currently specific knowledge domain ontologies are defined, specified, and formally represented in RDF, RDF-S, and later where needed also in OWL. Furthermore, the use of WPIM as an Upper Ontology is the starting point to inherit the available WPIM concepts from the WPIM upper process ontology to its manufacturing knowledge domain ontologies. Thus, systematic domain-specific extensions of the WPIM ontology are currently developed with the goal of ultimately modeling one integrated set of ontologies for the entire product lifecycle with its planning and production processes.

The general concept of developing an knowledge-based and process-oriented CAPP support by using the WPIM method as a basis was initially proposed in [1]. The WPIM approach offers the possibility of modeling and representing, e.g., innovation processes in a machine-readable semantic format and furthermore enables annotating the process representation in a semantic way with further planning information, content, data, and other types of planning- as well as execution-oriented knowledge resources. This whole semantic representation structure can then later be accessed and utilized by means of semantic queries. However, so far WPIM has only been applied in domains like component design and distributed production planning. It also

includes **Product Life Cycle Management (PLM)** support but it has not yet been practically applied in the knowledge domain of CAPP.

Wang et al., have introduced a method for representing web-based **Distributed Process Planning (DPP)** activities in [3], [4], and [5] as a basis for establishing CAPP support and in parallel to the development of the WPIM semantic process representation method. In the following we will use slightly adapted excerpts from [3] to introduce the necessary concepts and rationale of the DPP method as a building block for semantic CAPP support. The DPP method includes also the concepts of **Meta Function Blocks (MFBs)**, **Execution Function Blocks (EFBs)** and **Operation Function Blocks (OFBs)**.

Furthermore, Helgason et al. explain in [6] that “Today, machining-feature based approaches combined with **Artificial Intelligence (AI)** based methods are the popular choices for process planners”. This approach is already based on a DPP modeling-method but does not yet support machine-readability and semantic interoperability of such models as it could be achieved by utilizing representations as available in nowadays semantic web technologies and as e.g., supported by WPIM. Thus, while the proposed DPP approach is very useful and valid in terms of representing the product and machining features within MFBs, EFBs, and OFBs it does nevertheless not yet support semantic-web based cross-organizational and cross-domain knowledge sharing. This holds especially true for the areas of CMCM as a means of optimizing conceptually planned component production processes and at the same time enabling them to be re-used as CALLP knowledge representations.

However, to make such knowledge more widely available, for example, to be shared in collaborations of SMEs within CAPP, CMCM, and CALLP activities. Furthermore, the relevant CMCM and ALLP knowledge to be integrated with the machine-readable CAPP knowledge representations is currently not available in a machine-readable semantic representation at all.

Furthermore, the interoperability of such a CMCM and CALLP knowledge representation with technologies of the semantic-web and therefore with other applications and tools, like e.g., from the area of AI and **Machine Learning (ML)**, cannot easily be achieved.

Moreover, this CMCM and CALLP knowledge cannot easily be automatically shared, managed, accessed, exchanged, and re-used within collaborations that take advantage of cloud-based semantic repositories of CAPP-, CMCM-, and CALLP-knowledge. Besides, it is aiming at optimizing a conceptual CAPP instance for component production to also include CALLP and its optimization, ideally beyond planning domains and across organizational borders. If such a process-oriented and semantic integration of CAPP- and CALLP support would exist and would be based on a CMCM knowledge representation utilizing semantic-web technologies, it could be very well supported by other semantic-web enabled technologies and in this way become interoperable.

Therefore, an integration of cloud-based semantic CAPP and CMCM knowledge repositories with other e.g., AI, CAPP-, and MCM-support technologies could be achieved by means of integrating them based on the semantic web software development paradigm.

In consequence, this insight requires the application of semantic technologies to knowledge sharing and mediation in CAPP and CMCM to support overall CALLP processes. In this way process-oriented semantic representations of CAPP knowledge in which the **Product Features (PFs)** and **Machining Features (MFs)** are formalized within MFBs, EFBs and OFBs like domain-specific representations i.e., domain models of the DPP knowledge domain could support not only the CAPP knowledge domain but also the CMCM knowledge domain and the re-use of the planning and change management knowledge in the CALLP scenario at the same time.

Based on our preceding paper "Supporting Production Planning through Semantic Mediation of Processing Functionality" [31], we have already been describing in detail the application and implementation of the necessary DPP and semantic-web integration approach supporting CAPP by means of KPP within a so-called **Mediator Architecture (MA)** [14]. Such MAs are typical for distributed implementations of semantic-web repositories and are solving semantic integration challenges as well as integrating several local knowledge sources into a global, potentially cloud-based, semantic repository. We have also already explained that this can then be considered a semantic and cloud-based CAPP-knowledge repository which has been implemented in a very (technologically) open and distributed way. From the point of view of WPIM, we have also demonstrated that the semantic domain models for representing MFBs, EFBs and OFBs can be managed and integrated by a semantic integration in this MA-based repository with the existing WPIM domain concepts of **WPIM-Master Processes**, **-Process Instances**, **-Tasks** and **-Activities** as underlying interoperability and integration elements. Thus, it supports the semantic integration of WPIM- and DPP-based knowledge modeling, as well as the semantic representation of DPP knowledge to become available as a knowledge-based support to CAPP activities. We are now reviewing this result in the light of other related work supporting CALLP interoperability as well as possible integrations with CMCM and especially CALLP features.

To support this analysis of related work, we will start around currently emerging international standards aiming at supporting CAPP and at the same time aiming at supporting CMCM. Only recently the ProSTEP iViP Association [29] published a White Paper, called "Modern Production Planning Processes" [27]. This Paper is based on the currently emerging ISO/DIS 18828 Standard [30] and aims at representing an end-to-end reference process that can be adapted to individual needs. This formal process, so called **Reference Planning Process (RPP)**, is a recommendation and should be used in this paper as a basis for a proof of concept implementation evaluating and validating our KPP-based CAPP support approach as a possible reference implementation of RPP.

To start with and referring to our previous papers [31] and [32], we will revisit very briefly and in summary the FB concept as well as the related concept of MFBs, EFBs, and OFBs. Furthermore, the State of the Art of the FB-based production planning models and the proposed DPP method will be revisited. We briefly describe the State of the Art w.r.t. Process Ontologies and the WPIM-Ontology as well as the basics of the mediator technology. In the following modelling chapter of this paper, we will carry out a mapping of the WPIM ontology as an upper ontology to the method of KPP and its ontologies. This semantic mapping approach combines

the advantages of these ontologies in a hybrid approach that can be utilized as a starting point for an integrated manufacturing process ontology in the three level DPP mediation process described in our previous paper [31]. In the following use case section, we are going to discuss the manufacturing ontologies of the KPP method w.r.t. its capability to support flexible production planning with semantic production planning process representation ontologies. This takes place in order to semantically wrap, mediate, and integrate the overall DPP planning processes including its integration with the overall RPP. In the following, we will demonstrate our prototypical implementations of the KPP application with an integrated visually direct-manipulative process editor based on our KPP mediator architecture with a semantic integration including a query library based on the KPP ontology. Finally, conclusions and an outline of future work are provided.

## State of the Art and analysis

Documents in the Web are optimized for human readability and therefore only weakly structured. In addition, the Semantic Web wants to solve the problem that machines can not make clear semantic relationships between documents. The Semantic Web is not a substitution for the today's Web but an extension to support the web's further development in the semantic dimension.

### *Semantic Web, Ontologies and Technologies*

For the Semantic Web, additional information is added to content and information resources by means of adding semantic representation elements to documents. Using this semantic representation information, machines can establish semantic relationships between documents and their contents. This is not limited to simple content description and annotation, but includes, e.g. hierarchical, domain-related or data type-relevant enrichments. **Ontologies** formalize the real world in certain terms (so-called **Entities**) and relate them to one another (so-called **Relations**). Thus, ontologies are a basic building block of the semantic web. In addition, they help to separate **Knowledge Domains** from each other. This makes it easier to, e.g., distinguish between ambiguities from different knowledge domains. This means, that involved actors know about their common, i.e., shared and knowledge-domain oriented vocabulary. Ultimately, the formal representation of the entire world is possible only with considerable effort. To define an ontology, markup-based description languages are used. In the following, we explain some of the relevant description languages.

The *Extensible Markup Language (XML)* describes how additional information is included in a document. XML is a markup language, because it makes no statements about what information is included and how it is linked. In an XML document, tags (so-called **Markups**) are placed in the text and separated by angle brackets. This makes it possible for a machine to read additional information from the text and filter out the tags in human presentation.

*Resource Description Framework (RDF)* was developed to formulate general rules for machine-readable semantic information in documents. Such a statement about data is expressed

in **RDF Triples** consisting of **Subject, Predicate and Object (SPO Triples)**. A Subject describes a resource that is related to an Object through a Predicate. The Predicate itself also represents a resource while an Object is a resource or data value. RDF Triples are also encoded in XML-based documents to facilitate the exchange of formal descriptions.

**RDF Schema (RDF-S)** extends **RDF** with the ability to classify terms into classes and subclasses, as well as map properties and subproperties. With these universal representation mechanisms of **RDF and RDF-S**, semantic conclusions can now be drawn from the data, e.g., by means of automatic reasoning. With XML, RDF, RDF-S and related languages ontologies can now be formally mapped, exchanged and machine-interpreted (parsed). However, to access these semantic representations, an efficient semantic query language is needed.

**SPARQL Protocol And RDF Query Language (SPARQL)** serves as a query language for databases from multiple RDF and RDF-S files. SPARQL is similar to other query languages and also uses SPO-Triples to formulate queries.

**Process Specification Language (PSL, ISO 18629-1)** [13] is a process ontology developed for the formal description and modeling of basic manufacturing, engineering and business processes. The ontology was developed at the National Institute of Standards and Technology and has been approved as international standard ISO 18629. This ontology provides a vocabulary of classes and relations for concepts at the ground level of event-instances, object-instances, and timepoints.

**Business Process Model and Notation (BPMN)** [34] is a graphical representation for specifying business processes in a business process model. It is standardized for process modeling by the **Object Management Group (OMG)** [35] and can be encoded in a machine readable way based on XML.

### **Process-oriented Knowledge-based Innovation Management**

**“Process-oriented Knowledge-based Innovation Management”** is the english translation for German: **“Wissens-basiertes Prozess-orientiertes Innovations Management (WPIM)”**. The WPIM method [2] was developed in 2012 by Vogel for the semantic annotation of processes and resources. It is implemented based on the RDF and RDF(S). The semantic annotation of documents is realized with the *Dublin Core Element Set (DC)* [16] [17] [18] as well as for experts through the *Friend-of-a-Friend (FOAF)* [15] vocabulary. The integrated semantic search is implemented using DL-Query and SPARQL and is supported by an embedded RDF-Reasoner [19], the *Reasoner Pellet* and a specific *Query Library* for RDF-Queries.

### **Ontology Research and WPIM Ontology Roll-Out**

The WPIM application with its WPIM ontology, an ontology for processes in general, is applied in KPP to the knowledge domain CAPP and subsequently to the knowledge domain production. It will be demonstrated that the WPIM ontology can be used as an upper ontology for representing processes in this knowledge domain. Basically, using the WPIM Ontology as an



upper ontology is enabling to pass on its concepts to lower level ontologies, i.e., into so called knowledge domain ontologies. In the KPP research the WPIM Ontology is used to represent the CAPP knowledge domain ontologies, in particular to the CAPP knowledge domain ontology for *Production Planning* and the CAPP knowledge domain ontology for *Production*. The goal is to show that utilizing the upper ontology WPIM for domain-specific lower ontologies makes sense to support domain-specific knowledge representation, vocabularies, and concepts for, e.g., process typifications or refinement for specific sub-processes. In addition, after combining the upper WPIM Ontology with the CAPP knowledge domain ontologies supported by KPP, the correctness, decidability, and feasibility of semantic searching mechanism should be untouched.

### ***WPIM Ontology – An Upper Ontology***

The WPIM application allows processes to be formally described and annotated with knowledge. The annotated processes are machine-readable and can be searched by inferencing mechanism or semantic search. WPIM ontology is based on RDF and RDF-S. In the following, the usage and refinement of the WPIM Ontology is demonstrated, starting with an early meta-model for structuring process (details in [2, p. 21]), resources and classes on RDF-S and RDF level (see **Fig. 1** and **Fig. 2**) as well as an RDF level and instances preparing data storage, e.g., in a relational database (**Fig. 4**).

### ***Declarative Data Model***

The inheritance hierarchy of RDF-S classes has been adopted for the implementation of the WPIM application in order to represent the semantic inheritance (especially of vocabulary hierarchies). In particular, the inheritance of a RDF-S class to its subclasses is represented by means of the *rdfs:subClassOf* relation and further WPIM specific relations for supporting innovation process description vocabularies. Furthermore, the RDF-S class hierarchy in **Fig. 1** represents the resources *Document* and *Person* which can be related to *Processes* and its *ProcessElements* (see **Fig. 3**). To describe *Documents* in WPIM, the *Dublin Core Metadata Element Set* (ISO 15836) is used as well as *Friend-of-a-Friend* (FOAF), a machine-readable ontology describing *Persons*, and e.g. *Employees* or *Experts* (see **Fig. 1**), their activities and their relations to other persons and digital object classes.

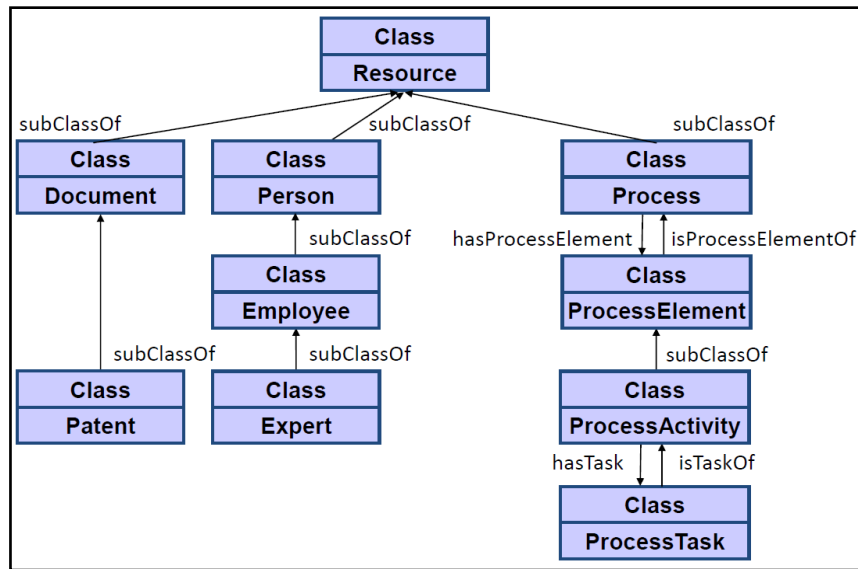


Figure 1: Digital Object Classes representing the WPIM Taxonomy as a RDF-S Class Hierarchy [2]

**Figure 2** displays the relationship of of RDF-S and RDF. The RDF-S schema describes a schema that defines the possible concepts and relationships to be used by RDF while RDF then describes specific instances of resources and therefore implements a schema with concrete instances. The type relationship represents the transition from classes (RDF-S) to concrete instances (RDF).

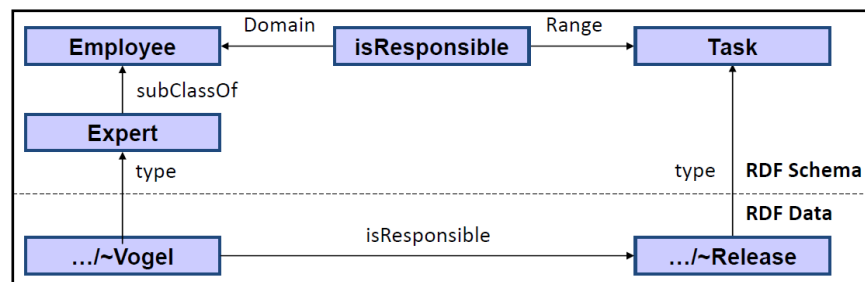


Figure 2: Classes and Instances in RDF-S and RDF see [12] and [2]

Following [12] a property *isResponsible* for linking, e.g., the domain of all *Employees* with the range of all *Tasks*. At the instance level (RDF), the resource, more precisely the *Expert* named *~Vogel*, is linked to the resource, more precisely to the *Task ~Release* by the relation *isResponsible*.

The *Upper Prozess Ontology WPIM* is shown in (see **Fig. 3**). It is an RDF-based ontology that derives the class *Process* from the class *Resources*. A process consists of *ProcessElements* (for details see **Fig. 1** and **Fig. 3**). These *ProcessElements* can be in particular: *ProcessActivity*, *ProcessGateway*, *ProcessEvent*.

*ProcessEvents* can be refined by *ProcessStartEvent* and *ProcessEndEvent*, both are start and end point of a process. A *ProcessActivity* can be composed of several *ProcessTasks*. A special feature in WPIM is the so-called *MasterProcess*. This class *MasterProcess* (as shown in **Fig. 3**) enables to save processes as templates and holds them available for later instantiations. All concepts of the WPIM Ontology have been defined and can be reused via the RDF namespace *wpim*:<sup>1</sup>.

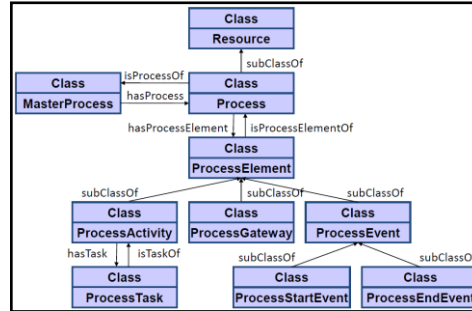


Figure 3: Upper WPIM Process Ontology in RDF [2]

*ProcessInstances (PI) of Processes* or *MasterProcesses* can be instantiated on the RDF level. Moreover, the separation of modeling and capturing generic, domain, and instance specific process knowledge is supported.

*MasterProcesses* (see **Fig. 3**) are generic high-level descriptions of processes. From a data set point of view, a MP describes a data structure and attributes of a higher-level template. The representation approach describes process structures and their attributes by using semantic representations but goes beyond the sole representation of the process structural schema. WPIM offers semantic descriptions of MPs. This MP schema exists as a formal generic description of a process and this independent of generated data instances during a certain execution of the process resources during execution of the entire process.

If a *Process* (see **Fig. 1** and **Fig. 3**) will be executed, data shall be gathered. From the data set point of view, WPIM describes this as a PI. The structure of an Activity is used to store all incoming and outgoing data as well as states of Activities. In this way, it is possible to describe and represent PIs and their *Activities* in a machine-readable and semantic format. Moreover, PIs are well-ordered in a chronological way. That means, during that execution of a first instance, the Lessons Learned can be stored within the MP (higher-level). Thus, this gathered information can be provided for the following executions of the process within the next PI.

An *Activity* (see **Fig. 1** and **Fig. 3**) needs to have well defined inputs to generate a required output and contains one to many tasks. An instance of an *Activity* defines a cluster of *Tasks* and thus can bundle *Tasks* that are assigned to a single resource. For example, these kinds of assignments can contain that tasks can be assigned to a resource like a machine but just in order to represent the execution of a machine operation or *Planning Tasks* which is needed to be executed by an expert, e.g., a planner. A *Task* (see **Fig. 1**, **Fig. 2**, and **Fig. 3**) structure in

<sup>1</sup> <http://www.inknowvation.de/WPIMvokabular.html>

WPIM, cannot be further split into subtasks. It is a simple action. Thus, a semantic data representation to archive values and the status when performing a *Task* will be offered. For example, such a *Task* can be executed by a machine and create a specified result. Therefore, a *Task* can represent an operation having a semantic representation contains the progress attributes, the incoming and outgoing status, and result specification. Moreover, WPIM allows to delegate a Task instance to various executing entities. Hence, to describe it by an example in the context of planning tasks, a plan must be finalized by signing the plan and setting it into action. Obvious, to release a plan by a signature is a unique task and this signed task cannot be split. Therefore, either the plan is released by signature or it is not signed and thus not released. An Activity consists of at least one or more Tasks and represents the transformation of an input into an output of an Activity.

### ***Technical Data Model***

From the point of view of KPP's overall architecture and of course especially of the KPP prototype, the underlying technical data management and the associated conceptual knowledge, information, and data model embodies the lowest layer of technically implementing the KPP information and knowledge representation approach. The technical data model and related data management considers the file formats of the information, content, and knowledge resources to be integrated as well as the file formats and databases intended for persistent storage [11]. The data model must allow application middleware to store, extract, and manipulate data with basic services. These basic data services must ensure import and export of data. The data model has the task of supporting the integration of implicit and explicit knowledge, information and data from different sources (within and outside the organization) such as data stores and information systems. We define interfaces and support them with suitable services. Data in XML format should be annotated with additional knowledge (e.g., from social networks, e.g., in XML or HTML format). In addition, resources from the intranet and internet are incorporated, such as, e.g., design and engineering data of the manufacturing industries. The available data should also be linked to structural knowledge (for example, from XML-based simple structural representations of taxonomies to RDF-, RDF-S-, and OWL-based semantic representations of statements, i.e., SPO-Triples based on ontologies). The data (manually or automatically enriched) has to be stored in a data store for availability and persistent storage. The data model of the WPIM application supports thee data storage, data access, and related data services of [cf. 11].

Class	
<i>uri</i>	
Resource	
Employee	
Expert	
Task	

subClassOf	
<i>source</i>	<i>target</i>
Employee	Resource
Expert	Employee
Task	Resource

Property	
<i>uri</i>	
isResponsible	

subProperty	
<i>source</i>	<i>target</i>

Domain	
<i>source</i>	<i>target</i>
isResponsible	Expert

Range	
<i>source</i>	<i>target</i>
isResponsible	Task

Figure 4: Excerpt of WPIM's underlying relational Data Model and Schema

(Fig. 4) shows an excerpt of WPIM's underlying relational data model and schema. It presents classes as well as subclasses, properties as well as domain and range assignments in relational tables. The property *isResponsible* does not belong to the basic scope of RDF and RDF-S but has been defined by *wpim:isResponsible* and is uniquely identifiable and referenced by a URI.

### Production and Production Processes

The first use of computers in production marks the beginning of Industry 3.0. Typical uses of the computer were the control of production machines - Computer-Aided Manufacturing (CAM) - and computer-assisted product design - Computer-Aided Design (CAD). The step towards Industry 4.0 is determined by the networking of all elements of production. The production machines are networked with each other and with the product to be produced. They exchange real-time information about the status of the manufacturing process. This information is the basis for production control in real time [7]. An important part of production technologies are the production processes. Classically, these are subdivided into six groups according to DIN 8580 [8]: primary forming, separating, joining, coating, and changing the material properties.

The additive manufacturing processes often mentioned at the time of this work are not explicitly categorized as a comparatively new method in the DIN standard but are mostly assigned to primary forming in the specialist literature [9]. Additive manufacturing processes (also known as generative manufacturing processes) make it, e.g., possible to produce plastic objects which have previously been designed in the form of CAD data on the computer. This process has long been used to produce prototypes very efficiently (rapid prototyping), but increasingly also to produce end products (rapid manufacturing) in recent years. There is a clear difference between the primary forming and the forming processes, thus that no mold must be produced which in turn would require a subtractive previous process [10]. Production processes can also be distinguished according to whether the sub-components are obtained by suppliers (production processes in which the product is only carried out by assembling the components) or by oneself. In the second case, often subdivided into additive (e.g. 3D printers), subtractive (e.g. milling or turning) and formative (e.g. casting or forging) production processes. In the following, only

logistic, additive, and subtractive production methods are used as an exemplar selection in the production planning data records. A central element of production is the definition of the individual production steps, which then lead to the final product. In each individual production step, it must be defined which production process is used and by what resources it is implemented. Resources can, e.g., be employees, machines, workplaces, or tools. All this together is called production planning. As this process quickly becomes complex, the use of computer technologies in the current production planning is indispensable.

### ***Knowledge-Based Production Planning***

KPP as it has been developed within CAPP-4-SMEs [1] is based on all the already above outlined concepts, methods and technologies. Moreover, as already mentioned, KPP is a proof of concept implementation of the formal concept of the RPP recommendation of the ProSTEP iViP Association. The RPP is an end-to-end reference process that can be adapted to individual needs. **Error! Reference source not found.** displays that this process is divided into three maturity level-related phases: *Concept Planning (CP)*, *Rough Planning (RP)* and *Detailed Planning (DP)*.

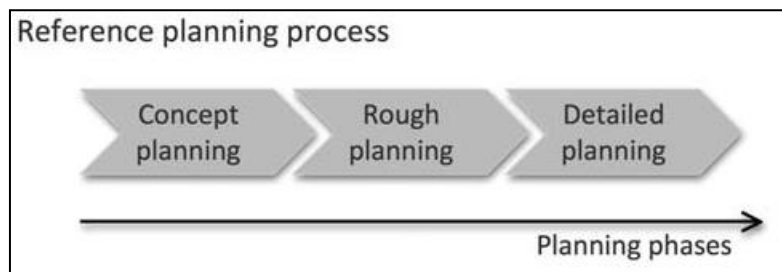


Figure 5: Phases of the Reference Planning Process (RPP) [27]

Thus, it can be seen as a high-level template for creating a concrete production planning process that takes individual company-specific and location-specific conditions into consideration in an adaptive way (i.e. CAPP). KPP takes advantage of this concept and integrates all its advantages into one integrated, distributed, and collaborative three-level approach (displayed in **Figure 6**) for supporting production planning. Furthermore, KPP does this in a knowledge-based way by integrating production planning knowledge resources along process representations of the planning process.

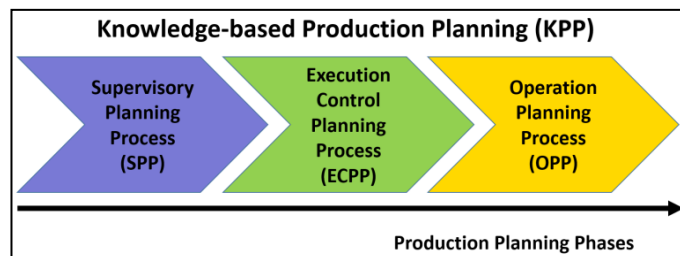


Figure 6: KPP Process Phases

Hence, it integrates the DPP planning process as well as the related resources with FBs and the semantic WPIM technology. The already presented steps of DPP were expanded and based on

WPIM concepts in order to represent the transformation of the **Supervisory Plan (SP)** into an **Execution Control Plan (ECP)** and this one into an **Operational Plan (OP)** in an optimized manner. In the understanding of WPIM, the DPP planning process and resource knowledge is represented by planning activities consuming and producing planning knowledge resources. These can, e.g., be FBs over all levels of CAPP activities from **SP Process (SPP)** activities through **ECP Process (ECPP)** activities to **OP Process (OPP)** activities. This is described in more detail in the related Paper [31].

The mediation process is also performed in a three-level MA. **Figure 7** displays the three level MA. The first mediator is called the **SPP Mediator (SPPM)** and integrates MFBs and other relevant and potentially distributed resources for the SPP activity. A down-stream DPP mediation can be implemented by means of two analogously derived additional mediators on the second and the third DPP level. On the second level of the MA follows then the deduced and so-called **ECPP Mediator (ECPPM)** which supports the above-mentioned ECPP activity. They assimilated at least an earlier iteration of the SPP-mediator as MFB and an OFB of the subsequent **OPP Mediator (OPPM)** (level 3) and various other relevant and potentially distributed resources. Coming from the machining-data point of view, the corresponding up-stream mediation process starts from machines with a defined need of steering information which can be harmonized by using wrappers and offering a mediated interface to clients. The third and final level of the MA of the KPP process forms the again derived **OPPM** and completes the mediation process.

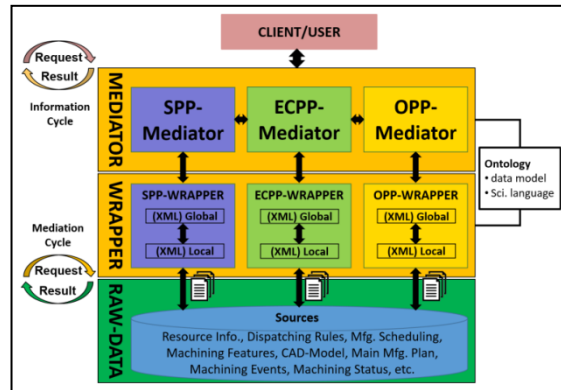


Figure 7: Conceptual Architecture of the KPP Mediator

This integrates relevant and potentially distributed manufacturing knowledge resources as FBs and by the second level generated EFBs (ECPP Mediator) for the OPP activity. This three-tier architecture can support a Semantic Information Intergration Process by providing data from distributed data repositories, combining and integrating various data schemata and corresponding formats into a single semantic-enabled globally integrated schema and format. Moreover, it enables a semantic mediation process that supports requesting, accessing, and collecting/gathering/combining data from different distributed manufacturing- and planning knowledge resources in a semantically integrated way.

## KPP Manufacturing Knowledge Resources

The whole portfolio of different types of product data related to supporting KPP activities for component production is represented in XML-based formats to eliminate the communication barrier between different software, hardware, and specialized tools. For this purpose, the MA in KPP uses a wrapper technology with all common machine information and -codes encoded in XML by using e.g., the STEP standard as a domain model. Initially, based on the first level KPP MA (SPPM) and with access to a corresponding sample data set (e.g., a Product Component CAD-Model (**Figure 20**) and Product Feature Extraction from the field of manufacturing is utilized to demonstrate the functionality of a wrapper for **Product Design Information** and **Product Feature Information**. In the next step, the access to a typical **Main Manufacturing Plan (MMP)** (see **Fig. 8**) represented as MFBs from a local relational database source is implemented by means of an appropriate wrapper and will be integrated and represented in the global representation schema as STEP compliant XML code. Through the normalization via the global schema, the parent mediator can get access to manufacturing information and may offer it to the client and vice versa.

```
<?xml version="1.0" encoding="utf-8"?>
<job name="Job 122612" description="manufacturing job request" material="P" owner="Yuguan Lu" id="122612">
  <serviceRequirements>
    <deliveryTime>none</deliveryTime>
    <costExpectation>none</costExpectation>
  </serviceRequirements>
  <machiningFeatures>
    <machiningFeature featureType="General Open Pocket" externalId="" unit="Metric" name="General Open Pocket">
      <parameters>
        <parameter name="Dp" description="Depth of pocket">20</parameter>
        <parameter name="Rm" description="Minimum radius in concave corner">3</parameter>
        <parameter name="Wo" description="Width of open area">12</parameter>
        <parameter name="Cs" description="Corner style">Corner Break</parameter>
        <parameter name="Cb" description="Corner break">1.6</parameter>
        <parameter name="Rg" description="Floor radius">0</parameter>
        <parameter name="Wc" description="Width of 45° chamfer">0</parameter>
        <parameter name="Aw" description="Angle of wall">90</parameter>
        <parameter name="Wl" description="Smallest width of the gap">0</parameter>
        <parameter name="Vp" description="Volume of the pocket">0</parameter>
        <parameter name="Qw" description="Quality of wall surface">N10</parameter>
        <parameter name="Unit" description="Unit of Tool">None</parameter>
        <parameter name="TType" description="Solid/Indexable Tool">None</parameter>
        <parameter name="SBType" description="Shank/Bore Type">None</parameter>
      </parameters>
    </machiningFeature>
  </machiningFeatures>
  <toolAssemblies>
    <toolAssembly referenceId="" />
  </toolAssemblies>
  <designModels>
    <model format="STEP">.\Models\PocketModel.stp</model>
  </designModels>
</job>
```

Figure 8: Typical Production Data in XML format [22]

Furthermore, the following code sample (see **Fig. 8**) from Y. Lu et al. [22] clarifies the representation of machining information that is integrated with the production plan information in the next step of the integration. This illustrated request represents the machining feature type, typical important parameters and requirements which are important for the production process. All remaining product information, manufacturing steps, requirements, and the CAD-Model which are necessary to produce a product component are now processed in a similar form in the SPP without being based on a concrete machine or tool. For example, this includes the “feature-based design”, “fixture information” and “machining technology and constraints” information and knowledge resource types. Now the KPP mediator respectively its wrapper has to be implemented and allows the individual access via a web interface to all parameters of a product component. Taking this as a starting point, it is not only possible to generate a product component file or a feasible machining plan of one single product component in the later KPP process, but rather individual modified product components as instances.



## KPP Prototype Implementation

First, all the existing implementations of WPIM were analyzed and the technologies and approaches used for this were checked for their relevance. For the practical implementation of the KPP prototype, an implementation concept based on a web-based Client/Server Architecture was developed using a modularized approach that uses the **Representational State Transfer (REST)** API [21] to integrate it into the Symphony-based **Knowledge Management Ecosystem Portal (KM-EP)** [20] of FTK – “Forschungsinstitut für Telekommunikation und Kooperation” (Research Institute for Telecommunication and Cooperation) e.V.. The storage and management of data is implemented independently of the data input and output. Thus, two independent software parts were created.

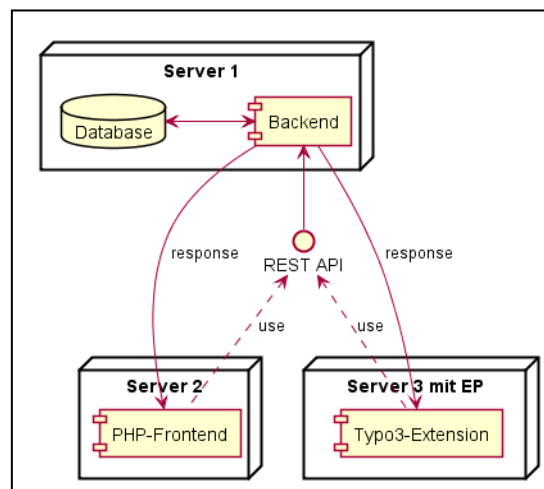


Figure 9: Client/Server Architecture with two Front-ends [26]

The goal of this approach was that several clients (front-ends) can access the same data base (server) and the data management is separate from the task of data retrieval and representation. This makes it possible, to use any technology or programming language for the frontend, but it can still be integrated into KM-EP [20] in the background. With this architecture, the frontend and the backend are no longer on the same system (see **Fig. 9**). To manage the required data, a relational MySQL database is used in the background. Furthermore, the concept of KPP was designed for multilingualism and a user administration was conceived and implemented. The front end was developed with the help of **PHP Hypertext Preprocessor (PHP)**, since it is widespread and under free license.

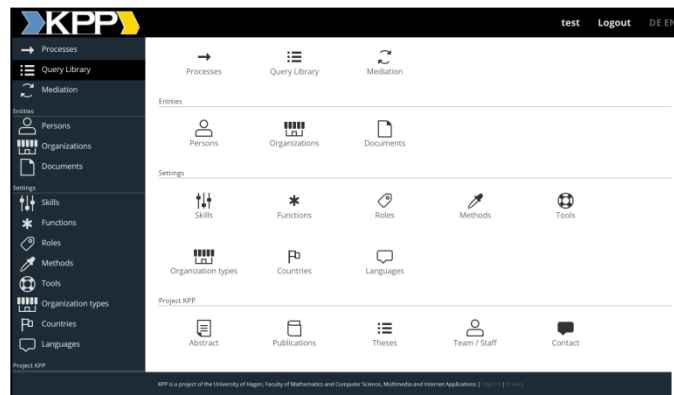


Figure 10: KPP Prototype Frontend

At the current stage of implementation, mainly the front- and backend as well as the core of KPP, the process editor, is developed. The KPP Mediator Architecture has not yet been completely integrated into the KPP application. However, a first functional prototype was developed and waits for integration.

## Usage AND extension of the WPIM Ontology in KPP and the domain of PRODUCTION PLANNING

The ontologies for the KPP application are derived from the WPIM ontology and adapted to KPP and the domain of CAPP and includes other entities such as processes, elements, people, organizations, documents, skills, functions and roles as well as methods and tools. KPP is based (just like WPIM) on RDF and RDF-S and allows processes to be formally described and annotated with information, content, and knowledge resources. In this way KPP allows CAPP processes to be formally described and annotated with related information, content, and knowledge resources. The annotated semantic CAPP process representations are machine-readable and can be searched by semantic inferencing mechanisms or semantic search engines. The annotated processes are machine-readable and can be searched by semantic queries. For demonstration we use illustrations based on RDF-S and RDF level. The ontologies were conceived and created so that changes or extensions can be carried out at any time. However, KPP basically includes two ontologies

1. KPP Ontologies
2. KPP - Planning Ontology

The KPP Planning Ontology (see **Fig. 11**) extends the WPIM Ontology (see **Fig. 3**) which is used as an Upper Ontology with domain-specific concepts from the domain of Production Planning. These extending concepts (RDFS classes and RDFS properties) described in **Figure 11** are highlighted in color and include (in particular on RDF-S level) the classes *Machine* and *Organisation* their associated subclasses, e.g. *3D-Printer* or *Supplier*, and their types, e.g., *Renkforce RF 1000 3D printer* on RDF level.

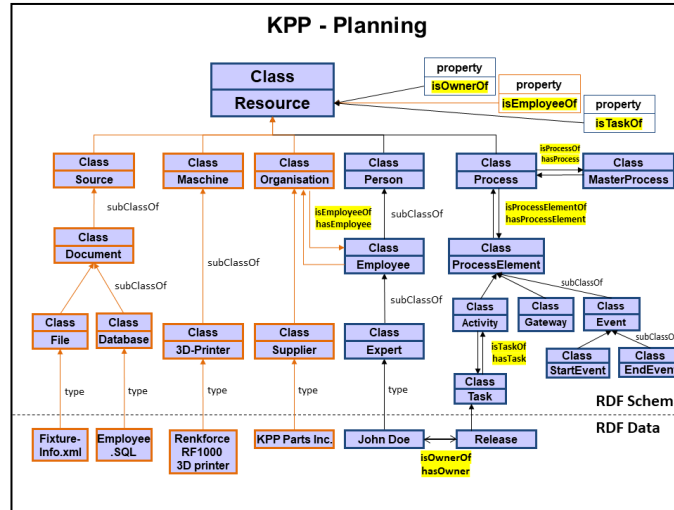


Figure 11: Domain specific KPP Planning Ontology

The class *Document* which already exists in the WPIM Ontology (with *subClass:Patent*, see **Fig. 1**) is extended by two further Classes, *subClass:File* and *subClass:Database* plus their instances on RDF level. In addition, RDF and RDF-S properties are introduced (see **Fig. 11**) or re-used from the WPIM Ontology. Examples for properties are: *isOwnerOf*, *isEmployeeOf* and *isTaskOf*. These properties are used as relations between classes on RDF-S level and between instances on RDF level.

### KPP - Production Ontology

The KPP Production Ontology (see **Fig. 12**) extends the WPIM Ontology (see **Fig. 3**) which is again used as an Upper Ontology with domain-specific concepts from the domain of Production. Especially the *class:Process* is extended by further class concepts, e.g., the *class:ProductionProcesses* with three *subClasses*: of Production classes: *subClass:Additive*, *subClass:Subtractive* and *subClass:Logistical*. These subclasses represent classes of production and manufacturing processes and are exemplarily instantiated on RDF level (see **Fig. 12**). For each exemplar KPP demonstrational production process

1. Toy Miniature Staircase
2. Toy Building Block and
3. Mill-cut iPhone Cover

a detailed example is given in the following sections. In the domain of Production additionally required classes are classes describing *ProductionMaterial*. The exemplar demonstrational *subClasses* *Wood*, *Plastic*, *Metal* have no claim to be complete and can be extended as needed. Furthermore, each of these subclasses are divided into the following additional *subClasses* *Types* and *Machines* and their corresponding types on RDF level.

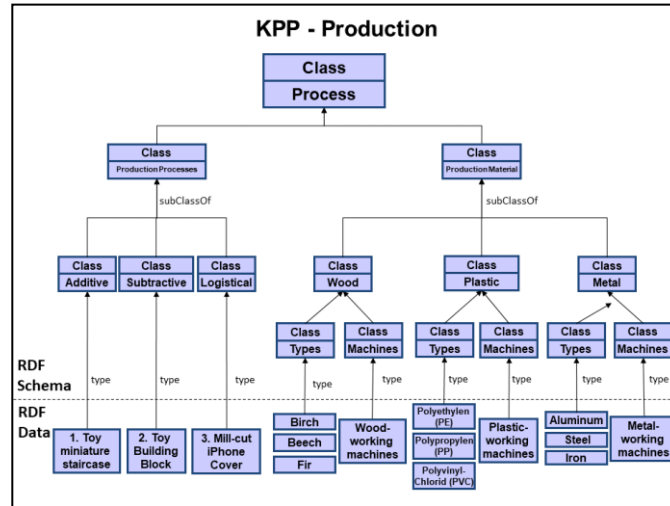


Figure 12: KPP domain-specific Production Ontology

### KPP Query Library

A KPP query library was introduced to save and execute semantic SPARQL queries. Queries are introduced here as entities, even if they only form a simple listing of semantic queries on the two KPP ontologies mentioned above. The WPIM application stores semantic information in a textual triple. This makes a query very slow and static. A relational database would solve the problem quickly and cleanly. At this point, we encountered the fundamental problem that relational databases do not contain semantic information. This means that, connections (foreign key relationships, comparisons between entities, etc.) are formulated together with the query and also views with the connections are generated or stored procedures that provide contiguous data, but there is no fundamental link between the relations. The World Wide Web Consortium (W3C) published a paper [33] in 2004 dealing with the mapping of relational queries into semantic queries and describing a possible solution. For this purpose, another server is introduced which runs parallel to the web and database server and converts semantic queries into SQL queries in real time using a (mapping file) and returns a result. This paper is intended mainly to handle and describe the WPIM upper Ontologie and the KPP ontologies. Therefore, the details of this solution will not be described in more detail in this paper. Otherwise it would be beyond the scope of this paper.

## KPP Process Editor

The centerpiece of the KPP application is a visually directly-manipulative production process editor. It is based on **BPMN**, more specifically, we use the framework *bpmn.io* [36], which has been developed in an Open Source project since 2014. The goal of this project is to develop a framework that allows the viewing and modeling of **BPMN** in the web browser. It is well documented and also extensible. However, it already meets many of our requirements, e.g., the graphical representation of process flows, Annotations and storage of graphical elements.

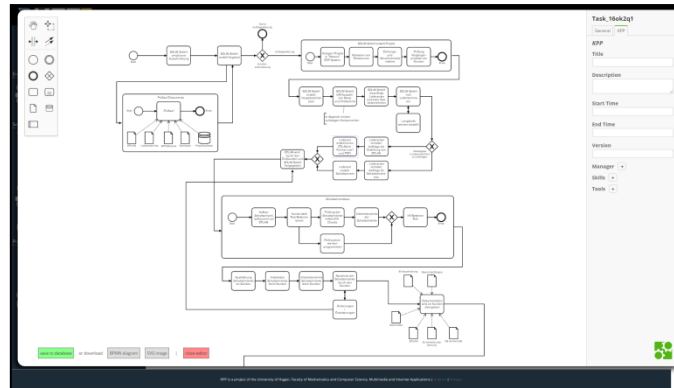


Figure 13: Visually direct-manipulative Process Editor

Furthermore, processes can be instantiated as already mentioned above and can be implemented by the **BPMN** structure, because the IDs of the elements in a process instance are identical to those in master processes. Thus, it is clear which elements must be replaced. The process editor makes it possible to create complex processes, sub-processes and process flows. It has been extended by KPP annotations, so it is possible to assign individual process steps to specific organizations, persons, groups, abilities, tools and much more. In addition, documents from a repository can be inserted into processes and can also be annotated.

## KPP Mediator Approach

At this point of development, only implementing the first Mediator (SPPM), was initially considered. In this initial step of production planning, mainly meta and raw data are processed. That means, usually CAD-, STEP-, IGES- and XML-data are used to derive the typical required dimensions, machines, tools and skills for the product to be produced (explanations for **Fig. 19**). For this reason, we have focused on the two most important formats in production, STEP and IGES. For the development of a suitable wrapper, we have used the full range of commands and identifiers of several examples to create a database for a global format. RDF is used as the central and global data format. In the later development, all wrappers respective all mediators should convert the various local data into RDF. This transfer makes it possible to make semantic queries to the local data sources using SPARQL.

**Mediation**

Please select a Project:

iPhone Cover

Please Enter a SPARQL query:

Select ?var1 WHERE (?var1 is PRODUCT)

Display Identifiers Send Query

These terms and relations may be used in a SPARQL statement:

Terms (Identifiers)	Relations	Already send Queries (click to reuse)
ADVANCED_FACE	is	Select ?var1 WHERE (?var1 is SURFACE_STYLE_USAGE)
APPLICATION_CONTEXT	contains	Select ?var1 WHERE (?var1 is SURFACE_STYLE_USAGE)
APPLICATION_PROTOCOL_DEF	count	Select ?var1 WHERE (?var1 is PRODUCT_CONTEXT)
AXIS2_PLACEMENT_3D		Select ?var1 WHERE (?var1 is PRODUCT_CONTEXT)
B_SPLINE_CURVE_WITH_KNOTS		Select ?var1 WHERE (?var1 is PRODUCT)
CARTESIAN_POINT		Select ?var1 WHERE (?var1 is PRODUCT)
CIRCLE		Select ?var1 WHERE (?var1 is PRODUCT_DEFINITIONS)

Figure 14: SPP Mediation with SPARQL-Query

The sequence of such a query is designed so that all relevant raw files are assigned to the mediation and the user automatic receives the possible identifiers, e.g., drillings, dimensions, etc. out of these files in real time, see **Figure 14**. With this information, he is able to formulate a typical SPARQL-Query and can query the desired information. For example, a user could make the request “*Select? Var1 WHERE {? Var1 is PRODUCT}*” And obtains a list of the names of the individual products contained in the files. As already mentioned, the development and implementation of the mediators and wrappers are still in its infancy.

## Classification of Production Processes in KPP

As already mentioned above, the KPP application<sup>2</sup> extends the WPIM application. In the following our KPP knowledge representation method classifies production processes into three main types. For each type we created an example in the KPP application. Moreover, we appropriately modeled and described each example in the KPP editor.

### Logistical Production Processes

We have constructed a sandbox approach example. A simple miniature staircase can be produced using toy building blocks as components which can in turn be produced using, e.g., a 3D printer (see Additive Production Processes). Therefore, the production planning for this sandbox example can be carried out using the KPP PoC prototype. To do this, a new KPP project has to be created and the various types of content, information, and data resources of this KPP project has to be determined. For example, in the case of the miniature staircase, these resources are, e.g., the 3D models of three different types of toy building blocks as well as the blueprint of the staircase (see **Fig. 15**), the feature-based design, the machining technology and constraints, as well as the main manufacturing plan. This necessary content, information, and raw data in various formats will be collected and integrated from different formats and from various sources.

<sup>2</sup> <http://kpp.fernuni-hagen.de>

These sources are assigned to an MFB and then integrated into the staircase KPP project and handed over to the SPP, where the production planning resources will be processed.

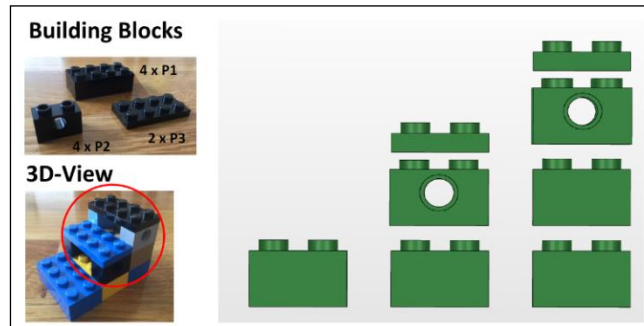


Figure 15: Simple miniature staircase example with three different toy building blocks

The individual resources are assigned to individual production tasks. The mediator functionality is used to normalize and integrate the various resources and to convert them into a globally integrated semantic schema being encoded in a uniform syntax. In this way, the data is retrievable for humans and the illusion appears of querying one single, integrated database with one integrated schema. At the same time, the individual production process plan can be defined in the KPP process editor. A start and end point must be created, and individual process and sub-process steps must be defined and linked together. The individual steps can then be annotated with explicit knowledge from the sources as well as implicit or expert knowledge from employees. Finally, all information and results are again stored in an MFB and transferred to the second process step, the ECPP. This step runs like the SPP, but the information from the first step will be expanded and provided with new data. The goal is to obtain in the end an machine-executable production code that can be directly downloaded and executed on a suitable machine. In our sanbox example a simple schedule will be created that 3D-prints the toy building blocks one after the other. The data can also be annotated in this step.

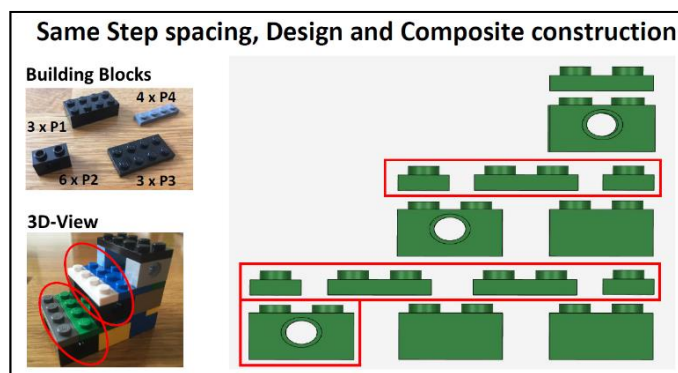


Figure 16: Simple miniature staircase example with same step spacing and composite construction

In addition, the instantiation of a process will also be applied in this step. Let us assume, we would like to optimize the current staircase (e.g. equal height of steps) or enlarge it (four instead of three stair steps), then all the information of the normal staircase from SPP is still completely



correct and usable as a basis for the new staircase. However, we could, for example, introduce a new part and thus adapt the height of the steps, the design and connect every individual step with each other (see **Fig. 16**). Finally, all information and results are stored in an EFB executable on a suitable machine but not optimized on the entire shop floor (production area). This EFB will be transferred to the third process step, the OPP. The last step, the OPP, runs like the other two previous steps. However, in this step, all current data from the given shop floor and basic dependencies will be introduced. For example, block 1 cannot be produced before block 2, but block 3 can be produced simultaneously with or before block 1.

### **Additive Production Processes**

The logistical approach can be consistently further developed. It is also possible to print the bricks from the toy building blocks example by 3D printers or to print the complete staircase in one piece with a printer. The KPP procedure is similar here except that now the **Production Ontology** for **Additive Processes** and a suitable material has to be chosen. In the case of a 3D printer, for example, a suitable **PLA Filament** out of the plastic working environment (see **Fig. 17**).

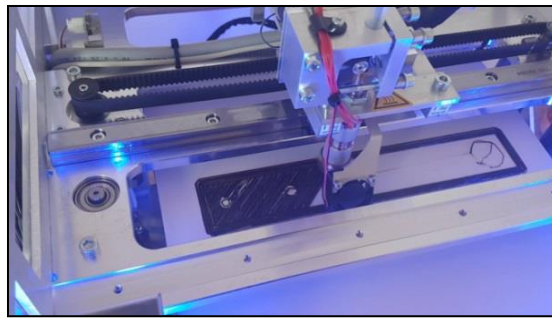


Figure 17: 3D-Printer printing a toy building block

First, a new KPP project is needed again and has to be created and the various content, information, and data resources of this project have to be determined. For the miniature staircase, we can instantiate the process out of the previously used Logistical Production Process and thus use again the 3D models and blueprints of three different types of toy building blocks, the feature-based design, the machining technology and constraints, as well as the main manufacturing plan. This necessary information and raw data will be collected and recorded out of different formats and from various sources. These sources are assigned to an MFB and then integrated into the staircase project and handed over to the SPP, where the production data will be processed.

After normalizing the various sources and defining the process in the process editor, the second step in KPP is the ECPP. Here we will create a rough but concrete and correct schedule for applying the filament. The STEP file of the simple toy building block will be broken down into so-called slices. Each slice contains a timetable and a roadmap with several XYZ coordinates. To complete a block slice by slice must be printed successively (see **Fig. 18**). This layering and coating of the layers then results in the whole toy block.



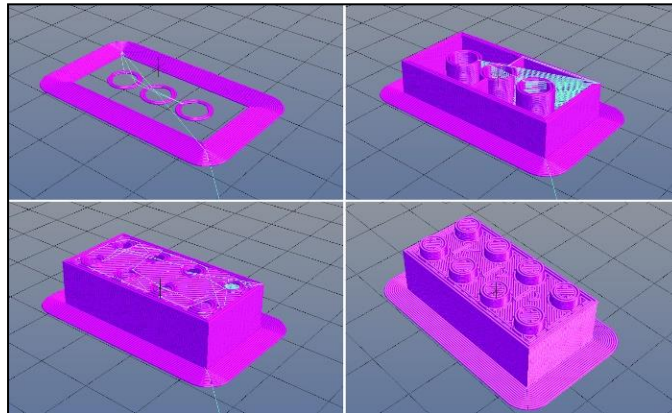


Figure 18: Simple illustration of a toy building block slice for 3D-Printer

In the third step in KPP, the OPP, the rough plan is further substantiated by actual data from the shop floor and made more effective. This means that the task will be assigned to an appropriate machine which e.g. with at least tasks or is in idle. For example: there are three matching 3D printers and one of them is already in use. In this way, a first optimization can be achieved because bricks can be printed in parallel on two printers, or two different blocks can be drawn simultaneously sequence by sequence on the same printer. Therefore, the output of OPP is an OFB - an optimized executable code considered all given machines and circumstances within the shop floor. Through that, all machines are appropriately utilized and not left idle.

### ***Subtractive Production Processes***

Basically, you could say that a subtractive production process runs inversely to an additive production process. Successively certain parts are removed from a workpiece, e.g. through a mill or a drill. Givehchi et al. [23] [24] have introduced a method how an MFB containing product design and feature information could be processed in a DPP environment. They have shown that similar product component features can be summarized and grouped as a nested directed graph of generic setups. They show that based on a simple product component example (see **Fig. 19**) which is, e.g., produced from a block of aluminium raw material.

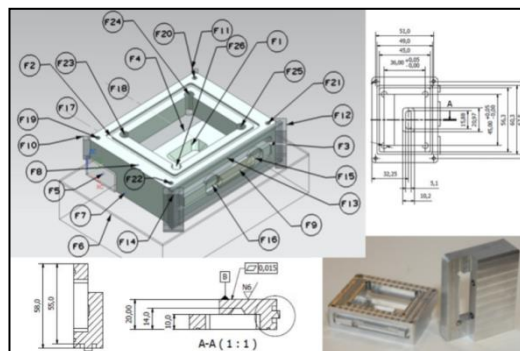


Figure 19: Exemplar Product Component Model [23] [24]

In this third example, KPP also proceeds in the same way as the other two. First, a KPP project has to be created and its resources assigned in KPP. In the SPP part, all important product features were extracted from local data sources and summarized unsorted as already mentioned above. As seen in **Figure 19**, all features (F1 to F26) were labeled and initialized. All the same or similar operations are summarized, e.g., such as Drilling (F23 to F26 bundle to Group G2), to combine the workflows and to shorten the timings of production. Furthermore, also related process steps will be summarized, such as drilling and milling (F2 and F7 are grouped (G1) with two drilling groups (G2 and G3)). Moreover, must be decided based on “fixture information” and various “constraints” which steps have priority over other steps. Out of this context so-called Setup Classes (SC) will be formed, and their processing sequence be determined and thus a fixed and directed graph of generic setups be generated. These SCs then have to be processed logically step by step, one after the other, so that they are subtractively removed from the entire workpiece, eg. an aluminum raw material block.

In the KPP second level - the ECPP, the planning process activities can continue to optimize the production processes of the machines and tools. This important first level planning result of grouping similar product features and building SCs in the product feature representation needs to be forwarded in ECPP. Of course, the result must be forwarded again as an MFB including the now existing nested directed graph of grouped generic setups and each of their corresponding features. On the ECPP level, this input information will now be examined and will result in a selection and assignment of possible machine specific data to the product feature representation. In addition, the ECPP gets also an OFB from the underlying OPP. This includes the currently available machine data such as machine-events, -status and -information to even further limit the possible selection of machines and setups and determine the best sequences in the next DPP Level which is OPP. To support the input that the OPP needs, the ECPP will now generate relations between the delivered product feature and machining data. For example, the sequence of two features is in form of two event relations between the function blocks. However, there are also other event connections for other purposes that cannot be distinguished easily. At this point, our mediation approach in conjunction with WPIM and the annotation function helps to distinguish the various FBs.

## Conclusion

As shown, our ongoing research in the field of process and production planning extends the *Upper Process and Resources Ontology*, so called *WPIM Ontology*, by domain-specific concepts related to CAPP. The developed ontology will be used to model, describe and execute processes in the domains of Manufacturing, Production and Assembly. This special extension for the domain of production planning is so-called KPP. KPP uses two ontologies, one for planning and one for production. The first ontology can be universally applied to all types of production planning. The ontology for production differs depending on the type of production and the type of material. We have introduced the different types of Production Processes - Logistic, Additives, and Subtractive and have explained this on the basis of several suitable examples.

Further work will be the evaluation of the different examples, materials, and types of production.

Furthermore, the integration of a *Collaborative Manufacturing Change Management (CMCM)* as well as, *Collaborative Assembly-, Logistics- and Layout Planning (CALLP)* up to an ontological representation of the entire *Product Lifecycle Planning (PLP)* containing *Process and Production Planning*.

## References

1. F. Miltner, T. Vogel and M. Hemmje; "Towards Knowledge Based Process Planning Support for CAPP-4-SMEs: Problem Description, Relevant State of the Art and Proposed Approach", vol. 1, International Manufacturing Science and Engineering Conference (MSEC), 2014.
2. T. Vogel, "Wissensbasiertes und Prozessorientiertes Innovationsmanagement WPIM - Innovationsszenarien, Anforderungen, Modell und Methode, Implementierung und Evaluierung anhand der Innovationsfähigkeit fertiger Unternehmen", Dissertation, Hagen, 2012.
3. L. Wang, G. Adamson and M. H. a. P. Moore, "A Review of Function Blocks for Process Planning and Control of Manufacturing Equipment", Journal of Manufacturing Systems, Vol.31, No.3, pp.269-279, 2012.
4. L. Wang, W. Jin and H. Y. Feng, "Embedding machining features in function blocks for distributed process planning," International Journal of Computer Integrated Manufacturing, pp. 443-452, 2006.
5. L. Wang, H. Y. Feng and N. Cai, "Architecture design for distributed process planning," Journal of Manufacturing Systems, pp. 99-115, 2003.
6. M. Helgesson, L. Wang, R. Karlsson, M. Givehchi and M. Tedeberg, "Concept for Function Block enabled Process Planning towards multi-site Cloud Collaboration", International Manufacturing Science and Engineering Conference (MSEC), Vol. 1, 2014.
7. R. Drath und A. Horch, „Industrie 4.0: Hit or Hype?“, IEEE Industrial Electronics Magazine, Bd. 8(2), pp. 56-58, 2014.
8. DIN 8580 - Fertigungsverfahren - Begriffe, Einteilung, Beuth, 2003-09.
9. U. Berger, A. Hartmann und D. Schmid, „Additive Fertigungsverfahren“, Verlag Europa-Lehrmitte, Haan-Gruiten, 2013.
10. C. Pickert und M. Wirth, „Additive Fertigungsverfahren, CEDIFA Arbeitsbericht 1,“ Universität Würzburg, 21.05.2013.

11. Kashyap, V.; Bussler, C.; Moran, M.: The Semantic Web; Semantics for Data and Services on the Web; Springer-Verlag; Berlin Heidelberg; 2008.
12. Zapotoczky Johannes: Speicherung von RDF-Daten; Grundlegende Aspekte des Semantic Web; Humboldt-Universität; Berlin; 2002.
13. Craig Schleno , Mihai Ciocoiu, Don Libes, and Michael Gruninger. Process specification language: Results of the rst pilot implementation. To appear in Proceedings of the 1999 International Mechanical Engineering Congress and Exposition (IMECE), November 1999.
14. G. Wiederhold, "Mediators in the Architecture of Future Information Systems", The IEEE Computer Magazine, 1992.
15. Brickley, Dan; Miller, Libby: FOAF Vocabulary Specification. HTML-File, May 2004; accessible <http://xmlns.com/foaf/0.1/>; posted 2006-01-2009, last access 2006-07-25.
16. Baker, Thomas; Fischer, Thomas: Bericht von der Dublin-Core-Konferenz (DC-2005) in Madrid, Spain; Keynote 10 Years Dublin Core; 2005.
17. Dublin Core Metadata Initiative: Dublin Core Element Set; <http://dublincore.org/documents/dces/>; last access 2009-10-15.
18. Dublin Core Metadata Initiative: Dublin Core Qualifiers; DCMI Recommendation; [www.dublincore.org](http://www.dublincore.org/); last access 2006-10-15.
19. Sirin, E.; Parsia, P.; Grau, C.; Kalyanpur, A.; Katz, Y.: Pellet: A practical owl-dl reasoner; 2005.
20. B. Vu, J. Mertens, K. Gaisbachgrabner, M. Fuchs, M. Hemmje; "Supporting Taxonomy Management and Evolution in a Web-based Knowledge Management System" 32nd Human Computer Interaction Conference, Belfast, Northern Ireland, May 2018.
21. Fredrich, Todd. "Learn REST: A RESTful Tutorial", <http://www.restapitutorial.com/>, last accessed Oct 26, 2016.
22. Lu, Yuqian und Xu, Xun. Process And Production Planning In A Cloud Manufacturing Environment. Charlotte, North Carolina, USA : ASME 2015 International Manufacturing Science and Engineering Conference, 2015. MSEC2015-9382.
23. Givehchi, Mohammad, Haghighi, Azadeh und Wang, Lihui. PaperGeneric machining process sequencing through a revised enrichedmachining feature concept. s.l. : Journal of Manufacturing Systems, 2015.

24. Givehchi, Mohammad, Schmidh, Bernard und Wang, Lihui. Knowledge-based operation planning and machine control by Function Blocks in Web-DPP. Porto, Portugal : Flexible Automation and Intelligent Manufacturing (FAIM), 2013.
25. D. Binh Vu, ‘Realizing an Applied Gaming Ecosystem - Extending an Education Portal Suite towards an Ecosystem Portal’, Master Thesis, Technische Universität Darmstadt, Darmstadt, Germany, 2015.
26. J. Kossick, ‘Reimplementierung, Erweiterung und exemplarische Evaluation einer verteilten und kollaborativen Unterstützung für die Produktionsplanung’ – Translation - ‘Reimplementation, expansion and evaluation of a distributed and collaborative support for a production planning’, Bachelorthesis, University of Hagen, Hagen, 2016.
27. Recommendation - Reference process for production planning PSI8, ProSTEP iVIP, March 2013; <http://www.prostep.org/en/medialibrary/publications/recommendations-standards.html>
28. Recommendation - Management of Changes during Production PSI12, ProSTEP iVIP, May 2015. <http://www.prostep.org/en/medialibrary/publications/recommendations-standards.html>
29. ProSTEP iViP Association e.V., <https://www.prostep.org>
30. ISO International Standard DIS 18828-2:2015. Industrial automation systems and integration -- Standardized procedures for production systems engineering - Part 2: Reference process for seamless production planning International Organization for Standardization, Geneva, Switzerland (2015).
31. B. Gernhardt, T. Vogel, M. Givehchi, L. Wang and M. Hemmje; „Supporting Production Planning through Semantic Mediation of Processing Functionality”, Vol. 1, International Conference on Innovative Design and Manufacturing (ICIDM), 2015, Auckland, New Zealand
32. B. Gernhardt, T. Vogel, M. Givehchi, L. Wang and M. Hemmje; „Knowledge-based Production Planning within the Reference Planning Process supporting Manufacturing Change Management”, ASME 2016 - Manufacturing Science and Engineering Conference (MSEC2016), in Blacksburg, VA, USA
33. E. Prud'hommeaux, “Optimal RDF Access to Relational Databases.” W3C, 2004, <https://www.w3.org/2004/04/30-RDF-RDB-access/>, last accessed Oct 29, 2016
34. Visual Paradigm, Business Process Model and Notation - Diagram & Tools, Hong Kong, China, <https://www.visual-paradigm.com/features/bpmn-diagram-and-tools/>, last accessed Oct 18, 2016

35. Object Management Group (Hrsg.), OMG Unified Modeling Language (OMG UML) Version 2.5. OMG, 2015, <http://www.omg.org/spec/UML/2.5/PDF/>, last accessed Oct 27, 2016
36. Camunda Services GmbH, “bpmn-js” Berlin, Germany, <https://bpmn.io/toolkit/bpmn-js/>, last accessed Oct 21, 2016

# **New learning environment and Libraries: A Marketing Challenge**

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## **Abstract**

There has been lot of changes in higher education in India during the last five years. The initiatives of Ministry of Human Resource Development of Government of India started with online admission to the digital initiatives including offering MOOCs on SWAYAM, SWAYAM Prabha, NDL, NAD and many more in higher education institutions by way of adopting seventeen point programmes. Further, offering courses to the extent of full online courses has become a reality now and a few universities have come forward to offer online programmes. It is also envisaged that the learning has become lifelong rather than attaining in a particular age and rely on that for rest of the life. Learning requirements are fast changing and multidimensional. But one of the greatest challenges we face is how to encourage our institutions of higher learning to become learning institutions themselves. The implication of the new learning environment is likely to be on libraries as well. The pace of technological changes on the higher education and libraries is so fast that they are unable to tap the potentials of the newer technological developments and larger community is not benefitted due to absence of effective marketing strategy –the greatest challenge of present time. Such issues will be discussed in the presentation.

# **Augmented reality based industrial inspection, maintenance, and repair: Deployments in India, USA and Japan smart factories**

**Ramya Hebbalaguppe**

## **Abstract**

Over the past decade, information technology has transitioned from desktop to mobile computing. With the extensive usage of smartphones, tablets, smart watches and head-mounted devices, the corresponding interaction mechanisms have also evolved. With this paradigm shift in terms of computing from office, home-office environment to an anytime-anywhere activity, AR is truly a metaphor in situated computing. My talk centers on the use of computer vision/deep learning for developing AR applications in a smart factory setting. In particular, I focus on mass market reach via frugal solutions that are easy to replicate on hand-helds such as smart phone. I demonstrate some in-house solutions developed at TCS research, New Delhi such as multi-label placement, resource constrained neural network models, generic gestural interface. I conclude my talk showing demos of industrial inspection deployments and highlights the performance gains in terms of accuracy and turn-around time, reduction in cognitive load for a person in task.



# Mobile-based Library Services: Big Ideas in Small Devices

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## Extended Abstract

Mobile technology has made dramatic changes in users' way of accessing information and opens the door for a new kind of learning and also providing anytime and anywhere access to information, processes, and communication. Mobile devices are rapidly becoming the primary way to access online information. They offer a new channel for accessing information and sharing with others. They are superb at delivering different kinds of resources, streamed video and music, written and spoken literature, travel directions, games, photos, etc. The compelling demand for mobile devices has one valid reason that they enable flexibility for users and libraries to access up-to-date information ubiquitously. Hence, Bring Your Own Device (BYOD), the practice of students bringing their smartphones, tablets, or other miniature devices to access information in a ubiquitous environment, is a common trend across different academic institutions.

Mobile library applications open doors for libraries for myriad opportunities. In the age of **"information on the go"** libraries, particularly academic and special libraries, can serve their users by leveraging the growing capabilities of mobile technology. Many initiatives are adopted by libraries in developed countries to expedite their existing library services and to make them mobile-friendly. With a good Internet speed, a user can access information with ease anytime, anywhere, his or her library. Thus, providing library services via mobile phones expands the scope of the library services, and a library takes a giant step toward becoming an around-the-clock service.

Further, libraries are offering new services to patrons through mobile web services that can help them to easy access without constraints of time and space, services that the users expect from the communities, and content providers. Libraries are always anxious to leverage the modern mobile technology that most of their users are using, such as smartphones and other sophisticated devices to deliver robust services with convenience. These devices are made ready through many library mobile initiatives to integrate library services with a user's daily lives.

Interestingly, no library in India has taken any initiative to implement mobile devices in the library services fully and not mobilized their existing services to mobile Web so far, and there is no plan to do so in the near future. Because libraries in India are facing a considerable and never-ending challenge, how to keep pace with the rapidly changing technological landscape, lack of skilled human resources, and ensure the services they provide tap into the new technologies

which are infiltrating society. They can mobilize and expand their existing services by offering mobile access to their websites and online public access catalogues, by supplying on-the-go portable reference services and by providing mobile access to e-books, journals, video, audiobooks, and multimedia content. This unavailability of mobile library services in the mobile world would ultimately create a gap between libraries and users.

The image of a library as an impervious vault wherein librarians serve as the gatekeepers, guiding patrons through myriad stacks, has become outdated. Today's libraries need to take a new channel to provide their resources, services, and Research tools to today's generations and stay tuned with users. Therefore, librarians must understand mobile devices and provide services through them. It has become an important issue to develop methodologies or tools to assist the user community by providing them easy access by developing information services on mobile devices.

Therefore, considering the potential for fast information access in miniature devices anytime, anywhere with mobile technology. The invited lecture highlights the problems faced by the users in accessing information on their mobile devices and how to enhance the existing library services into Mobile-based Library Services. It will also touch on various facets of mobile library services, such as Mobile library website; Mobile library catalogue; Library Apps; Library SMS notification; SMS reference service; Use of Quick Response (QR) codes in library services; Mobile collections; Mobile Audio tours; Mobile Augmented Reality; Mobile instructions; Mobile databases, and Mobile services for Persons with Disabilities.

# Big Data and Cloud Computing in Bioinformatics

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## Abstract

Big Data analytics is the technique of collecting, organizing and analyzing huge datasets to discover useful patterns and relevant information. Over the years, the quantity of biological data has been increasing in the form of DNA/Protein sequences, metabolic pathways, interactions, and three-dimensional structures. Biological data analytics is crucial for agricultural development. Along with this, weather forecast and irrigation related data is also important and needs to be stored and analyzed. Big data analytics is often associated with cloud computing because the analysis of large data sets in real-time requires a complex platform. Hadoop is a platform to store large data sets and Map Reduce to Coordinate, combine and process data from multiple sources. Hadoop is a software ecosystem for massive parallel computing and Map Reduce is a computational model that spreads the computation across a potentially endless number of servers. Amazon offers a variety of bioinformatics-oriented virtual machine images like Bio-conductor and Bioperl and also provides several large genomic datasets in its cloud.

Big data emerges from the advancement of technologies like next generation sequencing, which involve huge amount of data including parallel algorithms, statistical methods and machine learning techniques with various features and validation procedures. The volume, velocity, veracity and variety of agricultural databases in post genomics era, mainly due to affordable, reliable and new generation analytical technologies, have made the importance and application of big data analytics on cloud platforms in agricultural research and applications inevitable. Cloud computing for big data analysis and interpretation is essential for sustainable agricultural development. In agricultural aspects, technologies like Agro Mobile which is a cloud-based framework on mobile, Agri-Cloud for agricultural data storage, processing and analysis is based on Management of agriculture data (MAD)-cloud and MAD-Expert Service Module. With its application sharing and cost effective properties it is useful for all and should be made accessible. Big data analytics and cloud computing with respect to agriculturally important plants and animals is crucial for progressing towards a sustainable livelihood and development.

# Digital Knowledge Era and the Future of Work: Challenges and the Current Status of JST CyborgCrowd Project

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## Abstract

JST CREST CyborgCrowd Project is a Japanese government funded project that started in Dec. 2016 to extend crowdsourcing technologies to deal with hybrid workforce comprising of human and AI-powered machine workers (what we call AI workers) in the new digital knowledge era. The project has two goals: (1) to extend the traditional work force to include a diverse set of workers, including AI workers and people who were not considered as a part of workforce in the traditional organizations, and (2) to automate the task assignment process and dynamically optimize the assignment in terms of not only employers' but also workers' viewpoints. The project is also expected to conduct proof-of-concept experiments with real-world applications, based on the middleware that implements the research results. This paper overviews the project and gives the challenges and the current status of the project.

## Keywords

Crowdsourcing, AI, Bigdata, Future of Work, ELSI (Ethical, Legal and Societal Issues)

## Introduction

In the past, the cost to hire people to perform tasks was expensive. Therefore, it was reasonable to develop teams with only workers who had full commitment to perform your tasks. Crowdsourcing caused a long tail revolution in the workforce building. Today, we can easily ask a huge amount of people online to perform your tasks – They may be volunteers (e.g., contributors to Wikipedia) or paid workers (e.g., Turkers on Amazon Mechanical Turk).

JST CREST CyborgCrowd Project is a Japanese government funded research project that started in Dec. 2016 and is planned to continue until 2022 March with an overall budget of about three million USD. The objective is to develop fundamental technologies for the new digital knowledge era we can access a diverse set of workers who were not considered as a part of workforce in the past (Figure 1) to solve massive labor-intensive problems.

Japan Science and Technology Agency (JST) is an independent public body of the Ministry of Education, Culture, Sports, Science and Technology (MEXT), and CREST is one of JST's major funding schemes for stimulating achievement in fundamental science fields. The project team consists of four groups from three universities: University of Tsukuba, University of Toyama, and Kyoto University. Each group also has members from other universities and as a result, the project has more than 25 researchers as research participants and collaborators world-wide.

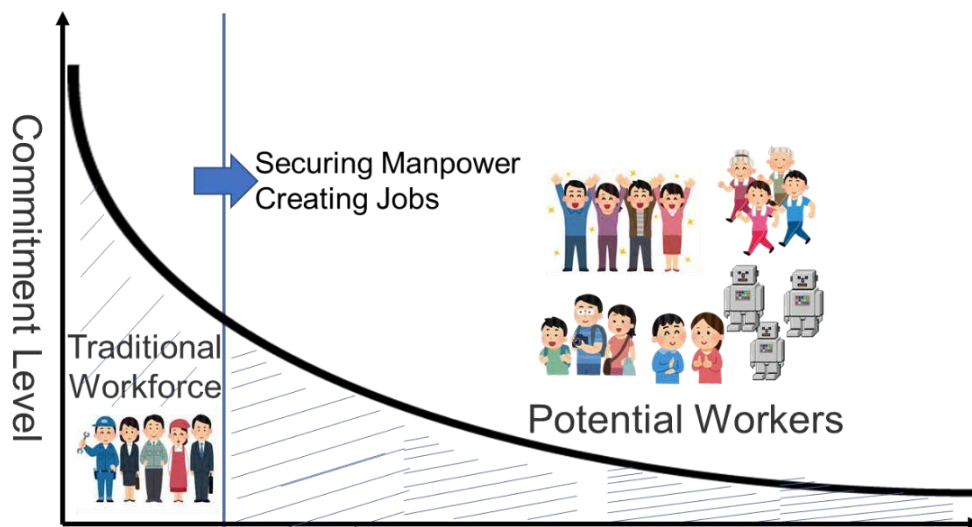


Figure 1. Crowdsourcing caused a long-tail revolution in the workforce building. The JST CREST CyborgCrowd project addresses technologies for exploiting a hybrid workforce comprising a diverse set of human and AI (machine) workers with different commitment levels

## Goals, the Approach and Research Issues.

JST CREST CyborgCrowd project has two goals – (1) to extend the traditional workforce to include a diverse set of workers, including AI workers and people who were not considered as a part of workforce in the traditional organizations, and (2) to automate the task assignment process and dynamically optimize it in terms of not only employers' but also workers' viewpoints.

The approach is to extend crowdsourcing technologies to deal with hybrid workforce comprising of human and AI-powered machine workers to solve massive labor-intensive problems. The project addresses three research issues.

**[Multi-channel Worker Recruitment and Integration Schemes]** The first issue is how to reach a diverse set of workers other than the people who sit in front of PCs or are using smartphones, through different channels for worker recruitments. Examples of such workers include AI agents (AI workers), people who are walking, and people who have disabilities so that they have problems in doing ordinary microtasks.

**[Automatic Task Assignment and Dynamic Optimization]** The second topic is how to automate the process of specifying workflows, assigning tasks and dynamically optimizing the assignments. The optimization must consider not only employers' but also workers' viewpoints. For example, we may need to consider the psychological stress of workers in the task assignment changes. In addition, since executing the workflow involving crowdsourcing tasks takes a long time in general, the optimization should be on the fly without restarting the workflow from the beginning.

**[Middleware-based Experiments with Real-world Applications]** The third topic is to conduct proof-of-concept experiments with real-world applications and obtain feedbacks from users for our further research. We implement some of our research results on Crowd4U, an all-academic open crowdsourcing platform [9]. We expect that the most promising applications are those that have labor-intensive massive problems.

## Challenges and the Current Status

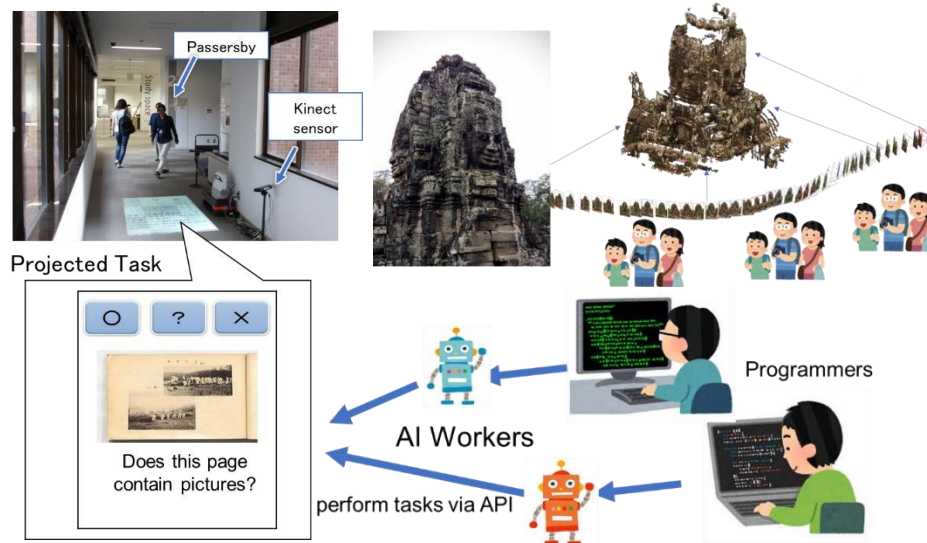


Figure 2. Examples of new channels for recruiting workers: [Left] People walking on the floor, [Top Right] visitors to world heritage sites, [Bottom Right] AI workers who perform the same tasks as those for humans via API.

## Multi-channel Worker Recruitment and Integration Schemes

The challenge in multi-channel worker recruitment is to develop new channels to recruit workers and devise integration schemes for utilizing workers from the channels. The challenge in the new channel development here is that we have to not only reach new types of resources but also make them serve as a part of ‘workforce.’ Some of the new channels we developed so far are given in Figure 2. First, in September 2017, L-Crowd Project, which is a nation-wide library crowdsourcing project in Japan [10] made an open call for AI workers, which are AI programs to perform the same bib identification tasks as those for human workers [8]

Second, we developed a scheme for quality management of the task results given by people who perform the microtasks projected onto the floor while walking [5]. The heart of the scheme is the classifier to distinguish the people who intended to perform tasks and those who just walked on the projected tasks without any intention to answer them. We also found conditions for determining whether we should use the classifier or not for obtaining better results. This way, we can incorporate the people walking on the projected tasks in the workforce.

Third, we developed a scheme to incorporate visitors into the workforce to help us to survey the status of the world heritages. The idea is to build 3D models from a set of photos they take in the venue (Figure 2). To incorporate them into the workforce, we developed an overlay processing method to improve the quality in the situation where the conditions of the taken photos (such as the background of objects and the sunshine condition) are different to each other [12].

We also clarified the conditions for the hearing impaired people to efficiently perform tasks to translate a sign language into a written one [15]. This way, we have explored several new channels for recruiting workers that we have not reached in the previous typical crowdsourcing contexts.

## Automatic Task Assignment and Dynamic Optimization

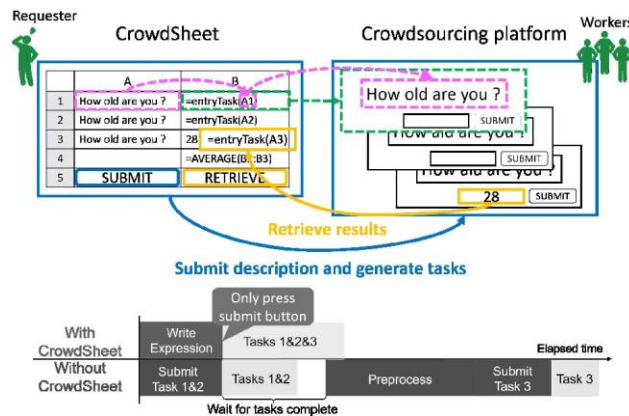


Figure 3. [Top] Microtasks written in CrowdSheet are automatically submitted to crowdsourcing platforms and the results are inserted into the spreadsheet cells. [Bottom] Therefore, complex dataflows involving microtasks are automatically executed without manual intervention [14].

The challenge here is to free people from the hard work of developing, deploying and optimizing workflow and task assignments. The multi-channels for worker recruitment give us a larger optimization space, so that we can conduct novel optimizations, such as those between humans and AIs, and those between crowdfunding and labor contributions. In addition, since the CyborgCrowd vision is about the future of work, the optimization should be performed not only in terms of employers' but also workers' viewpoints. So far we developed several techniques related to these issues.

For the rapid development of complex workflows containing crowdsourcing tasks, we developed CrowdSheet [14], which is an easy-to-use, one-stop tool for implementing complex crowdsourcing (Figure 2). CrowdSheet provides a spreadsheet interface for easily writing complex dataflows with a variety of microtasks, with crowdsourcing services such as Amazon Mechanical Turk (MTurk) in its backend. The focus is on making it easy for a wide range of people to exploit the power of complex crowdsourcing. Our design principle separates the concerns on aspects such as quality and costs from the essential logic of applications; CrowdSheet accepts independent modules implementing techniques for generating alternative execution plans [13]. With CrowdSheet, the user is released after writing simple expressions and pressing the submit button. Tasks are automatically submitted and the spreadsheet cells are gradually filled with the results of completed tasks. Because of its simplicity, the spreadsheet paradigm has been widely accepted by people who are not IT experts. Each cell contains either a value (numerical or string) or a function to compute a value whose parameters are often taken from other cells. CrowdSheet builds on this paradigm and provides two predefined functions to define and invoke tasks, whose parameters are often taken from other cells. We conducted a theoretical analysis to identify the expressive power, and we evaluated whether ordinary spreadsheet users can use CrowdSheet to write complex crowdsourcing applications by recruiting users via a crowdsourcing service and asking them to write applications with CrowdSheet.

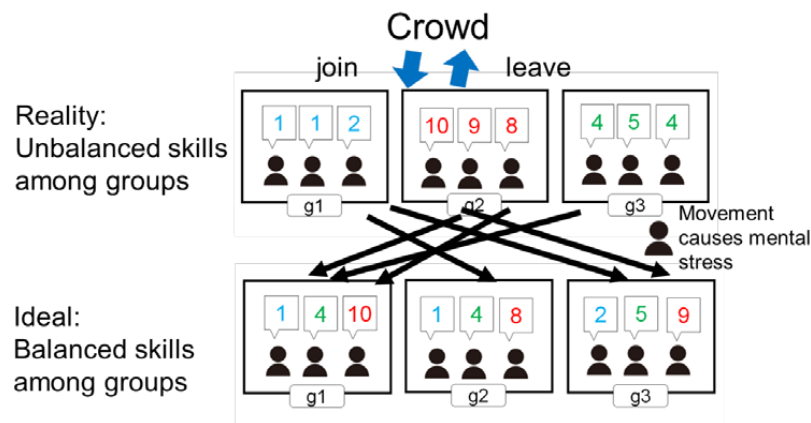


Figure 4. Task assignment changes cause psychological stress to workers. We developed a strategy that exploit a cognitive characteristic of humans, for moving people to keep the average skill of each group balanced with less psychological stress [6].



For an optimizations, we devised several techniques that consider human and social factors in the task assignment process [2][4][11]. For example, we addressed the problem of forming worker groups assigned to the same task in a task stream that requires more than one worker (Figure 3). The objective is that we want to balance the skills of workers in the worker groups. If the skills are balanced among groups, aggregations of the task results should be uniform in quality, which would avoid dissatisfaction caused by the curve of quality utility [16]. However, in crowdsourcing, workers can join and leave a queue. Therefore, we must restructure worker groups in a queue based on worker behaviors. On the other hand, this restructuring causes psychological stress in workers such as confusion or irritation; a clear trade-off exists between dynamically optimizing the distribution of skills among groups and the number of re-assignments of workers that often cause psychological stress. We compared three strategies in terms of the skill balance among worker groups, the quality of the final outputs, the number of worker re- assignments of workers, and psychological stress felt by workers. We found that one of the compared strategies yields good results based on these measures [6].

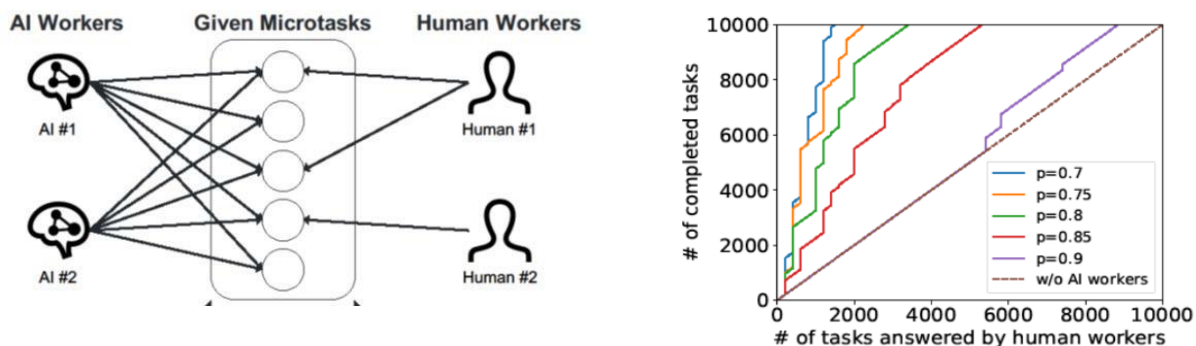


Figure 5. [Left] The problem is to determine which tasks should be done by AI workers to satisfy quality requirements. [Right] We devised a statistic-based method that can dynamically control the task assignment. X-axis is the number of tasks done by human workers, and Y-axis is the number of completed tasks by either human or AI workers.  $p$  is the parameter representing the quality of the results. When  $p$  is smaller, our method completes all the tasks with a smaller number of tasks assigned to human workers.

An interesting challenge is to develop effective and automatic ways to combine contributions from AI and human workers. As mentioned in the previous subsection, we model external AI programs as unknown AI workers. We devised a statistic-based method to dynamically determine when the task results by AI workers should be accepted (Figure 5). This method dynamically assigns tasks to human and AI workers while supplying the task results obtained by human workers to the AI workers as training data. The automated method for the integration process will provide a solution that not only is more scalable than manual integration, but also allows a wide range of people to exploit the power of AI technology, because the hybrid (AI+Human) crowd model frees them from the hard work of not only developing the AI programs but also integrating them to solve their problems effectively.

## ***Middleware-based Experiments with Real-world Applications***

The challenge in this issue is to develop middleware that implements the research results and use it for real-world applications so that we can conduct proof-of-the-concept experiments and obtain the feedback to know the real-world requirements related to our research. We implement our results on Crowd4U. We assume that our CyborgCrowd technologies are effective for solving labor-intensive data intensive problems. The natural disaster response is one of the promising applications.

In July 2018, we conducted a cyber natural disaster drill in Tsubame-city, Niigata prefecture, Japan. Our experiments were conducted in the frame of disaster drills that the town of Tsubame organizes twice a year, and this time new technologies were employed in order to gather different sets of information and reflect on solutions to real-world problems that can be addressed by implementing, in an effective way, the collaboration between crowdsourcing and AI [1]. On the early morning on July 1st, members of our team attached the signs along the streets using pink curing tape (Figure 6). For the signs that were placed on the residents' houses, we attached the pink curing tape on with on construction paper and fixed them on walls, pillars, etc. These signs stood for 'damaged water pipes', 'collapsed building', 'collapsed walls' and 'damaged road.'



Figure 6. The places of signs in the Tsubame-city cyber natural disaster drill

In the drill, we wanted to know whether people in the disaster venue can serve as in-situ workers to develop a disaster situation map. The participants to the drill were asked to recognize and memorize those signs. Once arrived at the designed evacuation center, the citizens were asked to remember where they had seen the signs and mark their position on a virtual map, previously prepared with the help of drones, using tablets. The position was made available for them to check on a big monitor. In the occurrence of an earthquake, drones can also be employed to check the position of collapsed buildings so to collect real-time information. And as soon as the

exercise began, the residents found the signs, memorized their positions and carried out evacuation. We put tablets on the evacuation sites for workers to report the places they saw signs. On the other hand, we collected images from drones and generated microtasks for online workers for comparison of online and the in-situ workers.

We found that the in-situ crowd worked well in terms of the speed and the result quality. The accuracy of the task results were 69 to 86% [1]. We also found that online workers produce comparable results. This suggests us that we can combine the results from different kinds of workers to improve and find important information (such as the missing report from the in-situ crowd may suggest serious damages in the venue).

In October 2019, we will conduct an international cyber natural disaster response drill with Ehime prefecture, Japan and Banda Aceh city, Indonesia (Figure 7). During the drill, starting from participants in Japan and Indonesia, many others will be recruited worldwide for developing a disaster situation map. Using the aerial photographs of the 2018 West Japan Flood, their aim is to uncover the flooded areas as quickly as possible by bringing together the collective power of human and AI workers, which are developed through open recruitment on crowdsourcing services.

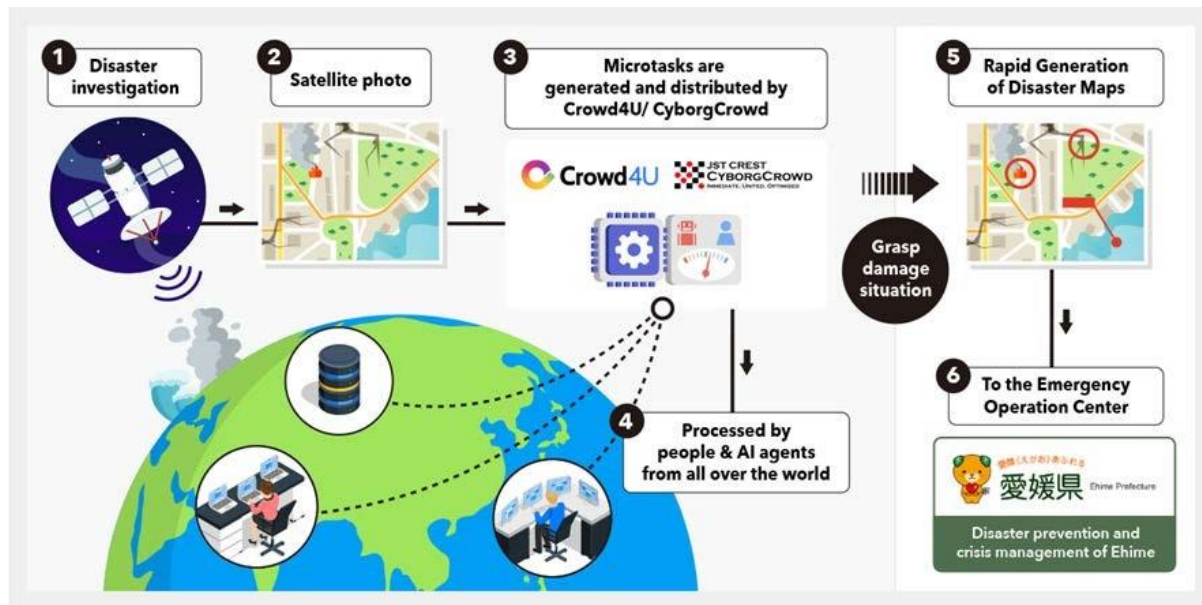


Figure 7. Indonesia-Japan Cyber Natural Disaster Drill with CyborgCrowd/Crowd4U Technologies

Participants from all over the world will judge the flood situation from satellite images and aerial photographs. At the same time, AI workers learn the judgment results and estimate the total damages. The results of human assessments and AI estimation are put together and send back to the affected area (Ehime Prefecture) to speed up decision making for disaster response. This represents a new form of support that consolidates the power of remote participation of people and AI in the new digital knowledge era.

We have also been working with the library community and academic societies. As mentioned in Section 3.1, Kyoto prefectural library called for AI workers that perform microtasks for the comparison of bibliographic records in their union catalog in September 2017, to integrate bibliographic records of

Kyoto prefecture area. The project members reported that the AI workers could produce reasonable results [3]. In 2018, we developed a session program draft for VLDB 2018 [17] by the ‘authors-in-the-loop’ approach [7], which helped PC chairs reduce the amount of time to produce sessions by half.

## Summary

This paper explained JST CREST CyborgCrowd project, a Japanese government funded project for extending crowdsourcing technologies to deal with hybrid workforce comprising of human and AI- powered machine workers in the new digital knowledge era. The project has two goals: (1) to extend the traditional workforce to include a diverse set of workers, including AI workers and people who were not considered as a part of workforce in the traditional organizations, and (2) to automate the task assignment process and achieve a balanced and dynamic optimizations in terms of not only employers’ but also workers’ viewpoints. In addition, we conduct proof-of-concept experiments with real-world applications, based on the middleware that implements the research results. This paper overviews the project and gives the challenges and the current status of the project. Some results have already been made open to public. We believe that the challenges addressed in the JST CyborgCrowd are essential for designing a better future of work that comes in the new digital knowledge era.

## Acknowledgements

The authors are grateful to the members and collaborators of JST CREST CyborgCrowd and Crowd4U projects, including Masaki Matsubara, Hidehiko Shishido, Fulco Flavia, Yoko Yamakata, Hisatoshi Toriya, Masaki Kobayashi. Some of the researches were conducted in collaboration with ISee project members. We are also grateful to the contributors who perform microtasks on Crowd4U. The names of contributors are listed at <https://crowd4u.org>. Note that the list of Crowd4U contributors contains only the names of contributors who have accounts on Crowd4U; there are many anonymous contributors who perform microtasks on Crowd4U. This work was supported by JST CREST Grant Number JPMJCR16E3 and partially supported by JSPS KAKENHI Grant Number 17K20022, Japan.

## References

1. Fulco, F., Inoguchi, M., Mikami, T. (2018), Cyber-physical disaster drill: preliminary results and social challenges of the first attempts to unify Human, ICT and AI in disaster response, The Second IEEE Workshop on Human-in-the-loop Methods and Human Machine Collaboration in BigData (IEEE HMDData2018), pp.3494-3496.
2. Duan, X., Tajima, K. (2019), Improving Multiclass Classification in Crowdsourcing by Using Hierarchical Schemes, The Web Conference, pp.2694-2700.
3. Harada, T., Fukushima, Y., Sato, S., Tsuruta, M., Yoshimoto, R., Morishima, A. (2019), Advancement of Bibliographic Identification Using a Crowdsourcing System. A-LIEP 2019, (to appear).
4. Hashimoto, H., Matsubara, M., Shiraishi, Y., Wakatsuki, D., Zhang, J., Morishima, A. (2018), A Task Assignment Method Considering Inclusiveness and Activity Degree, The Second IEEE Workshop on Human-in-the-loop Methods and Human Machine Collaboration in BigData (IEEE HMDData2018), pp.3497-3502.
5. Iwamoto, E., Matsubara, M., Ota, C., Nakamura, S., Terada, T., Kitagawa, H., Morishima, A. (2018), Passerby Crowdsourcing: Workers' Behavior and Data Quality Management, Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT 2018), Vol. 2, No.4, Article 169 (20 pages).
6. Kumai, K., Matsubara, M., Shiraishi, Y., Wakatsuki, D., Zhang, J., Shionome, T., Kitagawa, H., Morishima, A. (2018), Skill-and-Stress-Aware Assignment of Crowd-Worker Groups to Task Streams, The sixth AAAI Conference on Human Computation and Crowdsourcing (HCOMP2018), pp.88-97.
7. Kobayashi, N., Matsubara, M., Tajima, K., Morishima, A. (2017), A Crowd-in-the-Loop Approach for Generating Conference Programs with Microtasks, The First IEEE Workshop on Human-Machine Collaboration in BigData (HMDData2017), pp.4312-4314.
8. L-Crowd: The Library Crowdsourcing Initiative in Japan. <http://crowd4u.org/projects/lcrowd/> (accessed July, 2019).
9. Morishima, A., Amer-Yahia, S., Basu Roy, S. (2014), Crowd4U: An Initiative for Constructing an Open Academic Crowdsourcing Network. HCOMP 2014.
10. Morishima, A., Kawashima, T., Harada, T., Uda, N., Ohmukai, I. (2013), L-Crowd: A Library Crowdsourcing Project by LIS and CS Researchers in Japan, International Conference on Digital Library (ICDL2013), pp.40-47.
11. Mizusawa, K., Tajima, K., Matsubara, M., Amagasa, T., Morishima, A. (2018), Efficient Pipeline Processing of Crowdsourcing Workflows, The 27th ACM International Conference on Information and Knowledge Management (CIKM2018), pp.1559-1562.
12. Shishido, H., Kawasaki, E., Ito, Y., Kawamura, Y., Matsui, T., Kitahara, I. (2018), Time-Lapse Image Generation using Image-Based Modeling by Crowdsourcing, The Second IEEE Workshop on Human-in-the-loop Methods and Human Machine Collaboration in BigData (IEEE HMDData2018), pp.3540-3541.
13. Suzuki, R., Sakaguchi, T., Matsubara, M., Kitagawa, H., Morishima, A. (2018), CrowdSheet: Instant Implementation and Out-of-Hand Execution of Complex Crowdsourcing, 34th IEEE International Conference on Data Engineering (ICDE 2018), pp. 1633-1636.

14. Suzuki, R., Sakaguchi, T., Matsubara, M., Kitagawa, H., Morishima, A. (2018), CrowdSheet: An Easy-To-Use One-Stop Tool for Writing and Executing Complex Crowdsourcing. CAiSE 2018, pp.137-153.
15. Shiraishi, Y., Zhang, J., Wakatsuki, D., Kumai, K., Morishima, A. (2017), Crowdsourced real-time captioning of sign language by deaf and hard-of-hearing people, International Journal of Pervasive Computing and Communications, Vol. 13 Issue: 1, pp.2-25.
16. Trestian, R., Moldovan, A., Muntean, C., Ormond, O., Muntean, G. (2012), Quality Utility modelling for multimedia applications for Android Mobile devices. IEEE International Symposium on Broadband Multimedia Systems and Broadcasting 2012, pp. 1-6.
17. 44th International Conference on Very Large Data Bases (VLDB2018). <http://vldb2018.lncc.br/>

# **Re-Imagining TCS Information Resource Center (IRC) the Business 4.0 way**

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## **Abstract**

TCS IRC as one of the key corporate functions of the parent organization has continuously endeavored to align itself with the organization's vision. The impact of Business 4.0, enabled through TCS' digital directions in the form of four key technology pillars: Intelligence, Agility, Automation and Cloud, has mobilized changes in the IRC's Services.

The IRC has not only leveraged the organization's ecosystem, technology, resources and infrastructure but also included its stakeholders in its process of development. It continues to build on its formidable repertoire of resources, to enhance learning and knowledge of its four hundred thousand strong associates spread across the globe. Through the creation of value-adding information products & tailored content it strives to keep the organisation up-to-date and business ready. Its Services have been remodeled to improve productivity & delivery mechanisms, opening up a path towards an agile transformation. It has embraced risk as a positive propeller in its investments in resources and adoption of flexible service patterns. A reimaged IRC is visible in the synergy it has created to help TCS remain informed and able to retain its business edge.

# **Innovative Professional Skills and Challenges for 21st Century Academic librarianship in Delhi-NCR**

**Projes Roy**

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## **Introduction**

An academic library is the heart of an institution. Dr. Shankar Dayal Sharma, 9th President of India said, "A library is more important than a university because a library can function without a university whereas a university cannot function without a library." The 21st century full of new challenges, new inventions, new services and opportunities. Now library service has changed by the influence of computers, microelectronics and communication technologies.

## **Objectives**

The paper studied to review skills needed by library and information science (LIS) professionals in Indian context in the twenty-first century and suggested new approaches towards skill development, to identify impact of professional librarianship on users satisfaction, to identify the different modes of achieving the modern professional skills by the librarian, to identify overall level of satisfaction with the extent of their professional development, to study the organizational support regarding professionals skill enhancement

## **Methodology**

The above study has conducted in two phases, in the very first phase the study has chosen the different undergraduate college libraries under university of Delhi. The all selected library are surveyed and interviewed the library staff to know the different challenges in professional skills. In the second phase of study the some of the most prestigious higher educational institutes and universities has taken into the study. The institutions were surveyed and staff member of its library were interviewed. A separate user's interview was conducted to know the users need and satisfaction.

## **Findings**

Majority of the libraries utilize their maximum funds on the procurement of e-resources. All the libraries are automated, as far as staff strength is concerned, nearly all these libraries are facing



challenges. In all the libraries, staff members are well qualified, competent and efficient to perform their duties. The library staff in these libraries have the basic awareness of modern electronic technology such as internet related competencies, library operation / automation products, computer hardware peripherals and their usages.

## Discussion

The study focused on the different category of skill and different challenges faced by the professional. i.e. The Technical Skills: sift analyses, synthesize, assimilate, interpret and reformulate the information accessed and retrieved. IT Skills: data in electronic form, indexing techniques, selection and evaluation of sources, searching techniques, updating technique, and information retrieval skills include online searching. The advance programming skills: system administration, hardware maintenance and own trouble shooting, networking, system migration, etc.

## Conclusions

At the end of the study it has come to know that the environment of libraries are changing, now new technologies are available that make work easier, professional need new skills to meet the upcoming challenges.

## Recommendations

The study has found that the majority libraries in Delhi NCR are having excellent professional who are working towards the new technology innovation and meeting the day to day requirement of the users with fullest professional approach. Majority professional are self-motivated and trained themselves time to time. The users are mostly satisfied and avail new technologies, The study found that the higher officers are mostly well aware about the professional skills and challenges and they have routine training, but the lower level staff member need more training and intuitional policy for skills awareness training program.

## References

1. Nicole Johnston Rupert Williams , (2015)," Skills and knowledge needs assessment of current and future library professionals in the state of Qatar ", Library Management, Vol. 36 Iss 1/2 pp. 86 – 98
2. Pandey(A) (2012), New Skills for library and Information Sciences Professionals in Technology Intensive Environment: A study of Selected University Libraries in Delhi (Unpublished MLIS thesis), IGNOU, Delhi, India.
3. Paliwal (S K) (2013), Innovative Professional Skills for Library and Information Sciences: A case study of Selected College Libraries of University of Delhi (Unpublished MLIS thesis), IGNOU, Delhi, India.

4. Seema (2015), Professional Skills and Challenges for 21st Century Academic Librarianship in Delhi ( Unpublished MLIS thesis), IGNOU, Delhi, India.

# Libraries, Integrity, and the Battle against Untruth

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## Abstract

Even though Diogenes was said to wander ancient Athens searching for an honest man, there is some evidence that he himself was not entirely honest and may have manipulated currency by forging or debasing it. In ancient Greece, people could measure the value of currency by weighing it and testing for the quantity of precious metals, mostly silver or gold. Weighing the value of news and information is harder, but in some sense follows similar principles by measuring both the quantity of verifiable fact and the use of logic. Some tools to do this are available today. Publically available fact checkers can help, as can edited crowdsourced sources like Wikipedia, if used cautiously, since the reliability of the facts can depend on the topic. The quality of logic is harder to measure, not only because the rules of logic are not universally understood or accepted, but because misleading (but nonetheless true) facts can logically lead to false conclusions. It is the interaction of fact and logic that separates false information from conclusions that are likely to be true, and a greyscale range often plays a role, since reliable information is rarely a simple black and white matter.

People often view libraries as repositories of reliable information. To fulfill this expectation, libraries need reliable tools. This lecture looks at what tools are available and what still needs development.

# **Tinker and Try - What does the Cologne Public Library have to do with making knowledge cool?**

**Hannelore Vogt**

## **Abstract**

What is a library's core strength? Only providing information? Whoever thinks this is, perhaps unwittingly, out of date. In the context of digitization, the challenge for libraries lies elsewhere—in making knowledge available! The dissemination of this rapidly growing resource is our way of safeguarding the future. In the face of technological and social upheaval, libraries are places of reorientation.

Patrons are not passive recipients, but curious participants. The new objective is for people to try things out, to make things themselves, and to enjoy this newly acquired knowledge. Knowledge can be acquired alone or in groups, online or in person, in analog or digital format; what is paramount is the curiosity and joy of discovery.

Under the motto “Discover, Learn, Create”, the speaker will discuss current library trends and the future role of the library. She will present unique methods of digital education and promoting reading through play. The essence is future-oriented service offerings that primarily encourage doing and rely on the active participation of citizens. Makerkids, gaming, virtual reality, coding, robotics or digital storytelling are some examples of this.

She will use the experiences of the Cologne Public Library to demonstrate how library spaces can be gradually adapted to meet changing requirements. The physical library space must transform as well and become an inviting place of learning with high comfort that encourages users to spend time – a so called “third space”. This transformation must, however, be accompanied by teamwork, since innovation and change can only be successfully implemented with a collaborative effort. So change management and staff orientation are topics as well.

There is no need for cultural pessimism, as the Cologne Public Library shows by example the transformation of offerings and spaces that are possible in the digital age.

# Examining Twitter' Conversation during Indonesians' Students Protests: User and visibility analytics

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School of Applied STEM, Prasetya Mulya University

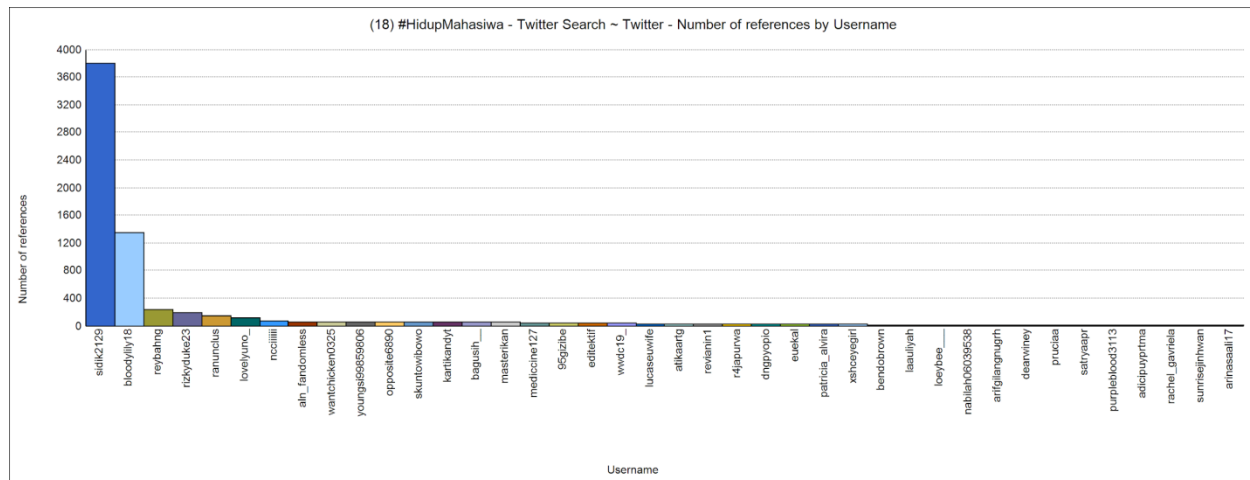
## Abstract

Social media has been widely adopted for various social activism worldwide. In particular, literature found that the digital platform contributes to coordinate, mobilize and organize various societal and political movements such as the Arab Spring (Castells, 2015), the Indignados movement (Bennett & Segerberg, 2012), the umbrella movement in Hong Kong (Lee & Chan, 2016) and the save KPK movement in Indonesia (Suwana, 2019). The capability of social media to facilitate wide and massive distribution of various information supports civic engagement and political participation. Moreover, the capability of social media application to provide various spaces for interactions amongst users and to facilitating a meeting, expressing opinions and debating a topic amongst various users, enable a support for social and political change (Wijaya, Watson, & Bruce, 2018).

Regarding the growing interest of social media roles in facilitating social movement, therefore this paper discusses online interactions amongst Twitter' users of *#hidupmahasiswa* hashtag. This hashtag is created to support the students rally demonstration against various new proposed laws in Indonesia which are perceived affect to weaken the anti-corruption eradication commission and threatening the civil liberties. Data is collected through *Ncapture* applications and analyzed using *NVIVO* qualitative data analysis software. To reach a better understanding of the online interactions within the hashtag, this research use two metrics as developed by Bruns and Stieglitz (2013): user' activities metrics and their visibility within hashtag participants. The first metric, user's activities metrics will measure the most active users within the hashtag through a simple count of tweets sent by each user. The number of tweets sent is divided into two groups: original tweets sent and @mention sent. Original tweet sent is simply an original tweet without any mention to other users. Then @mention sent is a tweet which mentions other users through '@username'. @mention sent is divided into genuine tweets and re- tweets. Then, the re tweets can be grouped into edited retweets and unedited retweets. The second metric, visibility of users within hashtag examines the most visible users within a hashtag by simply measure the number of @mention received by a user. Then, this indicator is grouped into two main sub indicator: genuine@mentions received and retweet @mention received. The retweet@mention received is divided into edited and unedited messages received.

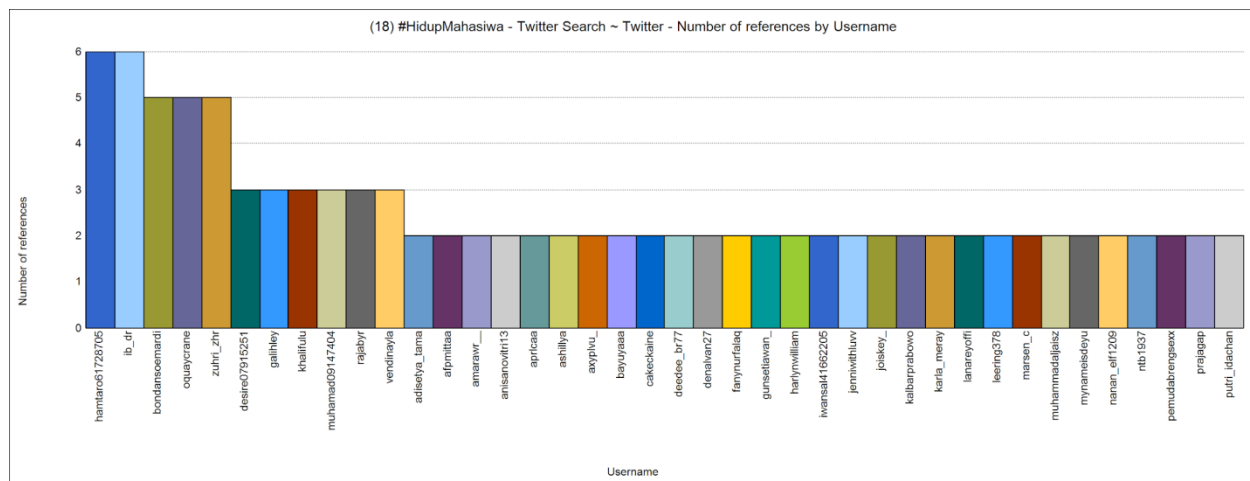
This research found that the most active user is a user who retweet a massive amount of a single message within a short period of time. It also happens for the second active users who did the same thing, sending a massive amount of a single message in a short period of time.

### The number of tweets sent by user.



When the message is filtered to original tweet, this research found that there is a little amount of original tweets sent by user.

### The number of original tweets sent by user



I think that the most active users within a hashtag to support a rally of protest does not need necessarily sending an original message, but the relevancy of the message with the aims of the activism could influence the impact of the tweets.

## References

1. Bennett, W. L., & Segerberg, A. (2012). The logic of connective action: Digital media and the personalization of contentious politics. *Information, Communication & Society*, 15(5), 739-768.
2. Bruns, A., & Stieglitz, S. (2013). Towards more systematic Twitter analysis: metrics for tweeting activities. *International journal of social research methodology*, 16(2), 91-108.

3. Castells, M. (2015). *Networks of outrage and hope: Social movements in the Internet age*: John Wiley & Sons.
4. Lee, F. L., & Chan, J. M. (2016). Digital media activities and mode of participation in a protest campaign: A study of the Umbrella Movement. *Information, Communication & Society*, 19(1), 4-22.
5. Suwana, F. (2019). What motivates digital activism? The case of the Save KPK movement in Indonesia. *Information, Communication & Society*, 1-16.
6. Wijaya, S. W., Watson, J., & Bruce, C. (2018). Understanding Empowerment in Social Media Context: Lessons from Indonesian Migrant Domestic Workers. *International Journal of Web Based Communities*, 14(2), 172-195.

# **The Past, Present, and the Future of Information literacy in the context of the 4<sup>th</sup> Industrial Revolution**

**Johnny Yuen**

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## **Abstract**

Information literacy, or IL, is an umbrella concept highly related to outcomes of study, research, inquiry, career, and even life-long learning. At the same time, IL infers to a wide range of skills, techniques, and capabilities. The concept has gone through significant changes in definition over the past 40 years. This change could be perceived as the result of the technological advancement of the information production cycle and context of information dissemination. This paper discusses the vision and mission of a cross-institutional information literacy project among eight university libraries in Hong Kong, and the design rationale behind InfoLit for U MOOC, a MOOC tailored to facilitate 21st century university study and research. As society continues to advance and AI-empowered everything just around the corner, would IL still have its relevance in the 4th industrial revolution?

## **Keywords**

Information literacy, information production, practices, beliefs, dispositions

## **Information Literacy: An Ever-evolving Concept**

Information literacy, or IL, is a person's capabilities with information. The term was first coined in 1974 by Paul G. Zurkowski, on behalf of the National Commission on Libraries and Information Science (NCLIS) (USA) to describe the tools, techniques, and skills learned by information literate persons to produce information solutions to their problems. Forty years have gone, and this statement is still relevant today because the goal of using information has not changed over the years, i.e., people need the information to solve problems and reach their goals. However, it is the information production cycle, together with the technological context of information production and dissemination, that make IL an ever-evolving concept.



## **Information in the context of technological advancement**

In summary, two forces shape our information landscape over the past 40 years. First and foremost, it is the combined effect of an increase in the number of information producers and information distribution channels. What comes naturally is the lowered efforts in collecting a vast amount of information in varying validity and reliability.

Back in the 1970s, information is produced by few who owns the equipment, disseminated through specialized channels at ground speed. Computers, as information consumption and authoring tool, were new inventions. Intel 8086, the first personal computer affordable by individuals, was not released until 1976. Information products produced by computers, in printed form or saved on physical mediums like magnetic tapes, floppy disks, could only be disseminated or transmitted on ground speed. Another medium of information influential to the general public is the wide-spread adoption of personalized medium consumption devices, like portable cassette players and the sales channel of records and tapes.

As technologies advance, the agency and autonomy of production of new mediums, like video shooting, are put in the hands of ordinary people in the 1980s. Video cameras, recording machines, and video cassette tapes quickly become household electronics affordable by many. However, the dissemination of home-made videotapes is still limited to ground speed. Real-time live transmission by satellites is still limited to television stations at a very high cost.

The 1990s see the bloom of multi-media and dial-up internet, enabling access to a vast amount of rich content at a lower-than-ever production and distribution cost. In the 1990s, computers with more processing power and high storage capacity through CD-Roms are much more wide-spread. Information is not only distributed in a single modality, but they also become multi-media. Although it still operates at a limited speed, e.g., 14k or 28k dial-up, information is being transmitted and distributed anywhere on the earth at an unprecedented rate. Today, high-speed internet and social media radically transform information production and consumption. Practically any internet users can distribute content and ideas to all internet users. Under such a context of technological advancement at an exponential speed, facilitating a critical mind is more future-proof than teaching techniques.

## **Catching-up with the context: From IL as operations to IL as dispositions**

The ever-changing information landscape and information and communication technology over the past 40 years have spawned new ways of interactions with information and corresponding effects on and among individuals. Under such context, many scholars and organizations had spent lots of effort to capture snapshots of 'what IL is at a particular time

and social context', to benefit students and people's work in information-intensive settings (Table 1).

Professional library bodies had been very active in suggesting IL models over the past 40 years, due to historical factors like knowing how to find relevant information in a physical library setting was detrimental to the success or failure of study and research. From the IL-as-operation-skills perspective, learners' need to master generic techniques and skills to utilize information tools of the era is emphasized. For example knowing when they have a need for information, be able to identify sources of information needed to address a given problem, locate required information, evaluate quality of the information, thus organise and use the information effectively to solve the problem or issue at hand (Zurkowski, 1974; ALA, 1989; ACRL 2000). Hence library-designed frameworks and training put much emphasis on four vital aspects of library search skills, including finding information, evaluating information, using information, and avoiding plagiarism. The Information Literacy Competency Standards for Higher Education proposed by ACRL (2000) is the pinnacle of operation-oriented models of IL. The ACRL's IL competency standards is a set of abilities requiring individuals to "recognize when information is needed and have the ability to locate, evaluate, and use the needed information effectively." Each of the seven standards describes indicators of satisfactory performance as well as observable outcomes. However, since information literacy is context-sensitive, these frameworks need to be updated from time to time and adapted into different subject disciplines. For example, ACRL has adapted the IL competence into more than a dozen subject-specific competency standards, including nursing, psychology, teacher education, and so on.

On the other hand, disposition oriented IL models pay detailed attention to the different facets of people's relationship with information. These facets include cognitive, meta-cognitive, or socio-metacognitive understandings and experience of information, and how do these experiences make up one's experience. For example, Bruce's (1997, 2008) informed learning focuses on six frames, or in her term 'lenses', of how information literacy underpins learning in general. These six frames are the content frame, the competency frame, learn-to-learn frame, the personal relevance frame, the social impact frame, and the relational frame. Bruce (1997, 2008) had further elaborated specific details and differences in focus of each of the six frames along view of information literacy, view of information, view of learning and teaching, curriculum focus, view of content and assessment, in order to inspire teachers to design teaching activities that facilitate informed learning from the above mentioned frames among learners.

ACRL's framework for information literacy for higher education (2015) is another example of disposition-oriented IL model. The ACRL 2015 framework, rather than a set of standards or outcome indicators, is a cluster of interconnected core concepts, with flexible options for implementation in the higher education setting to promote the kind of knowledge construction that happens in higher education settings. Its frames include descriptions about the construction process of knowledge, how subject authority came by, and details of information creation, research process, and the academic community. When it rolled out in 2015, it has stirred lots of controversies in the librarian community as many

had argued the dispositions in the new framework is not "teachable" at library workshops and events.

**Table 1.** Information literacy models and theories (selected) since 1974.

Report written on behalf of the National Commission on Libraries and Information Science (Zurkowski, 1974)	<b>"Techniques and skills" learned</b> by the information literate "for utilizing the wide range of information tools as well as primary sources in molding information solutions to their problems"
Presidential Committee on Information Literacy: Final Report (ALA, 1989)	<b>Information literate people know</b> how to find, evaluate, and use information effectively to solve a particular problem or make a decision--- whether the information they select comes from a computer, a book, a government agency, a film, or any number of other possible resources.
The six frames of informed learning (Christine Bruce, 1997)	<b>A relational model of six frames of IL at situations of learning</b> 1. Content frame \ 2. Competency frame \ 3. Learn to Learn frame \ 4. Personal Relevance frame \ 5. Social Impact frame \ 6. Relational frame
Information Literacy Competency Standards for Higher Education (ACRL, 2000)	<b>Information literacy is a set of abilities</b> requiring individuals to "recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information."
Framework for Information Literacy for Higher Education. (ACRL, 2015)	<b>Six concepts that anchor the frames of IL</b> Authority Is Constructed and Contextual \ Information Creation as a Process \ Information Has Value \ Research as Inquiry \ Scholarship as Conversation \ Searching as Strategic Exploration

## The Present: Incepting students with motives to transform information-related beliefs and practices

The InfoLit Project (2015-2018) is a teaching and learning related project, funded by the University Grant Committee Hong Kong, to develop and implement shared interactive multimedia courseware to enhance information literacy among students in eight UGC-funded institutions in Hong Kong. The vital components of this project complement each other and make up an "identify, design, collaborate & embed" project sequence to promote teaching and learning of IL for analytical, creative, and wise use of information. The components are, 1) investigate and build a knowledge base of students' IL educational needs through qualitative and quantitative research methods; 2) the design of a shared interactive multimedia IL courseware, i.e., InfoLit for U MOOC; and 3) enhancement of librarian-faculty collaboration on designing and embedding relevant IL pedagogies into courses.

## A Knowledge Base of Hong Kong Students' IL

When this project started in 2015, the project team members asked themselves a question: What do our university students (who are all born after google went online) still need to know regarding information? To investigate and understand the educational needs for information

literacy of undergraduates in Hong Kong, two studies were conducted, namely the IL educational needs study and the RRSA-HK survey study. Findings of both studies were studied in-depth by project staff and librarians to justify the design of InfoLit for U MOOC.

To explain, the students' information literacy (IL) educational needs study (IL Needs Study) is a cross-sectional case-study designed to investigate IL-related beliefs and behavior of Hong Kong undergraduates studying different domains. Each of the eight participating university designs a discipline-specific information task (Table 2) and recruits twelve undergraduates to participate this study. All ninety-six test sessions were completed in early December 2015.

**Table 2.** Subject domain and goal of IL task designed by participating universities

Discipline	Role of student	Goal of the information task
Arts & Humanities (by Lingnan University)	Staff of a local textbook publisher	To prepare a proposal for education resources pack to illustrate the aspects of the Japanese Occupation of Hong Kong and propose relevant resources.
Business & Economics (by The Hong Kong Polytechnic University)	Marketing director	To write an analytical report to identify the country that has the most significant market potential and develop a marketing strategy to generate the most profit.
Education (by The Education University of Hong Kong)	School teacher	To design a lesson plan for General Education module to address the cyberbullying.
Engineering (by Hong Kong University of Science and Technology)	Engineer of a consulting firm	To write a proposal for the HKSAR government to provide an innovative engineering solution to reduce air pollution emissions and carbon intensity in Hong Kong.
Health Sciences (by The University of Hong Kong)	Health care worker	To write an article for a magazine to illustrate the possible sources of lead poisoning and the effect of elevated blood lead levels on child development.
Law (by City University of Hong Kong)	Trainee solicitor	To write a report listing the options which are open to the parties to resolve the dispute.
Science (by Hong Kong Baptist University)	Advisor to the Commissioner of Hong Kong's Innovation and Technology Commission	To write an analytical report to identify: a) The potential benefits and risks of nanotechnology and b) Potential innovations in nanotechnology that will be particularly beneficial to Hong Kong society.
Social Sciences (by The Chinese University of Hong Kong)	Consultant of a think tank in Hong Kong	To prepare an analytical report to explain the property market and wealth gap situation in the past decade and suggest two factors that can help to improve the situation in Hong Kong.

## Students' IL At-Work and Self-Understanding

The findings of the IL needs study reveal interesting patterns of IL-related beliefs and information search behavior among Hong Kong students similar to the description of the Dunning-Kruger effect (Dunning, 2011). In particular, the project team categorised students with two parameters obtained from the IL need study; first, student's self-rating on their performance at the IL needs task (0-10), and second, actual score (0-12) they have obtained from the IL needs task rated with the AAC&U's information literacy value rubric. With these parameters, participants are grouped into four types for discussion (Table 3). Among the participants, both type A and type C students believe their performance at the IL needs task was good. However, only type C students' performance obtained a high score according to the scoring rubric. In contrast, both type B and type D students gave low self-ratings on their performance. However, only type B students' performance was not desirable in the study. Type D students rated their performance low out of humbleness.

**Table 3.** Types of student categories conceptualized from the IL educational needs study

<p><b>Type A students (over-estimated)</b> High self-rating (7-10) on performance, but the quality of output of the IL needs task is in fact not good according to the rubrics (<i>e.g. 0-5 total score, incomplete draft or copy-&amp;-pasted from the task outline provided</i>).</p>	<p><b>Type C students (honest reflection)</b> High (7-10) self-rating on performance, and quality of output of Q1 of the IL needs task is good according to the rubrics (<i>e.g. 6-12 total score, with elaborated draft outline of report that show intentions and efforts in exploring related issues, working through the content, and/or synthesizing arguments</i>).</p>
<p><b>Type B students (honest reflection)</b> Low (1-3) or medium (4-6) self-rating on performance, and quality of output of Q1 of the IL needs task is not good according to the rubrics (<i>e.g. 0-5 total score, incomplete draft or copy-&amp;-pasted from the task outline provided</i>).</p>	<p><b>Type D students (humble ones)</b> Low (1-3) or medium (4-6) self-rating on performance, but the quality of output of Q1 is <u>in fact good according to the rubrics</u> (<i>e.g. 6-12 total score, with elaborated draft outline of report that show intentions and efforts in exploring related issues, working through the content, and/or synthesizing arguments</i>).</p>

These findings lead to the insight that not all students' IL needs are identical. Also, before introducing operational or procedural information skills, a large part of effort should be devoted to addressing students' motivation to transform their IL-related beliefs and conceptions (e.g., type A students). While facilitation for type B students is rather straight forward, type C and D students should focus on helping these students to identify areas for further enrichment.

## HK Students' Strengths and Weaknesses in IL

On the other hand, RRSA-HK survey study (Research Readiness Self-Assessment (RRSA-HK)) is a standardized fixed-choice information literacy survey adopted and localized from the

original Research Readiness Self-Assessment (RRSA) instrument developed by (Ivanitskaya, 2004). Among the six aspects of IL measured, three belong to IL knowledge (namely obtaining information, evaluating information, understanding plagiarism) while three belong to IL-related beliefs (including browsing the Internet, library and research experience, and perceived research skill). It was administered to 3,200 local undergraduates in two rounds of data collection in two rounds of data collection (September 2016, and March to June 2018). Stratified sampling was conducted to ensure the sample reflects the proportion of the population of students studying different key learning areas. Findings of RRSA-HK provides in-depth insights into the strengths and weaknesses of IL among our students, thus guides the design of the InfoLit for U MOOC. Table 4 presents the mean overall and aspect scores of the two rounds of RRSA-HK survey. All mean scores from the 2018 dataset are higher than the 2016 dataset. Among the three aspects of IL surveyed, students in both sets of data had performed less successfully in evaluating information.

**Table 4.** The mean overall and aspect scores of the RRSA-HK.

IL Competence	Max Score	Dataset	N	Score Range	Median	Mean Score	Score*	S.D.
Overall IL (Sum Of All 3)	80	2016	1557	17-79	51	50.8	63.5	11.5
	80	2018	1445	22-79	55	53.5	66.9	11.9
Obtaining Information	30	2016	1557	9-30	20	20.1	67.0	3.9
	30	2018	1445	7-29	22	21.5	71.7	3.8
Evaluating Information	33	2016	1557	0-33	20	19.5	59.1	7.6
	33	2018	1445	0-33	20	20.2	61.2	7.7
Understanding Plagiarism	17	2016	1557	0-17	11	11.3	66.4	3.6
	17	2018	1445	1-17	12	11.7	68.8	3.7

\* Mean score/Max score

Individual question items from the RRSA-HK provide insights into what kind of facilitation Hong Kong students needs (Table 5). For example, in evaluating information, Hong Kong students are relatively weak in summarizing the intention and critical messages from information they found. Also, they have problems in telling the credibility of information.

**Table 5.** Hong Kong student's difficulties identified from RRSA-HK (selected).

<p>Ability to obtain information</p> <ul style="list-style-type: none"> <li>• Understanding the terminologies</li> <li>• Identifying scholarly documents</li> <li>• Differentiate primary and secondary information</li> <li>• Generating complete citation</li> </ul>
<p>Ability to evaluate information</p> <ul style="list-style-type: none"> <li>• Summarize key messages and purpose of information</li> <li>• Tell the credibility of information</li> </ul>
<p>Understanding plagiarism</p> <ul style="list-style-type: none"> <li>• Identifying cases of copyright violation</li> <li>• The proper way of citation and direct copying</li> <li>• Situations where citation are needed</li> </ul>

## Design Rationales of The InfoLit for U MOOC

InfoLit for U MOOC is the main focus of the “build” part of the InfoLit project, which is free and open to all learners around the world. The design of modules of the IL courseware is based on the Association of College & Research Libraries (ACRL) Framework for Information Literacy for Higher Education (2015) to address students' IL-related weaknesses identified in the IL Educational Needs study and RRSA-HK survey study. Professor Christine Bruce's (2008) frames for informed learning, including personal relevance, competency, and learning to learn, guide the instructional design of each module.

In InfoLit for U MOOC, information literacy (IL) is not only defined as library skills and practices. Instead, a broader definition of IL is presented to learners as an interaction of three inter-related aspects, namely 1) IL related values & beliefs, 2) IL related skills & practices, and 3) Context of task problem. The focal and the eight disciplinary modules of this MOOC are designed to help learners to become analytical, wise, and creative information user at university and professional challenges after graduation. The nine modules of this MOOC challenge common misconceptions, reinforce IL competence transferrable between disciplines, through an engaging learning experience.

### ***The Focal Module***

In the focal module "Not only search skills: What is InfoLit for U study & career?", learners learn how to use information for university-level inquiry works through five sections. Learners learn the essentials of university-level inquiry in each of these sections through the anchoring animations (Table 6) and interactive learning activities.

**Table 6.** Subsections of the focal module and title of its focal animation.

Subsections of Focal Module		Focal Animation
1	Think & plan the "Info Needs" of your research	At University, Learning = Inquiry
2	Don't find answers: Search for ideas to develop ideas	The Amazing Journey of Information
3	Not just filter: Evaluate ideas to form new ideas	The Information Checkpoint
4	Never list them: Connect ideas to create your own idea	The New Ideas Constructors
5	Stay hungry: Join & learn from communities	Learning Never Ends

### ***Discipline Modules***

The eight discipline-related elective modules, each designed by our participating university respectively, dive deeper into the journey and help learners find, evaluate, and create high-quality outputs for tasks.

In each of the discipline modules, learners will face a task scenario typical to the discipline (Table 7). Sub-sections of these modules were designed to guide learners to go through different stages of research (e.g., develop a framework, find, evaluate, create). Discipline-specific IL and research tips were introduced through different kinds of learning objects (e.g., animated clips, infographics, library guides, questions, and so on) to learners. By the end of each module, learners will do an assessment task to check their understanding, followed by formative feedbacks for further developments.

**Table 7.** Information scenario of each discipline module.

Discipline Modules	Scenario	Designed by
Arts & Humanities	Design an exhibition on the impact of Hong Kong cinemas and local culture	Lingnan University (LU)
Business & Economics	Prepare a business proposal	The Hong Kong Polytechnic University (PolyU)
Education	Lesson plan design scenario	The Education University of Hong Kong (EdUHK)
Engineering	An engineering innovation assignment	The Hong Kong University of Science and Technology (HKUST)
Health Sciences	Works related to a legal assignment	The University of Hong Kong (HKU)
Law	A community health project	City University of Hong Kong (CityU)
Science	Updating general chemistry laboratory manual	Hong Kong Baptist University (HKBU)
Social Sciences	Prepare a special report on elderly issues & social protection system in Asian countries	The Chinese University of Hong Kong (CUHK)

As at the end of December 2018, InfoLit for U MOOC has recorded more than 4,500 headcounts of users, of which more than 3,000 accessed through LTI (Learning Tools



Interoperability) links embedded in courses in learning management systems. The pages of the nine modules were accessed more than 23,000 times by learners. Peaks of MOOC pages loadings can be observed near the end of the semesters,

## **The Future: IL Needs in the context of the 4th industrial revolution**

In few years' time, the 5th generation mobile network (5G), artificial intelligence, machine learning, and robotics will go mainstream. These new technologies will undoubtedly revolutionise ways for human beings to interact with information, learning, and citizenship. Furthermore, these new information practices will replace older practices and beliefs before people could have understood it clearly. Therefore, in order to be an informed person or society in the context of the 4th industrial revolution, IL-related issues like the role and authoritativeness of AI, reliability and validity of machine-generated insights, impact of constant influx of information, unequal access or technological divide of AI, and so on, are pressing issues for all of us to think about seriously.

## **References**

1. American Library Association. (2000). Information literacy competency standards for higher education.
2. Bruce, C. (1997). Seven faces of information literacy. AUSLIB Press, Adelaide, S.A.
3. Bruce, C. (2008). Informed learning. Chicago: Association of College and Research Libraries.
4. Dunning (2011). "The Dunning–Kruger Effect: On Being Ignorant of One's Own Ignorance". **44**. *Advances in Experimental Social Psychology*: 247–296
5. "Framework for Information Literacy for Higher Education", American Library Association, February 9, 2015. <http://www.ala.org/acrl/standards/ilframework> (Accessed September 2, 2019). Document ID: b910a6c4-6c8a-0d44-7dbc-a5dcbd509e3f
6. Ivanitskaya, L., Laus, R., & Casey, A. M. (2004). Research Readiness Self-Assessment: Assessing Students' Research Skills and Attitudes. *Journal of Library Administration*, 41(1/2).
7. "Presidential Committee on Information Literacy: Final Report", American Library Association, July 24, 2006. <http://www.ala.org/acrl/publications/whitepapers/presidential> (Accessed September 2, 2019). Document ID: 106e5565-9ab9-ad94-8d9f-64962ebcde46
8. Zurkowski, P. G. (1974). The Information Service Environment Relationships and Priorities. Related Paper No. 5.

# The Contemporary Library's Role in Supporting Active, Informed Citizens

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## Abstract

This presentation focuses on how libraries are employing experiential learning techniques to engage, retain, and provide unique services to visitors. With an emphasis on programs designed to meet the needs of teenagers and young adults, Sarah Ziebell will explore learning models and educational trends that undergird the best practices of the network of South Asian American Spaces (international American cultural centers sponsored by the U.S. Department of State) she oversees. In particular, she will discuss the technology-based library programming as making, coding, virtual reality, civic mapping, and blended learning.

## Presentation

I am currently based at the U.S. Embassy in New Delhi in a public diplomacy position called Regional Public Engagement Specialist (or REPS). What that means, more simply, is that I manage the U.S. Department of State's South Asian network of around 40 American Spaces, U.S. cultural centers, in India, Nepal, Bangladesh, Sri Lanka, and Maldives. Globally, the American Spaces program includes over 650 of these learning, networking, and engagement platforms.

Over the past several years, those of us who engage with youth audiences in American Spaces have watched with great interest developments in the library, museum, and higher education communities as they have increasingly sought to add more collaborative, participatory, experiential learning elements to their engagement with their visitors. American Spaces have been an interesting platform through which to test these learning innovations on an international scale, and I would like to highlight some of our thinking and programs here today.

In their 2017 publication on the subject of distributed governance, Goldsmith and Keiman<sup>i</sup> discuss the importance of resident intelligence. This essentially means activating in citizens their latent knowledge and harnessing this power to inform government. To my mind, this concept goes hand in hand with strong democracies. Michael Goodchild puts it a slightly different way. He describes "citizens as sensors: six billion sensors, constantly sensing the surface of the earth, bring an enormous opportunity to understand people and our planet."<sup>ii</sup> Our public spaces, such as libraries, have tremendous potential to activate citizens through learning.

We see some of the same trends within higher education's turn toward deliberative pedagogy, which some have described as a brand of civic education that complements service learning and

community engagement. This educational tactic situates students outside the classroom, where they may connect theory with real-world problem-solving in the community through structures such as intergenerational learning circles and engagement with community members on public issues. What better place to offer these kinds of civic dialogues than libraries? In the words of Longo and Gibson, “without opportunities to learn about and experience all facets of the democratic process—including a wide range of deliberative, collaborative, problem-solving, and analytical/critical thinking skills—it will be difficult, if not impossible, for citizens to participate as fully and as meaningfully as required for a vibrant, healthy democracy.<sup>iii</sup>” I would argue that in order for libraries to maintain their centrality in learning societies, we also need to embrace our civic engagement and mobilization roles.

I would like to give one example in which our American Spaces network has begun to experiment with these experiential learning methods. The first is something on which we have just started to work in South Asia: training young people in the philosophy and methods of open street mapping (OSM). The idea behind working with OSM communities in American Spaces is quite simple: we believe that young people can contribute to the digital public good and reconnect to their community and the physical world while learning valuable digital skills. In turn, this can help to activate their citizenship and strengthen their societies. We do this by hosting “mapathons” with local volunteers, teaching OSM methodologies and then setting youth and volunteer mentors loose in the community to map, for example, slum areas in some of the megacities where we work, to enable better service provision to lower income people; mapping sources of potable water in areas experiencing a drought; or, in the case of the recent hurricanes in the Bahamas, using OSM to highlight areas where people may be stranded and needing assistance.

Another area in which we have taken heed of larger civic movements is in the area of citizen science. Through the proliferation of ICT technologies such as mobile and web 2.0 (the social web), combined with high-speed internet becoming increasingly commonplace and the mainstreaming of STEAM education, we now have a superb excellent environment in which individuals and communities to participate in scientific research and experimentation. New technological developments have helped to reinforce the ease and fun of citizen science and offered new mechanisms for engaging volunteers to collect and analyze data, as well as to create their own STEAM products through makerspaces, coding instruction, and entrepreneurship education<sup>iv</sup>. Again, libraries and other public institutions have stepped into that space with gusto and are creating opportunities for even those people who are economically marginalized to have the chance to take part in conducting and creating science products.

While I do not intend to go on a lengthy discourse of the many technological innovations like drones and wearables and their impact on the ability of citizens and scientists to collaborate on data collection and analysis—areas better covered by the many experts here at ICDL—I would like to give an example of an area in which we are beginning to explore through our American Spaces networks: virtual reality (VR). What intrigues me most are some of the cross-cutting VR programs I see American libraries offering: book club discussions paired with VR devices that allow readers to virtually visit places mentioned in books and disaster preparedness education for citizens in which they explore earthquake fault lines using VR alongside discussing earthquake

preparedness<sup>v</sup>. In American Spaces, we are beginning to offer VR development courses for youth as a workplace readiness skill, as well as campus tours of American universities in which international students may aspire to pursue their higher education.

Tugging on the thread of higher education, I would like to turn for the remainder of my talk to the topic of blended learning. I have been captivated by the potential of online education as a tool for exposing young people to U.S. higher education and research inquiry methods, helping them improve their English speaking and writing skills, and serving as a tool for expanded, people-to-people dialogue and connections between American youth and young people from around the globe.

Before diving into a couple of examples from the American side, I wanted to back up and explore a bit about how we define online education, why it matters, some barriers to widespread adoption, and how social learning can enhance online educational experiences for learners.

The William and Flora Hewlett Foundation defines Open Educational Resources as follows: Teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use and re-purposing by others<sup>vi</sup>. Creative Commons provides the licensing tools for permitting this free use and re-purposing. Hewlett considers the Creative Commons Attribution (CC BY) license to be the license of choice, allowing for maximum reuse and repurposing of copyrightable educational resources while still acknowledging the creative work of the developer.

OER has become an important tool for public diplomacy. We help exchange program leaders, educators, and social entrepreneurs use OER to identify and expand development opportunities for their audiences and grow connections between U.S. and international institutions. Popular content areas within OER include MOOCs (more on those soon), thematically relevant textbooks, research, and academic publications, resource-builders for curriculum development and localization, and teacher professional development opportunities using technology in the classroom.

Massive, Open, Online Courses (or MOOCs) are a subset of OERs. MOOCs, essentially, offer the prospect of borderless, serialized education from some of the world's most prominent universities. The vision for MOOCs is to reduce digital inequalities through unlimited access and participation online. And a 2018 study<sup>vii</sup> concluded that the online availability, absence of pre-selection, and low expenses did support the expectation that MOOCs alleviate barriers to higher education for those less privileged in formal education.

Some scholars have begun to explore the concept of education as a basic human right. As legal scholar Heidi Gilchrist wrote: "To deny someone with capacity access to higher education is to deny them their full dignity and potential as a human being."<sup>viii</sup> Online education offers the promise of freedom: freedom to access content, freedom from cost (in most cases), and freedom to use (or remix) in any way desired.

Others view education as a responsibility of the individual in relation to the state. Online education fosters new forms of participation, inclusion and engagement in society. In turn, learners, become digital citizens with the “capacity, belonging, and potential for political and economic engagement in the information age.”<sup>ix</sup>

Online education has its origins in the late 1990s. In 1997, California State University launched the MERLOT (Multimedia Education Resource for Learning and Online Teaching) system that provided free online access to higher education curricula. One year later, David Wiley of Utah State proposed the concept of a free and open content license, which was realized a few years later, in 2001, by Lawrence Lessig and the Creative Commons team. The same year, MIT announced its OpenCourseWare system, which today has more than 2400 live courses.

In 2008, Khan Academy came online. Khan Academy features practice exercises, instructional videos, and a personalized learning dashboard that empower learners to study at their own pace in and outside of the classroom<sup>x</sup>. The same year, Dave Cormier coined the term “MOOC.” 2012 has been declared the “year of the MOOC,” in which we witnessed the launching of several prominent MOOC platforms: Coursera, edX, and Udacity. India’s very own SWAYAM - Study Webs of Active-learning for Young Aspiring Minds<sup>xi</sup> - was announced in 2015, with China and Russia following in 2016 with online platforms of their own.

Barriers to access to online education include the lack of the necessary ICT infrastructure, although this factor is diminishing. Some learners and educators become discouraged in trying to find appropriate courses, at the appropriate level. Also, it is sometimes the case that certain courses presume a baseline subject knowledge that only becomes clear when a learner dives into a course -- and then ends up frustrated. For learners whose native language is not English, the predominance of English-medium instruction can also present a hurdle. Finally, some of the MOOC platforms offer pay-to-play certificates, and learners become confused about whether or not courses are actually free -- and what they might be missing out on by not getting a certificate.

Researchers have also documented learner and educator behaviors and beliefs that might present barriers to their adoption of online education. Some have concerns about quality, and some of these concerns are absolutely justified! I’ve seen some OERs that employ less than contemporary instructional design/navigation principles. Some audiences are also confused about whether their investment in these courses will be worthwhile. Will they count for college credit, continuing education credit, or help them get a job? I have also heard concerns, in my world, about online courses from American universities threatening local higher educational institutions. Some publishers also object to the “open” publishing model that can impinge on their own profits. It is estimated that roughly 40 to 80 percent of students drop out of online courses. I’ll talk more in a moment about some methods we’ve seen that have made course completion rates rise.

And finally, there are some educators and learners who fear that online education is a form of soft power manipulation or even modern day colonialism. I would argue that the more diverse platforms arise from global leaders like India, China, and Russia, the more level the playing field will be.

So, I just mentioned the pretty dismal course completion statistics for MOOCs. There is another component of learning that's being mashed up with online education to produce better results: social learning. Social learning may simply be defined as people learning from one another, via observation, imitation, and modeling.

In our experience, interaction feeds motivation. MOOC learning circles (which we call MOOC Camps) offer supportive learning environments for learners to gain confidence and develop their own online learning strategies. They have been demonstrated to result in higher completion rates (30% and above)<sup>xii</sup>. Augmenting online education with social media also assists with communication and assessing a learner's cognitive progression in the course. Two models for online education with a social learning twist that we have employed with our MOOCs may be described as production-oriented and content-oriented.

In production-oriented courses, where the focus is on hands-on learning (coding, developing a business plan, for example):

- Expert facilitator convenes learners
- Online lesson is the backdrop for hands-on learning
- Social learning and practicing as a community is the key process
- Virtual interaction via social media and video chats help document process and provide opportunities for peer feedback

In content-oriented courses, like political science or literature,

- Learning circle organized around a chosen MOOC.
- Members progress with the content on their own, with the support of peers for motivation/instruction.
- Regular meet-ups with facilitated discussions
- Social media and video chats work as vehicles for sharing ideas, giving shout-outs, etc.

The U.S. Department of State's Office of English Language Programs produces high-quality MOOCs<sup>xiii</sup> for English learners on such topics as English for Media Literacy, English for STEM Fields, English for Business and Entrepreneurship, English for Journalism, English for Career Development. These have reached nearly 450,000 learners through social learning, combined with experienced facilitators. OELP also produces MOOCs for English teachers (English Teachers: Content-Based Instruction, Teaching Grammar Communicatively, Integrating Critical Thinking into the Exploration of Culture in an EFL Setting, Using Educational Technology, Professional Development for Teacher Trainers) that have reached 40,000 and have a higher

completion rate of around 20%. In the Philippines, our eTeacher MOOCs have been recognized as a continuing ed credential for EFL teachers.

One of the most meaningful MOOC Camps in which I participated was in my previous assignment in Jakarta, Indonesia. There, we ran a fascinating MOOC offered by MIT's Sloan School of Management called "u.Lab: Leading from the Emerging Future<sup>xiv</sup>" that reached 300 youth leaders across Indonesia through innovative learning methods like active listening, peer coaching, meditation, design thinking. We had a 75% completion rate for the course, which one of our learners called "powerful and life changing."

One project in which I'm currently involved in Nepal, a series of MOOCs on local governance, will convene newly elected Nepali officials for study circles at seven American Spaces around Nepal. Here's a bit of background on why the U.S. Embassy in Kathmandu<sup>xv</sup> decided to invest its limited public diplomacy resources in partnering with the University of Maryland to create these courses: Nepal recently held the first phase of elections of local bodies, after a hiatus of nearly twenty years. Newly elected officials need help to utilize their new power to govern, even as the federal government figures out how to devolve power to them. These officials will need help in conducting public meetings, constituent service and outreach, providing basic services, addressing dissent and planning and budgeting. At present, there is no proper guidance and education available for these elected officials, many of whom come from traditionally marginalized groups, such as women and Dalits. Without some basic education, these representatives are unlikely to be able to govern properly and will be targeted for bribes and corruption by better educated and more connected individuals. These courses launched across Nepal in 2019.

At the American Center New Delhi (my home base)<sup>xvi</sup>, we have begun to dip our toe into online education. Before I close, let me tell you briefly about a program we are launching this fall. The series is called "World Affairs in Theory and Practice." Participants will complete one of three MOOCs on themes of global health, environmental security, and international trade offered by American universities and expertly facilitated at the NDAC. Following the completion of each MOOC course, participants will participate in a live simulation of diplomatic negotiations around a similar theme as their course, helping them understand complex issues in theory and practice. Finally, participants will be introduced to EducationUSA advisors from the U.S. India Educational Foundation<sup>xvii</sup> for one-on-one counseling on options for pursuing higher education in the United States.

In closing, I would like to thank ICDL for the opportunity to discuss with you this important topic of the library's place in modern society and share a bit about how American Spaces, the United States government's most visible public diplomacy platforms, are seeking to support an active, engaged, educated global citizenry.

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<sup>i</sup> "Mashed Up Government." *A New City O/S: The Power of Open, Collaborative, and Distributed Governance*, by Stephen Goldsmith and Neil Kleiman, Brookings Institution Press, Washington, D.C., 2017, pp. 151–176. *JSTOR*, [www.jstor.org/stable/10.7864/j.ctt1vjqnwd.10](http://www.jstor.org/stable/10.7864/j.ctt1vjqnwd.10).

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- <sup>ii</sup> Goodchild, Michael, “Citizens as Sensors: The World of Volunteered Geography.” *GeoJournal*, vol. 69, issue 4, pp. 211-221. 01 August 2007.
- <sup>iii</sup> Longo, Nicholas V., and Cynthia M. Gibson. “Talking Out of School: Using Deliberative Pedagogy to Connect Campus and Community.” *Deliberative Pedagogy: Teaching and Learning for Democratic Engagement*, edited by TIMOTHY J. SHAFFER et al., Michigan State University Press, East Lansing, 2017, pp. 37–48. *JSTOR*, [www.jstor.org/stable/10.14321/j.ctt1qd8zh2.8](http://www.jstor.org/stable/10.14321/j.ctt1qd8zh2.8).
- <sup>iv</sup> Mazumdar, Suvodeep, et al. “Citizen Science Technologies and New Opportunities for Participation.” *Citizen Science: Innovation in Open Science, Society and Policy*, edited by Anne Bowser et al., UCL Press, London, 2018, pp. 303–320. *JSTOR*, [www.jstor.org/stable/j.ctv550cf2.28](http://www.jstor.org/stable/j.ctv550cf2.28).
- <sup>v</sup> Goldstein, Phil, “Tips for Launching a Library Virtual Reality Program,” *StateTech Magazine*. 2019. Accessed 28 September 2019 at <https://statetechmagazine.com/article/2019/07/tips-launching-public-library-virtual-reality-program-perfcon>
- <sup>vi</sup> William and Flora Hewlett Foundation, “Open Educational Resources.” Accessed 30 September 2019 at <https://hewlett.org/strategy/open-educational-resources/>
- <sup>vii</sup> Van de Oudeweetering, Karmijn, and Orhan Agirdag. “MOOCS as Accelerators of Social Mobility? A Systematic Review.” *Journal of Educational Technology & Society*, vol. 21, no. 1, 2018, pp. 1–11. *JSTOR*, [www.jstor.org/stable/26273863](http://www.jstor.org/stable/26273863).
- <sup>viii</sup> Gilchrist, Heidi R. *Higher Education is a Human Right*, 17 Wash. U. Global Stud. L. Rev. 645 (2018), [https://openscholarship.wustl.edu/law\\_globalstudies/vol17/iss3/9](https://openscholarship.wustl.edu/law_globalstudies/vol17/iss3/9)
- <sup>ix</sup> Mossburger, Karen et al. *Digital Citizenship: The Internet, Society, and Participation*. Boston: Massachusetts Institute of Technology, 2008.
- <sup>x</sup> Khan Academy. <https://www.khanacademy.org/>
- <sup>xi</sup> SWAYAM. <https://swayam.gov.in/>
- <sup>xii</sup> Ornelas, Edgar. “Hey, MOOCs: meet #LearningCircles.” *Medium* May 2, 2016. <https://medium.com/open-edtech/hey-moocs-meet-learning-circles-2a60a3f1b88a>
- <sup>xiii</sup> American English. <https://americanenglish.state.gov/american-english-moocs>
- <sup>xiv</sup> EdX. <https://www.edx.org/course/ulab-leading-from-the-emerging-future>
- <sup>xv</sup> U.S. Embassy Kathmandu. <https://np.usembassy.gov/embassy/kathmandu/>
- <sup>xvi</sup> U.S. Embassy New Delhi. <https://in.usembassy.gov/education-culture/american-spaces/american-space-new-delhi/>
- <sup>xvii</sup> U.S. India Educational Foundation. <http://www.usief.org.in/>



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# **Use the Digital Information Fluency principles to guide library instruction sessions to students in engineering disciplines**

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## **Keywords**

Information Literacy, Digital Literacy, Digital Information Fluency, Engineering Education; library instruction

## **Abstract**

Libraries in Canada have been teaching information literacy skills and competencies to students for a number of years now. Librarians are tasked with creating programs and workshops, and one-shot instruction sessions, while adopting several pedagogical methods, information literacy frameworks as well as learning strategies. With rapid changes in technology and the advent of online repositories, discovery tools and digital resources, it is vital that students who are digital natives and are exposed to multitude of technologies develop fluencies to apply critical thinking skills to synthesize and evaluate the information they retrieve. This paper will briefly discuss the newly proposed Digital Information Fluency (DIF) program at the University of Victoria (UVic) libraries while providing background information on the design and implementation of the current library instruction sessions tailored to meet the needs of students in the Faculty of Engineering.

## **Information Literacy and Digital Literacy**

The Association of College and Research Libraries (ACRL) defines Information Literacy (IL) as a set of abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information." (ACRL, 1989). Information Literacy lays the foundation for user education at university libraries worldwide and forms the "basis for a life-long learning process" (Singh & Klingenberg, 2012).

Academic libraries in Canada have offered IL instructional sessions to develop competencies and skills in students of all disciplines of science and technology. While doing so, they have enabled students to not only critically evaluate, synthesize and analyze resources but provided

them with life-long learning opportunities and skills desirable in the workplace (Taraban, Suar, & Oliver, 2013). These IL skills provide students with “career-building skills”, a core competency for finding employment eventually and using the valuable information retrieval and analytical skills in a wide range of careers (Goldstein, 2016).

With the digitization of information, students are able to find, retrieve and access information from the internet within a matter of seconds. Librarians are facing a new challenge in imparting instruction sessions geared towards finding material that is born digital and to university students who (Palfrey & Gasser, 2011) according to Prensky (2001) are “digital natives” while anyone born prior to perhaps the 1980s can be considered as “digital immigrants”. One of the major challenges we face as librarians today is offering IL instruction to digital natives who have been exposed to a myriad of digital resources and technologies that are ubiquitous and rapidly evolving. While digital natives are technologically savvy and fluent in using social media, they are not fluent in identifying sources that are credible (Palfrey & Gasser, 2008), and they are incompetent in retrieving information (Bartlett & Miller, 2011). Digital natives often find information almost instantly by using Google or share it using social media, however the authenticity and accuracy of information of such information and data can hardly be validated. Recognizing this, some libraries have transitioned to “digital literacy” instruction, which while similar to IL is defined by the University of Illinois as the “as the ability to use digital technology, communication tools or networks to locate, evaluate, use and create information” (as cited in Lawal, 2017)

## Digital Information Fluency

The UVic Libraries recently introduced the *Digital Information Fluency (DIF)* program which entails imparting and developing fluency in IL skills in students through an amalgamation of different workshops and instruction sessions. According to Kim et al. (as cited in Lawal, 2017), this will enhance the core IL competencies of students overall by emphasizing the “development of higher order critical thinking skills”. Given that the online environments are constantly evolving, IL instruction and digital literacy instruction is key today as a lifelong learning skill.

While there is a fine divide between the terms digital literacy and digital fluency, in their article “Truth, Lies and Internet”, Bartlett and Miller (2011), state that digital fluency is the “ability to find and critically evaluate online information”. In defining this term, they identify digital fluency as an important “element” of digital literacy and has three important components namely, net-savviness, critical evaluative techniques and diversity. While net-savviness can be an important skill to understand how the internet and its derived tools work, critical evaluative techniques involve skills to search for information that is accurate and trustworthy and diversity refers to plethora of information that digital natives are exposed to today and knowing how that information is created (Bartlett & Miller, 2011). Digital fluency can be integrated into the design and implementation of current IL workshops and sessions and has clear advantages in stimulating digital natives to think critically.

While digital literacy and IL have been well understood and defined, it is pivotal to understand what digital fluency is. Several definitions of the term “Digital Information Fluency” can be

found. According to the 21<sup>st</sup> Century Information Fluency Project (2019), DIF is “the ability to find, evaluate and use digital information effectively, efficiently and ethically. DIF involves internet search skills that start with understanding how digital information is different from print information, knowing how to use specialized tools for finding digital information and strengthening the dispositions needed in the digital information environment.”

The DIF program at the UVic Libraries (2019) similarly defines DIF as “the ability to critically, ethically, and effectively discover, organize, use, evaluate, create and disseminate information”. The libraries are step ahead in identifying several crucial digital fluency skills that students will develop and are outlined within this program as follows:

- the use of tools and data sets
- writing and critical thinking
- digital professionalism
- communicating ideas effectively in a range of media
- producing, sharing and critically evaluating information
- collaborating in virtual networks
- using technologies to support reflection
- understanding data privacy and security
- managing reputation, and
- showcasing achievements (University of Victoria Libraries, 2019)

## **Library Instruction using DIF guidelines**

Keeping in mind the key areas of the DIF program, “research, create, and share”, librarians at the UVic Libraries will develop or transition current library instruction sessions tailored to meet the information needs of researchers, students, staff and faculty on campus. UVic librarians have conducted and developed workshops using various pedagogies and cover topics including but not limited to searching databases and the library catalog, developing search strategies by using Boolean operators, concept mapping and distinguishing between scholarly and non-scholarly resources. Additionally, librarians focus on teaching about academic integrity, plagiarism, citation and citation software. These sessions are either one-shot IL sessions where librarians only meet the students once in a term or use efficient pedagogical methods such as flipped-classroom design, active learning strategies, problem-solving assignments that enhance the deep learning of digital technologies and the use of videos, tutorials as well as learning objects such as library subject guides.

Since the DIF program is an amalgamation of various workshops offered by different library units, other workshops that will enhance the skills of engineering students include 3D printing, research data management, data visualization and other maker space workshops offered by the Digital Scholarship Commons. Additionally, several ongoing workshops such as creating effective academic posters and using citation management software will also fall under the umbrella program.

The engineering librarian covers most of the topics above, but has developed specialized instruction keeping in mind the changing landscape of information. By using the American

College and Research Libraries' (ACRL) *Framework for Information Literacy for Higher Education* (2015) the engineering librarian has worked closely with faculty by generating discussions about IL and integrating into engineering courses. The framework developed by ACRL by revising the standards and introduced threshold concepts or six frames that allow librarians to develop learning outcomes for discipline specific library instruction.

The frames focus on a student's ability to critically think about themselves as participatory collaborators in knowledge synthesis and creation and librarians can strategically adopt pedagogical approaches to teach students to use digital collections. One of the frames "Authority is constructed and contextual" can be used to teach students how to evaluate sources and distinguish between credible and non-credible sources of information. Other frames that have been used by the engineering librarian includes "Information has value" which can be used to teach students about the ownership of copyrighted material and to cite sources. The frame "searching as strategic exploration" allows students to learn how to synthesize information and understand the differences in using different sources such as websites or the library catalog for example.

While engineering students "are required to create, problem solve, and improve, using engineering principles to develop their skills in technical, environmental, socioeconomic and political aspects of the engineering process" (Mercer, Weaver, & Stables-Kennedy, 2019) they need to develop essential lifelong learning skills. IL instruction can provide students with an ability "to propose solutions to industry and work-based problems" (ACRL, 2017). Several studies have mapped the ACRL Framework for Information Literacy to the Accreditation Board for Engineering and Technology (ABET) and Canadian Engineering Accreditation Board (CEAB) criteria (Murphy & Saleh, 2011; Nelson & Fosmire, 2010; Riley, Piccinino, Moriarty, & Jones, 2009) and have highlighted the critical role academic librarians can play in integrating information literacy (IL) instruction into engineering curricula.

The ABET criteria 3.i and CEAB competencies, states that graduate students must attain through their engineering programs "a recognition of the need for, and an ability to engage in life-long learning" and also possess "investigation" skills and "lifelong learning" skills (ABET, 2018; Engineers Canada, 2017). For the success of IL instruction in libraries it is imperative to have supportive faculty - library partnerships and to develop IL programs by linking these criteria to the frameworks and standards of IL (Naimpally, Ramachandran, & Smith, 2012). Keeping in mind the newly proposed DIF program, most of these courses will adhere to or will be modified to reflect the guidelines of the program. The information literacy instruction sessions discussed in the next sections are currently offered to both undergraduate and graduate engineering students at the UVic Libraries.

### **The Engineering Design and Communications course (ENGR110/112)**

This is a first-year course offered to undergraduate students at UVic since 2009. The course is a collaboration between the Faculty of Engineering and the English Department. It includes a combination of the design process in engineering and a communication component which is taught by instructors in the Department of Communication and Writing starting 2019. ENGR110/112 hence is part of the Academic Writing Requirement (AWR) courses offered to

first year students registered in an undergraduate program at UVic. The focus of this course is solely on developing essential skills needed to write and present technical information in engineering.

In this course, students work with industry partners to develop engineering solutions to a real-world problem. Hence, students work in groups and are often looking for information to develop and learn how to apply solutions to the problem. The engineering librarian was integrated into the course in 2010 and offers a two-hour library instruction session that teaches students to conduct their research using a wide variety of resources such as subject-specific databases, the library catalogue for print and digital collections, industry websites, and association, trade and magazine publications. As the information they are seeking is available in a wide variety of digital environments, it is often difficult for students to evaluate the currency, reliability of the research and accuracy and authenticity of the results, whether a source is credible or not and if using Wikipedia or Google to search for non-scholarly sources is acceptable. During the two-hour intensive session, the librarian ensures students not only learn key methods of searching databases, which is an essential skill, but also the value in searching these proprietary subscription-based resources. An important aspect of this process is to teach them about academic integrity and citing sources using the IEEE citation reference manual. This is an important skill as it enhances the quality of their work when they cite other authors and use credible sources to support their own thoughts. All of the aforementioned fall under the criteria of the DIF program and it's guidelines.

Once the librarian teaches students the core concepts of using Boolean operators, concept mapping, using keywords to search databases and using the right tools to find engineering specific literature, students are given 60 mins to work on a 10-point assignment. The assignment is designed keeping in mind the theme (industry project) which requires specialized skills to find engineering solutions to real-world problems. The digital literacy instruction sessions prepare students as engineers giving them the capability to transfer their specialized technological skills to different contexts in their engineering careers. The online research skills are transferrable to different situations which might require engineers to evaluate and distinguish sensitive information in a digital environment.

Keeping in mind the proposed DIF program, the engineering librarian is in the process of developing several online tutorials using the LibWizard tool which is part of the SpringShare suite of programs. These will lay emphasis on developing the higher metacognitive skills of students such as searching and retrieving information from subject-specific databases, utilizing citation management software to manage and organize resources in addition to citing them, problem-solving skills by finding solutions in scholarly articles, and the use of library catalogs. Under the DIF program these are considered to be valuable 21<sup>st</sup> century skills required for good decision making in workplace situations.

### **Drinking Water Contaminants - Chemistry, Toxicology and Greener Interventions (CIVE 480B)**

Another course where the engineering librarian will incorporate several aspects of the proposed DIF programs guiding principles is a drinking water contaminants course CIVE 480B offered via the Department of Civil Engineering.

In this course, the engineering librarian is integrated to teach students how to evaluate articles for bias. When the instructor first approached the librarian, it was evident that students were not critically thinking or evaluating the required scientific literature. In an era of fake news, vast amounts of literature were unreliable and students mostly lacked skills to distinguish between studies that were biased by industry sponsors or the dearth of literature that included failed research or negative results.

By introducing students to using evaluative techniques such as the CRAAP or RADAR (Relevance, Authority, Date, Appearance and Reason) students develop metacognitive skills and critical awareness in identifying flawed research, unreliable and fake news in digital environments. While these techniques are primarily used as checklists to evaluate websites and guides students in evaluating internet sources, it provides students with an opportunity to determine the credibility of authors, affiliation of the institutes and associations that published research and whether the research can be reproduced by scientists in developing countries where results might mean better quality of life.

The librarian is integrated into this course and students are offered two sessions. The first session focuses on developing keyword searching using Boolean operators, wildcard operators and truncation that can help refine search strategies when using key databases for research. An introduction to identify bias using the evaluative techniques is also discussed.

Using a flipped classroom design method, students are grouped to work on a class assignment which requires them to present at the second session. Flipped classroom design “is the process of replacing traditional lectures with more student-centered learning strategies, such as active learning, discussions, problem-based learning, and other forms of group work and peer instruction. Content delivery is moved outside of the classroom, for example, through videos, or pre-class readings”(Centre for Innovative Teaching, University of Cornell, 2019). Using the CRAAP technique students need to articulate reasons for choosing three scholarly articles, evaluate the strengths and weaknesses of the databases in providing scientific evidence for their research and also evaluate each article for bias.

Under the DIF umbrella program, several of the instruction sessions will fit as outlined above. The DIF program will enhance student learning and success and ensure students will be provided with lifelong learning skills.



## Conclusion

The current student generation at institutes of higher education in professional programs such as engineering are definitely digital natives. There is a great impetus for libraries to develop robust information literacy programs and strategically develop competencies and ensure that students are adept at finding reliable information that can be validated and is authentic. While keeping the core values of the IL programs, librarians can advance digital fluency skills of students which will benefit them in their careers in the long term. By creating partnerships with faculty and integrating into courses, digital literacy and digital fluency skills can be incorporated into core subject-specific courses via cross-collaborations on campus.

## References

1. 21st Century Information Fluency Project. (2019). Digital Information Fluency Model: Common Core State Standards Mapped to Information Fluency. Retrieved from <http://21cif.com/resources/difcore/index.php>
2. ABET. (2018). *Criteria for Accrediting Engineering Programs, 2018 – 2019*. Retrieved from <https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2018-2019/>
3. ACRL. (1989). Presidential Committee on Information Literacy: Final Report [Text]. Retrieved from <http://www.ala.org/acrl/publications/whitepapers/presidential>
4. ACRL. (2015). Framework for Information Literacy for Higher Education. Retrieved from <http://www.ala.org/acrl/sites/ala.org.acrl/files/content/issues/infolit/framework1.pdf> ACRL. (2017). *Academic Library Impact on Student Learning and Success: Finding from Assessment in Action Team Projects. Prepared by Karen Brown with contributions by Kara J. Malenfant*. Retrieved from [http://www.ala.org/acrl/sites/ala.org.acrl/files/content/issues/value/findings\\_y3.pdf](http://www.ala.org/acrl/sites/ala.org.acrl/files/content/issues/value/findings_y3.pdf)
5. Bartlett, J., & Miller, C. (2011). *Truth, lies and the Internet: A report into young people's digital fluency*. Retrieved from [https://www.demos.co.uk/files/Truth\\_-\\_web.pdf](https://www.demos.co.uk/files/Truth_-_web.pdf)
6. Centre for Innovative Teaching, University of Cornell. (2019). Flipping the Classroom. Retrieved from <https://teaching.cornell.edu/teaching-resources/designing-your-course/flipping-classroom>
7. Engineers Canada. (2017). *Canadian Engineering Accreditation Board: 2017 Accreditation Criteria and Procedures*. Retrieved from <https://engineerscanada.ca/sites/default/files/accreditation-criteria-procedures-2017.pdf>
8. Goldstein, S. (2016). Information Literacy and Graduate Employability. *Information Literacy: Key to an Inclusive Society*, 89–98. [https://doi.org/10.1007/978-3-319-52162-6\\_9](https://doi.org/10.1007/978-3-319-52162-6_9)
9. Lawal, V. (2017). *Information Literacy and the Future of Digital Information Services at the University of Jos Library*. 30. Retrieved from <https://digitalcommons.unl.edu/libphilprac/1674/>
10. Mercer, K., Weaver, K., & Stables-Kennedy, A. (2019, June). *Understanding Undergraduate Engineering Student Information Access and Needs: Results from a Scoping Review*. 27. Retrieved from <https://www.asee.org/public/conferences/140/papers/24617/view>

11. Murphy, S., & Saleh, N. (2011). Information Literacy in CEAB's Accreditation Criteria: The Hidden Attribute. *Proceedings of the Canadian Engineering Education Association*. <https://doi.org/10.24908/pceea.v0i0.3681>
12. Nainpally, A., Ramachandran, H., & Smith, C. (2012). Lifelong Learning for Engineers and Scientists in the Information Age. *Lifelong Learning for Engineers and Scientists in the Information Age*, undefined-undefined. <https://doi.org/10.1016/C2010-0-67009-X>
13. Nelson, M. S., & Fosmire, M. (June, 2010). Engineering Librarian Participation in Technology Curricular Redesign: Lifelong Learning, Information Literacy, And Abet Criterion 3. Paper presented at *2010 Annual Conference & Exposition*, Louisville, KY. Retrieved from <https://peer.asee.org/engineering-librarian-participation-in-technology-curricular-redesign-lifelong-learning-information-literacy-and-abet-criterion-3>
14. Palfrey, J. G., & Gasser, U. (2008). *Born Digital: Understanding the First Generation of Digital Natives*. New York: Basic Books.
15. Prensky, M. (2001). Digital Natives, Digital Immigrants. *On the Horizon*, 9(5). Retrieved from <https://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf>
16. Riley, D., Piccinino, R., Moriarty, M., & Jones, L. (June, 2009). Assessing information literacy in engineering: Integrating a college-wide program with ABET-driven assessment. Paper presented at 2009 ASEE Annual Conference & Exposition, Austin, Texas. Retrieved from <https://peer.asee.org/assessing-information-literacy-in-engineering-integrating-a-college-wide-program-with-abet-driven-assessment>
17. Singh, N., & Klingenberg, A. (2012). Information Literacy in India and Germany: University Libraries as Activators of Life-long Learning. *DESIDOC Journal of Library & Information Technology*, 32(3). <https://doi.org/10.14429/djlit.32.3.2385>
18. Taraban, R., Suar, D., & Oliver, K. (2013). Information literacy of U.S. and Indian engineering undergraduates. *SpringerPlus*, 2(1), 244. <https://doi.org/10.1186/2193-1801-2-244>
19. University of Victoria Libraries. (2019). LibGuides: Library workshop menu: What is digital information fluency? Retrieved September 9, 2019, from <https://libguides.uvic.ca/instruction/dif>

# Digital Preservation and Accessibility of Indigenous Knowledge: Role of Libraries in Northeast India

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## Abstract

The preservation of indigenous knowledge has become a global concern today. Many bodies such as governmental and non-governmental are playing an active role in collecting and preserving indigenous knowledge. In this regard, libraries are in the forefront. Digital preservation in the library is one of the best means for managing information including indigenous knowledge. This study reports results of a study on challenges in digital management and accessibility of indigenous knowledge in selected university libraries of Northeast India. It found that these libraries do collect and preserve indigenous knowledge but not in a very organized manner and digital management is still minimal.

## Keywords

Indigenous knowledge, preservation, libraries, digitized, accessibility.

## Introduction

Indigenous knowledge is concerned primarily with those activities that are intimately connected with the daily livelihoods of people rather than with abstract ideas and philosophies. Indigenous knowledge is thus confined to local population that possesses highly detailed and richly complex information about agriculture, agro-forestry, pest management, soil fertilization, multiple cropping patterns, health care, food preparation and so forth. Local knowledge also called indigenous knowledge is often viewed as the latest and the best strategy in the old fight against hunger, poverty and underdevelopment (Atte 1989). Indigenous knowledge has permitted its holders to exist in “harmony” with nature, using it sustainably, it is seen as especially pivotal in discussions of sustainable resource used (D,Anderson;R 1987).

The knowledge and skills are derived from man's daily interactions with the environment, observations and experiments. They greatly shape and model the decisions made by people regarding exploitation of resources. The knowledge, skills and practices relating to natural resources are passed down to generations through the cultural learning process. It is the outcome of all these among different groups and the environment that is termed indigenous, local, tradition or people's knowledge (Akullo, Kanzikwera, and Birungi 2007). It exists nowhere as a totality, there is no grand repository, and hence no coherent overall theoretical model, although it may achieve some coherence in cosmologies, rituals and symbolic discourse, which are not notoriously difficult to access convincingly. It is as much skill as knowledge, and its learning across generations is characterized by oral transmission and learning through experience and repetitive practice. It is the heritage of practical every life, with its functional demands, and is fluid and constantly changing, being subject to on-going negotiation between people and their environments (Sillitoe 1998).

In simple terms, such knowledge has been orally passed for generations from person to person. Some forms of indigenous knowledge are expressed through stories, legends, folklore, rituals, songs, and even laws. Other form of indigenous knowledge refers to knowledge and values, which have been acquired through experience, observation, from the land or from spiritual teachings, and handed down from one generation to another. These sets of understandings, interpretations and meanings are part of a cultural complex that encompasses language, naming and classification systems, practices for using resources, ritual, and spirituality and worldview. It provides the basis for local level decision-making about many fundamental aspects of day-to-day life (Agrawal 2004).

## **Objectives**

- To identify how libraries manage indigenous knowledge
- To examine how libraries create access to indigenous knowledge; and
- To investigate the challenges of preservation and accessibility of indigenous knowledge.

## **Literature review**

### **Significance of indigenous knowledge**

Indigenous knowledge is regarded as the basis for local-level decision making in agriculture, pastoralism, food preparation, health care, natural resource management, and a host of other activities in rural communities staying very close to the nature (Farooquee, Majila, and Kala 2004). It mostly highlights the knowledge possessed by the poor and marginalized population, and emphasizes on empowering people like farmers to have greater control over their own destinies (Farooquee, Majila, and Kala 2004). The primary dimension of difference and uniqueness, according to Warren (Warren 1991), seems to lie in an organic relationship between the local community and its knowledge. An understanding of indigenous knowledge and customs can help the development planner to establish a more flexible position to suggest project

alternatives or innovative mitigated measures, in order to avoid inadvertent damage to the ecosystem or culture (Lalonde 1991). (Anyira, Onoriode, and Nwabueze 2010) in their study argue that, there is a growing appreciation of the value of indigenous knowledge and it has become valuable not only to those who depend on it in their daily lives, but to modern industry and agriculture as well.

### **Need for preservation of indigenous knowledge**

Several factors such as government developmental schemes and the spread of information communication technologies have led to the rapid change in the life of local communities which in turn has largely accounted for the loss of indigenous knowledge. With the influence of modern technology and education, today's younger generation tends to neglect and underestimate the importance of indigenous knowledge. It is evident that if indigenous knowledge is not recorded and preserved, it will be lost and remain inaccessible to other indigenous systems as well as to development workers. Development projects cannot offer sustainable solutions to local problems without integrating local knowledge (Warren 1991). Development needs people's knowledge. Otherwise it can be a failure in the process (Stubbings 1982). Therefore, to bring development in local-level community, indigenous knowledge plays a very important role. The use of indigenous knowledge can guarantee the survival of the economics of the developing world. Not only the expertise of scientific knowledge of professional should be taken into account for improving development, even the richest and most successful governments cannot provide all the needs of the people, it has been suggested that indigenous knowledge can also become vital tools for rural development (Atte 1989). Since indigenous knowledge is essential to development, it must be gathered, organized and disseminated in the same systematic way as modern knowledge (Agrawal 2004).

### **Role of Libraries in Preservation of Indigenous Knowledge**

Libraries can help in collecting, preserving, and disseminating indigenous knowledge and publicizing the value, contribution, and importance of indigenous to both non-indigenous and indigenous people. The National Library of South Africa deals with making recorded indigenous knowledge available for users (Lor 2004). National Museum of the American Indian (NMAI) in Canada transferred ownership of more than 800,000 indigenous cultural objects (Stevens 2008). Niger Delta Libraries in Nigeria makes indigenous knowledge accessible, including television/radio broadcasting, exhibits and displays, film, mobile library services, lending of relevant indigenous materials, and online access (Anyira, Onoriode, and Nwabueze 2010). Some libraries of Australia that deal with aspects of indigenous knowledge is studied below; Northern Territory Library and Information Service (NTLIS) acquired indigenous collection and shelved in designated area and is identified by an Aboriginal flag on the spine of each item. Queensland State Library also collects, preserves and provides access to Indigenous materials for all Queenslanders. Moree public library documented indigenous knowledge, photographs of people, places, ceremonies etc. Galiwin'ku Indigenous Knowledge Centre digitized old collections for local access (Nakata et al. 2005).

## **ICT application in preservation of IK**

There is no doubt that ICTs hold significant potential for supporting the recording, management, dissemination and long term preservation of Indigenous knowledge. But there remain significant challenges which will need to be overcome to ensure that such projects deliver real benefits to both the Indigenous communities who own the knowledge and the wider community (Nakata et al. 2005). The multi-media capabilities (*e.g.* digital video and recording devices), storage capacity (*e.g.* online databases) and communication tools (*e.g.* the Internet and digital technologies) offered by ICT's provide new opportunities to preserve and revitalize indigenous cultures and languages.

## **Accessibility and management of IK in the Library**

The main objective of all information management activities is to provide access to collections and materials. Though there is so much indigenous knowledge in different indigenous communities of the developing world, the availability of such knowledge does not mean its accessibility or use. Libraries can promote access to indigenous knowledge by creating an environment which permits face-to-face forums and network formation to discuss and debate on issues that might be useful to members of the communities. For example, libraries can organize talk shows involving traditional rulers, elderly people and professionals to gather and record information on various local vocations from different subject areas ranging from agriculture, ecosystem, medical care, and conflict resolution (Okore, et al., 2009). They also argue that, libraries can work in partnership with library schools to create indigenous knowledge collections, which can be repackaged and made accessible. Stevens (2008) believes that libraries and information professionals should partner with indigenous communities. Nakata and Langton (2005) suggest that libraries and archives must look at the broad issues involved in the preservation of IK. They assert that libraries must consider IK not simply part of a historical archive, but a contemporary body of relevant knowledge. There is therefore the need to provide ICTs such as computers, Internet, digital cameras, camcorders, and so on, to allow libraries to make IK accessible (Okore, et al., 2009).

Managing indigenous knowledge in the libraries required collection development associated policies and strategies. The libraries should be proficient with new developmental challenges. They should be well equipped with newly generated technologies to counter all sorts of competitions. There should be adequate and well trained manpower in the libraries management and preservation activities. Each library should be in the position to employ an expert who understands the required information of the physical and chemical nature of the materials in their library holdings. Information generated local practitioners and stakeholders of local indigenous knowledge forms the vital part in the decision making process. According to Okore, et al., (2009) challenges of indigenous knowledge management include:

- Intellectual property rights
- Labour requirements
- Time requirements
- Funding
- Reluctance of indigenous people to share their knowledge
- Competition with existing community structures for IK

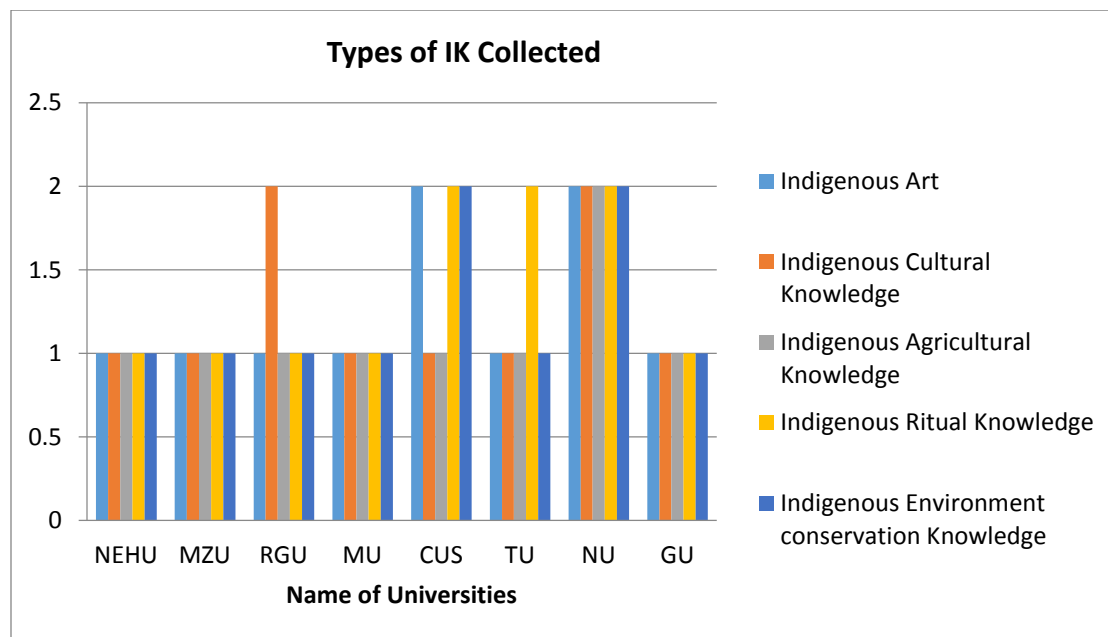
## Methodology

This study is a survey that used a questionnaire to collect data. Unstructured interviews and observation were also used to gather additional data. The libraries investigated are North Eastern Hill University (NEHU) Shillong, Mizoram University (MZU), Nagaland University (NU), Central University of Sikkim(CUS), Tripura University (TU), Gauhati University (GU), Rajiv Gandhi University (RGU) and Manipur University (MU).

## Data analysis

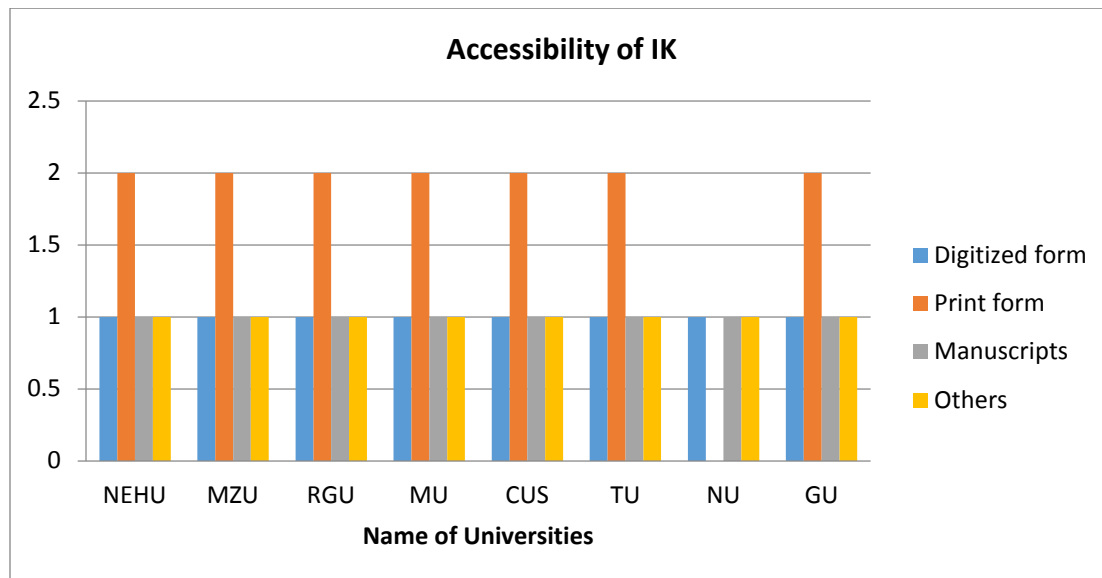
Data collected were analysed using statistical tools and charts.

**Chart 1.** Types of indigenous knowledge collected by libraries under study.



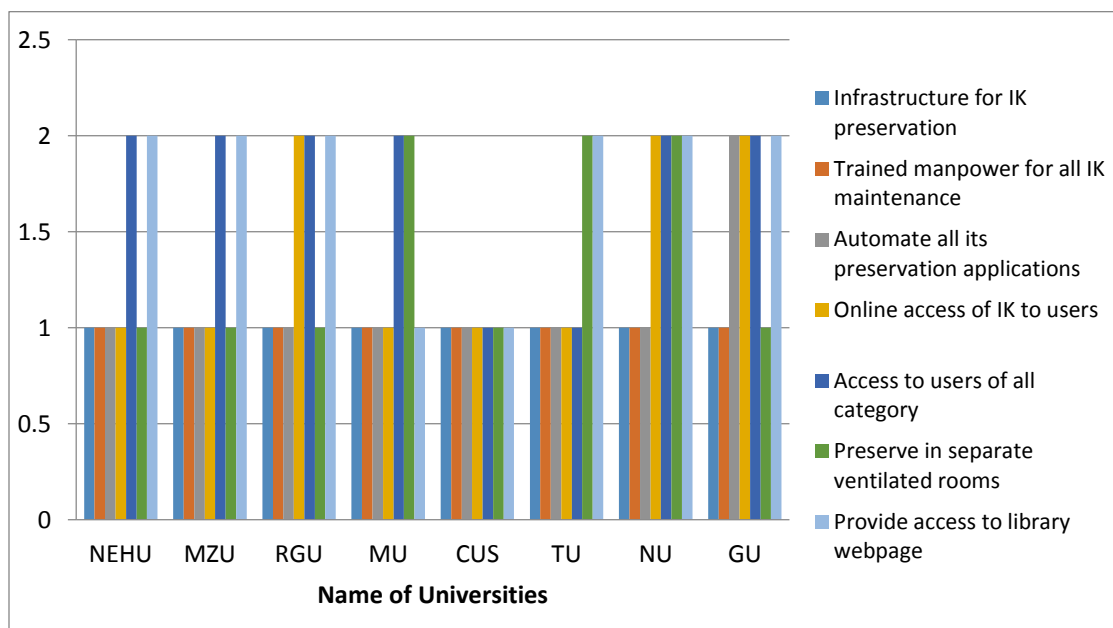
The data analysed above indicates that except Nagaland University library, the rest of the libraries has indigenous knowledge collection development policies.

**Chart 2.** Methods of making IK accessible.



Majority of the respondents agreed that collections of indigenous knowledge in their respective libraries can be access in print form.

**Chart 3.** Librarian attitudes towards management of IK in the libraries.



All respondents identified the needs and importance of IK infrastructures required for the well management of indigenous knowledge in the libraries.



## Discussion

The study found that libraries can play a prominent role in preserving and accessing of indigenous knowledge and that they are one of the most appropriate environments for sustaining the original perception of this knowledge. Many libraries recognize indigenous knowledge as an important source of developmental information (Nakata et al., 2005). They assert that libraries must consider IK not simply as part of a historical archive, but a contemporary body of relevant knowledge. (Role et al. 2006) in their study “The Role of the Library in Promoting the Application of Indigenous Knowledge (IK) in Development Projects” opines that libraries can raise awareness about indigenous knowledge, document indigenous knowledge, develop digital libraries based on indigenous knowledge, identify indigenous knowledge specialists, establish the value of indigenous knowledge, and build capacity to develop indigenous knowledge. She also argued that indigenous knowledge can usefully be applied in development projects since it is considered the basis for self-sufficiency and self-determination, providing effective alternatives to western technologies.

It was discovered that Indigenous Knowledge (IK) is not effectively managed in the libraries under study. Library and information professional has much learning to do, to meet the information needs of indigenous people and appropriately manage IK in library and information centres. The study also finds that, libraries don't pay much attention to acquiring and preserving of IK. It identified that IK collections are available in print form and there is no such policy of digitizing and archiving the indigenous collections in the libraries. However, the needs and importance of preserving IK in digitized form is much sensed by the librarians under study (Nakata et al., 2005).

## Conclusion and recommendations

Indigenous Knowledge help communities sustained their livelihood. This knowledge is embedded with their surrounding and support their growth and development in all aspects of daily activities. The significance of IK however is not recognised widely among the libraries.

It is important for the practitioners of libraries and librarian professionals to prioritize management of IK. Policy should be made to collect and preserve IK which are in threats of extinction. The libraries in collaboration with the local practitioners should collect and store every aspects of IK in the libraries and made available for user to access in print as well as in digitized form. Efforts should be made to collect and package IK and make it available on the Internet. Government and corporate organizations should collaborate with libraries by providing fund for of preservation and accessibility of IK. Copyright issues should be properly sorted out before embarking on any collaboration agreement.

## References

1. Agrawal, Arun 2004. Indigenous and Scientific Knowledge. *IK Monitor* 3(28-Apr-2008): 7–8.  
<http://www.nuffic.nl/ciran/ikdm/3-3/articles/agrawal.html>.
2. Akullo, D, R Kanzikwera, and P Birungi 2007. Indigenous Knowledge in Agriculture: A Case Study of the Challenges in Sharing Knowledge of Past Generations in a Globalized Context in Uganda. Durban, South Africa. ....: 1–14.  
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.151.1228&rep=rep1&type=pdf%5Cnhttp://www.ifla.org/iv/ifla73/index.htm%0A>.
3. Anyira, Isaac, Oghenovo Onoriode, and Anthonia Nwabueze 2010. The Role of Libraries in the Preservation and Accessibility of Indigenous Knowledge in the Niger Delta Region of Nigeria. *Indigenous Knowledge in the Niger Delta Region of Nigeria. Library Philosophy and Practice* 387: 1–9.
4. Atte, O. D 1989. Indigenous Knowledge Systems : Implications for Agriculture and International Development. *Studies in Technology and Social Change*(No. 20). Technology and Social Change Program, Iowa State University: 186. <https://www.cabdirect.org/cabdirect/abstract/19941800595>, accessed August 13, 2018.
5. D, Anderson; R, Grove, ed. 1987 . *Conservation in Africa: People, Policies and Practice*. Cambridge University Press.
6. Farooquee, Nehal A, BS Majila, and CP Kala 2004 . Indigenous Knowledge Systems and Sustainable Management of Natural Resources in a High Altitude Society in Kumaun Himalaya, India. *J. Hum. Ecol* 16(1): 33–42.  
<http://krepublishers.com/02-Journals/JHE/JHE-16-0-000-000-2004-Web/JHE-16-1-001-073-2004-Abst-PDF/JHE-16-1-033-042-2004-Farooque-N-A/JHE-16-1-033-042-2004-Farooque-N-A.pdf>.
7. Lalonde, Andre 1991. African indigenous knowledge and its relevance to environment and development activities. A paper presented during The Common Property Conference - Sept. 26-29, 1991, Winnipeg, Manitoba by the International Association for the Study of Common Property (IASCP). Retrieved from: [http://dlc.dlib.indiana.edu/dlc/bitstream/handle/10535/904/African\\_Indigenous\\_Knowledge\\_and\\_its\\_Relevance\\_to\\_Environment\\_and\\_Development\\_Activities.pdf?sequence=1&isAllowed=y](http://dlc.dlib.indiana.edu/dlc/bitstream/handle/10535/904/African_Indigenous_Knowledge_and_its_Relevance_to_Environment_and_Development_Activities.pdf?sequence=1&isAllowed=y)
8. Lor, Peter 2004. Storehouses of Knowledge? The Role of Libraries in Preserving and Promoting Indigenous Knowledge. *Indinga-African Journal of Indigenous Knowledge Systems* 3(1): 45–56.
9. Nakata, Martin, Alex Byrne, Vicky Nakata, and Gabrielle Gardiner 2005. Indigenous Knowledge, the Library and Information Service Sector, and Protocols. *Australian Academic & Research Libraries* 36(2): 7–21.  
<http://www.tandfonline.com/doi/abs/10.1080/00048623.2005.10721244>.
10. A.M. Okore, J.N. Ekere, and H.N. Eke 2009 . Promoting Access to Indigenous Knowledge in the Digital Age: Libraries as Facilitators. A paper presented at Nigerian Library Association 47th Annual National Conference and Annual General Meeting. Ibadan. July, 26th-31st 2009.
11. Sillitoe, Paul 1998. Knowing the Land: Soil and Land Resource Evaluation and Indigenous Knowledge. *Soil Use and Management* 14(4): 188–193.
12. Stevens, Amanda 2008 . A Different Way of Knowing: Tools and Strategies for Managing Indigenous Knowledge. *Libri: International Journal of Libraries & Information Services* 58(1): 25–33.
13. Stubbings, B. J. J. 1982. *Indigenous Knowledge Systems and Development*. Edited by David W. Brokensha, D. M. Warren and Oswald Werner University Press of America, 1980, 466 Pp. *Public Administration and Development* 2(1). Wiley-Blackwell: 85–85. <http://doi.wiley.com/10.1002/pad.4230020118>, accessed August 13, 2018.
14. Warren, Dennis M. 1991. Using Indigenous Knowledge in Agricultural Development. *World Bank Discussion Papers (USA)*. World Bank. <http://agris.fao.org/agris-search/search.do?recordID=US9154585>, accessed August 13, 2018.

# Role of Emerging Technologies in Governance: Learnings for India to achieve SDGs

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## Abstract

Development in a country is fostered by its efficient governance. To ensure the betterment of their citizens, governments over the world have accepted Sustainable Development Goals (SDGs), announced by the United Nations Development Programme (UNDP) in the year 2015, as acceptable governance targets for all. Information and Communication Technologies (ICTs) serve as meaningful contrivances to engage with all the cross-currents linking the 17 SDGs together. In present times, these technologies have also been accepted as a means for co-creating values for citizens as insisted by participatory models of governance too. This paper attempts to examine all aspects of employing emerging technologies in accelerating the processes of governance. Based on an analysis of the related academic literature and extensive field experience of the author, the paper seeks to address the following questions:

- How emerging technologies are expected to help achieve the SDGs and strengthen the relationship between the state and its citizens?
- What are some of the challenges that usually confront the uptake of emerging technologies in the governance context?
- What is expected to be the face of governance in the wake of emerging technologies?

After addressing these questions, the paper attempts to propose some viable strategies that can strengthen the application of digital emerging technologies in governance.

## Keywords

Emerging Technologies, ICT, Sustainable Development Goals (SDGs), Governance, Artificial Intelligence, Blockchain.

## Introduction

The concept of governance has evolved over a period. It can be understood as the manner in which power is exercised for the management of a country's affairs to facilitate development. Policies, institutions, market and stakeholders including citizens interact together to drive governance in a country. The emphasis on citizens as its prime stakeholder had been laid down by the guiding principles of New Public Management -NPM (Pollitt, 2000)[1]. Gradually 'citizens' and 'local governance' have been widely accepted as two major constituents of high-quality governance, especially in the context of democratic countries. The paradigm of 'good governance' that insists on achieving happiness-for-all, has been accepted world over as a benchmark of a utopian form of governance. Review of literature (for instance, Magno & Serafica, 2001)[2] vouches that digital technologies promote good governance in three basic ways: by increasing transparency, accountability and maximising the use of available information; facilitating accurate decision-making through effective public participation and ensuring the efficient delivery of public goods and services. Within the framework of good governance, the universal governance goals have been established by the SDGs. There has been a global effort to achieve social development, economic development and environmental sustainability through the achievement of 17 aspirational Sustainable Development Goals (UNDP, 2015). The SDGs too beseech emerging technologies as a means to ensure collective action among various governance stakeholders. Participatory decision-making approach, critical for attaining SDGs, is also more easily achievable if digital citizen engagement platforms such as MyGov of India are employed (Malhotra, 2018)[3]. The paper attempts to demystify the critical role of emerging technologies in governance by elucidating the related aspects in its eight sections as briefed below.

## Overview of the Paper

The first section titled 'Introduction' has already set the tone of the paper wherein it has summarized the evolution of the concept of governance from its initial version of the NPM to the present paradigm of good governance and the Sustainable Development Goals. The subsequent section is on Methodology, which is followed by section titled 'Digital Technologies in Governance' that differentiates the notion of 'e-Government' from 'e-Governance'. Its subsection titled 'Emerging Technologies- the Changing Realms of e-Governance', strengthens the readers' awareness about contemporary digital trends including artificial intelligence, transparently immersive techniques, newer digital platforms, Smart Cities and Smart Villages. This section also attempts to present the role of each of these technologies in the public sector by presenting global and national strides on this front. The sub-section of this section titled as 'Convergence of Emerging Technologies' suggests application of Emerging Technologies for each SDG Goals. At the end of this section, there is description, that depicts how India, is faring on global e-Government landscape by using e-Government Development Index (eGDI) and e-Participation Index (e-PI). The fifth section titled 'Existing provisions by Government of India', provides a glimpse of initiatives taken by GoI, that focus on leveraging emerging technologies in Governance. The next section summarises the "Challenges confronting e-Gov Implementation in

India”; subsequent to which the section titled “Way forward for e-Governance in India”. At last the paper closes with the concluding remarks

## Methodology

The methodology adopted for this study is descriptive, exploratory, and analytical in nature. The learnings for this paper flow from the qualitative research undertaken by the authors to decipher the uptake of emerging technologies in governance. The primary study of various e-Government initiatives that form the basis of this paper includes RASI (Tamil Nadu), Common Service Centres- CSCs (Haryana and Mizoram), TaraHaat (Madhya Pradesh), Nemmadi (Karnataka), Akshaya (Kerala) and e-Mitra (Rajasthan). This entailed field study undertaken by the first author in approximately 50 villages covering seven states of India, spread over almost five years. Secondary sources, related to the domain of Governance, e-Governance and emerging technologies, have been referred to glean the existing role of emerging technologies in governance and in achieving goals of SDGs. For this scholarly publication, related articles, research reports, and books have also been examined. The authors have further classified learning’s from the existing body of work and based on this suggested for a global consortium for the Emerging technologies.

## Digital Technologies in Governance

It was in the early 1990s that the concept of governance underwent a major transformation, with the acceptance of digital technologies. During this period, digital technologies had been primarily deployed for the delivery of public services and information and this was popularly referred to as ‘e-Government’. Slowly and gradually, it became relevant for democratic countries to include the ‘voices’ of its citizens in core strategic issues of governance. As a result, the initial version of ‘e-Government’ started being identified through its more all-encompassing avatar of ‘e-Governance’. Several agencies (UNPAN, 2005) [4] and researchers (Malhotra et al., 2007) [5] have clearly elaborated the conceptual difference in usage of the terms ‘e-government’ and ‘e-Governance’. The primary delivery models of governance using digital technologies are Government-to-Citizen/Customer-G2C, Government-to-Business-G2B, Government-to-Government -G2G, and Government-to-Employees-G2E.

### Emerging Technologies: The Changing Realm of e-Governance

Social media, Mobility, Analytics and Cloud (SMAC) have shown immense growth in the last decade. The synergy created by these tools provides an additional competitive advantage to the organisations. Newer technologies/products have also emerged for almost all existing forms of technologies. Inspired by ‘Gartner Hype Cycle for Emerging Technologies’ report [6], emerging technologies can be summarised (Table-1) in three distinctive categories.

*Category-I:* ‘Artificial Intelligence-AI’ is an area of computer science that emphasises the creation of intelligent machines that work and react like humans. Based on this logic, some of the applications of AI are Machine Learning, Robotics and Autonomous Vehicles (AV).

*Category-II:* ‘Transparently Immersive Technologies’ bring the physical world and the digitally simulated world closer, hence, creating a sense of immersion for the user. Real sensations can be experienced by using technologies such as augmented reality, virtual reality, assistive technologies, and wearable technologies.

*Category-III :* ‘Emerging Digital Platforms’ are all technologies that provide advanced digital connectivity mechanisms and tremendous computing power to process the humongous amount of fast data and ubiquity-enabling ecosystems. These features can be best experienced through digital technologies like 5G, Cloud Computing, IoT, Big Data and Blockchain technologies.

These emerging technologies are capable of completely displacing the ‘comfort zone’ or a ‘complacency’ state established by the existing formats of technology. This obviously causes a ‘disruption’ in the organizational/ individual ‘status-quo’ (Malhotra, 2017) [7]. That is why these newer forms of digital technologies are also often referred to as ‘Disruptive Technologies’.

**Table 1.** Categories of the Emerging Technologies / Disruptive Technologies

<b>Category-I Artificial Intelligence(AI) Everywhere</b>	<b>Category-II Transparently Immersive Technologies</b>	<b>Category-III Emerging Digital Platforms</b>
Machine learning/ Deep learning/ Cognitive learning	Assistive technology	Cloud computing
Sentiment analysis	Wearable technology	Internet-of-Things (IoT) / Internet-of-Everything (IoE)
Natural Language Processing	Virtual reality	Big data / Big Data Analytics
Robotics /Drones	Augmented reality	5G
Autonomous vehicles	Nanotechnology	Cryptocurrency
Conversational User Interfaces	Connected home / Smart Home	Blockchain
Commercial UAV (Drones)	4D printing	Edge Computing
Smart Dust/ Smart Robots/ Smart Workplace	Brain-Computer Interface	Quantum Computing
Enterprise taxonomy Ontology management	Ambient/ ubiquitous technologies	Digital twin
Enterprise Taxonomy	Volumetric Displays	Serverless PaaS

**Source:** Gartner, Top Trends in the Gartner Hype Cycle in 2017, available at [gartner.com](http://gartner.com)

Armed with a relevant application of these technological trends in governance, some of the interesting instances from each of the three categories are discussed here.

### **Category-I: Role of Artificial Technologies in Governance**

Artificial Intelligence and its varied manifestations (category-I) can be used in multifold ways. For instance, AI-based tools/machinery/ assistants, -that ‘intelligently’ perform repetitive chores such as pothole repairs and scavenging, can be employed to improve the productivity of public workforce in mundane or unsafe scenarios (Thomas, 2018) [8]. AI can collect feedback on projects and government interactions to gauge sentiments of the citizenry on city activities. AI can also make governments more vigilant about crime detection/ incident response processes/ prospective emergencies by analysing ‘digital footprints’ of certain suspicious people. Iceland has employed Machine Learning (ML) to provide innovations in healthcare. The machine learning sensors -also known as Össur Prosthetics Sensors uses ML for improving natural joint function in the human body. These sensors also give information, which helps the medical practitioners to understand the experience of prosthetics.

Currently, in India, NITI Aayog has been mandated (NITI Aayog, 2018) [9] to establish the R&D- based national program on AI with a view to establishing:-.

- Center of Research Excellence (CORE) that would focus on pushing technology frontiers through new knowledge creation
- International Centers of Transformational AI (ICTAIs) to develop and deploy application-based research in collaboration with the private sector

Another popular AI implementation is that of drones that are remotely piloted aircraft systems. Drones offer low-cost, safe, and quick aerial surveys which can be used for data collection and are useful in industries such as power, mining, realty, oil and gas exploration, railways and highways. Drones can inspect tall structures and offshore rigs and can help in relief, rescue work, policing and even in agriculture for selective pesticide/ fertilizer spraying. On August 27, 2018, the civil aviation regulator in India-the Directorate General of Civil Aviation announced a licensing regime for the commercial use of drones. The policy will take effect from December 2018 and will -not permit drones in no-fly zones. It will restrict permit operations of drones only within the site and during the day at a maximum altitude of 400 feet above the ground/surface area. With a market size of drones amounting to \$8857 million (by the year 2021), a robust legal framework for commercial use of drones could help develop the drone market, encourage investments for local production, thereby helping the Make in India scheme launched by the Central Government.

### **Category-II: Role of Transparently Immersive Technologies in Governance**

Another set of interesting emerging technologies is that of Virtual Reality (VR) and Augmented Reality (AR), which has been identified as a major megatrend that will drive businesses and

governance realm into next decade. The VR uses a computer-generated environment to provide interaction with the real system, using head-mounted systems, whereas, in the realm of AR, the actual machine is augmented or supplemented by computer-generated sensory output. Hence, AR is more ‘immersive’ and ‘real’. Nokia in Finland (in collaboration with Helsinki University Hospital) live streams neurosurgical procedure to approximately hundreds of surgeons using VR with the aim of advancing the healthcare industry by training more doctors. In India, startups like ‘Smartivity’ have been selling STEM (Science, Technology, Engineering, Math)-based educational content in the form of toys, and DIY (Do-It-Yourself) kits that are AR-enabled.

### **Category-III: Role of Emerging Digital Platforms in Governance**

The future of our existence lies in ‘interconnected’, ‘integrated’, ‘intelligent’ and ‘interactive’ smart devices, broadly represented under the category of the Internet of Things (IoT) / Internet of Everything (IoE). IoT defines the network of physical devices, vehicles, home appliances, which have three things viz. sensors, unique identifiers/ Internet address (IP address) and connectivity. Further, these ‘smart’ devices can compute and connect without requiring human-to-human or human-to-computer interaction. IoT can find applications in a plethora of governance areas such as in surveillance where sensors can monitor traffic etc. It can also be used for city planning, road planning, dynamic toll pricing, flood management, etc. A startup called Agrisource Data (based out of Atlanta) is using intelligent in-field sensors for measuring water levels, soil moisture, in-field crop health, fuel levels, storage temperatures and data analytics to provide farmers with detailed crop and field information and ensure more efficient field management. IoE is a concept that extends the IoT concept to include people and processes.

Big Data technologies help to ‘collect and collate’ ever burgeoning, customer-generated data being induced by technologies like IoT and SMAC. ‘Big Data analytics’ helps in ‘mining’ / excavating the data meaningfully, thereby creating new business models built around knowledge generated by analysing this large and heterogeneous data. Internationally, Security Exchange can catch illegal trading activity in the financial markets. In India, a pioneering initiative of the Maharashtra Government data-mapped and analysed three blocks of the district Chandrapur (2016-17) to create village development plans so that each of its villages could be transformed into a model village. Such contextualised, actionable insights and evidence-based decision-making by governing agencies can indeed propel a developing country to attain SDG targets by the year 2030.

Let us now move on to demystify a trusted/ assured data storage technique referred to as ‘Blockchain Technologies’ (category-III). A blockchain is a distributed database of records of all those transactions that have been ever executed. Once the information is entered, it can never be erased and each transaction is verified by the consensus of the participating people, making it both immutable and dependable, and hence Blockchain technologies are also called ‘Smart Contract Technologies’. The Dubai Government has already initiated the usage of Blockchain technologies in the management of land record system (<https://www.dubailand.gov.ae>). In India, NITI Aayog has developed the largest blockchain network by the name of ‘IndiaChain’ so that records/contracts based frauds are reduced, etc.



## Convergence of Emerging Technologies

It is also pertinent to note here that the three categories of emerging technologies are not ‘stand-alone’. To provide transformative experiences to its recipients, the technologies listed in one category could seamlessly collaborate with other technologies of the same category and/or with technologies listed in any other category. Let us decode this with an easier example of a Smart Home (category-II), where the majority of gadgets, including refrigerators, washing machines and cars are expected to be ‘Smart’- fitted with IoT technologies (category-III). It is not impossible to visualise that all these domestic gadgets could also be connected to conversational user devices (category-I) and have been safeguarded using Blockchain technology (category-III). The enormous data that is expected to be continuously streamed by all these domestic gadgets of Smart-Home could be leveraged by the owner of the house using big data analytics techniques (category-III) to plan family investments/expenditure, etc. On similar lines, there are several innovative ways in which these digital technologies can be integrated to contribute to the achievement of SDGs (Table 2).

**Table 2.** Suggested Applications of Emerging Technologies for Achievement of SDGs

Sustainable Development Goals	Suggested Application of Emerging Technologies
SDG 6 Ensure availability and sustainable management of water and sanitation for all	Using smart meters, soil sensors, remote irrigation management system, rainwater harvesting systems etc.
SDG 7 Ensure sustainable energy for all	Using smart grids, smart appliances, energy storage, predictive analysis, demand response technology.
SDG 11 Make cities and human settlements inclusive, safe, resilient and sustainable	Smart City Mobility- driverless mobility, interconnected infrastructure using IoT; Smart Building- Alarm management and automation, big data analytics and energy management, monitoring, detection and diagnosis technologies.
SDG 12 ensure sustainable production and consumption patterns	Smart Village- optimised farm management and automated irrigation system, soil sensors and satellite and integrated weather information, traceability and tracking system.
SDG 13 Combat climate change and its impacts	All digital solutions including smart villages, smart buildings, smart energy, smart manufacturing, smart mobility
SDG 14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development	Smart ways of conservation through advanced mapping and data technologies, submarine, coastal and inland smart sensors, real-time satellite imaging

**Source:** Achieving Sustainable Development Goals through ICT Services- Ono, Lida., & Yamazaki, 2017 [10]

## **Smart Cities and Smart Villages**

The heady thought of chalking out innovative futuristic possibilities in the public sector has already started tantalising our policymakers, academics, designers and practitioners to brainstorm together newer possibilities of our urban existence. Major components of city landscape include roads, transport, buildings, utilities, waste management, healthcare, housing, green space, and community spaces (including commercial and public spaces) are all stitched together in a digitally interconnected ecosystem.

For instance, the capital city of Estonia- Tallinn has become the centre of economic development for all of Estonia, harnessing ICT by fostering high-tech parks. It has developed a large-scale digital skills training programme, extensive e-Government, along with smart ID card for all its citizens. Ever since 2012, it has been using blockchain technologies in maintaining all its records/registries such as national health, judicial, legislative, security and commercial code systems, and plans to do so in other spheres like personalized medicine as well. Similarly, South Korea's Seoul Metropolitan Government (SMG) has developed various combined platforms that provide solutions to various issues to its citizenry by sharing information on various issues including city news, welfare, housing, traffic and much more on a real-time basis. SMG has also created a social network service (SNS) that enables two-way communication among the government and citizens using social media services. Another credible instance is of Singapore's citizen engagement portal, 'reach.gov.sg', which consults and collaborates with citizens' on relevant governance issues by employing techniques such as focus group discussions, surveys, and open meetings available on several channels including websites, mobile apps and social media. These achievements of Estonia, South Korea, and Singapore affirm that the quality of urban living can be substantially enhanced using emerging technologies. However, developing countries like India that are primarily rural require technology intervention in their villages too. For instance, billions of unconnected people live in rural India; therefore, the concept of 'Smart Village' has picked up gradually in recent times.

The aim of a smart village is to provide a sustainable ecosystem created by an interconnected and integrated village. Digital technologies are leveraged to bring ease of access to government services, diversified livelihood opportunities and technology-based micro enterprises, IT-based classrooms, cashless transactions and so on. In India, the Nokia's Smartpur Project plans to digitise villages by creating a hub to provide connectivity to villages and enable applications in the domains of healthcare, governance, education, digital-finance, and entertainment (<http://smartpur.in/the-project/>).

## **Measuring Global Digital Ecosystem: eGDI and e-PI**

To measure the development of national e-Government capacities, the United Nations has been generating the UN e-Government Development Index (eGDI) biannually since the year 2001. The eGDI is a composite indicator comprising three aspects viz. Online Service Index, Telecommunication Index and the Human Capital Index, which are equally weighted. It compares and describes the progress of this index for the member countries and elucidates the

factors contributing to successful e-Government implementation in these countries. India has jumped 22 ranks from the year 2010 to the present year 2018. In the year 2010 it was ranked 119 (total 193 countries) and in the year 2018, it has jumped to 96th rank (193 countries). This remarkable improvement in eGDI scores of India can be attributed to its various digital policy reforms such as National IT Policy, Digital India and so on

When participatory forms of governance are becoming more and more evolved, another interesting index viz. e-Participation Index (e-PI) has been included since the year 2010. e-PI is defined “as the process of engaging citizens through ICTs in policy, decision-making, and service design and delivery so as to make it participatory, inclusive, and deliberative” (United Nations e-Government Survey, 2018). India has climbed up by 43 ranks on its e-participation index (from 58th rank in the year 2010 to 15th rank in 2018) which could also be attributed to the presence of digital engagement platform of India, MyGov (launched in July 2014).

## **Existing Provisions by Government of India**

### **Emphasis on creation of Centre of Excellence for Emerging Technologies in the Union Budget (2018) of India:**

To strengthen the commitment towards the digitization drive government of India has put emphasis on Cyber technologies and on the creation of Centre of Excellence (CoEs) for emerging technologies in the union budget 2018. The financial assistance of Rs 3,07,30 million was also provided by the government under Digital India programme, to harness the potential of emerging technologies such as blockchain, artificial intelligence, robotic automation, and the internet of things (IoT). In the same budget, 100 billion were allocated to boost the digital infrastructure growth of the country. In addition to this, the government has proposed setting up 500 thousand Wi-Fi hotspots in the country that will provide broadband access to over, 50 million rural citizens.

Further, the government is trying to explore the use of the technology proactively, but for this, there is a need to revamp the technology infrastructure. In the current scenario, Governments are open to invest in and offering newer approaches to governance by improving transparency, preventing fraud, establishing trust and bringing significant time and cost savings. Here, blockchain technology can play an enormous role in collaborative governance and effective distribution systems for our society. Blockchain technology is being explored and adopted actively in various public affairs domains such as judicial decisions storage, asset management, production, digital identity management, digital wills, passports, criminal records, tax records etc. Application of blockchain will make the public sector more transparent, and the economy stronger.

## **National Strategy for Artificial Intelligence by NITI Aayog (Planning Commission of India)**

NITI Aayog has prepared a national strategy to direct the government's collective efforts into Artificial Intelligence (AI), research and development of related applications, for the benefit of the citizens. NITI Aayog calls this approach '#AIforAll'. The strategy aims at enhancing and empowering Indians with the skills to find quality jobs; it also encourages investment in research sectors that can maximize economic growth and social impact, and scale Indian-made AI solutions to the rest of the developing world.

In this strategy, NITI Aayog has identified five sectors *viz* healthcare, agriculture, education, smart cities and infrastructure and transportation, these sectors are envisioned to benefit the most from AI in solving societal needs. Use of AI in Healthcare would provide increased access and affordability of quality healthcare; in agriculture use of AI will enhance farmers' income by increased farm productivity and reduction of wastage. Quality of education would definitely improve by the AI. Better traffic arrangements and significant reduction in congestion problems is possible by the proper application of AI.

### **IndiaChain:**

NITI Aayog has developed the largest blockchain network by the name of 'IndiaChain' [11] so that records/contracts based frauds are reduced. IndiaChain is linked to India-Stack and other government digital identification databases to further strengthen transparency in transactions. It has proposed several application areas, including land records management, supply chain management (a la' public distribution system, pharmaceutical supplies, etc), and electronic health records.

## **Challenges Confronting e-Gov Implementation**

e-Governance initiatives have such a broad scope, crippling issues have a greater scope to occur. Extensive field-exposure of the author across the entire length and breadth of the country has given her fair exposure to delineate some of these challenges. For instance, close informal interactions of the author (in the year 2007) with approximately 28 district collectors / deputy commissioners from the states had indicated glaring issues such as inadequate technical, erratic power supply with limited supply of kerosene fuel to run the power backup generator machines, lack of customised software and absence of meaningful content. In recent times, in a global context, the investigation by the US national agencies into the rigging of US elections in the year 2016 poses issues from the other end of the spectrum. In this case, social media data of the American citizens had been captured by a British agency called Cambridge Analytica to 'influence' the perception of US voting community in favour of a particular candidate. This is an example of gross misuse of big data analytics and affirms the cascading repercussions of invasive potential of digital scenario on global governance. Clearly, these stray instances of CIC implementation in Mizoram (India) and Cambridge Analytica episode (US) reveal that there are

several challenges and risks assailing e-Governance scenario. The author has broadly classified the headwinds to e-Governance implementation as Technological challenges, Human Resource challenges and Governance challenges.

## **Technological Challenges**

The ‘beehive’ of technological challenges comprise of varied issues ranging from e-Waste damages to last mile-connectivity, to cybersecurity concerns and to the pertinent challenge of ‘digital divide’<sup>1</sup>. In addition, there is a lack of national technology standards for the same service that causes apparent disruption in user-experiences and convenience (Satyanarayan and Malhotra, 2018) [12]. According to Global e-Waste Monitor Report (2017) by ITU, around 44.7 million metric tonnes of e-Waste was generated in the year 2016. In developing countries like India, e-Waste is a bigger challenge because of unplanned discarding that makes disposal difficult as well as costly (Dasgupta, Debsarkar, Chatterjee, Gangopadhyay & Chatterjee, 2015)[13]. Also, with the growing amount of connected digital devices, unauthorised access to personal sensitive information also poses a challenge, especially in a country like India where data of almost 1,320 million citizens is at stake. In the present context, the implementation of emerging technologies (listed in section 2.1) requires a constant and a strong internet connection; therefore, a possibility of Internet blackout would completely retard the progress (Kathuria, Kedia, Varma, Bagchi, & Sekhani, 2018) [14]. In the context of emerging technologies, the programmers too should not end up ‘creating’ AI driven machines that could morph to create unpredictable ‘Frankenstein’ kind of unwieldy situations. Therefore, to counter these uncontrollable self-destructing scenarios, very strong emotional and spiritual IQ must be inculcated in AI programmers to create digital systems of our future, especially the ones that are employed in governance context (Malhotra, Kotwal & Dalal, 2018) [15].

## **Human Resource Challenges**

Human resource challenges are created for several reasons including lack of exposure, lack of easy availability or/and lack of skills. Further lack of trust, privacy challenges, and fear of inadequate security in the mind of masses too hamper the uptake of technology. The challenge confronted by the unaware citizens and reluctant employees is another critical aspect that stalls the smooth implementation of e-Governance. In a diverse country like India that boasts of varied profile and preferences of its citizens, digital divide phenomenon too manifests itself in a more complicated manner. Digital citizen engagement platforms do espouse participatory forms of governance; however, the aspirations of the citizenry evolve very fast, almost at tandem with the trends of digital technologies. These recursive variations in the needs and aspirations of citizens could lead to an unmanageable kind of fluidity in otherwise rigid institutional setups.

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<sup>1</sup> Digital divide refers to the inability of the citizens to access digital technologies, primarily due to economic constraints. According to the International Telecom Union (ITU) ICT Facts and Figures, 20% of households in developed countries and as many as 66% of households in developing countries do not have internet access, leaving almost 4 billion people from developing countries offline

## **Governance Challenges**

Issues of information management and electronic records preservation constitute one part of governance challenges (Palanisamy, 2004) [16]. Sponsor dictates, outdated institutional frameworks, and inefficient partnership models further aggravate Governance challenges. Digital surveillance by establishments and e-hegemony / data autocracy by the developed nations impede the uptake of digital technologies by the developing nations. Lack of robust regulatory mechanisms may further end up creating a national psyche of insecurity against uptake of digital technologies in governance.

## **Way Forward for e-Governance in India**

After gauging the complexity of challenges (section 6.0) that could constrain the role of digital technologies in governance, time is now ripe for our governments to evolve robust institutional frameworks and national strategies.

## **Institutional Frameworks and National Strategies**

At the institutional level, most important factors that must be incorporated are components of Information Security and Data Integrity, Sourcing and Outsourcing, Performance Measurement, Regulatory non-compliance, Technology management infrastructure and Strategy Building and Risk Management and Disaster Recovery Planning aspects (Chandiramani, 2007) [17]. There is a national need for realigning our approach towards 'managing technology'. A comprehensive and persistent national focus is required for designing more robust regulatory frameworks. Rather than laid back staid approach to usher in new IT-related Bills/ Acts / Amendments. India needs a more proactive, collaborative and recursive recourse to initiate and implement legal amendments in the Indian Penal Code/ IT Act, etc. Even access to public data should be controlled at several levels for safeguarding privacy, security, and integrity of data. Managing e-Governance implementation is also about 'managing changes'. Hence, there is a strong requirement to address the issue of change management for which a commitment of our political and executive leaders is crucial. To ensure hassle free and smooth transition from governance to e-governance, our leaders must follow eight step model that insist on creating a sense of urgency, building a core coalition, forming a strategic vision, getting everyone on board, removing barriers and reducing friction, generating short-term wins; sustaining acceleration and finally, setting the changes in stone (Kotter, 1996) [18]. To support the creation of state-of-art institutional frameworks as well as to formalise the change management strategies, a Center of Excellence (CoE) on 'Emerging Technologies in Governance' should be established. Such a research-oriented centre would help to propel an innovation-led progress model and help to formulate a cohesive approach for all the institutions in delivering digital services. Some global consortium on the lines of International Telecommunication Union (ITU) could be developed for the emerging technologies also.

## Concluding Remarks

Emerging technologies chisel governance systems to be responsive to the present and future needs of society and their usage can be synergised to the sustained development goals. The existing digital emerging initiatives spearheaded have accomplished a lot in the governance domain, particularly in the delivery of public services, education, health, agriculture, etc. However, these digital initiatives must not wither away as erratic experiments. To sustain these digital initiatives, the government agencies must provide citizens with what exactly they need and aspire rather than just an aped model where ‘one size fits all’. Only a citizen-centric and citizen-inclusive approach can bridle the ever-changing facets of technology and help to design a recursively self-regulated ecosystem of e-Governance. Keeping ‘citizens’ as the nucleus of governance / e-Governance systems would help us to achieve a more sustainable and equitable global economy, where emerging technologies act as an expedient means and not an ‘end’. Emerging technologies and innovations are central to the implementation of the 2030 Agenda and the Sustainable Development Goals (SDGs). So, if all these emerging technologies are utilized effectively, they could be proved assets in identifying barriers and in providing solutions for sustainable development challenges from the local to global level.

## References

1. Chandiramani, S. (2007). Information Technology and Corporate Governance. Retrieved from <http://unpan1.un.org/intradoc/groups/public/documents/APCITY/UNPAN026699.pdf>
2. Charru Malhotra (2017). Co-Creating Good Governance using Emerging Technologies. elets e-Gov. Retrieved from <http://egov.eletsonline.com/2017/08/co-creating-governance-using-emerging-technologies/-> is
3. Charru Malhotra (2018) “Enhancing Citizens' Participation in the Processes of Governance Digital India and MyGov”, International Journal of Open Government [2018 – Vol 7], pp 193-198 URL: <http://ojs.imodev.org/index.php/RIGO/article/view/250>
4. Charru Malhotra, Chariar, V., Das, L., & Ilavarasan, P. (2007). An Evaluatory Framework for ICT Interventions. In the Rural Areas: Review of Literature on E-Governance for Rural Development in the Indian Context, Adopting e-Governance (Eds.), pp.216-226. G P Sahu, GIFT Publishing, New Delhi: India
5. Charru Malhotra., Kotwal, V., & Dalal, S. (2018). Ethical Framework for Machine Learning, Submitted for ITU Conference, Argentina
6. CIO. Three Megatrends to drive digital business into the next decade - Gartner's Hype Cycle August 19, 2017, Retrieved from <https://cio.economictimes.indiatimes.com/news/strategy-and-management/three-megatrends-to-drive-digital-business-into-the-next-decade-gartners-hype-cycle/60129676>
7. Dasgupta, D., Debsarkar, A., Chatterjee, D., Gangopadhyay, A., & Chatterjee, D. (2015). Present E-waste Handling and Disposal Scenario in India: Planning for Future Management. *International Journal of Engineering Research and Applications*. ISSN : 2248-9622, Vol. 5, Issue 5, May 2015, pp.99-107

8. Department of Economic and Social Affairs. (2005). UN Global E-Government Readiness Report. (UNPAN). New York. Retrieved from [www.unpan1.un.org/intradoc/groups/public/documents/un/unpan021888.pdf](http://www.unpan1.un.org/intradoc/groups/public/documents/un/unpan021888.pdf); Last Accessed on August 21, 2018
9. Kathuria, R., Kedia, M., Varma, G., Bagchi, K., & Sekhani, R. (2018). The Anatomy of an Internet Blackout: Measuring the Economic Impact of Internet Shutdowns in India. *Indian Council for Research on International Economic Relations*. Retrieved from [https://icrier.org/pdf/Anatomy\\_of\\_an\\_Internet\\_Blackout.pdf](https://icrier.org/pdf/Anatomy_of_an_Internet_Blackout.pdf)
10. Kotler, J. (1996). *Leading Change: Why Transformation Efforts Fail*. Harvard Business School
11. Magno, A. and Serafica, R. (2001). *Information technology for good governance*. Manila: Yuchengco Center for East Asia, De La Salle University
12. NITI Aayog.(2018). *National Strategy for Artificial Intelligence #AIforall*. India
13. Ono, T., Lida, K., & Yamazaki, S. (2017). Achieving Sustainable Development Goals through ICT Services. *Fujitsu Science Technology Journal*, 53(6), 17-22
14. Palanisamy, R. (2004). Issues and Challenges in e-Governance Planning. *Electronic Government an International Journal*, 1(3). DOI: 10.1504/EG.2004.005551
15. Pollitt, C. (2000). *Public Management Reform: A Comparative Analysis*. USA: Oxford University Press
16. Satyanaraya & Charu Malhotra (2018) “Universalization and Replication: -Towards a consistent service experience- The role of a Digital Service Standard (DSS) in Citizen-Centric Governance”. In ‘Technology for Accelerating Development’, DARPG and NASSCOM Publication, Government of India: New Delhi. URL: <https://community.nasscom.in/docs/DOC-1696>
17. Sen, S. & Murali, A. (2017, November 13). IndiaChain: Niti Aayog starts on IndiaStack-linked, large-scale Blockchain projects. *Factor Daily*. Retrieved from <https://factordaily.com/indiachain-indiastack- blockchain>
18. Thomas, F. (2018). Lifting performance in the public sector with an AI augmented workforce . Retrieved from <https://www2.deloitte.com/au/en/pages/public-sector/articles/lifting-performance-public-sector-ai-augmented-workforce.html>



# Knowledge Management process and achievement of SDGs involving Demographic Dividend of Bangladesh

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## Abstract

The paper particularly addressed the potentiality to achieve Demographic Dividend (DD) of Bangladesh. It discussed the challenges in a general observation not with in depth economic analysis although some general statistics were cited. It further discussed the state of United Nations' (UN) formulated Sustainable Development Goals(SDGs),2016-2030 agenda that addressed to promote socioeconomic development as well as environmental sustainability and good governance. Bangladesh has experience in achieving most of the targets of the Millennium Development Goals(MDGs-1990-2015) those were formulated by the UN for same interest. As knowledge management for development issues is an vital ingredient and there is no way to ignore for any kind of development of its sharing and dissemination the paper tried to focus its importance and significance and ways of cultivation for sharing so that the communities concerned are benefited. A relations tried to highlighted between knowledge management, SDGs and Demographic dividend. Finally some recommendations were formulated from the experience for achieving Demographic Dividend and Sustainable Development Goals. Knowledge management policy adaptation was also recommended for in time decision making process relating to those achievement.

## Recommendations and Findings

As per the paper's discussion following steps are found necessary to achieve the DD and SDGs along with Knowledge sharing.

- Increasing domestic resources as because foreign resources seems constraint.
- Formulation of an effective job oriented education policy and Age based job creation
- Preparing of a job market based Human resource planning for need based recruitment
- Industrial investment to meet global and local market demand and encourage agriculture
- Training and orientation for skilled human resources
- Setting up of Skill development strategy including training, internship and need based exercise.
- Eradicate corruption and avoid malpractices in all public and private workplaces.
- Make sure good governance in public administration and political agencies as well as law and enforcement units.

- Ensure Supremacy in honesty and honour to aged citizen
- Safeguard good health and social security to all.
- Make sure a knowledge management policy to share current information for making timely and correct decision ensuring information to all.

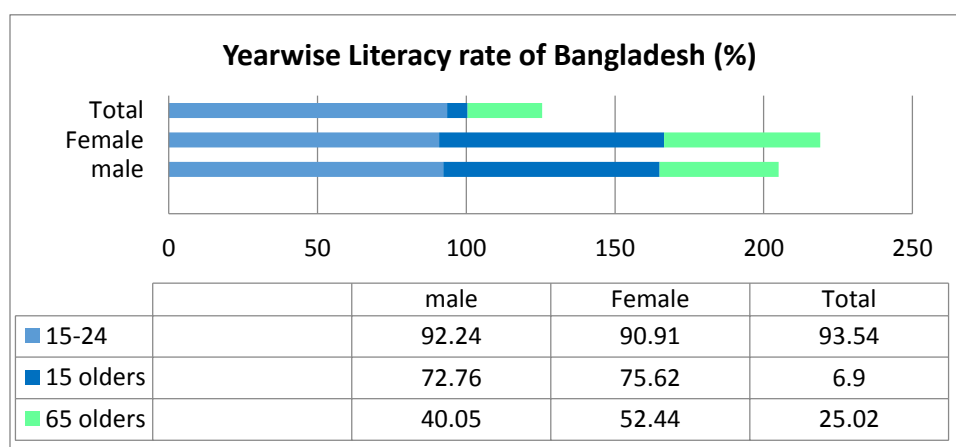
## Introduction

Bangladesh is now a member of lower middle income country. The per capita GDP was calculated in June 2019 is USD 1,827.00 as per Bangladesh Bureau of Statistics provided the information to Census and Economic Information Centre(CEIC data,2019)

The per capita gross national income (GNI) jumped more than 9 percent to \$1,909 last fiscal year from \$1,751 a year ago, as per provisional official figures released very recently(The Daily Star, Sept. 2,2019 )

Adult literacy rate as per Unesco Institute for Statistics (UIS) was calculated 72.76%. While the male literacy rate is 75.7%, and females is 69.90%. In the same year the literacy rate for men and women aged between 15 to 24 years increased to 92.24% . When declaring Bangladesh's eligibility for graduating from Least Developed Country (LDC) to middle income country status the UIS data said Bangladesh is now ahead of India (69.30%), Nepal (59.63%), Bhutan (57.03%) and Pakistan (56.98%) in the global literacy rate index(UNESCO,UIS data,2016). The data also discovered that the number of educated young males and females rose dramatically over the past 10 years.

The geographical location of the country is between 20<sup>0</sup> 34" and 26<sup>0</sup>38" north latitude and between 88<sup>0</sup>01" and 92<sup>0</sup>41" east longitude while drought, flood, cyclone, road accident, etc are the common melancholies of Bangladesh. The country has a **population density** of 1,115.62 people per square kilometer, which ranks 10th in the world (CEIC data,2019)



**Source:** BangladeshBureau of Statistics, 2016

Although technological development in terms of technical literacy is not remarkable more than 140 million **people**, out of **Bangladesh's** population of around 163 million, use mobile phones while around 80 million people access the internet (BRTA,2019) which is more than 86 percent of total population.

Note that, the rate of work force of the present population ,Bangladesh is now an opportunity to bring a remarkable change towards development . Due to the consequent changes in the age structure in Bangladesh the proportion of working age population has increased such a way that offering a window of opening referred to as the Demographic Dividend(UNFPA,2012). Instead of increasing older person this time is very crucial for the country in relation to explore opportunities. As the working group has been increasing Bangladesh is exploring various windows for job creation and encouraging people to startup economy . Information and communication technological activities in this regard has got a momentum in research and development with the young work force relating to knowledge management activities that involves in every sphere of development activity. There is a substantial prospect in relation to new job conception encouraging young into environment friendly circumstances .Using electronic information available for research and development young people can be think of better innovation in different sectors of development arena. To achieve demographic dividend national human resource planning relating to job availability is another important issue. The government is taking various initiative with due attention in this connection. In comparison to various decades population age ranking in Bangladesh at this moment is a very suitable position that brought the chance as demographic dividend.

The Population status in different decades may be compare from the following table(UN,World Population Prospect, 2017

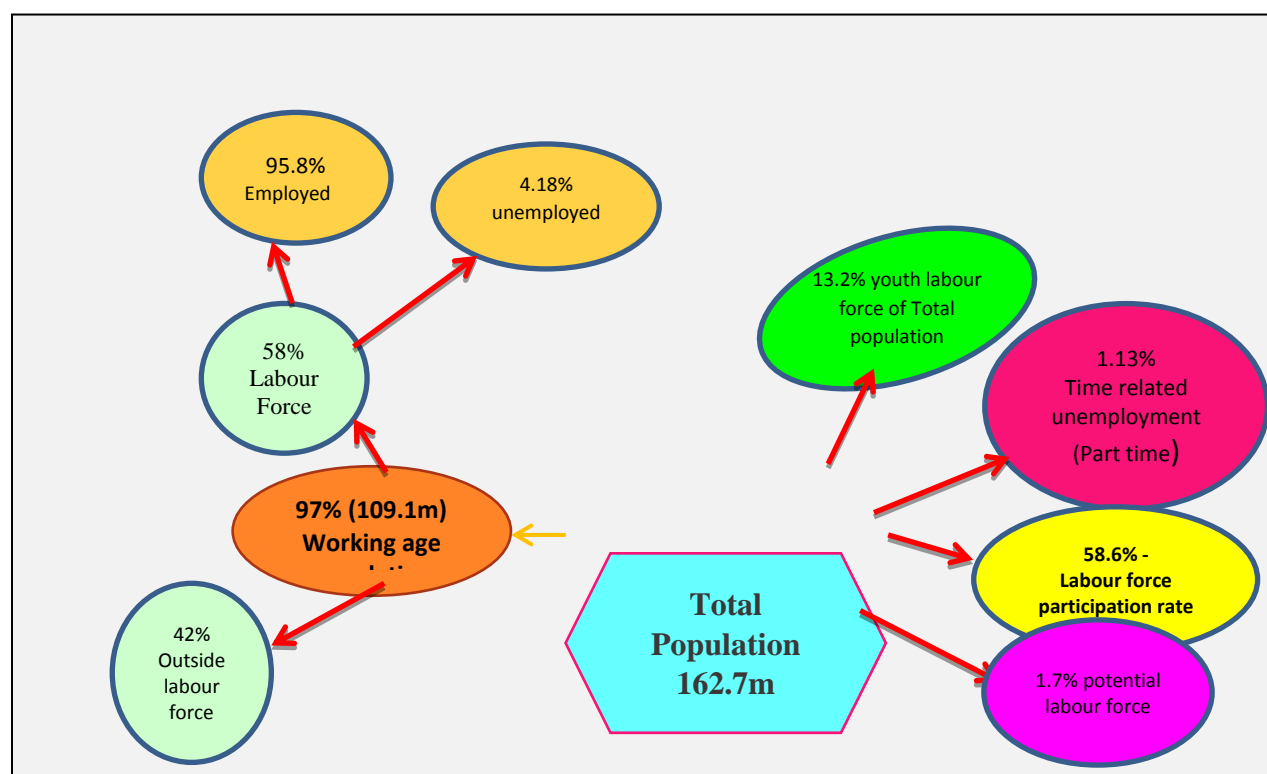
Bangladesh population					
Population in various year		Global Ranking		Life Expectancy at Birth	
Year	No. of population	Year	Rank	Year	Age
1950	3,78,95,000	1950	12	1990-95	60
2017	16,46,70,000	2017	8	2005-10	69
2030	18,55,5,000	2050	8	2010-15	71.2
2050	20,19,27,000	2100	14	2015-20	72.9
2100	17,45,49,000			2025-30	75.7
				2045-50	79.9
				2095-2100	87.5

**Source:** World population prospects: The 2017 revision: UN Department of economic and social affairs

As per quarterly labour force survey, 2015-16 of Bangladesh Bureau of statistics Working age population labour force ratio of Bangladesh may be seen from the following table and the figure of population projection tree below (BBS, 2016):

When Total population of Bangladesh 162.7m									
95.8	Employed	58%	Labour Force	Tabular form of distribution as per the tree above	Working Age population – 97%	Youth Labour Fore	13.2%		
	4.18					Unemployed			Time Related Unemployed(Part Time)
42%		Outside Labour Force	Labour Force Participation Rate						58.6%
			Potential Labour Force						1.7%

**Figure:** Labour force projection



**Figure:** Population projection Tree.

### Populatin Status of Bagladesh

The current population of **Bangladesh** is approximately **163.33** million , as of September 3, 2019, based on the latest United Nations estimate. (UN.worldometer) It also gave a historical feature comparing the population growth rate and median age from 1955 to 2019. The changed idea regarding this matter can be seen from following table (**Worldometers,2019**) :

**Table** Historical population table of Bangladesh

Year	population	Yearly % change	Total yearly change	Median Age
2019	<b>163,046,161</b>	1.03 %	1,669,453	26.1
2018	<b>161,376,708</b>	1.06 %	1,691,284	26.1
2017	<b>159,685,424</b>	1.08 %	1,708,271	26.1
2016	<b>157,977,153</b>	1.10 %	1,720,877	26.1
2015	<b>156,256,276</b>	1.15 %	1,736,169	25.7
2010	<b>147,575,430</b>	1.20 %	1,707,985	24.0
2005	<b>139,035,505</b>	1.72 %	2,275,530	22.5
2000	<b>127,657,854</b>	2.08 %	2,497,585	31,0
1995	<b>115,169,930</b>	2.22 %	2,399,595	19.6
1990	<b>103,171,956</b>	2.60 %	2,481,555	18.6

1985	<b>90,764,183</b>	2.65 %	2,224,938	17.8
1980	<b>79,639,491</b>	2.59 %	1,914,638	17.4
1975	<b>70,066,301</b>	1.75 %	1,166,764	17.7
1970	<b>64,232,482</b>	3.01 %	1,769,474	17.8
1965	<b>55,385,112</b>	2.90 %	1,474,322	19.3
1960	<b>48,013,504</b>	2.67 %	1,185,441	19.0
1955	<b>42,086,301</b>	2.12 %	838,324	19.3

## Demographic Dividen and potentials

### Concept and Achievement of Demographic Dividend

Although **growth of the working- age population is creating opportunities for economic growth achievement of demographic dividend is not easy**. According to some economists and population scientists at this moment jobs are not available in the country for all working-age population. In most of sub-Saharan Africa, and in parts of Asia and Latin America and the Caribbean, recent reductions in fertility have caused the population at working ages (25-64 years) to grow faster than at other ages, creating an opportunity for accelerated economic growth for a favourable population age distribution. To benefit from this “demographic dividend”, governments should invest in education and health, especially for young people, and create conditions conducive to sustained economic growth (UN,2019).

To exploit the full potential of the demographic dividend the country needs to create suitable adequate number of employments for the working-age population. Steps are indispensable to be taken including large-scale investments in education and health sectors to cash in. Present education system and procedure is not matched Bangladesh with the social and economic demand to sustain development though government recently took a decision for reshaping education policy towards achieving Demographic Dividend

Measuring demographic dividend and demographic transition, in a study at the Institute of Statistical Research and Training(ISRT), University of Dhaka identified some common but important indicators for consideration (Matin,A. Khan,2012)

- Crude Birth Rate and Crude Death Rates
- Annual Population Growth Rate
- Total Fertility Rate
- Expectation of life at birth
- Population Pyramid, 1950, 1975, 2010, 2050 and 2100
- Percentage share of Young, Working Age and Old Age population
- Median Age(years)
- Dependency Ratio: Total, Young and Old
- Labor Force and Population Growth Rate

- Demographic Dividend
- Timing and Duration of demographic dividend
  - Difference in growth rate of labour force and population (ii) Demographic support ratio.
- Population at different educational levels
- Savings and Investment

Considering all the alternatives above virtually demographic dividend in Bangladesh started in 1980s. There are three types of variants United Nations (UN) considered for demographic projection. As per the low variant it will end in 2035 according to population projection. Medium and high variants will continue until 2040. So, the country is in the middle of the dividend period. Note that the economic returns will not solely function to gain the demographic dividend. For gaining the benefit there is a need for policies dealing with education, public health and those that promote labor market flexibility and provide incentives for investment and savings (Matin, A. Khan, 2012). This benefit is absolutely depends upon appropriate policy formulation to create employment with technical and market oriented education, health insurance and old age security. Otherwise dividend may not cash in as desired.

### Bangladesh Population Forecast

This forecast calculated by United Nations, Department of Economic and Social Affairs, Population Division. (World Population Prospects: The 2019 Revision). For forecasted years, the UN medium-fertility variant was used. It seems in the projection that fertility rate is constant from 2020 to 2050. Except year 2020 in the rest years' population change found less than 1 percent a smaller amount of population found added to the original number. (UN. Worldometers, 2019)

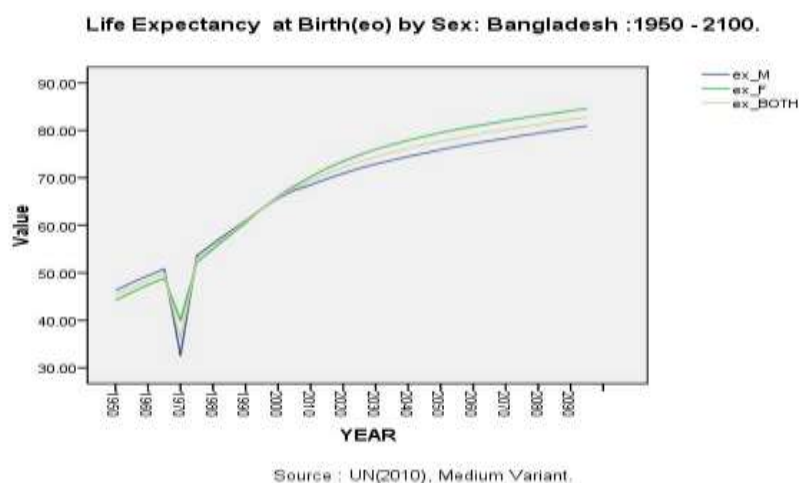
Year	Population	Yearly% Change	Yearly Change total	Migrants(net)	Median Age	Fertility rate
2020	164,689,383	1.06 %	1,686,621	-369,501	27.6	2.05
2025	172,399,078	0.92 %	1,541,939	-348,061	29.5	2.05
2030	178,993,869	0.75 %	1,318,958	-330,093	31.6	2.05
2035	184,374,127	0.59 %	1,076,052	-311,798	33.8	2.05
2040	188,416,727	0.43 %	808,520	-311,802	35.9	2.05
2045	191,142,270	0.29 %	545,109	-311,080	38.0	2.05
2050	192,567,778	0.15 %	285,102	-310,080	40.0	2.05

**Figure** Showing population and Fertility rate from 2020-2050

## Life Expectancy at birth

In Bangladesh Life expectancy at birth has been increased in the mean time. It happened due to suitable health policy and right sanitation programmes and its implementation over the country. The country achieved one of the important targets of Millennium Development Goals, 1990-2015 through this specific programme. The way population health is being maintained and policy adapted time to time life expectancy of Bangladesh may rise up to 90 years by the year 2100.

Based on the median variant UN made the following figure that may provide a distinct idea at glance regarding the matter.



## Potentials of Bangladesh Demographic Dividend

The current demographic transition in Bangladesh leads to many changes in the size and age structure of the fast growing population of the country. The opening of opportunity that has emerged since the 1990s will not last long and will not be repeated in the near future. Some predict this opportunity will reach its peak during the year 2020s and will remain open until the 2030s. This demographic dividend needs to be managed efficiently in order to be transformed into better and sustainable economic growth (Islam, Mazharul M, 2016). In order to ensure this benefit, appropriate planning in every development segment is unavoidable.

To meet the challenges achieving demographic dividend Bangladesh needs to change its policy including education. Accordingly, in the present revised education in secondary curriculum government decided to introduce a new disciplines. In this education policy, it has been made compulsory to teach Bengali, Information and Communication Technology (ICT) and Bangladesh Studies up to secondary level in all the educational institutions regardless of their medium of instruction. Ethics has been introduced to the textbooks of religious studies and these textbooks have been redesigned accordingly (Chandan, 2016). **It is expected to be made students sound in ethical knowledge hopping to make the country free from corruption, which is very important for achieving the dividend in remarkable development.** Another



decision is going to take by the government that consequently, every student will have to study at least one trade course in the secondary level of education from 2021.

To achieve a higher economic growth, some countries in East and East Asia invested much in comparison to any other sector particularly education and health.

To make people satisfy the wages fringe benefits in most working organizations are not practical in terms of basic requirements. As a result in one hand unmatched education does not fit to the work on the other hand working forces do not take honest interest for the organization he/she works. Skilled is drained. In public and private sectors in Bangladesh both wages have not much option for saving for life. One important thing is, Bangladesh Government should create an economic environment that encourages high rates of saving. To providing retirement income for individuals, high saving supports investment that Bangladesh institutions provide attractive and secure long-term investment opportunities in the context of low inflation, so that money saved today will retain its value tomorrow (UNA-UK, 2019)

Consequently, the UN SDGs is now an opportunity for Bangladesh to achieve Demographic dividend in addition to its own planning and development activities. In partnership with foreign countries as well as bilateral and multilateral development partner countries and agencies, taking development plan into action SDGs target will certainly be a catalyst for every sectorial growth. Again take into consideration that Bangladesh has achieved most of the targets of the UN's Millennium Development Goals (MDGs), 1990-2015, with due attention in comparison to any other LDC countries. Bangladesh is now going to be graduated a Middle income country (MIC). The SDGs target in association with MIC graduation action plan may benefit to achieve demographic dividend with more creativity and enterprise.

### **Age based job creation**

As per Bangladesh Bureau of Statistics report of Labour force survey, 2016-17 the largest share of all employed persons (32.4 per cent) was skilled agriculture workers. Some 17.2 per cent were employed in elementary occupations, followed by 17.0 per cent in Craft and Related Trades Workers, 16.5 per cent in Service and Sales Workers.

In urban areas, the largest share by far, at 24.6 per cent, of the employed population was in Craft and Related Trades Workers; within sex, 21.5 per cent were male and 33.0 per cent were female. In rural areas, skilled agriculture workers accounted for the largest share of the employed population, at 41.2 per cent, with the breakdown by sex, 63.0 per cent were females among rural employed.

The statement can be seen in a tabular form by the figure below (BBS,2017):

Occupation	Rural			Urban			Bangladesh		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
<b>Managers</b>	1.1	0.2	0.8	4.6	1.6	3.8	2.1	0.6	1.6
<b>Professionals</b>	3.6	3.6	3.6	6.7	11.4	8.0	4.5	5.5	4.8
<b>Technicians and Associate Professionals</b>	1.6	0.6	1.3	3.8	1.8	3.3	2.3	0.9	1.9
<b>Clerical Support Workers</b>	1.3	0.4	1.0	2.9	1.7	2.6	1.8	0.8	1.5
<b>Service and Sales Workers</b>	18.1	3.8	13.5	30.0	8.4	24.2	21.6	4.9	16.5
<b>Skilled Agricultural, Forestry and Fisheries</b>	30.8	63.0	41.2	6.8	16.9	9.6	23.8	51.7	32.4
<b>Craft and Related Trades Workers</b>	15.0	12.4	14.1	21.5	33.0	24.6	16.9	17.5	17.0
<b>Plant and Machine Operators, and Assembler</b>	8.2	1.7	6.1	10.6	3.8	8.8	8.9	2.2	6.8
<b>Elementary Occupations</b>	20.0	14.1	18.2	12.5	21.1	14.9	17.9	15.8	17.2
<b>Other Occupations</b>	0.3	0.0	0.2	0.4	0.1	0.3	0.3	0.0	0.2
<b>Total</b>	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

**Figure** Occupation by profession in Bangladesh

Although the agriculture, forestry and fisheries have the largest manpower skilled it is not enough for achieving the dividend concerned. The country needs more skilled manpower in industrial, health and contemporary technological sectors too. In this regards country's education policy needs to be revised based on the national and global demand. The country has been facing the young age based demographic opportunity since 1990. So, its already late to take measure for achieving the dividend.

At every stage of the age transition Jobs are highly critical. Policies should draw a wide range of the population into the workforce, including young adults, women and the elderly who can still work. Policy options for the labour market could include: increasing the mandatory retirement age; varying pension so that early retirement is neither encouraged nor discouraged; and improving flexibility for employers to hire part-time workers, which may be especially attractive to women and the elderly too (UNA-UK,2019)

## **Human resource planning to achieve the dividend**

To meet the country's demand an assessment for the sectors to be made for appropriate recruitment of manpower. Immediate human resource planning is a must to meet the demand without any fail. At the same time national education planning must be revised and job oriented. After emerging the demographic transition towards opportunity of engaging a good number of young manpower for development Bangladesh did not make the appropriate plan for manpower recruitment yet. As a result country has to hire more experts from foreign countries to meet the demand in different development zones. On the other hand much skilled and unskilled manpower are interested to have their job other than Bangladesh for higher wages. Although it gives much foreign currency which is not discouraging they are generally increasing the idle reserve. If country utilize those manpower by suitable planning and sensible wages it will certainly more beneficial for overall development of the country that will favour the country to achieve the dividend. Some countries have invested comprehensively in human resource development, in particular education and health, to achieve a higher economic growth rate during their time of demographic dividend when most citizens work (Liton, and Molla, 2017). Some experts of the country say Bangladesh's economy has been doing well for the last several years but currently its job growth is the slowest in two decades. It may be happen due to lack of proper human resources planning. As per the Bangladesh Bureau of Statistics' Labour Force Survey, 2015-16 the country could add only 1.4 million jobs between 2013 and 2015-16 fiscal year, down from 4 million jobs it had added between 2010 and 2013 (Liton and Mollah, 2017).

## **Skill Development Strategy: Training, internship and need based exercise**

Stated by a president of Bangladesh Employers association once that a good number of foreign employees work in many multinational companies, garments, pharmaceutical industries in Bangladesh. It happens due to unavailability of local skilled manpower in necessary sectors in Bangladesh. In a study of a private research organization 'Centre for policy Dialogue' in 2018 found that many foreign employees are working in 24 percent of garments industries in Bangladesh. It was found that there is a big scarcity of skilled professional manpower in mid level and top level in different profession. Most of the Manpower Produced through the current conventional education system that do not match the job available in most areas. (Musa, Shahjahan Ali, 2018).

## **Faulty recruitment policy hinders professionalism**

No profession grows without planned training and orientation where academic higher education in most cases is less important. Bangladesh has a remarkable number of higher education people are jobless where the general education rate about 76.2%. Unfortunately a good number of graduates and postgraduates from various universities are working in different public and private sectors with lower wages, beneath position as overqualified employees. Due to scarcity of job they have to start working. This work force can not match with their job position by reason of higher degree, they can not work honestly with full attention by superiority complex either. Where as higher degrees are not necessary in most cases. Its true that the education system of the country is not fit to work in every step of desired work, its also true that most of

the organizations except a large number of public agencies are not interested to arrange minimum training and orientation for an employee. They demand higher education with work experience which is very funny for a planned recruitment. The job position that usually advertised for recruitment in most private and in some government organizations add some extra experience as an additional qualification which is not supposed to be available. On the other hand this does not match with the position and compensation. As a result frustration comes out. Rather the recruiting organization should advertise for new untried novice manpower with minimum academic qualification so that authority can make those employees fit to the job as desired through training and orientation with reasonable wages. They can facilitate those employees for further qualifications based on the organizations' need and interest. Otherwise skilled manpower can not be produced overnight.

## **Demographic Transition Leading to Dividend**

In order to significant global and national inventiveness and noticeable improvements in the health sector death rate of Bangladesh has been decreased and simultaneously life expectancy has been increasing gradually especially like other LDC and developing countries in the world. This is the population shifting contribution leading to demographic transition. In this situation usually fertility rate starts decreasing and started increasing population of working age proportion in comparison to dependent age structure ideally less than 15 and people aged 65 and over (Abusaleh, Kazi, 2017)

Economic growth concerned the work force population. Work force depends upon a certain age of population. The United Nations Population Fund explained this substance in an orderly way. "The economic growth potential that can result from shifts of the population's age structure, mainly when the share of the working-age population (15-64) is larger than the non-working-age share of the population (14 and younger, and 65 and older)" defined UNFPA. (UNFPA, 2014, p.15). On the other hand "John Ross" discoursed "the demographic dividend occurs when a falling birth rate changes the age distribution so that fewer investments to meet the needs of the youngest age groups and resources are released for investment in economic development and family welfare" (Ross, John, 2004, p-01).

In future, the population size of working-age in the country would be declining gradually and the country may not get this dividend again very shortly is an important factor to be measured having divined.

Japan, China and many other countries have gained the demographic dividend to develop their economies but in Bangladesh, things are different. Due to lack of proper planning in most of the development economic issues it seems not in a good shape. In Bangladesh nevertheless education, health, industrial investment, good governance in each sector, etc are going to plan satisfactorily late socio-political stability and social safety are most important in this regard. Effort have been made to manage things in sustainable manner. Although the apparent development can not satisfy people due to unstable economic situations the country is now trying to ensure economic stability so that no one can be frustrated in the society that leads to

SDG target-1 which is not pessimistic . The country is also trying its level best to ensure social security and financial savings too.

Success of the 2030 Agenda for Sustainable Development, which initiates that no one will be left behind, is strongly bound to anticipating and planning for the effects of the demographic transition that will unfold during the SDG period(Mason and Lee,2019). Bangladesh needs to have a forward-looking policies by the new challenges to face demographic transition towards achievement .

Aminul Haque, chairman of Department of Population Sciences, University of Dhaka, explained in the way that a coordinated and well thought-out plan was required in four sectors , viz. quality manpower export, expansion of private sector, and expansion of government sector, and opportunity creation for the self entrepreneurship to get maximum dividends Liton and Mollah ,2017 ).

## **Sustainable Development Goals(SDGs) and its achievement**

### **What is Sustainable Development Goals(SDGs)**

After the success story of the MGDs 1990-2015 in September 2015, the General Assembly on the United Nations adopted the 2030 Agenda for a peaceful and reliable world that leads to Sustainable Development . The Sustainable Development Goals (SDGs) has 17 agenda . Building on the principle of “leaving no one behind”, the new Agenda emphasizes a holistic approach to achieving sustainable development for all. This is what about SDGs.

### **SDGs the United Nations Innovation**

Initiatives are taken by United Nations (UN) to step up economic development in demographic transition to dividend period defining the prospects of future of a nations. That is why the trend of the world population, as nearly one-third of the world population belongs to aged 10 and 24, urged the global leaders to initiate SDG to define a common future .

Its a set of 17 point goals that formulated by United Nations in consultation with UN countries over the world. Previously mentioned, there was a 15 year targeted goals articulated by the same body for 1990-2015 which was called Millennium Development Goals or MGDs includes 15 points for development targets. Many countries including Bangladesh of UN umbrella fulfilled almost all the targets of MDGs with satisfaction. MDGs has successfully focused world attention to a broad-based development framework (Guillaumont, 2013).

After the expected success of the MDGs the General Assembly of the United Nations is anticipated to assume a new set of goals for post-MDGs 2015, following an intergovernmental negotiation process. Its a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. A new extended plan has been adopted with 17 points

2030 agenda which is known as Sustainable Development Goals-SDGs stated earlier. The United Nations leaders from 193 countries of the world came together to face the future. They perceived frightening Famines, Drought, Wars, Plagues, Poverty, etc. not just in some faraway places, but in their own cities and towns and villages too(UNDP-2017)

A number of initiatives outside the UN framework also worked to conceptualize the post-2015 development agenda. During the working sessions a number of proposals with regard to global development agenda emerged following the MDGs initiative. The most noteworthy among those propositions are came into being as Sustainable Development Goals or SDGs “which came forward following the RIO+20.The SDGs reaffirmed the need to achieve sustainable development by promoting economic development, social inclusion, environmental sustainability and good governance. Virtually, the post-2015 development agenda is expected to be informed by both the unfinished agenda of MDGs and these new initiatives”(Commonwealth Secretariat,2014).

**SDGs 2030 Agenda:** The 17 SDGs goals and target are stated below:

Goal	Target
Goal-1: No poverty	End poverty in all its form everywhere
Goal-2: Zero Hunger	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
Goal-3: Good Health and well-being	Ensure healthy lives and promote well-being for all at all ages
Goal-4: Quality Education	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Goal-5: Gender Equality	Achieve gender equality and empower all women and girls
Goal-6: Clean Water and Sanitation	Ensure availability and sustainable management of water and sanitation for all
Goal-7: Affordable and Clean Energy	Ensure access to affordable, reliable, sustainable and modern energy for all
Goal-8: Decent Work and Economic Growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
Goal-9: Industry, Innovation and Infrastructure	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
Goal-10: Reduced Inequality	Reduce inequality within and among countries
Goal-11: Sustainable cities and communities	Make cities and human settlements inclusive, safe, resilient and sustainable
Goal-12: Responsible consumption and production	Ensure sustainable consumption and production patterns
Goal-13: Climate Action	Take urgent action to combat climate change and its impacts <sup>2</sup>
Goal-14: Life below water	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
Goal-15: Life on Land	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
Goal-16: Peace and justice strong institution	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
Goal-17: Partnerships to achieve the goal	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

**Figure** List of the UN Sustainable Development Goals (SDGs) and their targets

Based on the goals and targets the United Nations further formulated some indicators named “**Global indicator framework for the Sustainable Development Goals** and targets of the 2030) Agenda for Sustainable Development” (see UN General Assembly Resolution 68/261). Every goal has many indicators. The UN documents regarding the indicators stated that ,” Sustainable Development Goal indicators should be disaggregated, where relevant, by income, sex, age, race, ethnicity, migratory status, disability and geographic location, or other characteristics, in accordance with the Fundamental Principles of Official Statistics(UN,2018)

### **Role of Bangladesh to achieve SDGs**

Bangladesh is in on the roadway and aware of the global activities for achieving SDGs in line with partnership relations along with its individual programmes. The country needs to emphasize the importance and potential of South-South Cooperation as an increasingly potent feature of international cooperation for development . To tackle the challenges of 2030 i.e.SDGs targeted period, Bangladesh needs to avail the opportunities. It is encouraging that Bangladesh has been elected as Co-Chair of Global Partnership for Effective Development Cooperation (GPEDC) in its second High-Level meeting held in Nairobi, Kenya on 28 November-1December, 2016. Its main objective is to implement the universal and inter-related Sustainable Development Goals (SDGs).

### **Facing the common Challenge issues**

Collective action through the Global Partnership has driven stakeholders to improve the way development co-operation is delivered, contributing to gains in effectiveness. The 2030 Agenda calls for scaling up efforts to improve the effectiveness of development co-operation; action to mobilize the transformative power of private resources to deliver on sustainable development; and for enhanced exchanges between constituencies engaged in North-South, South-South and triangular co-operation to promote knowledge sharing” (Government of Bangladesh. Ministry of Planning,GED,2016).

Some events of vulnerabilities due to climate change like flood, drought, desertification, water logging, salinity interruption, tidal surge, uncertain rainfall, land degradation, extreme temperatures, incidence of new pathogen and diseases are appearing with serious threats to sustainable development efforts. The achievements in other areas of SDGs will be disfigured if the potential threats of climate change are not addressed properly. Beside local programmes country needs to have cooperation with development partner countries and agencies. South South Cooperation of United Nations (UNOSSC) may be sought for concrete and flexible global framework for South-South and Triangular cooperation to meet common problems to be solved and achieved the SDGs as well.

### **Steps taken by Bangladesh Government to achieve SDGs**

Bangladesh government prepared a mapping document describing the goals with its implementing process of action. The office of the Hon’ble Prime Minister, has formed an inter-ministerial committee, called “SDG Monitoring and Implementation Committee”. The

committee includes 16 key implementing ministries including Planning Commission (General Economic Division). Under the supervision of this committee all the ministries/divisions were consulted several times to prepare this mapping document. All the ministries/divisions were agreed upon in delineating their jurisdiction, which was influenced by the Allocation of Business of the Government, to implement and achieve their respective targets .  
A Monitoring and Evaluation (M&E) Framework would be prepared following the Action Plan for SDGs implementation.

The estimation for additional resources required to implement the Sustainable Development Agenda is under assessment. A full-fledged needs assessment and costing of attaining SDGs by 2030 will be prepared soon. To have a complete mapping of the ministries/divisions by SDGs targets, procedure is being initiated to ensure private sector involvement in SDGs implementation. Development Partners of Bangladesh have also been requested to align their Country Strategies within the framework of the SDGs targets relevant and line up for Bangladesh according to 7th Five Year Plan ,2016-2021. Thematic and goal wise consultation with stakeholders from private sector along with Development Partners at a large scale will also be carried over regarding Action Plan and Monitoring Framework(Government of Bangladesh. Ministry of Planning,GED,2016)

The Handbook has given a ministry wise targeted plan for implementation to achieve SDGs. The points indicated in the handbook are action oriented. Under every goal of 2030 the handbook identified the actions based on following step that can be seen in a table as follows(Government of Bangladesh. Ministry of Planning,GED,2016).

Sustainable development goal and associated target	Lead Ministries/ Divisions	Associate Ministries/ Division	Actions to achieve SDG target during 7 <sup>th</sup> five year plan(2016-2020)	Actions to achieve target beyond 7 <sup>th</sup> FYP period(2021--2030)	List of existing policy instrument( Act/policies/ strategies,et c.)	Proposed global indicators for performance measurments	Remarks

## How SDGs and DD relate to KM

Knowledge management(KM), Sustainable development goals(SDGs) and Demographic Dividend (DD) are closely related with each other . We believe , nothing can be achieved without knowledge and its application where management is concerned, Sustainable Development Goals is the outcome of UN based on research and knowledge cultivation and demographic dividend is the coincidental natural opportunity and prospect of Bangladesh of the moment the SDGs are formulated for global development in view of partnership cooperation for economic progress when Bangladesh is being graduated to a middle income country from LDCs.



Bearing in mind this relations may be designed by some parameters as follows for economic as well as industrial and technological development of Bangladesh:

Parameter identified	KM	SDGs	DD
Strategic Planning	Knowledge for basic information and	Need to know SDGs in details available in knowledge centre	Gaining knowledge, understanding SDGs , find potentialities of Demographic Dividend
Economic growth(rate and increasing situation)	Researchers, policy makers, decision givers are the end users of processed information that needs management of knowledge. It links between SDGs target indicators and position of DD.	Need to go through the SDG target points and report to the authority concerned of the Government .	Processed Knowledge is required for assessing demographic dividend
Startup Economy	Study and cultivation of knowledge is required. The early stage startups expect specialised and experienced technical support for measuring calculative risk to overcome and to build a sustainable plan ( <a href="#">Saqiful Alam</a> and Sanjida Akhter,2017) Fostering knowledge to make somebody innovate and get ready for SDGs achievement.	For Sustainable development and growth can be achieved by startups ecosystem that includes creation of sustenance nurtured organization that relates knowledge for fulfilling the target.	So long the manpower is concerned for every action for development demographic dividend is the most importantly measured. It will not see the day light without proper information or knowledge
Sector wise development (infrastructure, energy, etc. 6 sectors)	Ned to know detailed plan of actions for SDGs implementation by the competent authority.	A handbook for Targeting the implementation of SDGs aligning with 7th Five Year Plan (2016-20) has already been prepared and printed by the Government of Bangladesh for strategic development detailing action oriented programmes.	It needs continuous preservation to understand the possibility through gaining Explicit knowledge
Economic Diplomacy (foreign aid gaining strategy,etc.)	It can be can arranged and disseminated by knowledge management for sharing and synchronizing	Country needs to identify sectors and indicators for gaining foreign resources. Economic Relations Division already made a strategic planning in this regard.	Based on KM activities and SDGs information will make sure he progress of DD.
Technical cooperation	Provide current Knowledge information and communication technological supports is required for indulgent any other issues.KM is the source.	The updated and chronological activities need to know to achieve SDGs targets . KM relations is the best suit to manage things well.	SDGs and DD of Bangladesh will depend upon the KM programme of action in line with relvant and correct information vaiability. This leads to technical cooperation for achievement

Based on the conviction that “knowledge is a valuable core asset of its organizations and its best comparative advantage.” United Nations system organizations in their attempt to systematically and efficiently develop, organize, share and integrate knowledge to achieve their cross-cutting goals.” Three characteristics of knowledge make KM critical to improving the effectiveness of the UN system, and particularly organizations concerned with development: 1. *Knowledge is needed to improve professional competency.* 2. *Experiential knowledge is as important as expert knowledge* 3. *Knowledge is measured in person-years.*

## **Knowledge and Knowledge Management:**

Knowledge is a catalyst – an indispensable ingredient in all human progress and development. (Cummings, Sarah, 2017) Unfortunately it did not get a room in the SDGs topics at the beginning. As governments, civil society, businesses and researchers are engaging in understanding and achieving the 2030 Agenda for Sustainable Development, and its 17 Sustainable Development Goals, the SDG Fund is proud to launch an online repository to fill an important gap: creating an online platform for publications with accessible content related to the SDGs.

### **Knowledge Management rationale for SDGs and DD**

Knowledge Management (KM) strategy for SDGs is to ensure that generated knowledge and innovations for multicounty approach, aimed to regional localization efforts are properly documented, analyzed and widely disseminated for application and replication. The key elements of the KM strategy therefore consist of: knowledge capture and development, as a means of collecting lessons learned to serve as a basis for further investigation, analysis and documentation. knowledge sharing and dissemination, including the sharing of lessons learned aimed at ensuring that the experiences and lessons of the localization efforts are carried over to future development initiatives in the SDG focus (Abebe, Jack, 2018?) As the SDGs demand knowledge DD also needs knowledge to achieve similarly.

### **Knowledge and its usability**

Every organization generates and accumulates enormous quantity of knowledge relating to their own functions. They have to acquire different types of knowledge from outsources too. It stands to reason for every organizations and person to be effective and made useful for their own survival in the society. Naturally this knowledge needs to be shared for their effective functioning. Sharing knowledge increases its quality and way out utility. It can be possible by a strong knowledge management process. Unfortunately there are a few example of effective knowledge management in organizations. If knowledge is what one knows, then knowledge management (KM) is expeditiously getting what you know to the person who needs to know it (Glovinsky, Steve, 2017).

In one sense knowledge is nothing but a collection of information, meaningful context, useful understanding and skills that someone gains through education or experience (Oxford Dictionary-2010). It may be physical, logical or mathematical and social. On the other hand information is data that have been put into a meaningful and useful context communicated to a recipient to make decision (Bradford) leads to knowledge.

## **Knowledge Management and Development**

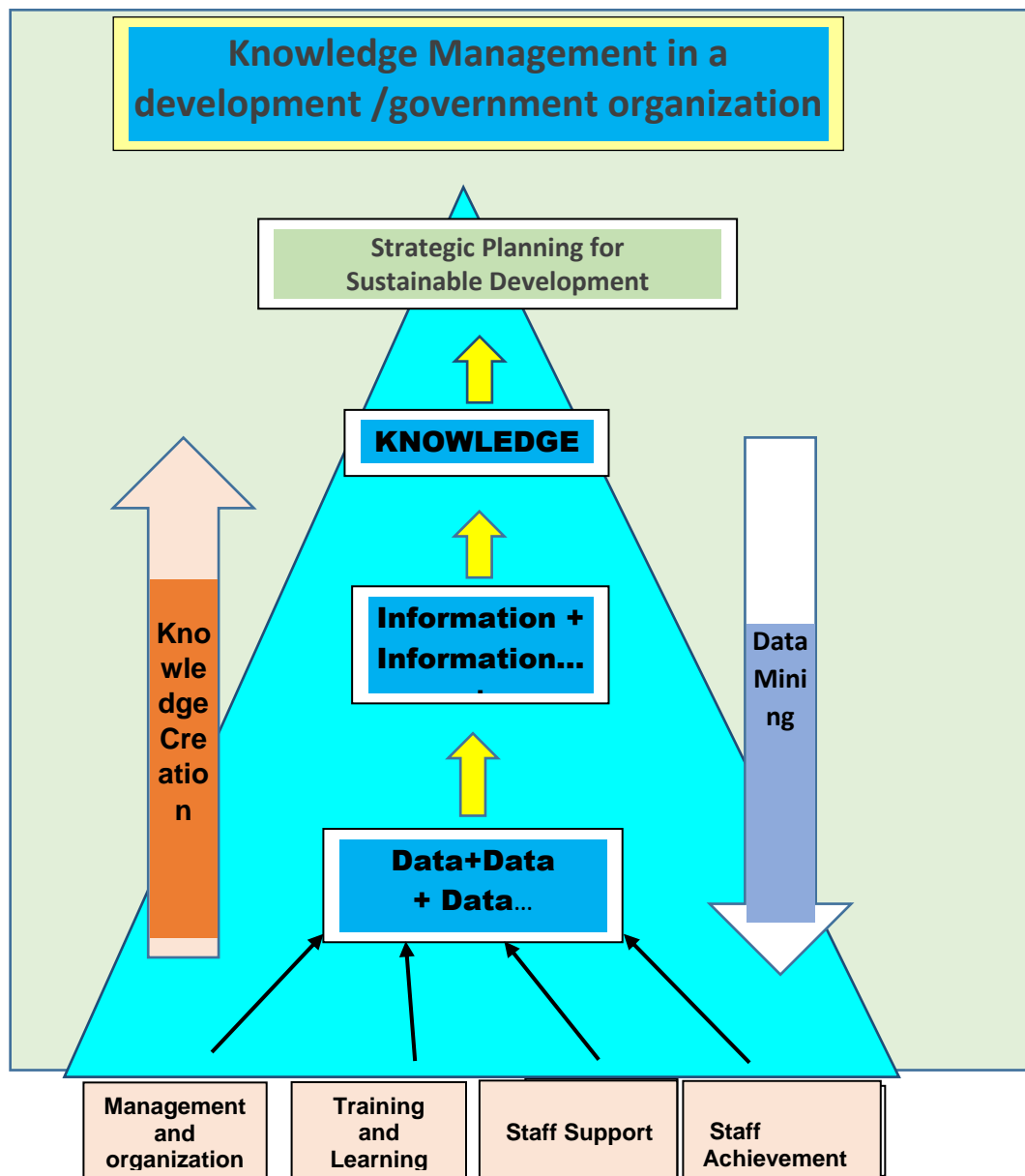
The World Development Report 1989-99 has given an effective definition and justification of Knowledge relating its management that communicates development and human basic need for maintaining standard of living. It says, “knowledge is critical for development, because everything we do depends on knowledge. Simply to live, we must transform the resources we have into the things we need, and that takes knowledge. And if we want to live better tomorrow than today, if we want to raise our living standards as a household or as a country—and improve our health, better educate our children, and preserve our common environment—we must do more than simply transform more resources, for resources are scarce. We must use those resources in ways that generate ever-higher returns to our efforts and investments. That, too, takes knowledge, and in ever-greater proportion to our resources” (World Dev. Report-1989-99) Human resource development is associated with this statement. Here we can also see the relations between SDGs achievement for attainment of Demographic Dividend in Bangladesh. The country acquires a natural position by receiving a young age bonus demographically. But by effective and useful planning only can achieve this extra opportunity. Taking into consideration that every development needs knowledge and its cultivation. Knowledge management is a process to cultivate knowledge for making it available for use. Its stand to reason that without processing nothing can be used appropriately. Use of appropriation means right information and knowledge at the right time for making right decision for development is like use of right medicine to right patient at the right time. Otherwise as development might have been disrupted the patient might not be survived. Everybody knows, the world is full of alternatives. But knowledge does not have any. For enlighten peoples’ live there is no alternative of knowledge. More important is management of knowledge for end users by processing mechanism by appropriate professionals. Knowledge management is more important than knowledge gathering and pooling. It needs to put into a process for making available. Without availability and practicality knowledge values like a dump hay stake. When a knowledge is not worthwhile development, life standard and all other activities and necessities in life are less worthy almost value less.

Consequently, we may consider good management. Parenthetically, as Rockefeller says, good management consists in showing average people how to do the work of superior people

## **Knowledge Management (KM) Cycle**

When a knowledge management cycle is considered for development information can not be overlooked. On the other way round information come into being by data. Considering a sustainable development when a strategic planning is measured data, information and knowledge are equally taken into account. It can be supposed where Information Management

ends the Knowledge Management starts. We can look at the following figure as per ECK Cheng model that may give a relevant vibrant feature about KM:



**Figure.** The way data converted into knowledge for development and decision making.

Cheng Indicated by his knowledge management model, how assimilation and collection of data and information transferred into knowledge and how they share it (Cheng,ECK,2015). Data and information are collected from internal and external sources for the organization. With the activities of staff concerned they achieve knowledge and support the organization for

development. These things are happen in a regular way by knowledge management accomplishments. Any kind of strategic or uncalculated planning requires knowledge. Strategic planning formulation is usually expected managed knowledge for any sustainable development rather than unplanned strategy. So, knowledge is obvious in this connection. Without professional planned Knowledge management a fruitful strategy can not be formulated for development sustainability.

### **Think tank for Knowledge cultivation**

Making virtuous decisions every organization needs to have a think tank for their research and development towards healthier operation. A think tank can make it possible to provide current beneficial information to make a correct decision. Policy makers must have profound thinking for analysis information to make decision. But they don't have much time to innovate things and deep thought for their constraint of time. They need to analyze information, data, etc, for better understanding on any substance. Without better understanding decision may not be a healthier one. A knowledge comes into effect for any purposeful work with a vessel of information and data. A worthy conversant man always go through enormous number of information and data for his work done effective and expedient. A think tank in an organization usually has to think of the organization's wellbeing so that policy makers can take an effective and valuable decision. Keeping in mind that decision maker and policy makers are the end users of knowledge and they require finished product. That demands processing. For the same reason, it has to collect, analyze, communicate, reorganize and synthesize information to convert it into knowledge. In this regard in a report made by United Nations emphasized the knowledge and knowledge management for effective policy making. Points to ponder generated by peoples who usually involved with research and development. The report says, the role of think tank is to provide policymakers with the deep analyses that their staff do not have the time for, so that they can make better informed policy decisions(UNDS,2017).

### **Knowledge-Information-Data relations for knowledge management**

Information is data that have been put into a meaningful and useful context communicated to a recipient to make decision(Bradford,). In the above chapter it was tried to make understand the need of information and knowledge for decision making procedure. When information is further processed and/or used we treat it as knowledge. Information containing perception is known as knowledge.

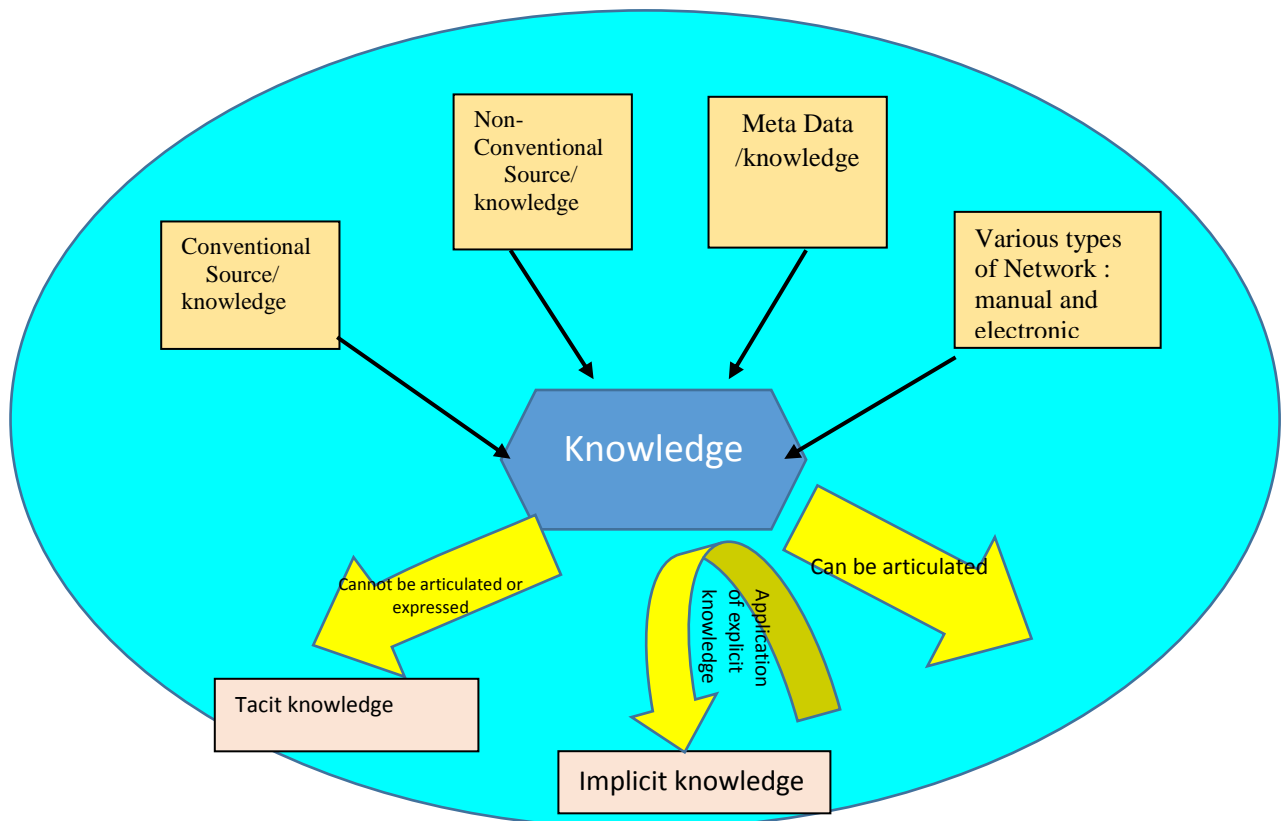
When we talk about knowledge we notice two basic terms-tacit and explicit knowledge.

- **Tacit knowledge** is such a kind that we usually can not transfer to another person by **means** of writing it down or expressing verbally or speaking it out. It's a matter of something that has an explicit power to make things possible. It's a particular challenge for **knowledge** management. This Knowledge gained from personal experience that is

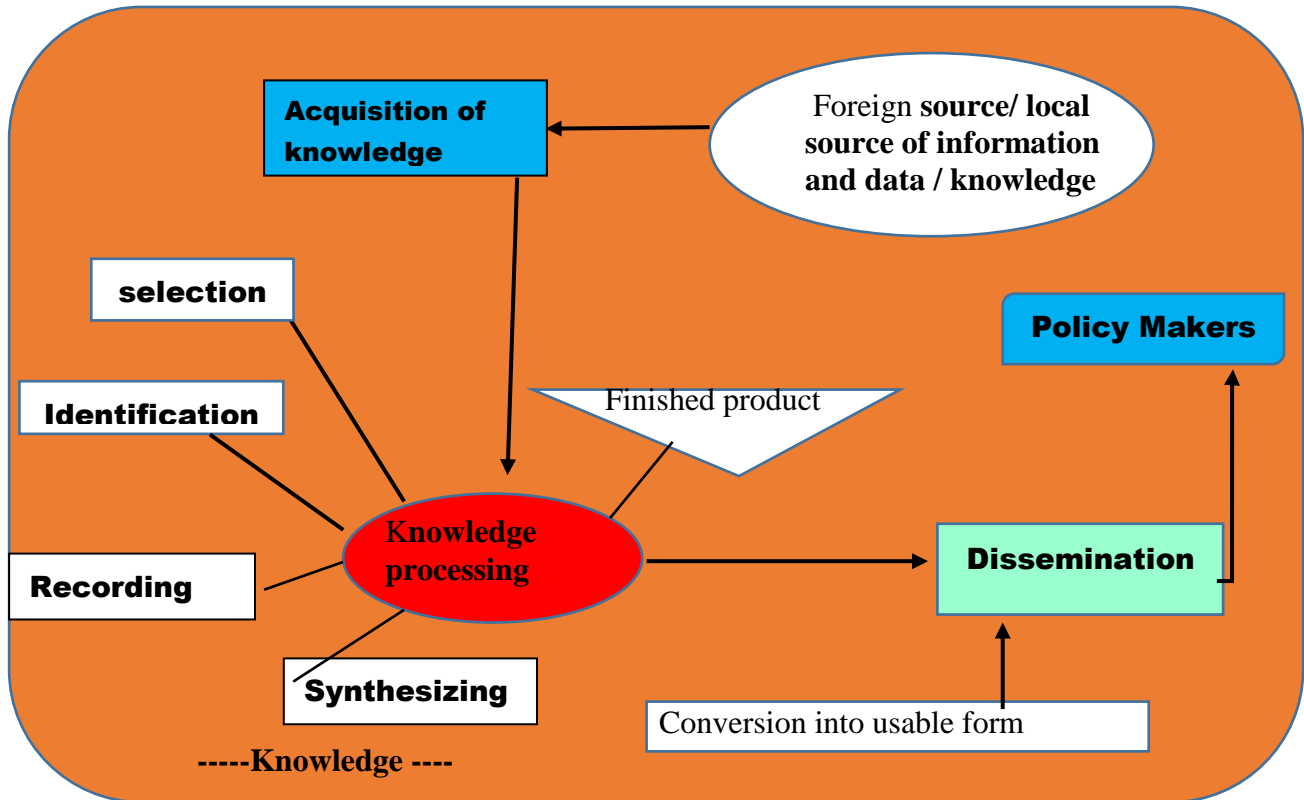
more difficult to express. Its exists in the peoples' head. Nobody can touch it. Its uncodified knowledge.

- **Explicit Knowledge:** Knowledge that is easy to articulate, write down, and share. It might have an physical existence. By touching a paper, computer, watching television we can gain this knowledge. By thinking a matter we can easily write it down if desires and can easily transfer to others physically unlike tacit knowledge. Through processing, organizing , making structure, and interpretation of data is explicit knowledge. Its a codified knowledge
- **Implicit Knowledge:** In addition to the above two types there is an other type of knowledge is known as Implicit Knowledge. The application of explicit knowledge is called implicit knowledge . Skills when transfer from one job to another is an example of implicit knowledge. For example , in an organization we usually ask someone how to do a particular work by his or her team. This stimulates a talk about the array of options to perform. The person educates by the implicit knowledge with the conversation of how to do that. The best practices and skills that are transferable from job to job (Bloomfire,2018)

The following figure may give a clear feature of various knowledge types for use:



Since knowledge identified as a core ingredient for sustainable development planning knowledge management is found crucial . In a knowledge management cycle the process screening importance may be revealed as under :



**Figure** how data and information become usable and useful as knowledge.

## Conclusion

The Sustainable Development Goals (SDGs) are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity .SDGs is a UN extract of development framework in consultation with all UN countries of the world. It was formulated for a better world to live peacefully facing climate change challenge by ensuring basic requirements in all respect. Bangladesh is at the population transition period that gives a benefit by its enormous number of present workforce aged 24-65. This workforce opportunity leads to achieve demographic dividend for the country. This opportunity does not come frequently for a nation. Once it appears will may not appear in next 100 years. Coincidentally SDGs have been formulated by United Nations. Knowledge found an indispensable element to coordinate, manage and achieve any kind of development. A country's national development is more related

to knowledge sharing and dissemination . It stands to reason, achieving Demographic Dividend- DD and Sustainable Development Goals- SDGs knowledge management can not be overlooked in any way. Nurturing knowledge by it professional management achievement of demographic dividend and fulfillment of SDGs targets can be made possible .

## References

1. Abusaleh, Kazi(2017)., Demographic Dividend in Bangladesh: Quest for Initiatives. Society & Change, Vol. XI, No.3, July-September 2017 .
2. *Bangladesh Telecommunication Regulatory Commission-BTRC(2019). Mobile phone users in Bangladesh top 140 million available at <https://bdnews24.com/business/2017/11/14/mobile-phone-users-in-bangladesh-top-140-million>*
3. Bngladesh. Ministry of Planning,Planning Commission,General Economics Division(2016).Planning Commission.General Economics Division. Mapping of Ministries by Targets in the implementation of SDGs aligning with 7th Five Year Plan (2016-20): A handbook,Dhaka,the Division,2016.
4. loomfire(2018) available at <https://bloomfire.com/blog/implicit-tacit-explicit-knowledge>
5. *CEIC(2019)available at <https://www.ceicdata.com/en/indicator/bangladesh/gdp-per-capita>*
6. Chandan, shahnawaz khan ,2016).Education policy: Excellent on paper. The Daily Star.Dhaka,Feb. 03 ,2016.pp.18 & 25.
7. Cheng E.C.K. (2015) A Knowledge Management Model for School Development. In: Knowledge Management for School Education. SpringerBriefs in Education . Springer, Singapore.
8. Cummings, Sarah (2017). Available at <http://www.thebrokeronline.eu/Blogs/Inclusive-Economy-Africa/The-missing-ingredient-Adding-knowledge-to-Agenda-2030-and-the-Sustainable-Development-Goals>
9. *Commonwealth Secretariat(2014).Istambul programme of action for the LDCs(2011-2020),London, the secretariat,2014.p.23.*
10. *Dalkir, Kimiz (2011). Knowledge Management in Theory and Practice.2<sup>nd</sup>. Ed. London, The MIT Press,2011.*
11. Davenport, Thomas H. (1994), Saving IT's Soul: Human Centered Information Management. Harvard Business Review, March-April, 72 (2)pp. 119-131. Duhon, Bryant (1998), It's All in our Heads. Inform, September, 12 (8).
12. Glovinsky,Steve.(2017).United Nations,..Future United Nations Development System: briefing.-45, Feb.2017 , Ralph Bunche Institute for International Studies, New York, NY .[www.futureUN.org](http://www.futureUN.org) )
13. Guillaumont, 2013).Taking into account the specificity of vulnerable countries in a universal agenda paper presented at the conference titled 'Vulnerable developing countries in the post 2015 Agenda'Paris, available at [www.ferdi.fr/uploads/fsCms\\_News/html/217vulnerable%20agenda\\_PstationsPGillaumont.pdf](http://www.ferdi.fr/uploads/fsCms_News/html/217vulnerable%20agenda_PstationsPGillaumont.pdf)
14. Islam, M. Mazharul (2016). Demographic transition and the emerging windows of opportunities and challenges in Bangladesh. Journal of Population Research,v.33(3)pp.283-305 Muscat, University Muscat,2016
15. John D. Rockefeller,avaiaible at the the digital project management .com)
16. Knowledge management tools(2019). Available at <http://www.knowledge-management-tools.net/knowledge-management-definition.html>]



17. Liton, Shakhawat and Molla, Mohammad Al-Masum (2017). Dhaka, The Daily star, July 11, 2017.
18. Mason, Andrew and Lee, Sang-Hyop (2019). UNA-UK, Demographic Dividend, SDGs :transforming our world , available at [www.una.org.uk](http://www.una.org.uk), <https://www.sustainablegoals.org.uk/demographic-dividends/>
19. *Matin, A. Khan (2012). The Demographic Dividend In Bangladesh: An Illustrative Study. Dhaka, The Institute, DU, 2012. The paper presentation at the 18th Biennial Conference of the Bangladesh Economic Association to held on 12-14 July, 2012*
20. Musa, Shahjahan Ali (2018). The Daily Ittefaq. Sept. 09, 2018. Dhaka, The Ittefaq Group , 2018. p.8.
21. Musa, Shahjahan Ali, 2018. The Daily Ittefaq. Sept. 09, 2018. Dhaka, The Ittefaq Group , 2018. p.8.
22. Oxford advanced learner's dictionary. A S Hornby. Oxford, University Press, 2010. p.856
23. Ross, J. (2004). Understanding the demographic dividend. Policy project. [online], 8, available at [http://www.policyproject.com/pubs/generalreport/Demo\\_Div.pdf](http://www.policyproject.com/pubs/generalreport/Demo_Div.pdf)
24. Saqiful Alam, Km and Sanjida Akhter Tanny (2017). Challenges of the startup ecosystem. Dhaka: The Daily Star. Feb. 25, 2017. p.25
25. The Daily Star (2019). Dhaka, the Daily Star, 2019, available at <https://www.thedailystar.net/business/news/capita-income-hits-1909-1717606>
26. The Dhaka Tribune (2018). Dhaka, the Dhaka Tribune, 21 Mar. 2018, available at <https://www.dhakatribune.com/bangladesh/education/2018/03/21/unesco-bangladesh-literacy-rate-reaches-time-high-72-76-2016>
27. UNDP (2017). [<https://shop.undp.org/pages/the-sustainable-development-goals>]
28. Unesco (2016). Dhaka, The Dhaka Tribune. Available at <https://www.dhakatribune.com/bangladesh/education/2018/03/21/unesco-bangladesh-literacy-rate-reaches-time-high-72-76-2016>
29. *United Nations Development System: briefing. -45, Feb. 2017 , Ralph Bunche Institute for International Studies, New York, NY .www.futureUN.org*
30. United Nations (2018) United Nations Statistics Division, Development Data and Outreach
31. Branch . New York, UN, 2018. Avail at <https://unstats.un.org/sdgs/indicators/indicators-list/>
32. United Nations (2019). World Population Prospects: The 2019 Revision), New York, UN, 2109
33. United Nations (2019). Worldometers. New York, Department of Economic and Social Affairs, Population Division, 2019, available at ([www.worldometers.info/](http://www.worldometers.info/))
34. United Nations (2019). Worldometers. New York, Department of Economic and Social Affairs, Population Division, available at ([www.worldometers.info/](http://www.worldometers.info/))
35. UN Women. Knowledge Management Strategy for Localizing SDGs at the Multi/Country Level Focus on SDG 5 on Gender Equality and Empowerment of Women and Girls. Nairobi, UN, 2018?.

# Frame Work for Accessing Multimodal Multilingual Digital Library – NLP Way

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## Abstract

The digital contents for some specific domains like Election Commission do have specific types of data which can be descriptive, audio, visual and video. These contents may be contents created by Commission Offices, contents taken from legal domain, contents taken from social domain, contents taken from basic data bases such as electoral rolls, contents from Election Management Bodies, instructions issued from time to time, manuals and compendiums created for sub-domains, publication and broadcast data by media pertaining to elections, election planning related information or voter education and broadcast information. The collection of all these contents may not be difficult but the organising factor of these contents is complex, particularly if it is to be used as knowledge base for organisations. Library science practices such as creation of metadata and indexing may not be enough because of many reasons such as multilingualism of data, which is cross section of many domains, perception of the content, need of multi-domain terminology and glossary, which may include Named Entities, Noun Phrases and Verb Phrases. The fact that content is multilingual, the need of multilingual WordNet and relating terms in one language with those in other languages along with its grammatical characteristics, becomes a dire necessity. These are enough reasons to infer that a specific system of metadata creation and organization is needed to manage contents. The proposed system framework is centred around NLP (Natural Language Processing), NER (Named Entity Recognition) and KE (Knowledge Engineering) processes. The interface to the user is proposed directly as a simple search or through query processing. The query processing module itself is proposed to be added with some knowledge base to resolve context of the query for handling the semantics. Administrative metadata provides structured indexing search, descriptive metadata helps context resolution and structural metadata provides depth of the results of the end result. To handle multiple languages, with context stitched, multilingual WordNet is proposed. For organising the knowledge, terminology extraction, formulation of glossary, identification of key words and identification of named entity is used. This paper also tries to identify some processes and techniques to befit the framework for election domain.

## Introduction

### Metadata

Digital library contents can be textual, audio and video all together. It is different from physical storage of contents in libraries, where each component is itemized as physical unit and indexing is done for “locating” the content needed by the user. In digital storage however, naming files and folders to hold the content and attaching metadata to these files system is required, so that IT system itself can help searching the needful to users. The metadata in this context crosses its classic definition of ‘data about data’. It has to be machine understandable information to identify, locate and or describe web resources holding the desired content (Baldonado et al. 1997). It is different from card catalogue system used in physical libraries. Such cards containing the title of the book, subject of the book, author, date of publication, pages of the book etc is the metadata (such as MARC 21) with set of rules (such as AACR2), which may include bibliographic information, perhaps is enough for physical library. For having a set of conventions to enable exchange of metadata between and with machines, Dublin Core has the potential of being adapted as an international standard for resource description and discovery, partly because of the simplicity. In recent IT mechanism developed for digital libraries data association with objects gained importance, which relieves potential users to get the full knowledge of their existence and/or characteristics a priori. In other words, standard bibliographic information summaries, indexing terms and abstracts are all surrogates for the original material. Information about authenticity, availability and accessibility, digital signature, copyright, reproduction, etc is also metadata (Baldonado et al. 1997). Metadata describes the attributes of information bearing object document, data set, database, image, artificial, collection etc as well. Three features of metadata viz.

- Content relates to what the object contains or is about, and is intrinsic to an information object,
- Context indicates who, what, why, where, how aspects associated with the objects creation and is extrinsic to an information object,
- Structure relates to the formal set of associations within or among individual information objects and can be intrinsic or extrinsic, are used for all three types i.e. *Administrative Metadata* (information to manage to resource), *Descriptive Metadata* ( e.g. title, abstract, author etc) and *Structural Metadata* (Necessary internal structure information of an item for using it at the time of rendering).

With increasing multimodal digital contents and objects, conventional information such as author, producer, title, subject, and abstract, metadata creation is not enough for data description, data browsing, data transfer and other aspects of digital resource management, for the need of increasing accessibility, interoperability, pieces wise information through besides Copy Right management and preservation. Dublin Core is found to be widely acceptable metadata standard

describing categories of networked electronic object. It was developed jointly by OCLC and NCSA (National Centre of Supercomputing Application) and the conceptual framework was developed in the March 1995 workshop sponsored by the OCLC and NCSA to advance the state of the art in the development of metadata records for networked information resources. DCME (Dublin Core Metadata Elements) set includes Title, Creator Subject, Description, Publisher, Contributor, Date, Type, Format, Identifier, Source, Language Relation, Coverage and Rights.

## **Terminology, Glossary and Keywords**

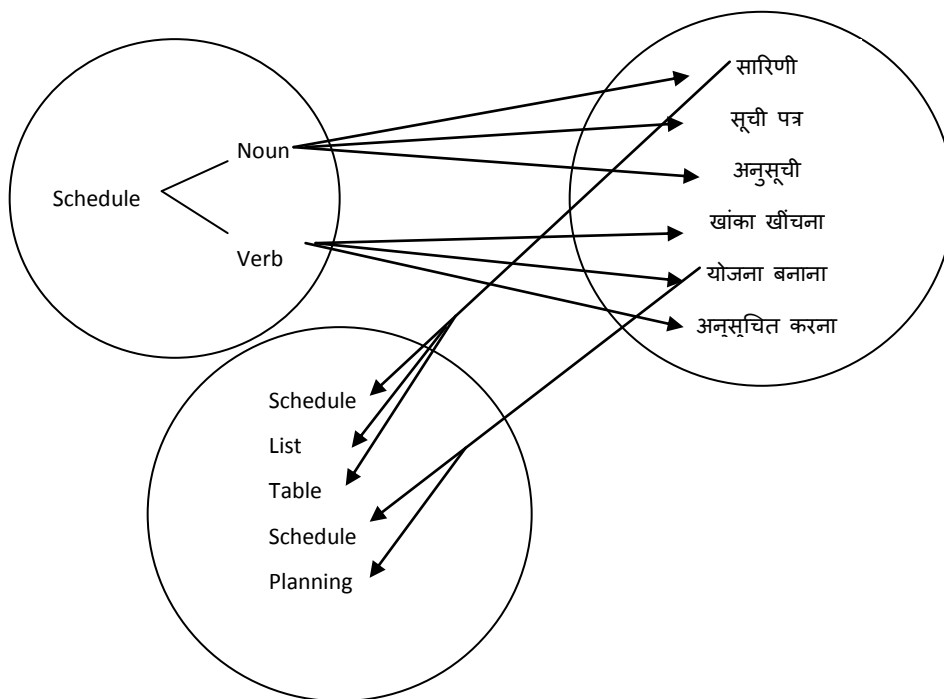
The terminology is list of words (with or without definition or meaning) from a specific domain. These terminology words would have high occurrence frequency in almost all contents created/developed for that domain, because of which presence of such words helps identification of the domain many times. For example, when terms like debit or credit appear, it gives feel of finance domain. Likewise, poll, election, canvass, leader etc are terms in election domain, whereas glossary means set of words with clear meaning or definition arranged in order. Such meanings are specific, in spite of having many meanings or definitions for these words in the dictionary. Domains are characterised by glossaries too, but the richness of the domain depends upon the quality of glossary words and phrases (Lagoze et al. 2006). Election domain too has large amount of terms, words and phrases e.g. Poll, Poll Day, Model Code Conduct, Counting Day, Due Constitution, etc. However often terminology and glossary for election domain cannot be restricted since, fundamentally, election domain itself is a mix of multiple domains. Therefore, the terminology and glossary of those domains equally applies in election domain too. E.g. deposits, income, expenditure, observers are terms of different domain but occur in election domain too. Keywords are words (or group of words) having higher frequency of occurrence, or having very unique meaning, which is totally different from literal meaning e.g. Model Code of Conduct, Star Campaigners, etc.

## **Multilingual Dictionaries**

India is culturally and language-wise a very diverse country. Therefore, bilingual dictionaries for Election Domain are not as much effective as multilingual dictionaries. Multilingual dictionary is dictionary of meanings on multiple languages for a single word in the source language, on which sets are organised alphabetically (Shukla et al. 2004). Bilingual dictionaries can be seen as set of two dictionaries, in which source and object languages are interchanged. However, for multilingual dictionary it is very difficult to have such advantage. Also, the dictionary always presents grammatical reference, such as noun, verb, adjective, adverb and pronunciation of the word. For multilingual dictionary, this fact itself is a very big challenge, since the source word may be noun, but all meaning words may not be noun, but other factors as well. E.g. ‘आई’ in Hindi is a verb, where as in Marathi it is a noun. The grammatical nature of the word plays very major role. Verbs are gender, number and person specific, since based on this information suffixes are identified. For example, ‘Come’ reformed to ‘coming’ translates to ‘आई’ or ‘आया’, based on gender. Besides this for Indian language honorific representations makes important

mark. For example, for a sentence ‘my son /daughter came’ translation would be ‘ मेरा बेटा/बेटी आया/आई’. But ‘My father came’ translates to ‘मेरे पिताजी आये’ ( Not ‘आया’) (Shukla et al. 2011). One good example of glossary term is ‘Model Code Conduct’. In the library science jargon, Glossaries are treated as unique terms. It is effective for monolingual context. But in bi or multilingual context it cannot be restricted to have singular specific representation as per definition. One has to take into account language and grammar context too.

### WordNet and Multilingual WordNet



**Figure 1.** WordNet Example for ‘schedule’

By definition, words are nouns, verbs, adjectives, adverbs and particles. The language dictionaries describe a word as one of the above, but not necessarily singular. Word could be noun as well as adjective or verb or adverb. Further, by adding suffixes noun could be converted to adjective or adverb. This characteristic makes language as natural language (it is not so for computer or machine languages) and therefore MT (Machine Translation) Systems become more complex. For example, a noun when translated in another language may change its nature. Multilingual dictionaries therefore may not be fully covering all these features. Therefore, use of

multilingual dictionaries in MT may not be enough. This fact asks for another tool such as WordNet. For digital libraries, if search is expected to produce useful outcome from multilingual content, then from dictionaries, translation is needed to provide meaning of the keyword in that language. If words change their nature e.g. from noun to verb, then search engine would need that knowledge as well. It can be provided by setting some rules, but alternative solution of use of WordNet is proposed in this paper. The graph is generated for set of words and their translations in another language. The meanings of words are also checked for their nature and then they are reverse translated in source language, causing a graph to appear, where links of the graph are qualified by transition of the word. E.g. The word 'Schedule' is noun as well as verb in English, having meaning in Hindi as 'सारिणी' as noun and 'खांका बनाना' as verb. When you take Hindi word 'सारिणी' and reverse translate in English, it would also be 'List' or 'Table'.

Similarly, if 'खांका बनाना' is translated back in English it would be 'Planning or Architecting or Tabulating' depending upon the context it is used in. Therefore, the WordNet representation for 'Schedule' would be as shown in Fig 1.

## Named Entity and its extraction issues

Entities in text such as date, time, location, quantities, names, products, proper nouns etc are named entities. Recognizing these names in the text or audio digital data is required, so that their respective linkages in other languages would have one-to-one relationship (Silvello 2008). For example, names of persons or places do not have alternative meanings but relates singularly with each other. Use of named entities in the text or audio is very important feature of the knowledge in that data. Entities may be named entities but may also be general word in the dictionary. For example, word 'Sky' may be used to create named entity as 'Mr. Sky' or 'Washington' may relate to 'George Washington'. It is the semantic or the context of this word which decides if these entities are general word (which needs to be translated) or Named Entities (which are required to be transliterated not translated). All named entities are general words but vice versa is not true. To make knowledge radiate out of words or sets of words (phrasals), content creators use innovative techniques. Such innovation is often done while domain gets created and these words become specific entities of that domain in due course of time. For example, Poll Day, EVM (Electronic Voting Machine) counting, VVPAT (Voter Verification Paper Audit Trail) counting in election domain do have specific meaning. For the digital content of such specific domain, named entities need to be identified and added as knowledge base to search engine, to make it intelligent enough for resulting in most proper results in search. Merely metadata, key words or indexing may not be enough. Before adding newly created content to the digital library of the domain, NER tool needs to be used to identify, mark and index them before adding to the library. Many NER software tools exist but they are for monolingual content. Election domain in India is multilingual. The content in one language often is not merely translated, but good amount of trans-creation is used for making it available in all major Indian languages. Therefore, NER tools also need to be supported by multilingual WordNet. The named entity, like a single

word, does have a need of getting affected by gender, person and suffix requirement. Therefore, the role of MA (Morph Analyser) also becomes important.

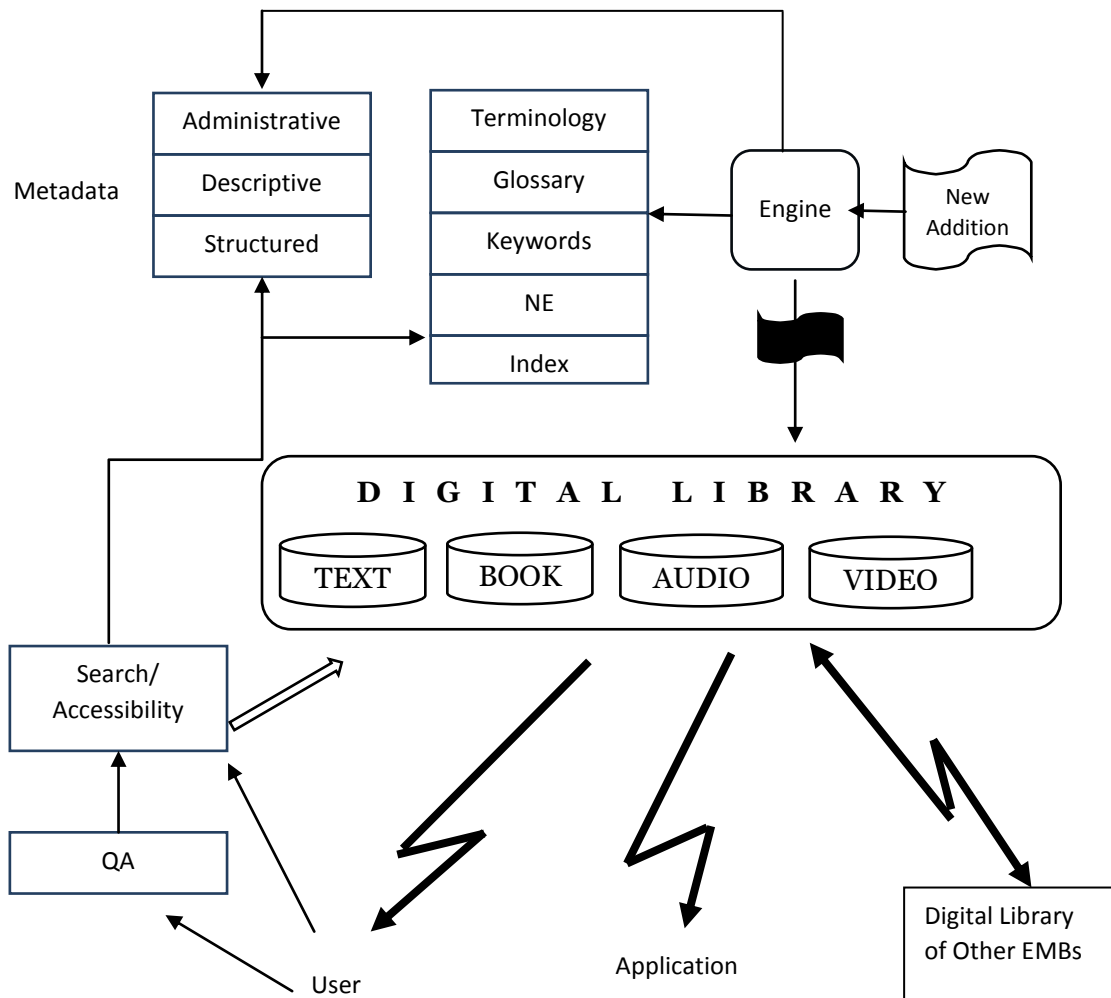
## **Parsers, Shallow Parsers and Morph analysers**

Parsing a sentence is required to capture the grammatical structure and semantics, for radiating the meaningful knowledge out of it. Shallow parsers are required to have a capacity of understanding missing words in partial sentences. ‘Welcome’ is not a word but partial sentence. Merely translating it to ‘स्वागत’ in Hindi would not be sufficient. It should be ‘आपका स्वागत है’. Morph analysers are useful in capturing semantic from the syntax and placement of the words in the sentence (Shukla et al. 2011). Also, MA can find GNP (Gender Number Person) information of each word. Complete knowledge of morph analysis is required for context resolution in translation. So, it is required for effective search and knowledge representation in Digital Library.

However, in this paper Parsers and Morph analyser is quoted for their use in Query processing module. Simple QA (Question Answer) modules of general domain may not be enough for multilingual multimodal domain content. If QA is presented with a question ‘What is EVM Counting?’ and if QA does not know – what’s ‘EVM’ - Is it Named Entity? - Is it singular or plural? - Is it male or female? - Is it a numbering system?( like Decimal or binary) - Is it a counting EVM? - etc, then QA may not be able to parse it properly leading to correct answer which is ‘Counting of Votes in the machine which is called through its acronym as EVM and has long form as Electronic Voting Machine’.

## **The Frame Work**

The system frame work proposed is shown in Fig 2, with central block as the Digital Library which contains Text material, Books, Audio files and Video files. To add content to it, the new entity of any type to be added first has to pass through ‘Engine’ which is meant for creating necessary information using NLP tools with manual guidance. Once the necessary information such as Metadata, Terminology, Glossary, Named Entity, etc are identified from the content, they are to be searched in the already available list and if not found then accordingly the lists are updated. Then, necessary indexing for text material, marking on audio and video files with respect to appropriate run time (seconds, minutes and hours) is done and then only it is added to the library (Sheth 1999). This ensures that all the contents in library are appropriately added with due tagging.



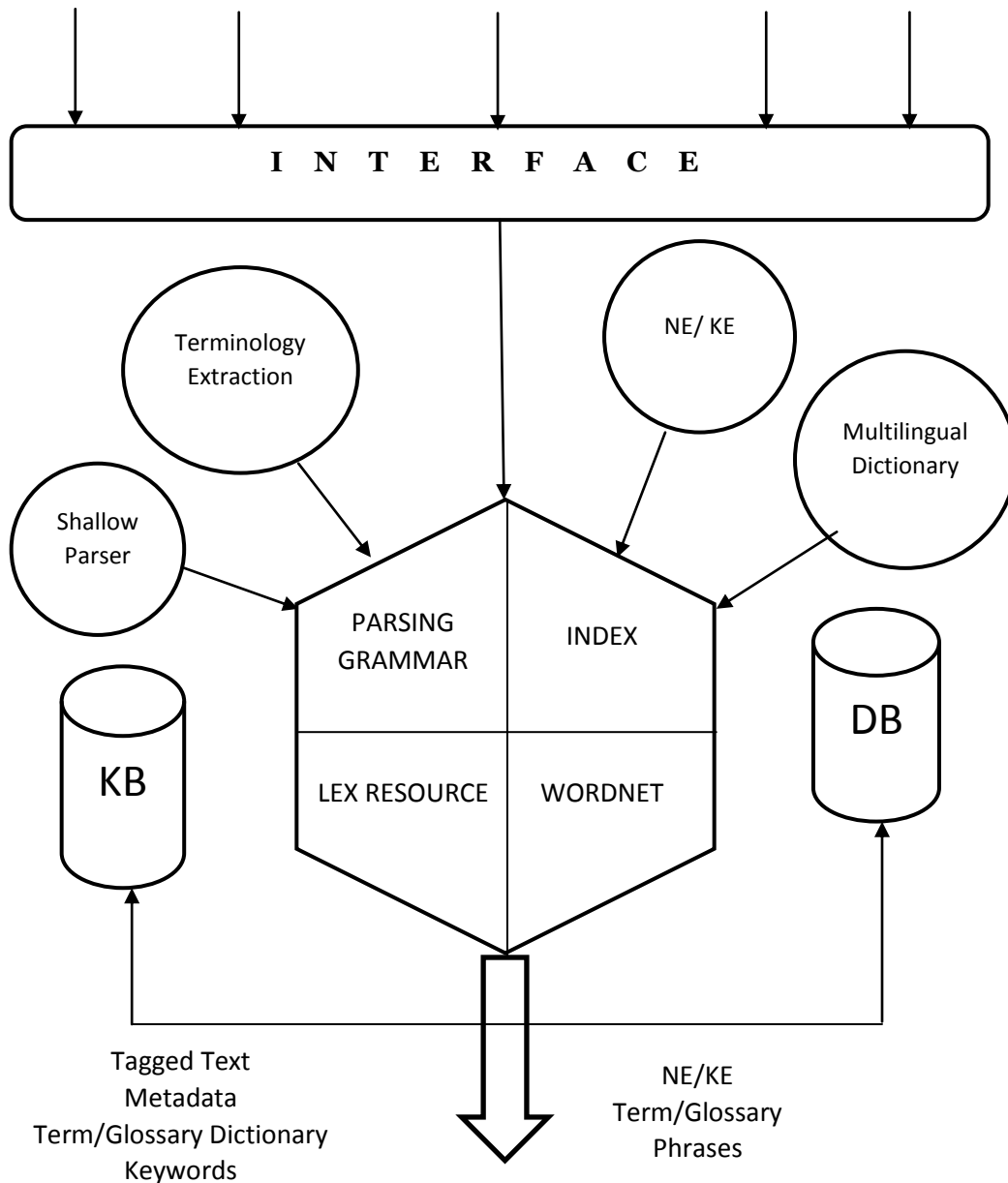
**Figure2.** Proposed Framework

The architecture of Engine is as shown in Fig 3. The interface is manual or can be made semi-automatic with shell scripts written based on the overall pattern of the Digital Library, its domain and expected service being provided to anticipated class of user. For extraction of Names Entities various free ware tools available can be used. But mostly such tools are not available for Indian languages. Some of them could be found at [www.tdil-dc.in](http://www.tdil-dc.in). Based on the nature and domain of the library these tools need to be modified a bit before using them. It is not difficult because for specific domain mostly named entity lists are available which can be used as dictionary in the tool. Same is the case of terminology and n-gram extraction tools. The task



more involved is creation of multilingual dictionary. For domain such as election where 14 major Indian languages are used, the separate frame work for multi-lingual dictionary can be easily proposed by be-fitting existing dictionaries, for the reason that mostly words in Indian languages being all phonetic in nature, have same GNP. Of course some exceptions are also there e;g.

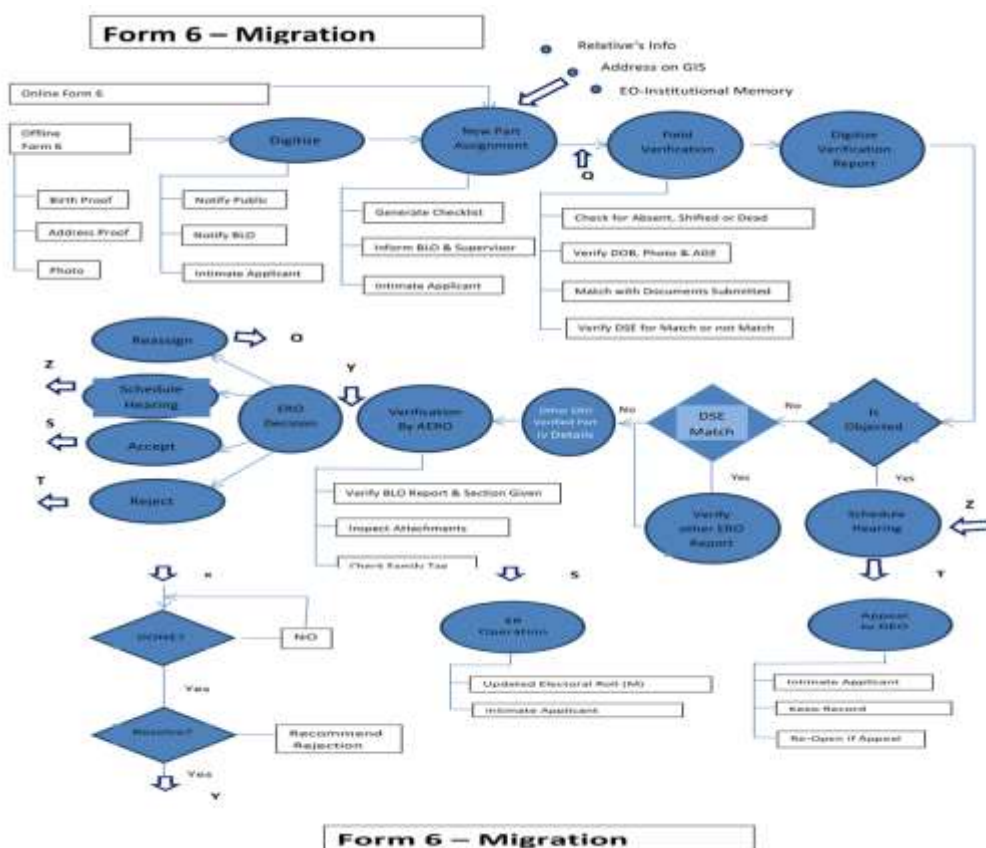
‘आई’ in Hindi is feminine verb but in Marathi it is noun. But these can also be easily handled because the source language is assumed to be English and all sets of English to an Indian language are to be put under interface shell script, which is to be put in interface layer.



**Figure 3.** Architecture of the Engine

Once interface of the Engine provides the data to be added to library, with the help of tools intermittent information in XML form can be provided to software tools for parsing, indexing, forming lexical resource and word-net. The congruent outputs from these exercises carried out with these tools can be put in two categories as KB (Knowledge Base) and DB (Data Base), as shown in the Fig 2. The information available in KB and DB proves very handy to the search engine, which accepts query from the user and with the help of Index search in the content of the library. Since the KB, DB, Metadata, Terminology, Glossary, NE, WordNet etc. all are available it makes search engine intelligent enough. Also, a very simple Query processor can handle WH type of queries (queries with what, when, how, etc.) and produce quality results.

As an example, Fig 4 shows a complete process of enrolment of Indian citizen to the official Electoral Roll through which only he derives right to vote. The process is bound by Legality of Constitutional frame work and is to be carried by officer designate only. Citizens enrolled are known as Electors, who can be General Elector, Overseas Elector or Service Elector. Citizens resident can enrol in the electoral Roll of the Constituency marked by Delimitation Commission which decides spatial area. Non Resident Indians can enrol themselves as Overseas Electors and service men working in entities created under Arms Act ( such as Indian Army, Navy, Air Force, Coast Guard, CRPF, CISF, NSG etc) and Government Officers/Staff working outside India in Embassies can enrol themselves as Service Voters, who are given provision of Postal Ballots or permitted them to appoint Proxy Voter to vote in polling station designated by proxy. There are Legal Forms (Form 6, 6A, 7, 8, 8A, 2, 2A and 3) which need to be processed through specific process. All forms and the Electoral Roll are multilingual. For educating citizens and officials responsible for handling the process huge documentation, Audio and Video contents are available in many Indian Languages besides English. To organize the content with the view to provide effective search facility terminology (74000), named entities (84000), bigrams (1940) and trigrams (86), terms for word net etc have been identified.



**Figure 4.** Enrolment Process for Migrating Electors

## Conclusion

The domain which is mix of multiple domains is always a challenge for data storage. The complexity further increases when it becomes multimodal and multilingual. The use of NLP and linguistic rules become advertently a necessity for data management. The complexity further increases if it is expected to support users not only for the object search but also the piece of object search, requiring the tagging of each micro object of the content. Although because of the nature of the data as digital, tagging becomes easier to achieve, but the volume of such tags and its management equally become difficult. Therefore, Natural Language Processing and linguistic rules becomes a necessity for data management as well as for accessibility. Linguistics and NLP may have their own complications in handling language and content for general domain, but are not as difficult for the specific domains. Well defined architecture, properly identified terminology and glossary, linguistic relations established through word net and use of phoneme for handling multilinguality of the contents not only help improve storage and accessibility but also gives rise to creation of knowledge base for the domain. The approach tried for election domain has helped a lot in all the above. As an example, the enrolment process of citizens to the Electoral Roll, which is basic entity for effective, inclusive and transparent conduct of elections, and which has been described in flow diagram (Fig 3), can be stored as knowledge base to have voters' education, e-Roll management, and e-Roll processes. It was effectively achieved by

implementing ERO-Net (Electoral Registration Officer Network) in Election Commission of India all across the country bringing in the standard process implementation as well. The knowledge base of e-Roll is made seamlessly accessible to all the stake holders.

## References

1. Baldonado, M., Chang, C. C. K., Gravano, L., & Paepcke, A. (1997). The Stanford digital library metadata architecture. *International Journal on Digital Libraries*, 1(2), 108-121.
2. Khalid, H., & Zimányi, E. (2019, September). Using Rule and Goal Based Agents to Create Metadata Profiles. In *European Conference on Advances in Databases and Information Systems* (pp. 365-377). Springer, Cham.
3. Lagoze, C., Krafft, D., Cornwell, T., Dushay, N., Eckstrom, D., & Saylor, J. (2006, June). Metadata aggregation and automated digital libraries: A retrospective on the NSDL experience. In *Proceedings of the 6th ACM/IEEE-CS joint conference on Digital libraries* (pp. 230-239). ACM.
4. Sheth, A. P. (1999). Changing focus on interoperability in information systems: from system, syntax, structure to semantics. In *Interoperating geographic information systems* (pp. 5-29). Springer, Boston, MA.
5. Silvello, G. (2008, September). Building a distributed digital library system enhancing the role of metadata. In *BCS-IRSG Symposium: Future Directions in Information Access* (pp. 46-53).
6. Shukla, V. N., Arora, K., & Gugnani, V. (2004). Digital Library: Language Centered Research, Test Beds and Applications. In *International Conference on Digital Libraries*, New Delhi, India.
7. Shukla, V. N., & Sinha R.M.K. (2011). Divergence Patterns from Urdu to English and English to Urdu Translations: *Proceedings of the 8th International NLPCS Workshop* Vol. 41, ((pp. 46-53).
8. Southwick, S. B., & Lampert, C. (2011). Metadata dictionary database: A proposed tool for academic library metadata management. *Journal of Electronic Resources Librarianship*, 23(4), 339-360.

# **E-Research information discovery and delivery within a virtual research environment: evidence from an academic library**

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## **Abstract**

The web has facilitated the emergence and acceleration of cyberinfrastructure as a hub of the virtual research environment (VRE) across various academic domains. The VRE embedded technologies have indisputably become integral parts of the e-research activities and associated e-services of the networked academic library as they were found to be smarter, faster, and convenient ways of making research information easily accessible, retrievable, and exchangeable at a real-time. This paper highlighted how an academic library could identify and develop its specific pattern of e-research information discovery and delivery to the academic and research users within VRE. It also investigated the potential role and value of the expert information services in support of research activities from the viewpoints of the academic users. The responses of Research Support Desk assisted in proposing a model of e-research support service that includes e-resource selection, search formulation, query processing, information discovery, retrieval and delivery in the VRE as a product of the academic computing environment (ACE) ecosystem that launched by the UAE University (UAEU). The study argues that as the UAEU library should have to move its traditional user-centred services to VRE paradigm to meet the arising challenges of e-research information delivery to cope with the new e-research spheres of data-enabled pure and applied sciences and social studies.

## **Keywords**

Research-oriented University, Cyberinfrastructure, Academic Computing Environment, Virtual Research Environment, E-resource Discovery, Research Information Delivery.

## **Introduction**

The term *e-research* encapsulates empirical research activities that utilise capabilities of a wide range of smart ICT tools to embrace new research approaches emerging from increasing access to a broadband network, along with research-oriented infrastructure services that could enable

secure connectivity and interoperability (Allan, 2009). The past two decades of the dynamic spread of the Internet and related web-based applications into a wide range of uses had facilitated vehement emergence of the VRE across the business, academic, and research settings. Nevertheless, the current unprecedented and exponential growth of both VRE infrastructures and the e-resources being cast over the Internet has initiated a dynamic increase in the scholarly use of the web in a wide array of academic, research, and business settings to establish what is so-called *cyberinfrastructure*.

Such increase in some professional users and researchers has led to increase in the number of queries, questions, and research consultations received by the networked academic libraries via electronic means (Pomerantz et al., 2003; Taha, 2006). In response to meeting the challenges of emerging information needs of VRE researchers, research and academic libraries should craft new roles and responsibilities for librarians by either reinventing current library job description or creating new job roles that require specific skill sets that are not practised or learned through the library on-job training or acquired through library classes (Goetsch, 2008). The consequences of learning, socio-economic, and technological changes had resulted in changing the traditional roles of the academic librarians, while new ones have emerged for both library and librarian (Vassilakaki & Moniarou-Papaconstantinou, 2015).

The phenomenon of scholarly use of the web had precipitated urgent needs for synchronised online e-research information services to support the remote researchers in the emerging VRE. This VRE had nurtured e-research paradigm to promote research activities that utilise a wide range of advanced ICT capabilities and facilities to encompass new research designs and approaches (Si et al., 2019; Zhao, 2009). Recently, VRE infrastructure introduced online Q&A services, which are research information sources where researchers could identify their particular information need, which is filled by natural language processing; this facility makes the interaction of the researcher with each other easier. Hence, smooth access to a variety of e-research information has become dynamically one of the hallmarks of the scholarly use of the Internet (Choi & Shah, 2016).

Consequently, the researchers working in VRE might face the monumental challenge of searching, discovery, and retrieval from a plethora of accessible information. Likewise, the e-resources librarians might face similar challenges of discovering relevant sources while probing the e-resources across different domains with efficient navigation for offering meaningful and complete sets of reference materials. With such e-research consultations, the researchers could further use the retrieved resources in a knowledge base. Thus, the new multifaceted roles of the e-research librarians reflected the typical impacts of VRE paradigm and ICT-inducing changes (Taha, 2010).

In 2017, the UAEU operated high-performance computing (HPC) network to provide research-support software for numerical applications and big data analytics related to advanced studies and e-research in natural sciences and engineering research, such as simulation, aerospace, composite material, healthcare and nanoscience. This paper highlighted how an academic library could identify and develop its specific pattern of e-research information discovery and delivery to the researchers (e.g., research faculties and postgraduate students) within and academic VRE. It also proposed a model of e-research support service that includes e-resource selection, search

formulation, query processing, information discovery, retrieval and delivery in the VRE that emerged within the academic computing environment (ACE) at the UAEU.

## Literature Review

The present relevant scholarly works are reporting a consistent growth of research studies tackling various aspects of library-devoted e-research services, along with emerging roles and tasks of library professionals. The e-publishing paradigm had enhanced the proliferation of e-resources, as well as the rapid growth of VRE across many settings. The impacts of VRE are increasingly pervasive, with profound activities ranging from the business, applied research to the social and educational domains (Chiu et al., 2006). Such ubiquitous advent of the VER has accelerated the element of concern to investigating the potential pervasive effects of the web-based library applications on the discovery and delivery of research information to fill the needs of e-researchers. Moreover, the e-research paradigm is pushing the academic library to keep the momentum of upgrading its services and functions to pace with VRE requirements (Taha, 2013).

This attention resulted in generating a considerable amount of research and theoretical works concerning newly available scholarly e-resources and the means of accessing information electronically. The relevant literature in this study was published post-2000 to focus on crucial research activities as **i) the evolution of the VRE, research cyberinfrastructure, e-science e-research paradigms** (e.g., Atkins et al., 2003; Taha, 2008; Allan, 2009; Meyer & Dutton, 2009; Zhao, 2009; Jankowski, 2010; Reimer & Carusi, 2010; Ribes & Charlotte, 2010; Stewarts et al., 2010; Cox & Pinfield, 2014; Koloniari et al., 2019; Parashar et al., 2019; Si et al., 2019), **ii) knowledge creation and sharing within the web sphere** (e.g., Spink et al., 2001; Han & Goulding, 2003; Hummelshøj, 2003; Vakkari, 2005; Chiu et al., 2006; Taha, 2013; Brown et al., 2015), and **iii) changing roles of library professionals and the future of the academic library in the EVR era** (e.g., Stemper & Bulter, 2001; RUSA, 2004; Taha, 2006; Atkinson, 2016; Loesch, 2017; Wilson, 2017; Lang et al., 2018; Cassell, & Hiremath, 2019; Cox et al., 2019).

### Research Cyberinfrastructure: *Shifting Boundaries and Paradigm*

Change has been continual and far-reaching in libraries parallel with the emergence of the microcomputer technology in 1983 along with a great deal of research and effortful development in the arena of the electronic information service and delivery. Such developments in ICT have shifted the paradigm of mediated information searching from professional-mediated mode to end-user self-service mode; in other words, end-users can reach out access to library e-services despite time or physical distance without librarian mediation (Han & Goulding, 2003).

In recent decades, academic organisations worldwide have witnessed significant changes in research methodologies, and diversity of knowledge production associated with advances in ICT to establish cyberinfrastructure leading to emerging networked environments to spawn various e-information products, which are readily moveable and capable of transmitting across vast physical distances. Stewart et al. (2010) traced the evolutionary history of cyberinfrastructure. The term cyberinfrastructure was formulated in the late 1990s as a result of advancements in computer sciences (e.g., supercomputer, data visualisation, grid and high-performance network),

that could provide reliable, trustworthy, persistent, and cost-effective access to high-performance computational capabilities to pave the way to widespread usage and shifting paradigm to a digital medium.

Atkins et al. (2003) prepared a report to the National Science Foundation (NSF) of the USA that documented cyberinfrastructure as “*Cyberinfrastructure refers to a new form of high-performance networked infrastructure that consisted of Internet applications, distributed computer commons and related ICT-based components*” to improve scholarly productivity and enable knowledge breakthroughs and discoveries not otherwise possible. Hence, if cyberinfrastructure is embedded within a research setting, then it would be required for developing an *e-research paradigm*; if it is required for economic activities; thus, it could say that cyberinfrastructure is required for developing a *knowledge economy*.” (Ribes & Lee, 2010).

Star (1999) defined the cyberinfrastructure of an organisation from ethnographic aspects that could display the human interaction with the cyberinfrastructure components, such as:

- Embeddedness (i.e., it is operating within the specific social organisations and technological employments).
- Transparency (i.e., it should be transparent to support aided tasks invisibly).
- Reach-out beyond a particular event (i.e., it keeps the momentum of continuity surpassing the physical boundaries and premises).
- Getting the most benefit from the learned lessons as an organisation’s member (i.e., the new members are gradually becoming familiar with infrastructure components).
- Adherence to required core practices (i.e., the patterns of core practices of the members could shape the fundamental functions of the infrastructure and its further development).
- Inclusion of accredited standards (i.e., the transparency promotion of infrastructure needs the plug-in to a benchmarked infrastructure).
- Establishment on robust base (i.e., infrastructure does not propagate progressively without gaining strength from the base).
- Consistency of operation quality (i.e., if infrastructure encounters an unpredictable breakdown, the invisible weakness must not spoil its total quality).
- Gradual development (i.e., developing an infrastructure to be mature functionally needs a room of time).

In the scholarly research context, the robust computational and data-centric facilities along with expert research-devoted e-services have been progressively enhancing the emerging e-research paradigm across various disciplines. Thus, cyberinfrastructure capabilities could be playing crucial roles in promoting the advancement of computer-aided and data-enabled science, technology, engineering, medicine (STEM), and business. Moreover, storing, sorting, analysing, maintaining and ability to transform these big datasets into knowledge-based usages requires an efficient cyberinfrastructure capable of keeping abreast with streaming of newly generated data (Parashar et al., 2019).

The landscape of web-based research information was rapidly expanding. Consequently, three features characterise cyberinfrastructure is promised transformations in the scholarly research: i)



community-wide and cross-disciplinary collaboration, **ii**) computational focussed collection, representation and analysis of data, and **iii**) end-to-end integration (Jirotko, Lee, & Olson, 2013). Therefore, enduring challenges are negotiating the future with the diverse user community in academic and research settings. In this context, the design of cyberinfrastructure model of easy-to-use networked library and planning for real-time e-research services urge the academic and research libraries to take into consideration the information demands of the remote users within the VRE. Consequently, the academic library strives to pursue reflection of its values, mission and long-term vision of excellence in developing e-research information collection and services for supporting its competency.

## The Emergence of the VRE and Library Adaptation

E-research currently utilises a data-centric set of research methods necessitating specific digital infrastructure that could be capable of sustaining remote and decentralised collaborative activities through the discovery and delivery of big data (Atkins et al. 2003). The concept of community is diverse to include homo-, or heterogeneous groups, which can either be real-life including social, business, and knowledge communities or virtual interactions among these groups in cyberspace around a standard set of interest, issues, or needs (Atkinson, 2016).

The emergence of VRE might be taking place through two scenarios:

- *Webbed organisations paradigm*: Many research organisations in academia and industries are internally internetworked via Intranet to create a new brand of the virtual working environment (i.e., *cyber-work*) where all work processes are integrated using ICT-based network in a flatter hierarchy and teamwork-based pattern (Jansen et al., 2008).
- *Virtual research network (VRN) paradigm*: VRN represents innovative web-based infrastructure enabling researchers and academics to communicate and exchange knowledge across a wide range of *cyber workstations*. This web-based communication had created a type of *invisible college*, where individuals or organisations of similar or related interests could get the most benefits from each other in terms of collaboration and information sharing within their virtual sphere (Spink et al., 2001; Atkins et al., 2003; Allan, 2009).

Based on the given scenarios, a VRE paradigm could be reflected as a set of ICT-aided applications, e-services and e-resources integrated by standard specifications and service-oriented framework. Thus, the research teamwork and ICT professionals working in a partnership pattern could populate the VRE paradigm. The herein reviewed literature suggested that a VRE should do the following:

- Enhance various processes of researching to include arranging of relevant reference resources, scholarly communication, building and sustaining collaborations across domains, i.e., be compatible with currently used digital infrastructure.
- Satisfy the users' requirements, along with addressing usability and accessibility, with appropriate evaluation mechanisms and benchmarks for new service and tool development.
- Provide secure and trustworthy access, and transactions since the VRE components should have to interoperate with federated cross-institutional authentication and authorisation mechanisms, i.e., including modes of access and supporting queries processing.

- Support the creation, sharing and curation of digital content, through the ease of discovery and access for authoring and publishing, i.e., building research-support collections.
- Be upgradeable and extensible with appropriate enhanced tools (i.e., domain-specific) through incorporating standard specifications and software, which could interoperate with the VRE components.
- Support tailoring the environment of the research activities by users or groups to reflect the domains of their interests and preferences.

The smart ICT infrastructure at the UAEU (including high-performance network, digital contents, digital laboratories, and e-learning delivery) provides a suitable platform for emerging cyberinfrastructure to conduct a wide range of *virtual* experiments on the web (e.g., simulation, computer-aided design, modelling, numerical applications, and the like). Such e-infrastructure could be considered as a hub upon which scholarly communication, delivery of research data and information to the research project and e-learning courses could be performed promptly and effectively.

### **The UAEU Networked Library- *Negotiating the Future***

The networked library had responded to such escalating digital changes that are frequently taking place in the VRE communities by creating real-time user-librarian online interaction for providing expert research consultations, subject search and discovery expertise, relevant retrievals over the web (Spink et al., 2001). Therefore, the exponential growth of such web-based library services has proliferated overtime to gain cardinal popularity among the research communities.

The term of *e-research-oriented library services* is frequently being used to describe library e-services that utilised digital technologies or built-on-the web. The e-research library service has therefore been re-conceptualised as a composite of five distinct but interrelated user-oriented e-services **i)** directional and factual information retrieval, **ii)** research consultations, **iii)** in-depth information discovery, **iv)** e-literacy and instruction, and **v)** technical assistance (Taha, 2013). The web-based applications had become integral parts of the UAEU library's cyberinfrastructure and e-service delivery. This new genre of library service has taken place by expanding its e-services within the ACE far beyond the physical premises to reach the desktops of the remote and off-campus users.

### **Library Strategic Plan- *Pacing with Future Trends***

The statement of the UAEU Main Library mission and vision (*be a leading example of a 21<sup>st</sup>-century university library service to support the research and scholarly communication to augment university academic reputation and ranking*) are aiming at defining its long-term strategic goals, service philosophy, and scope of functions in a specific academic learning environment. Hisle (2019) indicated the top critical issues that might encounter the functionality and effectiveness of academic library; among these are:

- Recruitment, education, and retention of professional librarians.
- Library capabilities in supporting the academic enterprise and research activities
- Impact of emerging technologies on library services and functions

- Creation, control, and preservation of digital scholarly resources (e-repository)
- Chaos in scholarly communication, e-publishing and subscriptions.
- Support and orientation of new users
- Higher education funding (reduction and restricted budget)

To meet the mentioned challenges, the UAEU Library has set in 2019 a bundle of eight strategic goals for 2019-2021 to reformulate the direction of current functions for keeping pace with future trends and emerging technologies related to an academic library. The proposed goals are concerned with:

- Developing course-focussed collection (i.e., library collection to be the course's reading resources besides the textbooks.)
- Preparing professional librarians to provide expert research and scholarship support services (i.e., embedded librarian to college or research project.)
- Promoting a supportive research environment and scholarly communication (i.e., establishing expert services for dissertation and manuscript editing and publishing.)
- Furnishing academic e-infrastructure to support hybrid learning, collaborative research, and engagement activities (i.e., increase library visibility and involvement.)
- Providing instruction programmes on how to use library resources effectively and retrievals on a knowledge base (i.e., enriching information literacy content with appropriate models and standards.)
- Remodelling library services and function for developing active engagement and partnership with the UAEU academic and research communities (i.e., adherence to the UAEU priorities and strategic goals.)
- Striving to gain academic accreditation and apply international library standards for keeping its functions and services in continuous improvement (i.e., accrediting the Library as a hub of core academic and research information source.)
- Fundraising for keeping the library functional and growing, as well as responding to emerging technologies (i.e., the library is a growing and responsive organism.)

The UAEU library is on-campus; it strives to pursue quality services provisioning in a networked library environment. Furthermore, it possesses a wide variety of e-resource packages bundled together with online push-type services for remote users and virtual knowledge communities (e-research and e-learning). In advanced step, the library launched in early 2004, *EZproxy* access point at library portal <http://www.library.uaeu.ac.ae> to extend the range of access to web-based licensed databases from remote distance 24/7 hours. To achieve this, the Library placed much emphasis on the acquisition of innovative library information systems and equipment of their day since 1992, as documented in **Table 1**.

**Table.1:** Milestones of the UAEU Main Library's e-Infrastructure Aided Services

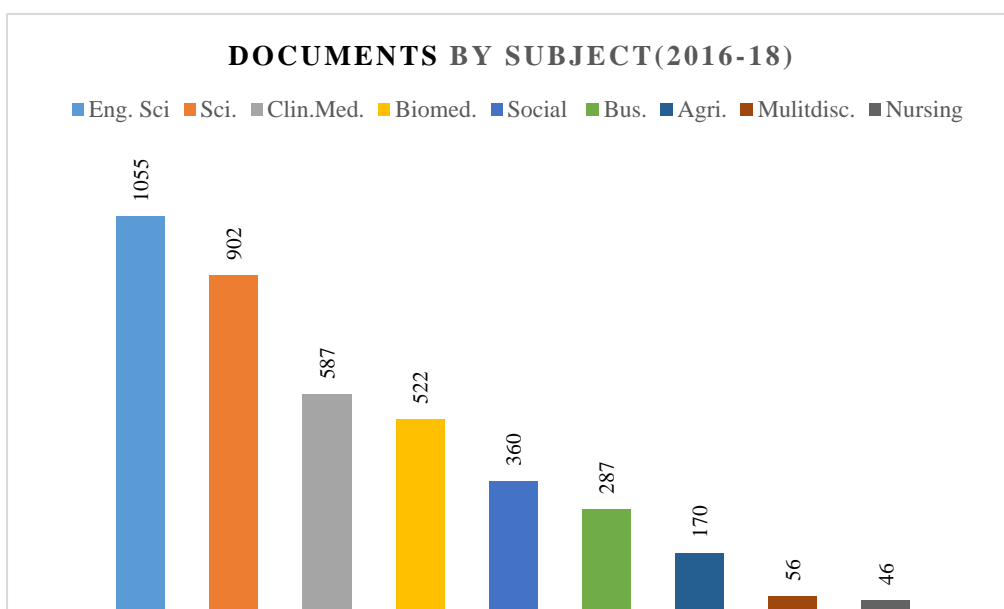
Year	Application
1992	<i>VTLS</i> <sup>TM</sup> OPAC initiated the conversion of catalogue cards into MARC
1993	CD-ROM entered the public services
1996	Internet connection to place library and information services on the Web
1997	Subscription to online bibliographic database packages
1999	Interconnection of UAEU campus-LANs to launch a university wired WAN (Intranet)
2000	Subscription to textual databases run on CD
2002	Subscription to e-journal databases to foster access to 8000 online titles (Hybrid)
2002	Wireless WAN introduced to increase the capacity of the Intranet significantly
2002	Established the facilities of the multimedia library
2003	OPAC <i>Millennium</i> <sup>TM</sup> initiated the integration of the significant library e-services
2003	The UAEU launched CMS <i>e-Blackboard</i> <sup>TM</sup> as an interactive e-learning tool
2003	The Library introduced the wireless services to remote & off-campus users
2004	Switch of all printed journal holdings to e-journal database subscriptions
2005	<i>EZproxy</i> <sup>TM</sup> facilitates 24/7 off-campus access to library e-resources on the Web
2007	Incorporation of e-book collection development
2010	Integration of e-resources and OPAC with Summon <sup>TM</sup> software
2013	Mobile Apps based library access
2015	Digital repository; thinking of cloud-based library functions and services ( <i>ScholarWork</i> )
2016	Operating 3D printing facilities, digital assistive technology for visually impaired users
2019	WorldCat replaced <i>Millennium</i> as a global resource sharing/integrated library system

## E-Research Support Service: A Catalyst Role

In today's knowledge-driven society, a growing body of heterogeneous data and information could be dynamically accessed, discovered, processed, converted, organised, stored, disseminated, and shared across miscellaneous applications, routes, channels, and e-infrastructure (e.g., databases, networks, platforms, and systems). The ICT-aided library functions and services have drastically increased the ability of the Research Support Desk to handle a wide array of research queries and consultations, which dedicated less effort and time consumed by the librarians concerning human intermediaries (Spink et al., 2001; Brown et al., 2015). Furthermore, the ICT advancements notably enhanced easy access to web-based e-resources to meet scaled up expectations of the academics and researchers to receiving just-in-time satisfying answers to their own queries or requested documents.

On the other hand, the incorporation of social media platforms into user-oriented services promoted interactivity between the librarian and end-users. Hence, the information specialists are responding to the received questions and providing different levels of reference information; from encompassing short-answer information or guidance about search strategy or using specific library e-services to offering in-depth consultation service and expert assistance for tracking down highly specific information. In this information discovery and delivery gateway, such employed intermediation has bestowed multiple roles of library specialists to serve as an information explorer, knowledge synthesiser, research advisor, service innovator, and collection developer (Taha, 2013; Lang et al., 2018).

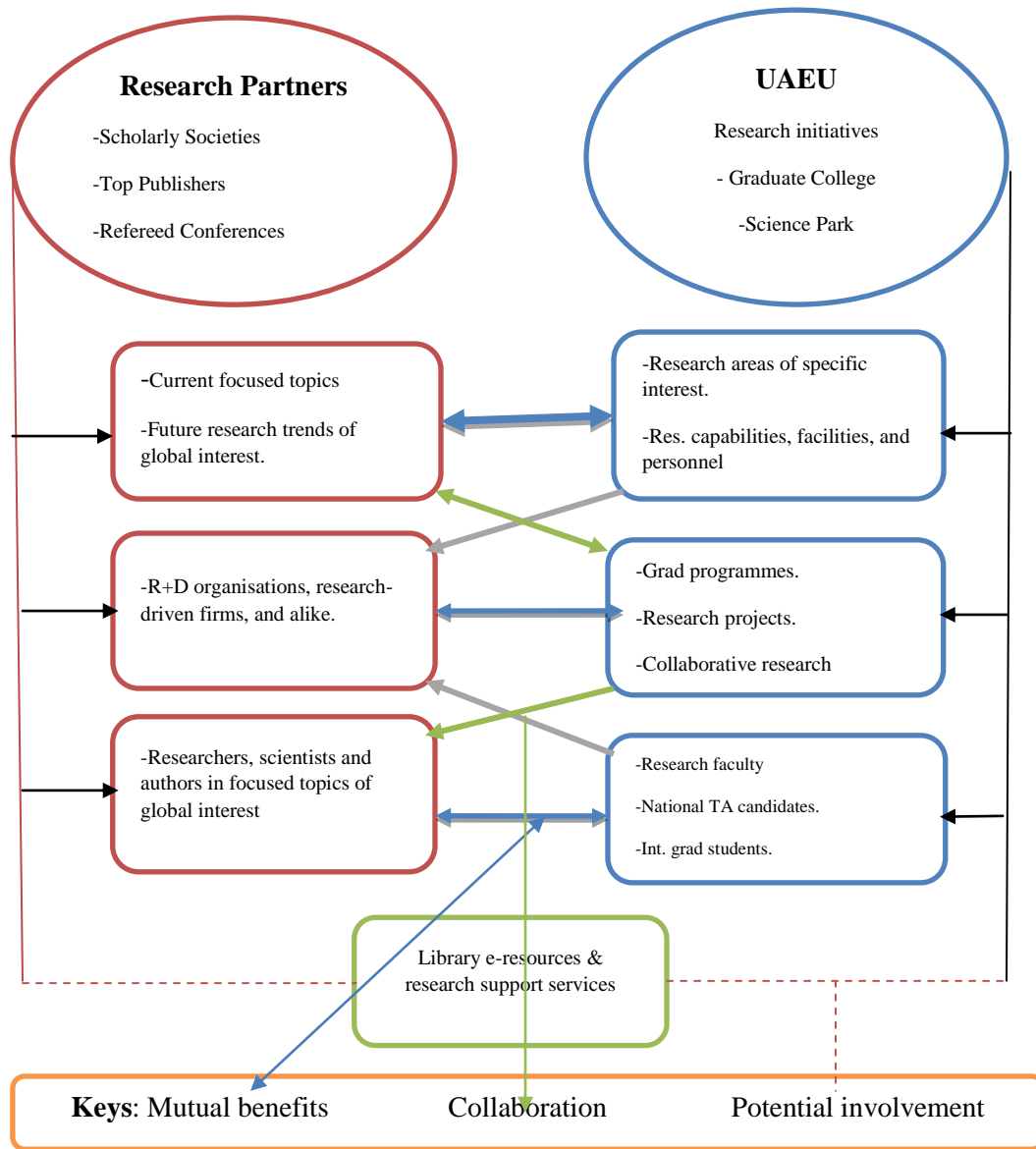
Increasingly universities worldwide and their affiliated researchers need to enrich their profile be able to exhibit the quality and impact of their research contributions. The scholarly publishing activities have grown steadily due to introducing and implementing research-support infrastructure and resources. For instance, the scientific publications in 2016 were 738, in 2017 were 836 (i.e., increase by 13.28%), while in 2018 were 976 (i.e., increased by 16.75%) and so on continues growth forwards. **Figure 1** shows the published documents by subject area.



Despite the academic libraries have identified several opportunities to take a broader role in supporting the research activities in their institutions; however, there are several significant obstacles encountered their outreach services that should initially be overcome if they are to be capable of providing relevant and useful services to be geared towards the actual needs of the research community (Atkinson, 2016; Lang et al., 2018).

## **E-Research Support Model**

The schema of the research consultation model in this thesis is consonant with UAEU library motto "*We provide the 21<sup>st</sup> Century E-Services*". The proposed model illustrates the mutual collaboration established between the Research Support Desk and the researchers at the UAEU to go beyond the scope of the traditional academic information assistance to meet the specific user's need. The past five years of expert research support consultations and e-services accumulated various responses expressed by the beneficiaries. Several responses furnished valuable suggestions concerning college/research-library collaboration with the recently established specialised research units and science park to recognise the UAEU as a research-oriented organisation. **Figure 2** illustrates the potential collaboration.



**Figure 2:** College/Research-Library Collaboration Model

This model of collaboration connects the UAEU's research activities to current international research areas and trends that recommended by renowned scholarly societies and publishers. The UAEU also could outreach to national and international R+D centres, and promote collaborative research through connecting its faculties and doctorate students with scientists and researchers bestowed international reputation in their respective fields.

The UAEU Library could play a crucial role in supporting research programmes. The process of research consultation is a symbiotic task between the expert library specialist and the researchers that modelled on the theory of task-based information searching, which extrapolated from the existing theories on information-seeking behaviour (Vakkari, 2005); yet enlightened with RUSA

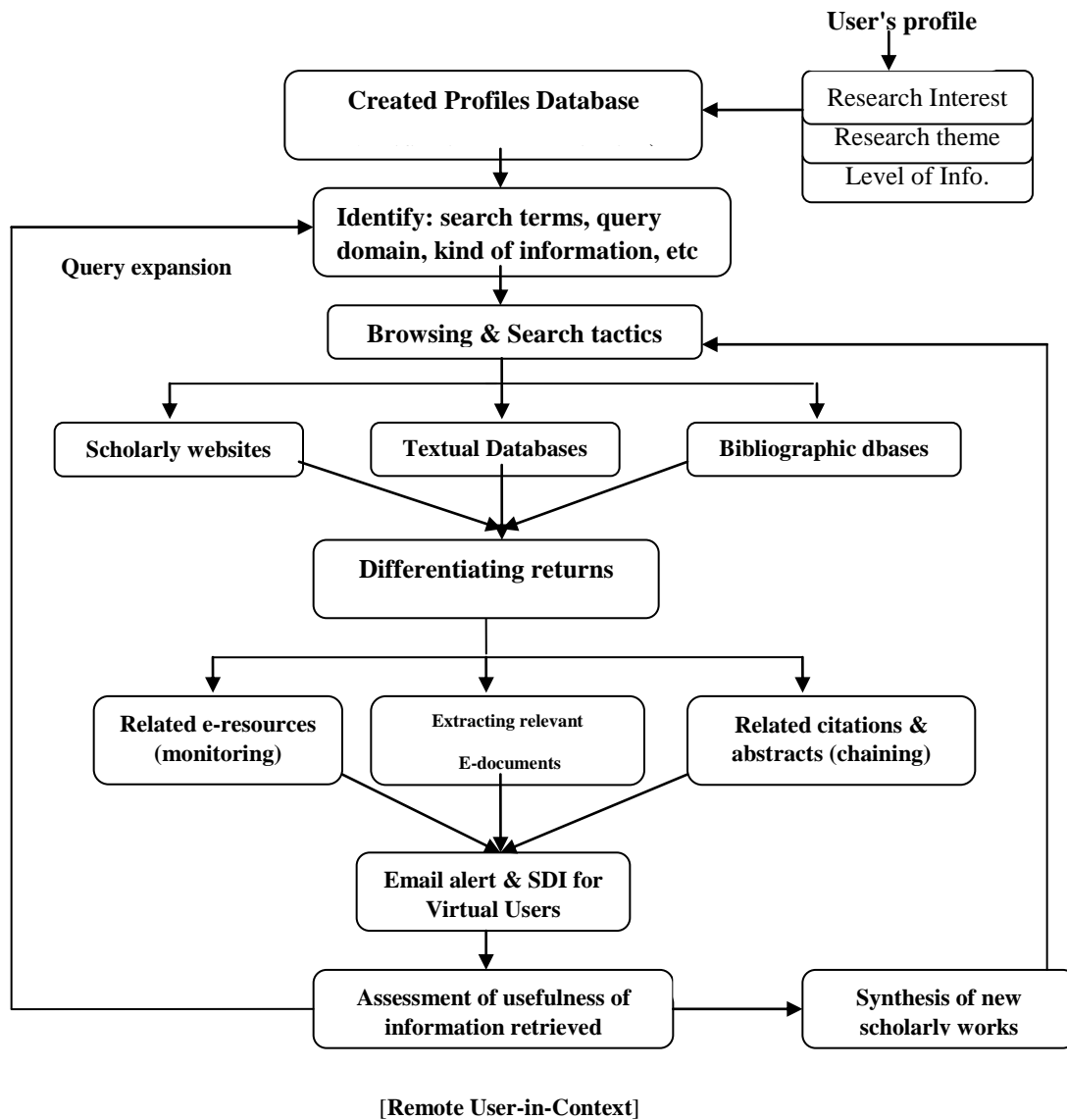
*Guidelines for Implementing and Maintaining Virtual Reference Services* (RUSA, June 2004). The objectives of the discovery and delivery model are aimed at:

- Strengthening the interoperability between the library and UAEU research community.
- Enhancing services for e-research and e-learning paradigms as the research support specialist closed to the current trend and research interests of the faculties, graduates, and e-learning instructors.
- Supporting different phases of research with the latest relevant literature through web-based push services.
- Reducing the isolation of the users within the VRE as e-services and e-resources are actively promoted among their community.

The model acknowledges the new roles of the academic librarian. Thus the librarian would act as:

- *Knowledge explorer* to locate and retrieve the required information from different resources.
- *Educator* to assist in learning and promoting information literacy among the users' community
- *Consultant* to evaluate the quality and authenticity of information resources
- *Knowledge synthesiser* to help in developing and compiling relevant information to be used in a knowledge base
- *Service innovator* to look for improving the efficiency of information access and delivery in pace with new trends.
- *Research advisor* to assist in academic and technical writing of research manuscripts.





**Figure 3:** Discovery and Delivery Model

## Conclusion

Cyberinfrastructure, e-Infrastructure, e-Science, and e-Research paradigms are the current terms applicable to the various networked information technologies that involved in supporting VRE activities, such as collaboration, sharing of interesting data, and dissemination of generated findings. Nevertheless, cyberinfrastructure has heralded as a transformative and driving technological force for enabling new forms of scholarly investigation, as well as interdisciplinary collaboration (Ribes & Lee, 2010). Therefore, many practitioners and researchers in the field of networked information discovery and delivery have begun to conduct critical investigations on knowledge sharing and information-seeking behaviour of the users in the internetworked or

virtual research community (Savolainen, 2019), since the web became an indispensable tool for providing direct access to e-resources without the intervention of the human intermediaries (Cassell, & Hiremath, 2019).

The modern academic library, in its many forms and terms, represents a further diversification of the modes in which research information service can be delivered (Stemper & Butler, 2001). A new information-seeking scenario has been created in academic library settings with the pervasive scholarly use of the Web. Two models of particular interest are designed to depict the remote user-intermediary in internetworked UAEU library cyberspace. Human intermediaries are still needed to catalyse user-librarian interactions. With this in consideration, academic libraries need to pay much attention to various development aspects of e-science and e-research paradigm shift within a broad and holistic approach context (Wilson, 2017).

The study argues that as the UAEU should extend its research agendas into broader empirical studies to achieve the research priorities and contribute to the national research strategy. On the other hand, the library should prepare itself to meet the challenges of emerging ICT applications that have a direct impact on its survival and further development. Thus, the e-research librarians should have to consider how to continuously adjust to the emerging VRE and new e-information needs, as well as stay relevant.

## References

1. Allan, R. N. (2009). *Virtual research environments: From portals to science gateways* (various pages). Oxford: Chandos Publishing.
2. Atkins, D. E., Droegemeier, K. K., Feldman, S. I., Garcia-Molina, H., Klein, M. L., Messerschmitt, D. G., (...), & Wright, M. H. (2003). *Revolutionising Science and Engineering Through Cyberinfrastructure* [Report]. Washington, DC: The National Science Foundation, Blue-Ribbon Advisory Panel on Cyberinfrastructure. Retrieved from <https://repository.arizona.edu/handle/10150/106224>
3. Atkinson, J. (2016). Academic libraries and research support: An overview. In *Quality and the academic library* (pp. 135-141). Oxford: Chandos Publishing.
4. Brown, R. A., Wolski, M., & Richardson, J. (2015). Developing new skills for research support librarians. *The Australian library journal*, 64(3), 224-234.
5. Cassell, K. A., & Hiremath, U. (2019). *Reference and information services* (various pages). 4<sup>th</sup> edition. Santa Barbara: Library Unlimited for the American Library Association.
6. Chiu, C.-M, Hsu, M.-H., & Wang, E. T.-G. (2006). Understanding knowledge sharing in virtual communities: An integration of social capital and social cognitive theories. *Decision Support Systems*, 42(3), 1872-1888.
7. Choi, E., & Shah, C. (2016). User motivations for asking questions in online Q & A services. *Journal of the Association for Information Science and Technology*, 67(5), 1182-1197.
8. Cox, A. M., & Pinfield, S. (2014). Research data management and libraries: Current activities and future priorities. *Journal of librarianship and information science*, 46(4), 299-316.

9. Cox, A. M., Pinfield, S., & Rutter, S. (2019). Academic libraries' stance toward the future. *Portal: Libraries and the Academy*, 19(3), 485-509.
10. Goetsch, L. A. (2008). Reinventing our work: New and emerging roles for academic librarians. *Journal of Library Administration*, 48(2), 157-172.
11. Han, L. & Goulding A. (2003). Information and references services in the digital library. *Information Services & Use*, 23(4), 251-262.
12. Hisle, W. L. (2019). Top issues facing academic libraries: A report of the focus on the future task force. *College & Research Libraries News*, 63(10), 714-715.
13. Hummelshoj, M. (2003). Web-based reference services and community information: The role of public libraries (Vol. 516). In *11<sup>th</sup> NI&D Conference, Spring for information*, 30 May-1 June 2003, Reykjavik, Iceland.
14. Jankowski, N. W. (Ed.). (2010). *E-Research: Transformation in scholarly practice*. London: Routledge.
15. Jansen, B. J., Booth, D. L., & Spink, A. (2008). Determining the informational, navigational, and transactional intent of Web queries. *Information Processing & Management*, 44(3), 1251-1266.
16. Jirotko, M., Lee, C. P., & Olson, G. M. (2013). Supporting scientific collaboration: Methods, tools and concepts. *Computer Supported Cooperative Work (CSCW)*, 22(4-6), 667-715.
17. Karasti, H., Millerand, F., Hine, C. M., & Bowker, G. C. (2016). Knowledge infrastructures: Part I. *Science & Technology Studies*, 29(1), 1-12.
18. Koloniari, M., Vraimaki, E., & Fassoulis, K. (2019). Factors affecting knowledge creation in academic libraries. *Journal of Librarianship and Information Science*, 51(1), 20-33.
19. Lang, L., Wilson, T., Wilson, K., & Kirkpatrick, A. (2018). Research support at the crossroads: Capability, capacity, and collaboration. *New Review of Academic Librarianship*, 24(3-4), 328-338.
20. Loesch, M. F. (2017). Librarian as a professor: A dynamic new role model. *Education Libraries*, 33(1), 31-37.
21. Meyer, E. T., & Dutton, W. H. (2009). Top-down e-infrastructure meets bottom-up research innovation: The social shaping of e-research. *Prometheus*, 27(3), 239-250.
22. Parashar, M., Honavar, V., Simonet, A., Rodero, I., Ghahramani, F., Agnew, G., & Jantz, R. (2019). The virtual data collaboratory. *Computing in Science & Engineering*. <https://doi.org/10.1109/MCSE.2019.2908850>. [In press].
23. Reimer, T. F., & Carusi, A. (2010). *Virtual research environment collaborative landscape study*. Conducted jointly by the Centre for e-Research (CeRc) at King's College London and the Oxford e-Research Centre (OeRC) at Oxford University.
24. Ribes, D., & Lee, C. P. (2010). Sociotechnical studies of cyberinfrastructure and e-research: Current themes and future trajectories. *Computer Supported Cooperative Work (CSCW)*, 19(3-4), 231-244.
25. RUSA-ALA (Fall, 2004). Guidelines for implementing and maintaining virtual reference services. *Reference & User Services Quarterly*, 44(1), 9-13.
26. Si, L., Zeng, Y., Guo, S., & Zhuang, X. (2019). Investigation and analysis of research support services in academic libraries. *The Electronic Library*, 37(2), 281-301.

27. Savolainen, R. (2019). Seeking and sharing information dialogically: A conversation analytic study of asynchronous online talk. *Journal of Documentation*, 75(3), 530-549.
28. Spink, A., Wolfram, D., Jansen, M. B., & Saracevic, T. (2001). Searching the web: The public and their queries. *Journal of the American Society for Information Science and Technology*, 52(3), 226-234.
29. Star, S. L. (1999). The ethnography of infrastructure. *American Behavioral Scientist*, 43(3), 377-391.
30. Stemper, J. A., & Butler J. T. (2001). Developing a model to provide digital reference services. *Reference Services Review*, 29(3), 172-188.
31. Stewart, C. A., Simms, S., Plale, B., Link, M., Hancock, D. Y., & Fox, G. C. (2010). What is cyberinfrastructure? (pp. 37-44). In *Proceedings of the 38<sup>th</sup> Annual ACM SIGUCCS on Navigation and Discovery*. 24-27 Oct. 2010, Norfolk, Virginia: ACM.
32. Taha, A. (2006). Streamline e-information service for virtual users: A quality function deployment (QFD) approach. In Khoo, Singh, & Chaudhry (Eds.): *Preparing Information Professionals for Leadership in the Digital Age*. Singapore: NTU.
33. Taha, A. (2008). E-research: A new genre of digital library services. *World Digital Libraries-An international journal*, 1(1), 19-26.
34. Taha, A. (2010). A new paradigm for networked resource sharing in the United Arab Emirates Universities. *Journal of Interlibrary Loan, Document Delivery & Electronic Reserve*, 20(5), 293-301.
35. Taha, A. (2013). E-research support desk: A new genre in e-reference services. *World Digital Libraries*, 6(2), 101-114.
36. Vakkari, P. (2005). Task-based information searching. *Annual Review of Information Science and Technology (ARIST)*, 37, 413-463.
37. Vassilakaki, E., & Moniarou-Papaconstantinou, V. (2015). A systematic literature review is informing library and information professionals' emerging roles. *New library world*, 116(1/2), 37-66.
38. Wilson, T. (2017). Why is the library involved in research support? Demonstrating why and how the library can contribute and add value to the university research priorities. *Proceedings of the 38<sup>th</sup> IATUL*, 18-22 June 2017. University Library, the Free University of Bozen-Bolzano, Italy.
39. Zhao, Y. (2009). Changing of library services under the e-research environment. *The Electronic Library*, 27(2), 342-348.

# **Perception of users and library staff towards effective library service quality: A survey**

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## **Abstract**

The study aims to identify the users and employees perception of library effectiveness with regard to service quality of a university library. An attempt is also made to recognize the factors they consider essential in indicating the effectiveness of a library. Two separate questionnaires that listed indicators of effectiveness for library service quality were administered to employees as well as users of Delhi University Library System during the month of August 2019. The findings have shown slight differences in the perception of the two stakeholders group i.e. users and library staff, as to what indicators they deem necessary to consider their library effective.

## **Keywords**

Library Users; Library Effectiveness; Academic Library; Indicators of Library Effectiveness.

## **Introduction**

Performance measurement is an essential component of any service organization. However assessing the effectiveness of any public service undertaking such as libraries is hazy because there is no clear cut demarcation of profits which may certain the organizations to determine if their library is meeting its goals or not. Assessing library's performance through different

approaches is being conducted in different types of organizations. Effectiveness is a multidimensional concept which means that no single measure is enough to describe the whole system. Many authors have penned that quality and effectiveness are found to be the interchangeable terms in which the main objective is to find out the working scenario of the organizations taken under study, especially library systems. Thus, whenever we talk about judging the service quality of libraries, we indirectly mean its effectiveness. An effective library is a library that performs well in comparison with other libraries given the milieu in which it functions. (Glorieux,2007). In simpler terms an effective library can be defined as one that satisfies the information and research needs of the users in the most proficient manner, gives most efficient outcomes in regards to fiscal returns and in general helps to achieve the goal and objectives of the institution involved. The functioning of University Library is primarily dependent upon its employees and its potential users. It was Lancaster (1978) who presented one of the most universally accepted criteria for evaluation which includes three essential aspects i.e. effectiveness, cost effectiveness, and cost-benefit. It has also been concluded from past research studies that library effectiveness is not well defined by a narrow range of dimensions because effectiveness is a multi-dimensional construct (Cullen and Calvert, 1995). Hence, library effectiveness must be measured by considering the viewpoints of the employees as well as its users.

## Review of Literature

The present research study is an attempt in series of few past studies covering the national and international settings. The study was conducted at Visvesvaraya Technological University (VTU) to focus on user's attitude about the effectiveness of library resources and services. It was revealed that the overall effectiveness is good. Moreover, library services in the VTU research center libraries is effective enough for their users with the existing printed journals, e-journals, books, thesis/dissertations/project resource, abstracts, indexing resources conference/workshop/seminars proceedings resources, etc. These resources found to be around 50% effective whereas government publications, patents/standards resources, CD ROM database resources are not so effective in library services (Chandrashekara, Adithyakumari and Mohan, 2016). Abdallah and Bilal (2015) conducted a research study based on quantitative research method and a survey design to assess the nature and effectiveness of information resources and library services given at four academic libraries in Lebanon from the users' perspectives. A total of 1100 survey questionnaires were disseminated to students at Beirut Arab University (BAU), the Lebanese University (LU), the Lebanese American University (LAU) and the Holy Spirit University of Kaslik (USEK) getting a response rate of 78.63%. The findings of this study exposed more differences than similarities among the four university. Ezealaand Yusuff(2011) has conducted an analysis of effectiveness of agricultural research institute libraries with special reference to user satisfaction with library resources and services and revealed that out of 340 researchers from all the 14 agricultural research institutes in Nigeria, received the response rate was 73.5%. The main objective was to assess its effectiveness and recommended measures to improve it by finding out its inadequate services and underfunding by its parent organizations. Lu (2010) conducted a study to assessing public library effectiveness at Taipei municipal library in

Taiwan to examine the features used by librarians and users to evaluate public libraries. It was revealed that there are significant differences between the views of librarians and users on criteria like statistics, access to materials and staff service, whereas the least chosen dimensions are public relations and traditional statistics. Users' library habits show a positive correlation such as age affects librarians' preferences for some dimensions and the analysis of correlations shows sex, age and occupational groups with dissimilar preferences. Investigator proposed ways to identify possible perfections for library staff based on the results. Ezeala (2009) has conducted another similar study to assess the effectiveness of library resources only in Nigerian Agricultural research institutes and highlights the factors which causes the library ineffective such as poor funding, infrastructure and lack of technology. Majid, Anwar and Eisenschtz (2001) studied those factors that contribute in influencing users' perception of library effectiveness. They conducted a survey in five major agricultural libraries in Malaysia .It was revealed that the adequate collections, services and facilities were highly regarded in perceptions of library effectiveness. Other factors were effectiveness of library promotion, participation of users in selecting library collections, well-located library, involvement in user's education programs etc. It also proposes that for any trustworthy library effectiveness study, all factors related with user's satisfaction must be carefully checked.

The above review of the literature clearly shows that over the past decade, various national and international studies have been conducted to assess the effectiveness of library services and resources through user satisfaction and their preferences. But so far, no research has been conducted in the central universities in the country. In this study, employees and users of Delhi University Library System (DULS) have to be ranked their preferences based on few indicators as suggested in the questionnaire instrumented by Cullen and Calvert (1995) for assessing the public library effectiveness.

## Objectives

The specific objectives of the study are as follows-

- To examine the key indicators of library effectiveness as perceived by different user categories of Delhi University Library System (DULS);
- To determine what indicator of library effectiveness is given the highest rank by the users and employees of Delhi University Library System (DULS).
- To map the difference among the employees and users group in their preferences of indicators of library effectiveness in Delhi University Library System (DULS).

## Research Methodology

In the present study, Investigators consulted an already tested and established questionnaire created by Cullen and Calvert (1995) and further it was adapted and refined after observing the local needs, expectations and satisfaction of the users and assessed the effectiveness of library services, infrastructures and resources from the employees' point of view. Investigators has created two separate questionnaires, each consists of 30 indicators each for library users and employees of the library after reducing the overall 99 indicators as mentioned in the questionnaire (Cullen and Calvert, 1995). Respondents were asked to indicate on a Likert scale of 1-5 (1-Strongly disagree, 5-Strongly agree) on how strongly they agreed with each of 30 indicators derived from the already tested questionnaire to judge the effectiveness of a university library. The random sampling method was adopted by the investigators to carry out the study. A total of 200 and 50 questionnaires were circulated among the library users and employees of Delhi University Library System respectively in the month of August 2019. The library users consist of Research Scholars and PG students while Staff comprises of University librarian, Deputy librarian, Assistant librarian, Professional Assistant, Semi-Professional Assistant and Library Attendants. A total of 200 questionnaire were administered among library Users and 50 were distributed among library staff, out of which, 216 questionnaires (180 questionnaires from library users and 36 from the employees of the central library) were completed and returned by the both group of respondents showing an overall response rate of 86.4 percent. The collected data was then coded and inserted in the Statistical Package for Social Sciences (IBM SPSS, Version 20.0) and analyzed through descriptive and inferential statistics.

## Data analysis

The responses were entered into the SPSS (Version 20) and analyzed by producing ranked lists of indicators for each group i.e., Library Staff and Library Users. Each ranked list was based on means of scores as given by all respondents from both the groups, the ranking of indicators thus showing how important each indicator was to both the group under study. Table 1 and Table 2 shows the mean ratings and standard deviation chosen by the group of library users and library staff respectively, in order to denote a ranked list of indicators. The similarities between means and the large standard deviations propose that small differences in ranking are not significant in top ten indicators of the ranked lists, but in the mid of the ranked list.



**Perception analysis of Library Users towards library effectiveness:-****Table 1.** Ranked Indicators of Library Users

Rank	Statements	Mean	Std. Deviation
1	Need of the expert Reference Staff in the library	3.82	1.180
2	Quietness of study environment	3.81	1.176
3	Availability of reference staff when needed	3.61	1.121
4	State of repair of materials (books, journals, etc.)	3.61	1.106
5	Staff is helpfulness and courteous	3.57	1.094
6	Smooth access to library catalogues throughout the campus	3.55	1.100
7	Consistent maintenance is essential for all library equipment	3.50	1.297
8	Special Provision made for disabled users	3.49	1.292
9	Maximum library services are available whenever library is open	3.49	1.126
10	Ease of use of library catalogues	3.48	1.011
11	Provision of multiple copies of items which are in high use	3.47	1.084
12	Display of new books and new periodical issues	3.46	1.203
13	Sufficient number of library staff per full-time equivalent student	3.41	1.199
14	Consistently consider the needs of the user groups	3.37	.975
15	Currency of library materials need to be checked	3.36	1.064
16	Able to answer reference questions	3.35	.974
17	Availability of online searching from different databases	3.34	1.068
18	Adequacy of library collection compared with other institutions	3.32	1.011
19	Speedy acquisition of new materials	3.31	1.115
20	Provision of personal study carrels	3.31	1.078
21	Provision of photocopiers/printers in all divisions of library	3.28	1.414
22	Availability of printed periodical indexes	3.27	1.167
23	Equitable and effective fines policies	3.24	1.250
24	Comfort and appealing library building structure	3.24	1.262
25	Access to CD-ROMs, databases, via networks throughout the campus	3.23	1.259
26	Speedy provision of items through inter-library loan	3.22	1.177
27	Availability of sitting space for users near reference collection	3.03	1.262
28	Provision of microfilm and microfiche readers	2.74	1.201
29	Provision of group study cabins	2.73	1.425
30	Receives regular notification of new materials added to stock	2.73	1.335

From these ranking, it is apparent that highest mean with rank 1 indicator is the “need of the expert reference staff in the library” whereas the “quietness of study environment” (ranked 2<sup>nd</sup>), availability of reference staff when needed (ranked 3<sup>rd</sup>), state of repair of materials (ranked 4<sup>th</sup>), and staff is helpfulness and courteous as ranked 5<sup>th</sup>. This concludes that users feel the need of the expert reference staff in the library and the study environment is quiet. In the results we can see the highest rank is achieved by indicators who are laying emphasis on the information services and sources. It may be justified as in current scenario more emphasis is given on the immediate information need of the user. Users have also placed great emphasis on competent staff, in particular reference staff as their critical thinking skills are highly beneficial in connecting the user to his information needs. Library OPAC is the guide to library resources and without a well constructed catalogue it gets very difficult for the users to discover and make full use of the resources that the library has to offer, therefore” Ease of use of library catalogues” was amongst the top 10 ranks. It is highly refreshing to see that “Special Provision made for disabled users” indicator was also ranked among the top 10. Their inclusion is very important as libraries are expected to provide equal opportunities and services to all library users without discrimination. Currency of information resources was also given emphasis by the users, which is fully justified in today’s ever changing information driven world. It is important to note here that the least effective indicator in the library is the “provision of group study cabins” (Rank 29<sup>th</sup>) followed by the statement “receives regular notification of new materials added to stock (Rank 30<sup>th</sup>).

### Perception analysis of Library Staff towards library effectiveness:-

**Table 2.** Ranked Indicators of Library Staff

Rank	Statements	Mean	Std.Deviation
1	Expert staff assistance to users available when needed	4.61	.964
2	Facility for users to recommend items for purchase	4.61	.494
3	Proper allocation of division in expenditure (such as books and periodicals)	4.56	.504
4	Speed and accuracy of re-shelving of materials	4.39	.494
5	Proper use and implementation of collection development policies	4.33	1.014
6	Library has achieved its goals and objectives	4.33	1.014
7	Flexibility of budget to acquire new subject area	4.29	.970
8	Staff made our users aware of services available in the library	4.28	1.003
9	Frequent evaluation of library collection	4.22	1.098
10	Speedy provision of items through inter-library loan	4.22	.797
11	Need of the expert Reference Staff in the library	4.22	.722
12	Adequate and pleasant workspace for library staff	4.22	.989
13	Library expenditure per full-time equivalent student is sufficient	4.17	.609
14	Reporting back to users who recommend items for purchase	4.11	.667
15	Existence and Quality of written management policies for staff and library	4.11	1.304

16	Percentage of potential users actively using library is high	4.11	.747
17	Transparency in management procedures of the library	4.06	1.094
18	Currency of library collection need to be checked	4.06	1.040
19	Cost-benefit analysis or cost effectiveness strategy is required	4.00	1.121
20	Provision of photocopiers/printers in all divisions of library	3.94	1.241
21	Safeguards against mutilation and theft	3.94	1.286
22	Proportion of library budget spent on staff	3.94	1.040
23	High level of staff work load	3.83	.775
24	Library staff involvement in organizational life of university	3.78	.989
25	Equitable and effective fines policies	3.78	.722
26	Regular evaluation of library building	3.72	1.003
27	Job rotation of the library employees	3.61	1.225
28	Provision of multiple copies of items which are in high use	3.56	.969
29	Regular communication with user groups	3.50	1.183
30	Provision of microfilm and microfiche readers	2.78	1.333

Similar approach has been employed to assess the library's effectiveness from the view point of library staff, which comprises of a complete hierarchy from higher position to the bottom one. It is notable that library staff surveyed have quite different priorities as that from their users. The highest mean rating regarding the effectiveness of the library agrees with the "expert staff assistance to users available when needed" (ranked 1<sup>st</sup>), followed by "facility for users to recommend items for purchase" as the next effective indicator (ranked 2<sup>nd</sup>) and proper allocation of division in expenditure (such as books and periodicals) as the 3<sup>rd</sup> effective indicator in the library, according to the employees of the library. These ranking resonates with the fact that libraries are user oriented organizations and there prime objective is so satisfy the needs of the users. Keeping this motto in mind they have regarded users' recommendation for any resource due importance. Also it is a known fact that budget is a bottleneck for most of the libraries and staff needs to justify their expenditure to the parent organizations; hence they have placed "Proper allocation of division in expenditure" as ranked 3<sup>th</sup> in order to prove library effectiveness. A good collection development policy is essential to fulfill the information requirements in a efficient manner therefore it was ranked 5<sup>th</sup>. The least effective indicator in the library is "regular communication with user groups" (Ranked 29<sup>th</sup>) followed by "provision of microfilm and microfiche readers" (Ranked 30<sup>th</sup>).

## Conclusion

In today's internet age the library must prove its relevance by providing the best possible services and information to its patrons. There is a dire need of constantly assessing, monitoring and evaluating the library effectiveness through designed indicators. Libraries often conduct the mistake of restricting the effectiveness of libraries on functions without giving due consideration of stakeholders who are actively involved with the day to day working of a library. In other words perception of the organization effectiveness as held by different users must be taken into account when assessing the effectiveness of a library. Also it is very important to know the difference of perception of library users and employees so that they may be brought at a common ground so there is a smooth transfer of library information services from the source to the receivers as well as better fulfillment of organization's objectives and goals.

## References

1. Abdallah, F and Bilal, D. (2015). Exploring the Effectiveness of Library Services and Resources in Academic Libraries in Lebanon from Users' Perspectives. IFLA WLIC Conference, Capetown, South Africa. Retrieved from <https://www.researchgate.net/publication/282328998>
2. Cameron, Kim. (1978). Measuring Organizational Effectiveness in Institutions of Higher Education. *Administrative Science Quarterly*, 23(4). 604-632. Retrieved from <https://www.jstor.org/stable/2392582>
3. Chandrashekar, J., Adithyakumari, H. & Mohan, B. S. (2016). Researchers Opinion about Effectiveness of Library Resources and Services in VTU Research Center Libraries, India: A study. *International Journal of Information Dissemination and Technology*, 6(4), 268-275.
4. Cullen, R. J. and Calvert, P. J. (1995). Stakeholder Perceptions of University Library Effectiveness. *The Journal of Academic Librarianship*, (November). 438- 448.
5. Ezeala, Lily Oluebube and Yusuff, Eunice Olufunmilola, (2011). User Satisfaction with Library Resources and Services in Nigerian Agricultural Research Institutes. *Library Philosophy and Practice* (e-journal). 564. Retrieved from <http://digitalcommons.unl.edu/libphilprac/564>
6. Ezeala, L. O. (2009). Effectiveness of Library Resources in the Libraries of Agricultural Research Institutes in Nigeria. *Library Philosophy and Practice*, 21(2), 1-6
7. Glorieux, I., Kuppens, T., & Vandebroek, D. (2007). Mind the gap: Societal limits to public library effectiveness. *Library & Information Science Research*, 29(2), 188–208. doi: 10.1016/j.lisr.2007.03.003
8. Lancaster, F.W. (1978), "The cost-effectiveness analysis of information retrieval and dissemination systems", in King, D. (Eds), *Key Papers in the Design and Evaluation of Information Systems*, Knowledge Industry Publications, Inc., White Plains, NY, (reprinted from *Journal of the American Society for Information Science*, January/February, 1971, pp. 13-27), 23-8.
9. Lu, W. (2010). The study of indicators and dimensions for assessing public library effectiveness: a case study of Taipei Municipal Library. *Bulletin of Library and Information Science*, 16(32), 75-90.
10. Majid, S., Anwar, M. A. and Eisenschitz, T.S. (2001). User perceptions of library effectiveness in Malaysian agricultural libraries. *Library Review*, 50 (3 & 4), 176-186.
11. Nwalo, Kenneth Ivo Ngozi. (1997). Measures of library effectiveness in Nigerian polytechnic libraries with emphasis on user satisfaction (Doctoral Thesis). University of Ibadan.
12. IBM Corp. IBM SPSS Statistics for Windows. 2011, Version 20.0. Armonk, NY: IBM Corp.

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# National Repository for Indian Government Publication: Prototype

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## Keywords

National Repository, Digital Library, Government Publication, Indian Government Publication, Open Source Software.

The Indian government generates crucial socio-fiscal data that is crucial for people to comprehend issues linked to the nation. Few of the government-generated facts are printed chiefly for executive and functional reasons; however, most of the details are effectively beneficial for different sections of the Indian populace. Employing the Information and Communication Technology (ICT) to generate and provide details to the Government publications not only makes the process effective, efficient and cost-effective, it also make it available 24x7 to a wider population of users. The government generates huge amounts of data at varied levels by different agencies, bureaus and ministries. Currently, these governmental agencies create data in the electronic format and display it via their websites. As such, a vast amount of available information in full-text is distributed across web sites of different ministries their departments and affiliated organizations in an unorganized and unstructured manner. Sometimes these Government publications can be searched through general-purpose search engines like Google and Bing. The proposed model of national repository would function as a single-point access portal that would facilitate organized and structured access to all Government publications in India in open access to world-wide community of users using open source institutional repository software. The proposed national repository would exclusively host Government Publications, predominantly in English and Indian languages with a search and browse interface with a comprehensive navigation facilities.

One of the major objectives of the proposed model for the National Digital Repository of Indian Government Publications (NDRIGP) is to provide a distinct one point approach to full-text of 2 Government magazines with suitable web-dependent interface for users to communicate with the repository to browse and retrieve documents of their interest.

## Statement of Problem

Electronic versions of government publications are scattered across hundreds of web sites maintained by the respective ministries, their departments and divisions. As such it is not easy to get any particular report or data quickly from a single site. It is therefore desirable to make government publications available in a highly structured and organized manner with elaborated search, browse and navigational facility through a single interface. It is, therefore, proposed to evolve a model for national digital repository for government publications using institutional repository software such as Dspace, Fedora, E-prints, etc.

## Need and Benefits

An institutional repository provides the benefit of bringing together all government publications at one place with a provision to make it accessible to the users world-wide (Chan, Leslie 2004). Some of the specific benefits that the model of National Digital Repository of Government Publications (NDRIGP) using institutional repository software are as follows:

- Institutional repository offers a coherent and coordinated approach for identifying capturing, accumulating, storing, preserving and providing free online access to government publications published by different ministries and departments. The wider access to government publications would make citizens of the country more aware and better prepared about the government's plans and programmes.
- Showcase the designs and programmes of the government through a single window by bringing all government publications together in one place, that otherwise, are distributed over several web sites of ministries and their departments and demonstrate government's contributions towards social and economic growth and its impact on the citizen;
- Increase in visibility of government publications and its public value. The increased visibility of government publications gets translated into better aware citizen and tangible benefits in terms of better utilization of government's plans and programmes;
- Improves chances for successful employment of extant plans and programmes of government with increased opportunities for collaboration between different bureaus and divisions of the government within the country and also outside the country;
- Provides an opportunity to the country to participate as an element of the international system distributed interoperable digital libraries and contribute to the open access movement. Networked open access repositories, eliminates the retrieval impediments and provides the biggest likely spread of government magazines;
- Dissemination of the government publications in digital form through a secure archive;



- Digital repositories offer faster and more efficient dissemination of publications including grey literature, presentations, conference proceedings, reports, economic and social data;
- Provides opportunity for dissemination of local issues and appropriate technological solutions used for solving them and for making them accessible worldwide;
- Publications in IRs are catalogued by Google Scholar, OAIster and other search engines. As such, contents in IRs are searchable via the Internet. IRs, therefore, provides wider access and visibility to publications and thereby improved visibility; and 4 x. IRs offer a huge capacity for indexing, searching, cross-searching, personalization and other value-added services.

## **Origin of National Digital Repository of Government Publication (NDRIGP)**

National Digital Repository of Indian Government Publications is a service to collect and disseminate documents published by Government of India for public use through an Institutional Repository Model. It provides an aggregation of metadata accompanied with full- text digital resources. The prototype of NDRIGP, provides access to selected documents published by Central Government Ministries and their departments or agencies and available on their website. The repository comprises of reports, maps, images, acts and rules, archives and more. The repository can potentially grow to a full fledge service by State Ministries, Museums, Government committees, agencies etc. Designing user friendly, systematic and simple workflow is one of the essential requirements of any IR system to be successful. We have successfully customized and restructured the entire workflow process as per the requirement as perceived. Digitization is not a new phenomenon. The Government of India through its digital India initiative, is providing 'Government to Public' services using a variety of technological means. Since then, there have been leaps in evolution of technology from low-cost mobile connectivity to the Internet. The triangulation of mobile penetration, Internet connectivity and digital authentication has spawned multiple socio-economic benefits. It can provide the underprivileged population greater and equal access to a variety of opportunities- ranging from access to formal financial system, education to basic health. On the other side, connecting the population via digital platform can open large unaccessed market to government for delivery of services. While digital reforms have been on the government's agenda, government has given it a fresh impetus. The Potential Reach of Digitized Government Documents Fiscal Saving Facilitating better governance, reducing information asymmetry, reducing Fraud Connecting rural and semi urban areas effectively, avoid duplication of work providing interconnected and transparent governance through Digital India, an umbrella initiative envisaging connecting all Indians to the Internet, enhancing financial inclusion, and delivering government services efficiently.

Technology Platform According to E-Government Complete Survey conducted by Union of International Associations (2013), there is a drastic change in percentage of people using Internet. Broadcasting model of governance unlocks an alternative channel for people to gain access to data and also distribute it on 172 Government Websites used by maximum all segments of society, government officials, faculties, researchers, businessmen, students others IT professionals to the local or public domain from outside-sources.

As per a report by Ginsparg, Paul. (2011). of Silicon Valley venture capital firm Kleiner Perkins Caufied Byers showed that while global growth in Internet usage was flat 9%, in India, growth was the fastest at 44%. Digital transactions have exploded in all segments, especially after 2014. People from all segments of society are using government websites frequently to get information. Digitization offers an unparalleled opportunity to connect with government more rapidly and effectively. Major users of Government documents are from business world, private sectors, educational institutes, health organizations, students and research scholars, NGOs etc. Recent change and development in technology is the main reason of rapid change in government mechanism. Digital technology started connecting every corner of globe by inter connecting individuals and organizations. Government also started using technology to reduce costs and to provide better services. Hyperlinks are used to connect central government websites with other department websites with each other to avoid duplication of work. In India, National Informatics Center (NIC) offers the network mainstay and e-Governance backing to central government, state governments, UT administrations, districts and other government entities. It provides a huge variety of ICT services including Nationwide Communication Network for decentralized planning, enhancement in Government services and wider transparency of national and local Governments.

The demand of easy access of government publications in day to day life is the foundation of the development of National Digital Repository of Indian Government Publications. To handle a wide variety of government publication and dissemination of information is not a simple task for individual content provider. The main aim of NDRIGP is to provide full text search facility to accessing government published documents in minimum three clicks in the form of a web based user interface. NDRIGP will work as central portal to collect and disseminate information for public. It is a platform to provide government documents, circulars and notifications uniformly for public use. The major challenge of NDRIGP is to deal with a wide variety of data on its collection. In this case metadata plays main role in handling of heterogeneous collection by identifying every document digitally and makes archiving and preservation effective. Dublin core metadata gives facility to customize metadata field according to the need of repository and type of collection to handle. To maintain the standard and controlled vocabulary NDRIGP is built on subject headings from Library of congress Subject Headings. Use of DSpace open source software as soul of NDRIGP is the main reason which makes this model a perfect example of institutional repository for Government publications. The NDRIGP model is built around the idea of Ministries/ departments as “communities” that contain one or more “collections” of digital “items”, each of which can have one or more files, such as images, documents, datasets etc. DSpace captures, stores, indexes, preserves and disseminate stored data effectively. It also gives facility of email notification, and administrator’s login accounts.

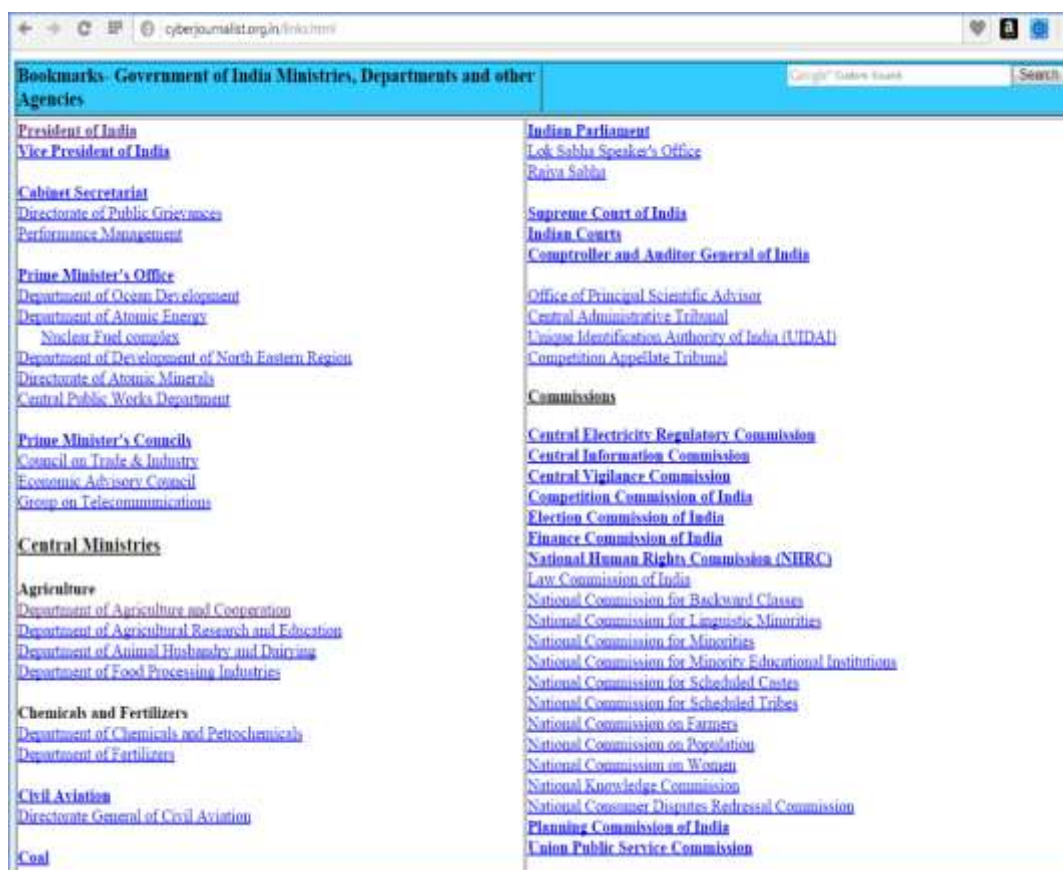


**Figure 1.** Home Page NDRIGP

## Defining Standards: Configuration and Customization

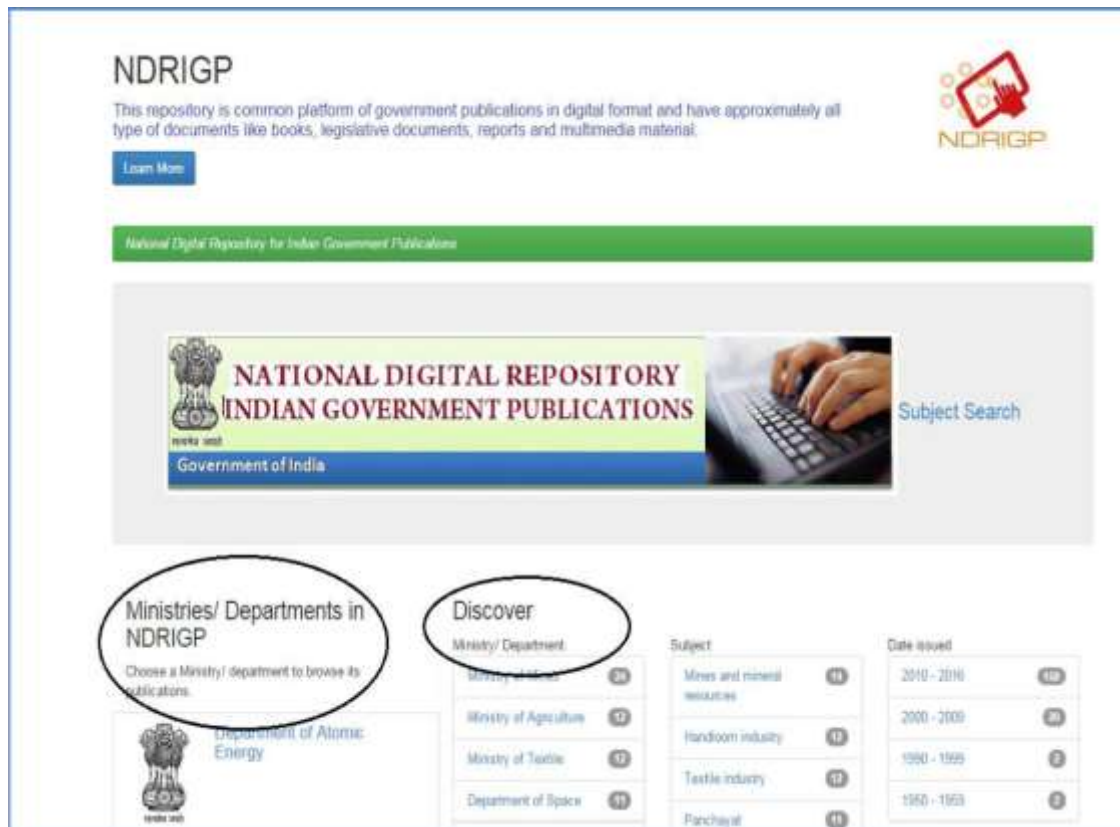
To make NDRIGP user-friendly, DSpace was customized in number of ways. Customizing the interface helps in streamlining the appearance and workflow process of DSpace. Look and feel (figure 1) of DSpace was changed also as per need of NDRIGP. Text colour, display of community and collection is also customized.

DSpace has a unique feature of connecting links of websites and portals. “Learn More” option on Home page is used to connect websites of Indian Government Ministries, departments and other agencies as bookmarks shown in figure 2. This feature is very useful to connect users directly with source website to get details, clarifications or updates on any topic. Some maximum used websites like central government organizations and undertaking, Defence, Earth Science, External Affairs, Commodity Boards, Export Promotion Councils, Authorities and other trade related agencies, Excise, Customs, Telecom, Income Tax, Railways and Ports, Public Sector and Scheduled Banks, Financial Agencies, Research Institutions, Central/ National Institutes, Deemed Universities, Universities, Districts of India, Offices of United Nations Agencies in India like UNAIDS, UNDP, UNFPA, UNICEF, United Nations Information Centre, WHO Regional Office, World Bank etc. Map of India (Political), Indian Missions Abroad are also linked as bookmarks with NDRIGP.



**Figure 2.** Ministries and departments individual websites

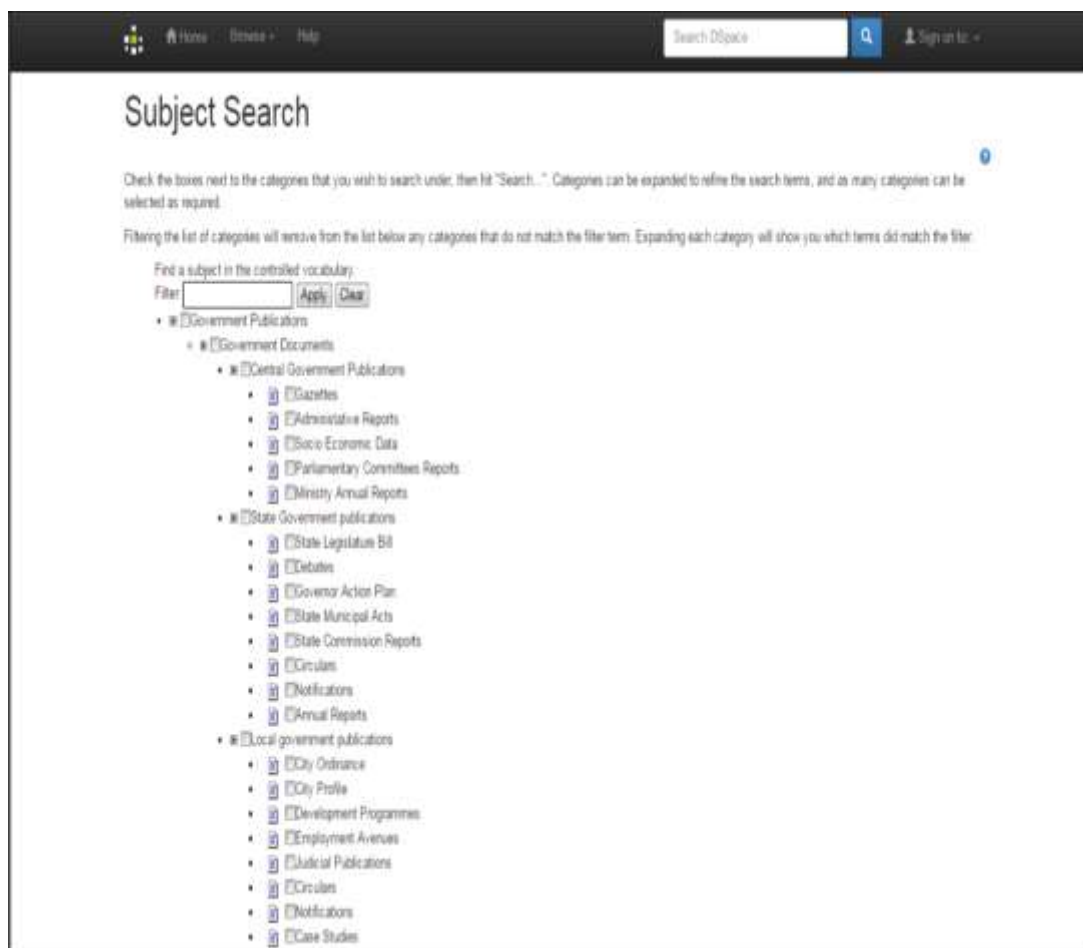
The next part of customization of DSpace starts with editing in `dspace.cfg` file. `Dspace.cfg` file is a Java property file and contains basic information of DSpace installation, comments for all properties, system path information, network host information etc. Figure 3 shows change of labels from default value of Communities and Collections to Ministries/Departments.



**Figure 3.** Government websites as bookmark under “Learn More” option

### **Controlled Vocabulary**

NDRIGP is a perfect example of using controlled vocabulary to locate information by using words that maybe not known to users but gives description and solve language problem. After understanding user’s need, NDRIGP adopted Library of congress subject headings and arranged them in hierarchical order where terms are narrowed down from broadest concept Government Publications and Government documents to narrowest term like type of publications as shown in figure 5. NDRIGP help users to comprehend the culture and the jargon employed in repository and make it simple for the users to come back to the term and comprehend the full meaning of it by subject/word searching. As this is the aim of controlled vocabularies to identify words and relate it with required search in minimal time.



**Figure 4.** NDRIGP Subjects from Library of Congress Subject Headings

NDRIGP is primarily organized to reflect organizational structure of Indian government in terms of Ministries and their Departments. In addition to default search and browse option provided by DSpace, a subject search based on Library of Congress's LCHS (Library of Congress Subject Heading) is provided to support subject wise browse and search. Figure no 4 depicts LCSH based organization of NDRIGP.

### ***Content Organization in DSpace***

National Digital Repository of Indian Government Publications organizes documents in a hierarchical manner. Files or documents are added to one or more Collections, and Collections can be grouped into sub community and then into larger Communities as shown in figure 5. Each Collection and Community has its own logo and customized homepage. It gives opportunity to submitter to replicate the structure of the organization within NDRIGP.



**Figure 5.** Content Organization showing Community, Sub Community and Collection

All documents are stored as a “*Bitstream*”, and two or more bitstreams are grouped and called “*Item*”. These items are characterized by the presence of relevant metadata. NDRIGP is a web application and users can effortlessly deposit content and browse collections. Materials in NDRIGP are distributed through the Internet and gain exposure through search engines like Google. NDRIGP is based on DSpace and equipped with customizable interface. Digital documents or items are archived in a way that can be used by researchers or users for long term. NDRIGP supports item submissions a broad, non-technical audience.

### **Search Interface**

NDRIGP provide extensive and fully configurable search and browse facility with ability to easily drill-down to search results. Along with regular search filters, it has the ability to define a number of additional search filters based on the DSpace advance search options. NDRIGP offer both metadata and full-text based searches.

### **Full- Text Search**

NDRIGP gives facility of full-text searching of contents from uploaded document along with the metadata provided for a given document. As such, full- text of the contents are indexed and made searchable as well. Users can search with keywords and by any word that appears in the content and may not be provided in description or metadata.

## Navigation

In National Digital Repository of Indian Government Publications (NDRIGP) can be searched and navigated using the following options,

- Looking for one or more keywords in metadata or extracted full-text;
- Faceted browsing i.e. browsing through filters;
- Browsing through various indices such as title
- Author and subject terms for a particular collection or Ministry/Department.
- Through external reference, such as a Handle.
- Advanced Search that allows user to search using specify fields and combine them with Boolean “AND”, “OR”, “NOT”. Figure 6 to 8 shows types of search and browse facilities offered by NDRIGP.



**Figure 6.** NDRIGP- Home Page with Search facility



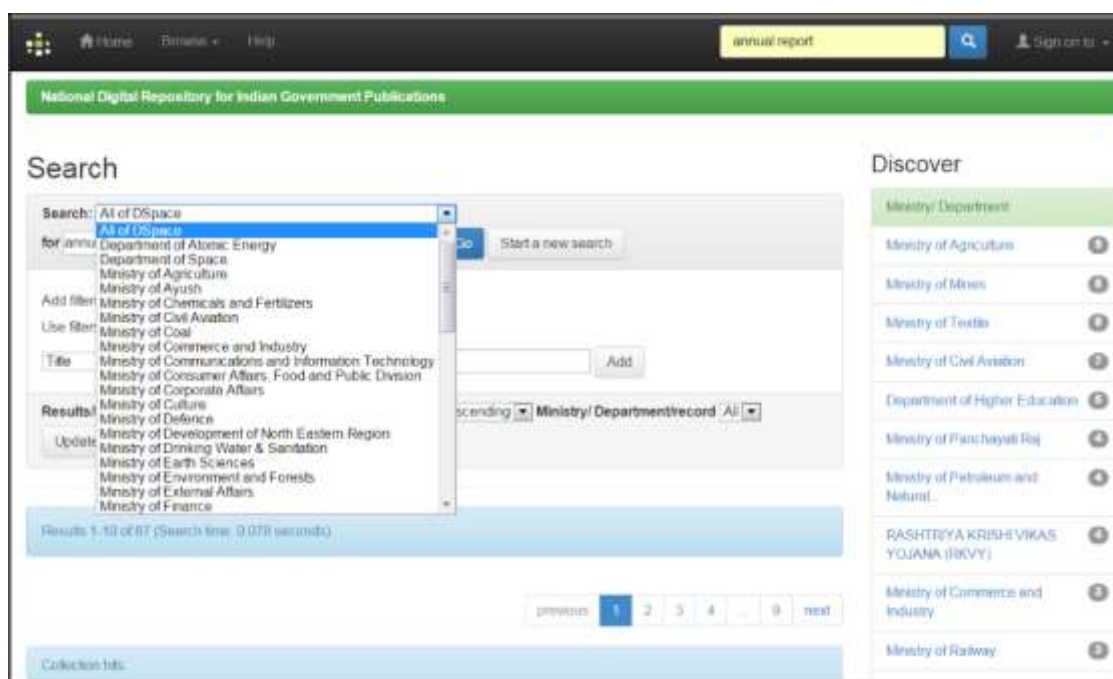


Figure 7. Search & navigation

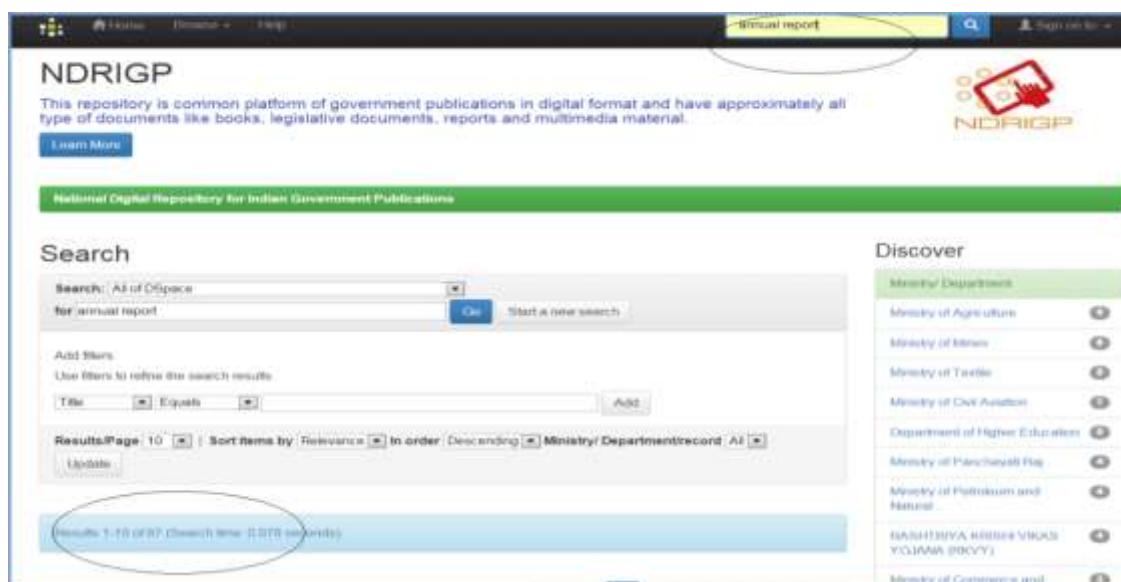
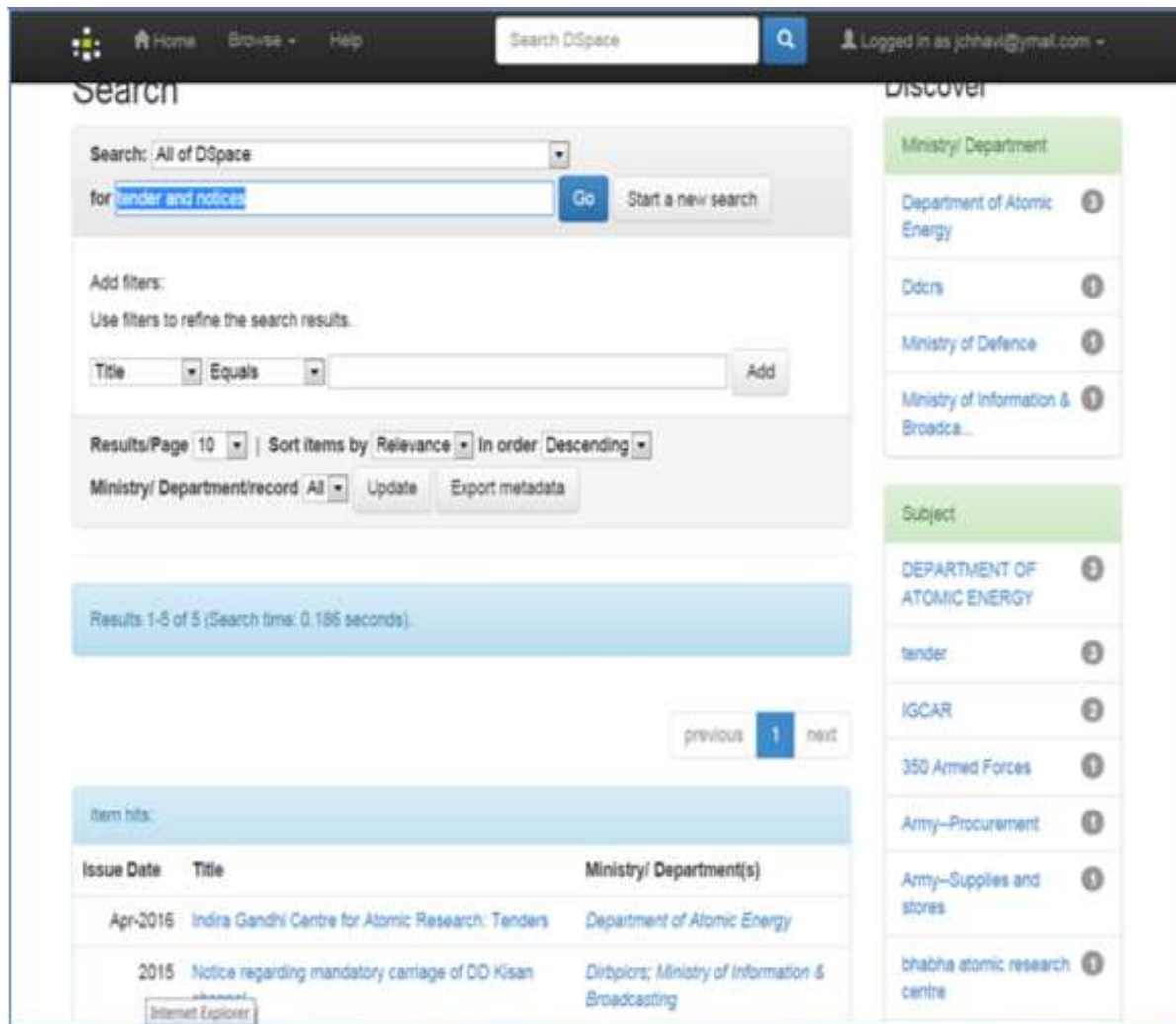
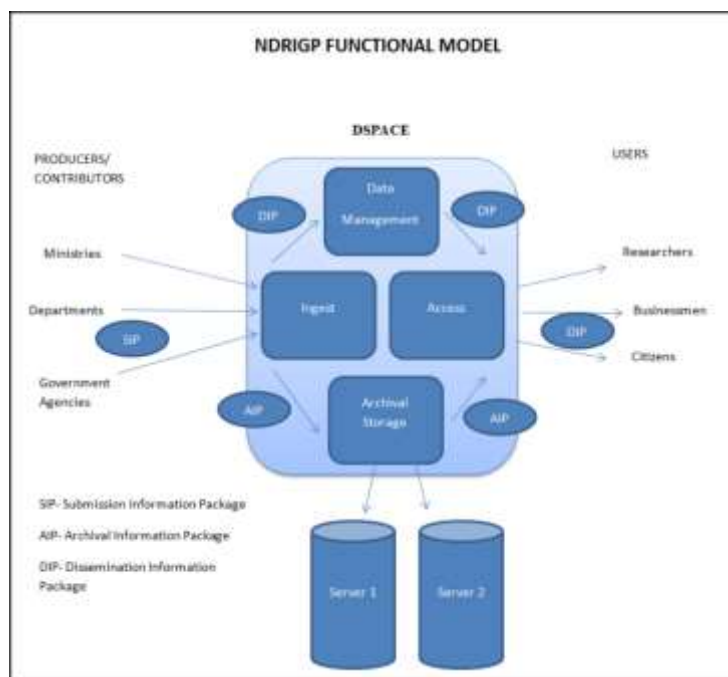


Figure 8. NDRIGP- Search through Filters



**Figure 9.** Boolean Search facility in NDRIGP

Prototype of NDRIGP is used extensively to capture, access, and store large number of digital Government publications in digital formats. Figure 10 depicts conceptual archival model of NDRIGP



**Figure 10.** National Digital Repository of Government Publications Functional Model

## Future Perspective of NDRIGP

NDRIGP can be the strategic priority which can take a leadership role in this important endeavor. NDRIGP will provide its services to researchers and scholars for conducting research. This will be helpful for all segments of society. In real conditions this model can be elaborated for State Level Ministry websites, Municipal Corporations, Gram Sabha and Gram Panchayat level.

All museums and government offices can be connected and integrated in NDRIGP. This national repository can give better services like

- All non-confidential, policies and practices related to submission, accessing and downloading will be easily available for users to avoid any kind of confusion. The NDRIGP will be user friendly, so that not well trained citizen also can retrieve their required data within maximum 3 clicks.
- NDRIGP will assign handle number of every document to avoid any confusion during retrieving of desired documents.
- In collaboration with all State and Central Government ministries and departments, NDRIGP can become a central place to get all type of non-confidential document which are published by government for citizens.

- Users will get one daily e-mail that has outlines from all the newsletters, new uploaded documents, etc. to which they subscribe. The e-mail can also has a link to a personalized intranet page that aggregates all resources into one central page.

## Strengths

- Fulfills the anticipations of both Government and citizens of a contemporary information center that meets the anticipation of the corporate world.
- Permits closer ties amongst Government and citizens with electronic communication systems.
- Permits a rise in depth and breadth of information resources
- Permits one to retrieve information 24/7 from anywhere
- Removes the requirement to process and circulate incoming print material
- Removes copying of resources
- Allows it to develop one user interface to all resources.
- Offers for customization and personalization of the user interface.
- The vision of a National Digital Repository for Indian Government Publication can be a reality. The government needs to resolve problems pertaining to staffing, management, collection development, contract negotiations, and spacing prior to the execution. The shift from conventional print to total electronic repository can be a feasible choice with evident pre-set aims, adequate staffing, and strong management backing.

## References

1. Chan, Leslie (2004). **Supporting and Enhancing Scholarship in the Digital Age: the role of open access institutional repository**, *Canadian Journal of communication*, Canada, vol29, p. 277-300.
2. Ginsparg, Paul. (2011). **It was twenty years ago today**. Retrieved from <http://arxiv.org/pdf/1108.2700v2.pdf>
3. Union of International Associations (2013), **International Organizations Publications**. Retrieved from <http://www.uia.be/>

# **Building a Web-enabled Digital Repository: A Case Study of NSTMIS Research Publications**

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## **Abstract**

National Science and Technology Management Information System (NSTMIS) of the Department of Science and Technology (DST) makes available the information and data on resources devoted to R&D activities in the country through its regular and occasional publications for evidence based S&T planning. Digitization of all the publications brought out under NSTMIS scheme since its inception in 1973 and developing web-based digital repository for quick access and retrieval purposes was the mission. This paper presents the results of an initiative by the NSTMIS to build a web-enabled digital repository of all its Publications.

## **Introduction**

Science and technology plays a vital role in the economic development of a country. The Department of Science and Technology (DST) set up in May 1971 by Government of India has been playing the role of nodal department for promoting science and technology activities in the country. The DST has been known to set the pace for scientific research initiatives and innovations, and has built a huge information base on a continuous basis on resources devoted to the advancement of scientific and technological activities and policy planning in the country.

Digitization is the process of converting printed information or data into a digital format. To move into digitization era, it is extremely crucial to take the first step i.e. conversion of the existing printed publications or documents into digital format and facilitate access through a central digital repository for the benefit of scientific community and society as well. As a first step in realizing this mission, the National Science and Technology Management Information System (NSTMIS), a division of the DST took the initiative to create a web-based Digital Repository for providing digital access to all its publications and to make them available over the Internet and for the benefit of scientific community, S&T Policy Makers, Planners and Administrators.

### **About NSTMIS**

The NSTMIS has been entrusted with the task of building the information base on a continuous basis on resources devoted to scientific and technological activities for policy planning in the country. It is the nodal agency responsible for providing information on both financial and manpower resources devoted on R&D for evidence-based S&T policy planning. The NSTMIS division, as an outcome of its in-house and sponsored research activities, has been bringing out a number of regular and occasional publications for more than thirty years. These publications are in the form of reports, directories, booklets, statistical data sheets etc.

The mission thus aimed at designing and developing a web-based digital repository of all the publications brought out by the NSTMIS up till 2019. It included collection of printed documents, reports, directories, booklets, CDs and all the other forms in which publications are available. Methodologies were evolved for digital accessibility, data preservation and information retrieval of NSTMIS publications as outlined below.

## **Methodology**

### **Collection of NSTMIS Documents**

The project started off with a collection of publications of NSTMIS – both in print and electronic formats – for the purpose of digitization and data organization in the digital repository. Types of documents that have been digitized and organized in the Digital Repository include:

#### **Regular Publications**

- Analysis of Outcome of Extramural R&D Projects
- Directory of Research and Development institutions Biennial
- Directory of Extramural Research and Development Projects Annual
- Funding Pattern of Sponsored Research by Scientific Agencies Quinquennial
- Research and Development Statistics Biennial

#### **Occasional Publications**

- Indian National Innovation Survey with special focus on MSMEs
- Three Decades of NSTMIS Scheme -1985-2015: Research Summaries
- Teaching and Research in Science and Technology Faculty in Universities- Selected Statistics

## Projects Reports brought out under Sponsored Research Programme of NSTMIS

### ***Digitization and Creation of Meta Data***

#### **Scanning, restructuring and importing of data**

Both regular and occasional publications as listed above were scanned in the text readable format to make it searchable applying Optical Character Recognition technique. Additionally, contents such as statistical tables, charts, graphs, chapters etc. representing each publication were separately scanned for the purpose of keywords and phrase search capabilities.

These scanned documents were then restructured into the database template according to a requisite format for importing and organizing to match with the order and content of respective publications.

#### **Meta data format**

The scanned documents are organized based on the Dublin Core Metadata Format describing the content of each document by title, publisher, date of publication, description, identifier, rights, audience, etc. as shown below: The repository is updated periodically and publications can be added and edited through the 'add publication' module.

**Metadata Template for NSTMIS Publication**

**Add Publication**

Title\* Funding Pattern of Sponsored Resear

Publisher\* NSTMIS Division, Department of Sci

Date of Publication\* November 2008

Publication Type Funding Pattern of Sponsored Research by Scientific Agencies

If others, pls specify

Subject Select Subject

Keywords (none entered) Higher Education Economics Expen

Description The report provides analysis of 12523 projects approved for funding by 28 Central Government Departments/Agencies during the period 2000-2008.

Pages 179

Identifier ISBN-31-87687-16-5

Audience Scientists, Planners, Policy Makers

Upload TIT file D:\NSTMIS\Table of Conte Browse

Upload Keywords D:\NSTMIS\Analysis.docx Browse

Upload Full text D:\NSTMIS\Full text Publi Browse

Save

## Digital Repository: Design and development

A web-accessible framework using the LAMP platform was designed and developed with a query-based retrieval methodology based on the meta data fields. The acronym stands for Linux, Apache, MySQL, and PHP. Linux is a computer operating system assembled under the model of free and open source software development and distribution; Apache a free open source software which runs over 50% of the world's web servers; while MySQL is a powerful database management system used for organizing and retrieving data on a virtual server; PHP is an open source web scripting language that is widely used to build dynamic webpages.

### HOME PAGE: NSTMIS DIGITAL REPOSITORY

<http://digitalrepository-nstmis-dst.org/>

In-house Research		Sponsored Research
Regular Publications	Occasional Publications	Extramural R&D Projects
Analysis of Outcome of Extramural R&D Projects	Indian National Innovation Survey with special focus on MSMEs	Project Completion Reports
Directory of Research and Development Institutions <i>Annual</i>	Three Decades of NSTMIS Scheme -1985-2015' Research Summaries	
Directory of Extramural Research and Development Projects <i>Annual</i>	Teaching and Research in Science and Technology Faculty in Universities- Selected	
Funding Pattern of Sponsored Research by Scientific Agencies <i>Quinquennial</i>		
Research and Development Statistics <i>Annual</i>		

### Search options

The Digital Repository is searchable over a large number of terms and phrases used in statistical tables and graphical representations contained in NSTMIS publications. E.g. Directory of Extramural Research and Development Projects, an annual publication of NSTMIS since 1990-91 is searchable through various ways. Repository features a quick search based on both free-text and keywords as well as phrase search terms. Advanced Search Page offers Boolean search facility (AND; OR; NOT) for combination search narrowing or expanding searches based on



project by type, project title, funding agency, scheme, year, subject, gender, name of Principal Investigator (PI), Implementing Institute, and state.

Other features of the database include provision to highlight search terms in the display record and Search button to begin search, and a Reset Button to clear the search page.

Queries conducted in the search button is case insensitive, i.e., a word entered in lower case will match words entered in upper case, lower case, or mixed case. There is also a provision to take printout and e-mail the search results.

The digital repository contains records of over 49000 Extramural Research projects [in terms of title, address of principal investigator, duration, name of funding agency/scheme and funds approved] covering the period 1990 to 2010 in searchable format.

The web-based digital repository with user-friendly interface and advanced search and retrieval system thus facilitates easy access to large number of past and present NSTMIS publications. The system will help in the generation and dissemination of knowledge and will greatly benefit in terms of data preservation, information accessibility, retrieval, space saving and from information sharing to workflow processes. Below are snapshots of two select publications:

## Regular Publications

### Analysis of Outcome of Extramural Research and Development Projects

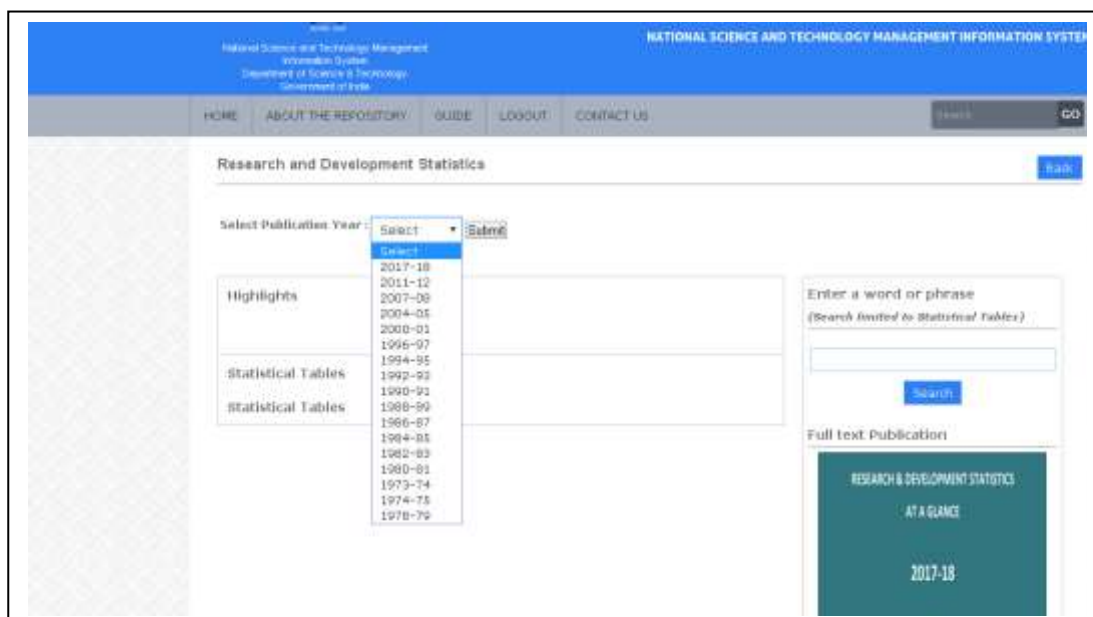
The publication brings out an analysis of outcome of (extramural) research and development projects.

The web page provides full text coverage of the publication, besides offering search facility for terms and phrases used in statistical tables.



## Research and Development Statistics

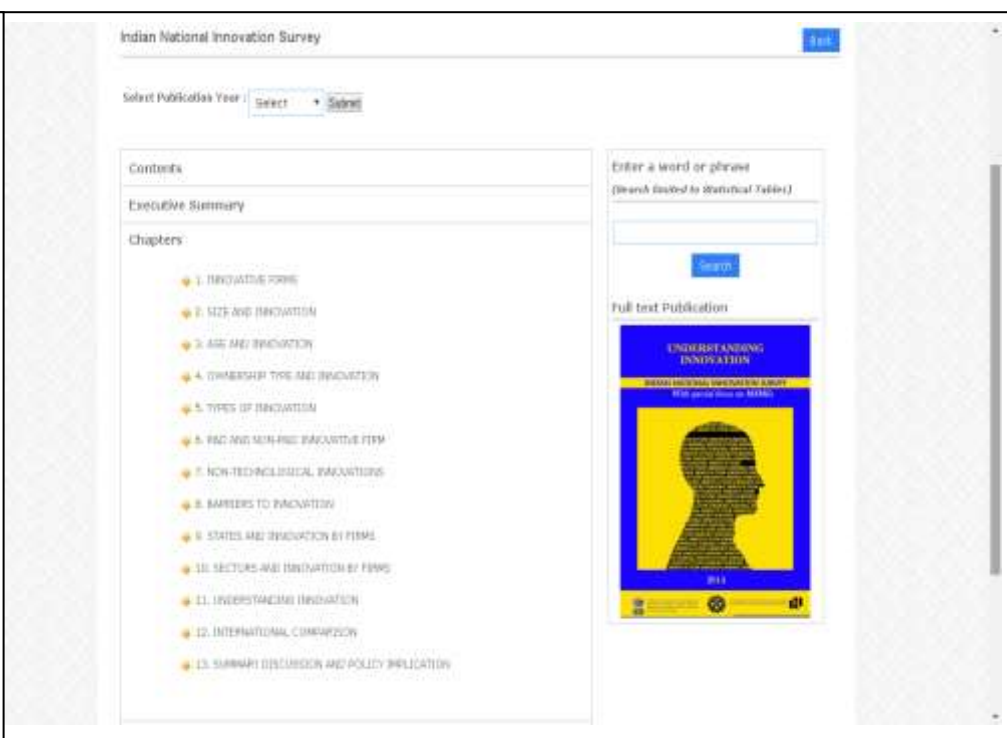
Past and present publications covering the period 1973-74 to 2017-18 were digitized and organized in the Digital Repository. Below is the screenshot of the latest publication



## Occasional Publications

Indian National Innovation Survey with special focus on MSMEs

The national report, first of its kind, benchmarks innovation potentiality of Indian firms in terms of innovation activities, sources of innovation, linkages, human resource, effects and factors affecting innovation activities. The report is based on the analysis of sample survey of 9001 firms, largely MSMEs, spread across 26 states and 5 Union Territories across various industrial sectors in the country.



### **Project Completion Reports**

The NSTMIS division sponsors research projects/studies to researchers /organizations under its Scheme. The broader areas where studies have been conducted are S&T investment, S&T infrastructure, S&T output, S&T databases, S&T manpower, R&D productivity/efficiency etc. Following are the themes under which 220 projects reports have been organized:

- (i) Human Resources in S&T (ii) IPR Management (iii) Mobility of S&T Professionals  
(iv) R&D and Innovation (v) R&D Infrastructure/ Resources (vi) S&T Studies in Higher Education Sector (vii) Scientometric Studies in S&T

The screenshot shows a web application titled "PROJECT COMPLETION REPORTS" with the subtitle "BROUGHT OUT UNDER THE NSTMIS SPONSORED RESEARCH PROGRAMME". The header includes the Government of India logo and the NSTMIS division name. A "HOME" button is visible in the navigation bar. The main content area is titled "Project Completion Reports" and contains a brief description of the scheme. Below this, a list of themes and their corresponding project counts is displayed:

Theme	Count
1. Human Resources in S&T	600
2. IPR Management	1
3. Mobility of S&T Professionals	4
4. R&D and Innovation	174
5. R&D Infrastructure/Resources	171
6. S&T Studies in Higher Education Sector	14
7. Scientometric Studies in S&T	19
8. All	220

Below the list, there is a search form with the following fields:

- Project Title
- Principal Investigator
- Implementing Agency
- Year of Completion
- Theme
- Keywords

Each field has a dropdown menu or a search button. At the bottom of the form, there are three buttons: "Search", "Reset", and "Add".

### **Future Plans**

The digital repository aims to facilitate digital access to all the research publications brought out by the NSTMIS division. The repository will be made dynamic in nature. It will be maintained and updated to provide information on the NSTMIS publications on a regular basis. It is also proposed to enhance the repository by adding forthcoming regular and occasional publications as well as project completion reports brought out under the NSTMIS sponsored research programme.

## Conclusion

The repository would facilitate digital access to printed publications of NSTMIS and also benefit in terms of data preservation and information retrieval as per needs. This would help NSTMIS, DST in sharing the valuable data and its rich historical context with the scientific community and other stakeholders both nationally and globally in a structured and time efficient mode. Searchable web-enabled databases of Extramural R&D Projects funded by central S&T agencies, R&D Institutions etc. can be updated easily with all the information and data available at the single platform. The repository is web-enabled and can be accessed through NSTMIS web site under the option 'Database Search'.

The address of NSTMIS website is [www.nstmis-dst.org](http://www.nstmis-dst.org). It is also available at <http://www.teriin.org/digitalrepository/home.php>

## Acknowledgements

The project team is grateful to the National Science and Technology Management Information System (NSTMIS) Division of the Department of Science and Technology (DST), Government of India for providing the opportunity to undertake this important project entitled on 'Long-term Development and Sustenance of NSTMIS Digital Repository'.

The team thankfully acknowledges the support and initiative by the DST to carry out this task. It gratefully acknowledges the direction, guidance and inputs provided by DrParveenArora, Scientist 'G' and Head –NSTMIS, Department of Science and Technology, Government of India, Dr A.N. Rai, Scientist 'F', Department of Science and Technology, Government of India.

# **A Scientometrics Analysis of ‘Information and Communication Technology’ Research Output Using Scopus Database from 1999-2018**

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## **Abstract**

The present study focuses on the growth and development of ‘Information and Communication Technology’ research in terms of publications output during the period of last two decades i.e. (1999-2018). The data was collected through the Scopus database. The study examines and analysis various scientometrics parameters and found that the maximum 1622 (8.82%) of research papers were published in the year 2017 and annual growth rate was (51.30) recorded while the highest compound annual growth rate was (0.23) recorded. The highest (7345) of publications from computer science subject area and the maximum 9623 (52.35%) of records were journal articles while the significant keyword was ‘Information and Communication Technologies’. The mean (145.3) of publications were contributed by top 10 organizations in which a maximum (256 publications) were contributed by Japan National Institute of Information and Communications Technology. A large amount of (22%) papers were contributed by United States researchers. Toyoshima, M. was the most productive author with (53 research papers) contributions. The relative growth rate was shown in decreasing trend while the doubling time recorded in an increasing trend. A total of 18382 research papers 109919 of citations were recorded from the marked period of study. The highest 5058 research papers were contributed by two authors, followed by a single author with 4733 publications. The average of authors degree of collaboration was (0.92) found while the average Collaboration Coefficient (0.69), Modified collaboration coefficient (0.69) and Collaborative Index (4.21) of authorship pattern. Lotka’s law of scientific productivity shows the authors observed are somehow different from the numbers of authors expected during the period of study.

## Keywords

Scientometrics, Information and Communication Technology, Relative Growth Rate and Doubling time, Degree of Collaboration, Collaboration Coefficient, Modified collaboration coefficient and Collaborative Index of authorship pattern.

## Introduction

In the present era Information and Communications Technology play a vital role in society. Information and communication technology (ICT) is an extensional term for information technology (IT) that stresses the job of bound together interchanges and the combination of media communications (telephone lines and wireless) and PCs, just as fundamental venture programming, middleware, stockpiling, and audio-visual media frameworks, that empower users to get to, store, transmit, and control information.

Scientometrics is a very important measurement tool for the assessment of scientific production. Scientometrics is the most dependable approaches to follow science and technology activities is the investigation of scientific publications. The recent couple of year scientometric investigation has been progressively used to assess the research performance of scientists and the development of different disciplines of sciences. It is especially analysis the trends of the growth rate of publications, authorship pattern, institutions productivities, the collaboration pattern and relative growth rate and doubling time, collaboration coefficient, collaborative index and so on.

## Scope of the study

The study is globally restricted to 10 countries which are contributed the maximum publications in information and communication technology research during the period (1999-2018) i.e. (1) United States (2) United Kingdom (3) Spain (4) Australia (5) Germany (6) Italy (7) India (8) Japan (9) France, and (10) Canada. All the research papers were indexed in the Scopus database.

## Literature review

Gupta and Dhawan (2018)<sup>1</sup> investigated a scientometric assessment of artificial intelligence research in India during the period (2007-2016). The study examines various scientometric parameters and found that the annual average growth rate (27.45%), average citation (2.76 each paper). The maximum (86.99%) of papers were contributed by computer science subject, followed by engineering with (30.69%) while the most productive organization name was Anna University, Chennai with 294 publications, 761 citations and S. Das was most productive author with 36 publications, followed by B. K. Panigrahi, IIT Delhi with 32 contributions.

Kumar and Kaliyaperumal (2015)<sup>2</sup> conducted a scientometric analysis of mobile technology research publications during the period (2000-2013). The data was collected by the Web of Science database in which a total 10638 of research papers were published and the average publications per year were (759.86) recorded while the highest 1495 of papers were published in the year 2013. The most productive authors were Kim with 42 publications and collaboration Index ranges was recorded from (3.67) in the year 2000 to (4.57) in 2009 with a mean (4.32) of per joint authored publications. The highest 243 research papers were contributed by the University of California System (USA) during the period of study.

Majid et al (2015)<sup>3</sup> carried out a bibliometric analysis on publishing trends in information literacy literature during the period (2003-2012) in which a total 1989 research papers were published. The highest 347 research papers were published in the year 2011, followed by 336 publications in 2012. A majority of the research papers published by used in the particular study were written by more than one authors. Julien, H. was the most productive author with 18 contributions while the maximum 23 research papers were contributed by University de Granada, followed by 22 papers contributed by University of Sheffield and University of Alberta. The maximum 1585 publications were published in a social science subject, followed by computer science with 453 publications. A large number (942) of publications were contributed by the United States scientist.

Selvi and Dhanavandan (2014)<sup>4</sup> conducted a scientometric study on research output and literature growth of information literacy (1919-2013). The data was collected by Scopus database out of a total of 10254 publications, a maximum 1379 research papers were published in the year 2013. The maximum 4292 (41.85%) of publications were contributed by the United States, followed by the United Kingdom with 815 (7.94%) publications and in the social sciences subject a large number of publications (4841) were published while the maximum 6799 (66.3%) of record were researched article type publications. Wolf, M.S was the most productive authors with 52 (0.5%) of contributions. The maximum 74 publications were contributed by VA Medical Center during the period of study.

Kumar (2014)<sup>5</sup> carried out a scientometric study of digital literacy in online library information science and technology abstracts (LISTA) from the marked period (1997-2011). The study examines and analysed various scientometrics pattern and found that the out of a total 137 publications, a maximum 75 (54.74%) of publications were published in the 2009-2011 time period and the highest 73 (53.28%) of publications were published in education subject. A large number 95 (69.34%) of records were published in an academic journal while the maximum 48 (35.04%) of articles were contributed by three authors, followed by two authors with 43 (31.39%) of publications from the marked period of study.

## Objectives of the study

The main objectives of the study are to:

- Examine the Degree of Authors Collaborations.
- Analysis of the Relative Growth Rate and Doubling Time of the publications.
- Identify the Collaboration Coefficient, Modify Collaboration Coefficient and Collaborative Index of the authors.
- Examine the Co-Authorship Index of the authors in ICT research.
- Identify the Lotka's law of scientific productivity.

## Methodology

The data for the present study were retrieved from the Scopus database which is published by Elsevier. It is an international online citations database. The following search string used to collecting the data for the study: (TITLE-ABS-KEY("Information and Communication Technology") AND (LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 1999)) AND (LIMIT-TO (AFFILCOUNTRY, "United States") OR LIMIT-TO (AFFILCOUNTRY, "United Kingdom") OR LIMIT-TO (AFFILCOUNTRY, "Spain") OR LIMIT-TO (AFFILCOUNTRY, "Australia") OR LIMIT-TO (AFFILCOUNTRY, "Germany") OR LIMIT-TO (AFFILCOUNTRY, "Italy") OR LIMIT-TO (AFFILCOUNTRY, "India") OR LIMIT-TO (AFFILCOUNTRY, "Japan") OR LIMIT-TO (AFFILCOUNTRY, "France") OR LIMIT-TO (AFFILCOUNTRY, "Canada")))). A total of 18382 research papers were published during the period (1999-2018) in which the maximum 16513 records were another type accessible while only 1869 publications were an open access type. These records along with full bibliographical details and have been extracted from the Scopus database. The data were analysed and tabulated in MS Excel application software and tested by the various scientometrics tools to achieve the objectives.

## Data analysis

### Year-wise distribution of publications

Table 1 shows the year wise distribution of Information and Communication Technology research papers during the period of the last 20 years i.e. (1999-2018). On the observation of the particular table, it has been shown that the frequency of ICT publications is very high in the present era compare to begging years of the study. ICT research papers were shows an increasing trend, but in the year 2009, 2011, 2014, and 2018 it was depicted in slightly decreased. The maximum 1622 (8.82%) of the research papers were published in the year 2017, followed by 2018 with 1615 (8.79%) publications and the third highest publications year was 2016 in which a total 1453 (7.93%) of research papers were published in ICT research from the marked period of study.



**Table 1.**Year Wise Distribution of Publications

<b>Year</b>	<b>No. of Publications</b>	<b>Cumulative Sum</b>	<b>Percentage</b>
1999	115	115	0.63
2000	174	289	0.95
2001	214	503	1.16
2002	291	794	1.58
2003	357	1151	1.94
2004	399	1550	2.17
2005	601	2151	3.27
2006	670	2821	3.64
2007	802	3623	4.36
2008	1147	4770	6.24
2009	1020	5790	5.55
2010	1264	7054	6.88
2011	1160	8214	6.31
2012	1252	9466	6.81
2013	1417	10883	7.71
2014	1352	12235	7.36
2015	1453	13688	7.90
2016	1457	15145	7.93
2017	1622	16767	8.82
2018	1615	18382	8.79
<b>Total</b>	<b>18382</b>		100.00

### Annual Growth Rate and Compound Annual Growth Rate of Publications

Table 2 depicts the annual growth and compound annual growth rate in information and communication technology research literature retrieved from (1999-2018).AGR is a useful method to evaluate the yearly trends in research productivity (Kumar & Kaliyaperumal, 2015)<sup>5</sup>. The annual growth rate was lies between (-11.07 in the year 2009 to 51.30 in 2000) during the period of study. The annual growth rate was some time shows in decreasing trends, it's mean the particular years the publications were not published in same or not increasing but less published in comparison to previous year publications.

$$\text{AGR} = ((\text{ending value} / \text{first value}) / \text{first value}) \times 100$$

Compound Annual Growth Rate represents the growth of an initial investment assuming it is compounding by the period of time specified. The compound annual growth rate has been shown in a fluctuating trend some time it also recorded in minus. The highest CAGR (0.23) recorded in the year 2000, followed by (0.08) in the year 2002. The overall data of annual growth and compound annual growth rate was shown in below table 2.

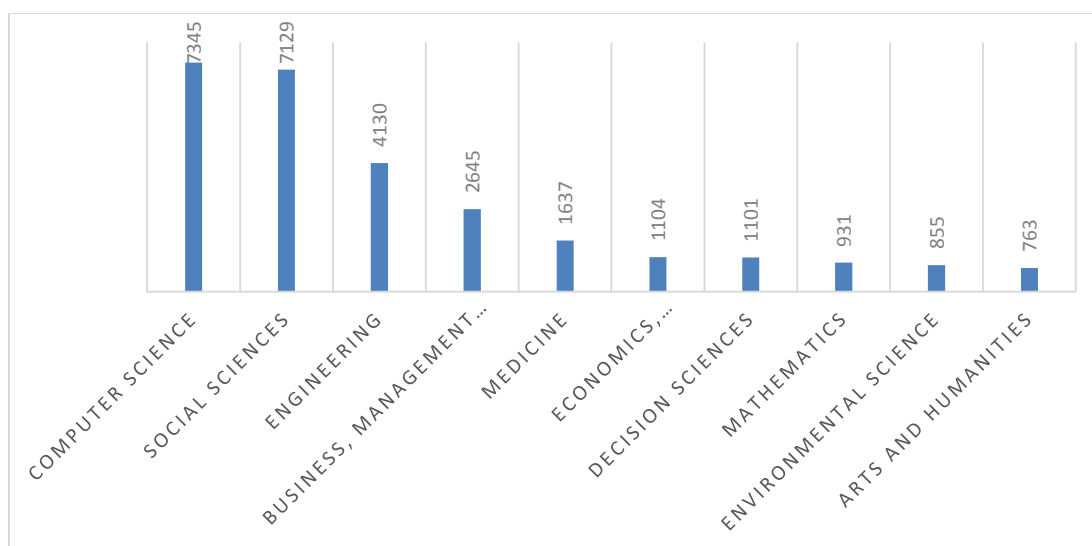
$$\text{CAGR} = (\text{ending value} / \text{beginning value})^{1/\# \text{ of years}} - 1$$

**Table 2.**Annual Growth Rate and Compound Annual Growth Rate of Publications

Year	No. of Publications	Annual Growth Rate (AGR)	No. of Years	Compound Annual Growth Rate (CAGR)
1999	115	0	1	0
2000	174	51.30	2	0.23
2001	214	22.99	3	0.07
2002	291	35.98	4	0.08
2003	357	22.68	5	0.04
2004	399	11.76	6	0.02
2005	601	50.63	7	0.06
2006	670	11.48	8	0.01
2007	802	19.70	9	0.02
2008	1147	43.02	10	0.04
2009	1020	-11.07	11	-0.01
2010	1264	23.92	12	0.02
2011	1160	-8.23	13	-0.01
2012	1252	7.93	14	0.01
2013	1417	13.18	15	0.01
2014	1352	-4.59	16	0.00
2015	1453	7.47	17	0.00
2016	1457	0.28	18	0.00
2017	1622	11.32	19	0.01
2018	1615	-0.43	20	0.00

### Top 10 Subject-wise distribution of research output

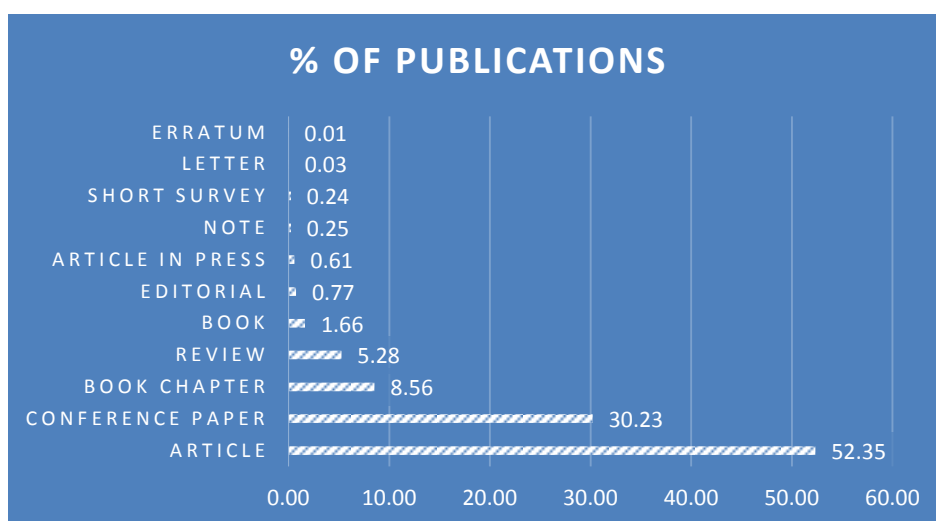
Figure 1 depicts the subject wise distribution of research output on Information and Communication Technology research covering the period (1999-2018). On the observation of figure, it has been revealed that computer science accounted for the largest share (7345), followed by social sciences (71229), engineering (4130), business, management and accounting (2645), medicine (1637), economics- econometrics and finance(1104) etc., The septennial research reflected the core area of information and communication technology was computer science, social sciences and engineering during the period of study.



**Figure 1.** Top 10 Subject-wise distribution of research output

### Document wise distribution of research output

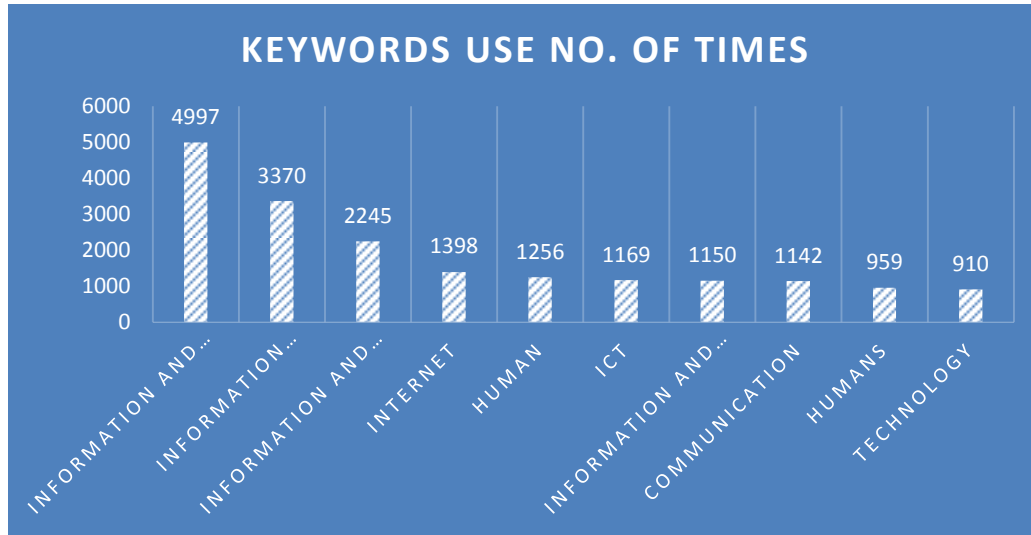
**Figure 2** shows the document wise distribution in Information and Communication Technology research output from the marked period (1999-2018). Out of a total 18382 publications, the maximum 9623 (52.35%) of research papers were ‘Article’ type document, followed by Conference paper 5557 (30.23%), Book chapter 1574 (8.56%), Review 970 (5.28%), Book 305 (1.66%) etc. Figure 2 also depicts the thinking of researchers for research papers published in which type of document and maximum scientists were preferred to publish their research result in the Journal.



**Figure 2.** Document wise distribution of research output

### Top 10 most significant keywords in ICT research publications

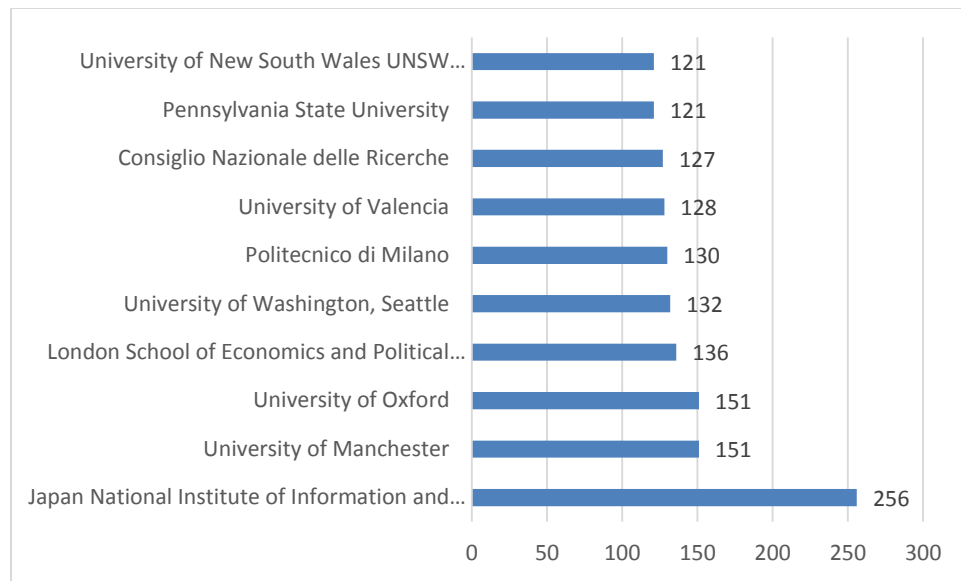
Figure 3 illustrates the top 10 most significant keywords in Information and Communication Technology research. Information and Communication Technologies was seen as the most significant keyword in terms of number of research papers it retrieved (4997), followed by Information Technology (3370), Information and Communication Technology (2245), Internet (1398), Human (1256), ICT (1169), Information and Communications Technology (1150), Communication (1142), Humans (959), and Technology (910) during the period (1999-2018).



**Figure 3.** Top 10 most significant keywords in ICT research publications

### Top 10 organizations in ICT research output

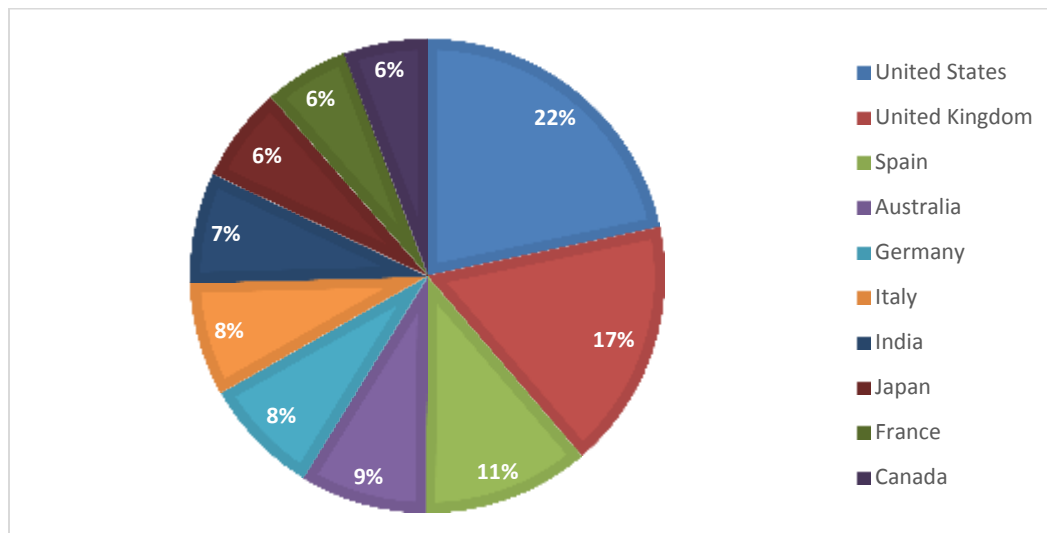
Figure 4 depicts the top 10 most productive organizations in Information and Communication Technology research and found that the average of (145.3) research papers per organization: Japan National Institute of Information and Communications Technology (256 papers), University of Manchester and University of Oxford (151 papers each), London School of Economics and Political Science (136 papers), University of Washington, Seattle (132 papers), Politecnico di Milano (130 papers), University of Valencia (118 papers), Consiglio Nazionale delle Ricerche (127 papers), Pennsylvania State University and University of New South Wales UNSW Australia (121 papers each). The maximum papers were contributed by JNICT while the minimum PSU and UNSW during the period of study.



**Figure 4.** Top 10 organizations in ICT research output

### Top 10 countries in ICT research output

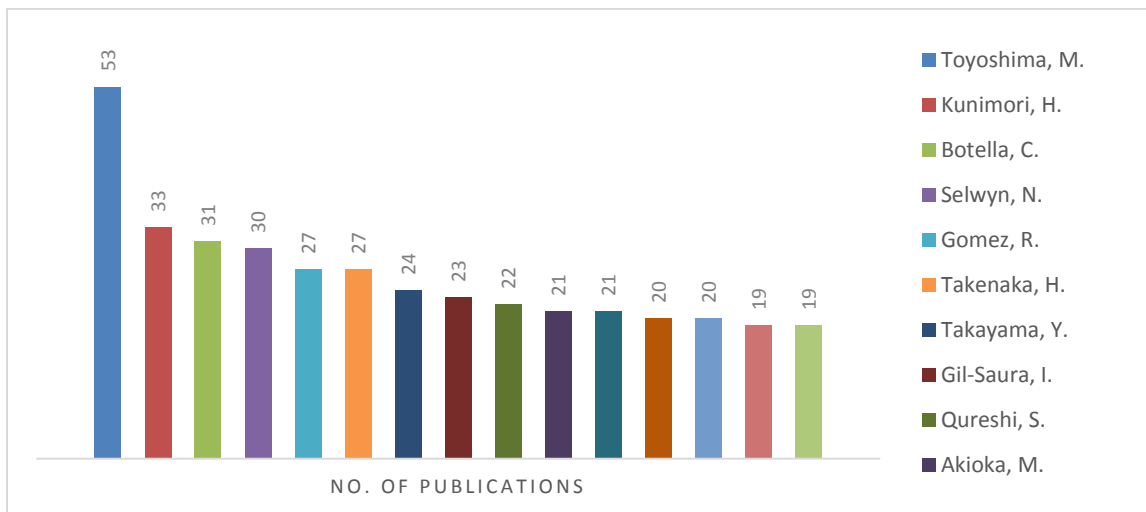
Figure 5 illustrates the top 10 most productive country in Information and Communication Technology research output in which a maximum (22% papers) of research papers were contributed by the United States, followed by United Kingdom with (17% papers) of research papers contributions, Spain (11% papers), Australia (9% papers), Germany (8% papers), Italy (8% papers), India (7% papers), Japan, France, Canada with (6% papers each) contributed during the period of study.



**Figure 5.** Top 10 countries in ICT research output

### Top 15 authors name in ICT research output

Figure 6 depicts the top 15 most productive authors in information and communication technology research during the period (1999-2018). The maximum 53 publications were contributed by Toyoshima, M., followed by Kunimori, H. with 33 contributions, Botella, C. (31 papers), Selwyn, N. (30 papers), Gomez, R. and Takenaka, H. (27 papers each), Takayama, Y. (24 papers), Gil-Saura, I. (23 papers), Qureshi, S. (22 papers), Akioka, M. and Mouftah, H.T. (21 papers each), Gagnon, M.P. and García-Peñalvo, F.J. (20 papers each), Koyama, Y. and Sawyer, S. (19 papers each) during the period of study.



**Figure 6.** Top 15 authors name in ICT research output

### Relative Growth Rate and Doubling Time of publications in ICT research

Table 3 illustrates the relative growth rate and doubling time in information communication technology research publications during the period (1999-2018). The scientists have applied the relative growth rate (RGR) model which is given by (Mahapatra, 1985)<sup>6</sup> to analyse the growth rate of contribution by the researchers. The relative growth rate increases in the number of publications or pages per unit of time. It also measured the specified period of the interval for the following equations.

Where,

- RGR = Growth Rate over the specific period of the interval,
- W1 =  $\text{Log}_e$  (natural log of the initial number of publications)
- W2 =  $\text{Log}_e$  (natural log of the final number of contributions)
- T1 = the unit of initial time
- T2 = the unit of the final time

Doubling time indicator used for evaluates the growth rate of papers published, there is a direct equivalence that exists between the RGR and DT, this model is given by (Mahapatra, 1985)<sup>6</sup>. The doubling time model indicates that if the number of contributions or pages of a subject doubles from the marked period of study, then the difference between the logarithm of the numbers at the starting and at the end of the specified period must be number 2. If one uses a natural logarithm, this difference has a value of 0.639. According to (Beaie, 2009)<sup>7</sup> doubling time is, “The number of years required for the population of an area to double its present size, given the current rate of population growth.” The doubling time for contributions can be measured by using the following formula.

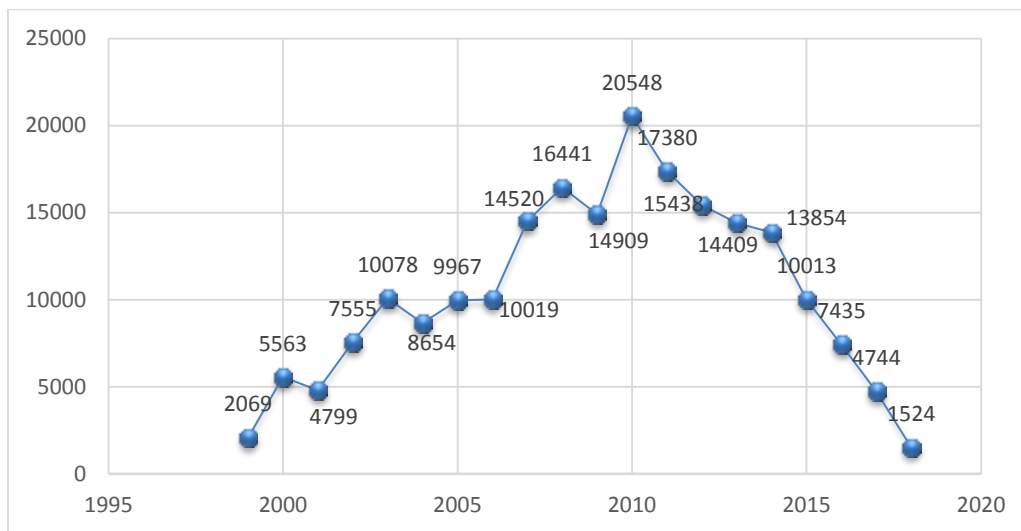
On the observation of the particular table, it has been shown that the relative growth rate was recorded in decreasing trend i.e. (0.92 – 0.09) and during the period of study some years it was fluctuating while the doubling time was opposite, it was recorded in an increasing figure i.e. (0.75 – 7.54) and some years it also in fluctuating trend. The overall data of relative growth rate and doubling time was shown in below table 3.

**Table 3.** Relative Growth Rate and Doubling Time of publications in ICT research

Year	No. of Publications	Cumulative Sum	W1	W2	RGR	Dt
1999	115	115	0	4.74	0	0
2000	174	289	4.74	5.67	0.92	0.75
2001	214	503	5.67	6.22	0.55	1.25
2002	291	794	6.22	6.68	0.46	1.52
2003	357	1151	6.68	7.05	0.37	1.87
2004	399	1550	7.05	7.35	0.30	2.33
2005	601	2151	7.35	7.67	0.33	2.11
2006	670	2821	7.67	7.94	0.27	2.56
2007	802	3623	7.94	8.20	0.25	2.77
2008	1147	4770	8.20	8.47	0.28	2.52
2009	1020	5790	8.47	8.66	0.19	3.58
2010	1264	7054	8.66	8.86	0.20	3.51
2011	1160	8214	8.86	9.01	0.15	4.55
2012	1252	9466	9.01	9.16	0.14	4.88
2013	1417	10883	9.16	9.29	0.14	4.97
2014	1352	12235	9.29	9.41	0.12	5.92
2015	1453	13688	9.41	9.52	0.11	6.18
2016	1457	15145	9.52	9.63	0.10	6.85
2017	1622	16767	9.63	9.73	0.10	6.81
2018	1615	18382	9.73	9.82	0.09	7.54

### Year-wise distribution of citations

Figure 7 depicts the year wise distribution of citations in information communication technology research during the period of the last 20 years i.e. (1999-2018). The citation counts are an indicator of the influence research has had on the larger scientific community. Out of a total 18382 publications a total 209919 of citations were found in which a maximum 20548 (9.79%) of citations were recorded in the year 2010, followed by 17380 (8.28%) of citations were found in 2011 and 16441 (7.83%) of citations were recorded in the year 2008. The whole data of year wise distribution of citations has been shown in below figure 7.



**Figure 7.**Year-wise distribution of citations

### Year-wise distribution of Authorship Pattern

Table 4 shows the year wise distribution of authorship pattern in information and communication technology research publications from the marked period (1999-2018). On the observation of table 4, it was found that out of a total 55913 authors, the maximum 5058 papers published by two authors, followed by 4733 publications with single author, and 3974 research papers were published by three authors, 2186 research papers were contributed by four authors while 39962 publications were contributed by more than four authors.



**Table 4.**Year-wise Authorship Pattern

Year	Single Author	Two Authors	Three Authors	Four Authors	More than Four Author	Total
1999	55	33	10	7	140	245
2000	91	54	18	7	181	351
2001	94	70	29	13	223	429
2002	133	80	43	20	356	632
2003	155	107	50	29	458	799
2004	147	127	55	36	600	965
2005	218	170	107	55	943	1493
2006	214	221	116	62	1055	1668
2007	241	261	147	78	1378	2105
2008	291	359	236	164	2051	3101
2009	277	299	234	109	1837	2756
2010	344	373	269	146	2493	3625
2011	311	325	267	133	2329	3365
2012	305	324	297	156	2791	3873
2013	345	369	337	173	3241	4465
2014	302	357	309	189	3142	4299
2015	308	395	339	189	3706	4937
2016	300	369	360	186	3959	5174
2017	327	369	374	169	4364	5603
2018	275	396	377	265	4715	6028
<b>Total</b>	<b>4733</b>	<b>5058</b>	<b>3974</b>	<b>2186</b>	<b>39962</b>	<b>55913</b>

### Degree of Collaborations

Table 6 shows the degree of collaborations of authors in information and communication technology research. The degree of collaboration gives the proportion of multiple authored contributions, as calculated of the strength of collaboration in a discipline. The DC lies between 0 and 1, it can be interpreted as a degree. The degree of collaboration (DC)= 1 for maximal collaborations. (K. Subramanyam, 1983)<sup>8</sup> is given the DC formula to determine the degree of author collaboration in quantitative terms.

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Out of a total of 55913 authors, a single-authored paper was 4733 while the multiple authored publications were 51180 during the period of study. The average degree of collaboration (DC) was (0.92) recorded. It is also found that the DC has been shown in the fluctuating trend and it slightly increased year by year.

**Table 6.** Degree of Collaborations

Year	Single Authored Publications (Ns)	Multiple Authored Publications (Nm)	Degree of Collaboration (DC)= Nm/(Nm+Ns)
1999	55	190	0.78
2000	91	260	0.74
2001	94	335	0.78
2002	133	499	0.79
2003	155	644	0.81
2004	147	818	0.85
2005	218	1275	0.85
2006	214	1454	0.87
2007	241	1864	0.89
2008	291	2810	0.91
2009	277	2479	0.90
2010	344	3281	0.91
2011	311	3054	0.91
2012	305	3568	0.92
2013	345	4120	0.92
2014	302	3997	0.93
2015	308	4629	0.94
2016	300	4874	0.94
2017	327	5276	0.94
2018	275	5753	0.95
<b>Total/Average</b>	<b>4733</b>	<b>51180</b>	<b>0.92</b>

### Collaboration Coefficient, Modified collaboration coefficient and Collaborative Index of authorship pattern

Table 6 depicts the collaboration coefficient, Modified collaboration coefficient and collaborative index of author's pattern-ship in information and communication technology research from (1999-2018). (Ajiferuke, Burrell and Tague, 1988)<sup>9</sup> suggested collaborative coefficient and it is used by (Karki and Garg, 1997)<sup>10</sup>. It is very helpful to remove the shortcomings pertaining to CI and DC. The CC every time lies between 0 and 1.

$$\frac{\sum_{j=1}^A \binom{1}{j} f_j}{\sum_{j=1}^A \binom{1}{j}}$$

Where,

“j = the number authors in an article i.e. 1, 2, 3 .....

f<sub>j</sub> = the number of j authored articles

N = the total number of articles published, and

A = the total number of authors per articles”

Thus, table 6 is calculated by the using above formula thus:

CI for 1999 is

$$\frac{\sum_{j=1}^A \binom{1}{j} f j}{(-55) + (-33) + (-10) + (-7) + (-140)}$$

Similarly, the value of CC is calculated for all the corresponding years.

### Modified collaboration coefficient

The new measuring technique is almost the same as that of CC, MCC is also given by (Ajiferuke, Burrell and Tague, 1988)<sup>9</sup>. In this indicator, it is found that if a paper has a single author, the author receives one credit, with two authors, each receives ½. MCC value lies between 0 and 1. Since 0 corresponds to single authorship, define the MCC.

Thus, table 6 is calculated by the using above formula thus:

MCC for 1999 is

$$\begin{aligned} & \left( \text{---} \right) \left\{ 1 \frac{\sum_{j=1}^A \left( \frac{1}{j} \right) f_j}{\text{---}} \right\} \\ & \left( \text{---} \right) \left\{ 1 \frac{\left( \text{---} \text{ } 55 \right) + \left( \text{---} \text{ } 33 \right) + \left( \text{---} \text{ } 10 \right) + \left( \text{---} \text{ } 7 \right) + \left( \text{---} \text{ } 140 \right)}{\text{---}} \right\} \\ & \quad ) \left\{ 1 \text{---} \right\} \\ & \quad ) \left\{ 1 \text{---} \right\} \\ & \quad ) \{ 1 \quad 43 \} \end{aligned}$$

Similarly, the value of MCC is calculated for all the corresponding years.

## Collaborative Index

Collaborative index formula is given by (Lawani, 1980)<sup>11</sup>. CI is a calculate of the average number of authors per paper, it has no upper limit and can't be expressed as a (%). Single authored publications give a non-zero, which involve no collaboration. The collaborative index is defined as (CI), recreate as:

$$\frac{\sum}{N}$$

Where,

“j = the number authors in an article i.e. 1, 2, 3 .....

fj = the number of j authored articles

N = the total number of articles published, and

A = the total number of authors per articles”

Hence, table 6 is calculated by the using above formula thus:

CI for 1999 is

$$\frac{\sum}{N}$$

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Similarly, the value of CI is calculated for all the corresponding years.

The average collaboration coefficient and Modified collaboration coefficient was the same i.e. (0.69) recorded while the average collaborative index was (4.21) recorded. The maximum CC, MCC and CI was shown in increasing trend and also found that it was in fluctuating trend the overall data of collaboration coefficient, modified collaboration coefficient and collaborative index of authorship pattern has been shown in below table 6.

**Table 6.** Collaboration Coefficient, Modified collaboration coefficient and Collaborative Index of authorship pattern

Year	Sing le Aut hor	Two Auth ors	Three Auth ors	Four Auth ors	4<	Total	Collabora tion Coefficien t (CC)	Modified Collaborati on Coefficient (MCC)	Collabo rative Index (CI)
1999	55	33	10	7	140	245	0.57	0.58	3.59
2000	91	54	18	7	181	351	0.54	0.54	3.38
2001	94	70	29	13	223	429	0.57	0.57	3.47
2002	133	80	43	20	356	632	0.58	0.58	3.61
2003	155	107	50	29	458	799	0.59	0.60	3.66
2004	147	127	55	36	600	965	0.63	0.63	3.84
2005	218	170	107	55	943	1493	0.64	0.64	3.89
2006	214	221	116	62	1055	1668	0.65	0.65	3.91
2007	241	261	147	78	1378	2105	0.66	0.66	3.99
2008	291	359	236	164	2051	3101	0.68	0.68	4.07
2009	277	299	234	109	1837	2756	0.67	0.67	4.06
2010	344	373	269	146	2493	3625	0.68	0.68	4.12
2011	311	325	267	133	2329	3365	0.68	0.68	4.14
2012	305	324	297	156	2791	3873	0.70	0.70	4.24
2013	345	369	337	173	3241	4465	0.70	0.70	4.25
2014	302	357	309	189	3142	4299	0.71	0.71	4.28
2015	308	395	339	189	3706	4937	0.72	0.72	4.33
2016	300	369	360	186	3959	5174	0.72	0.72	4.38
2017	327	369	374	169	4364	5603	0.72	0.72	4.41
2018	275	396	377	265	4715	6028	0.73	0.73	4.45
<b>Total/ Average</b>	<b>4733</b>	<b>5058</b>	<b>3974</b>	<b>2186</b>	<b>39962</b>	<b>55913</b>	<b>0.69</b>	<b>0.69</b>	<b>4.21</b>

### Co-authorship Index in Information and Communications research publications

Table 7 shows the co-authorship index in information and communication technology research publications from the marked period of study. On the observation of the particular table, it has been shown that the maximum CAI(306.27) recorded in single author in the year 2000, Two authors CAI was (180.37) recorded in the year 2001, three authors CAI was (119.46) found in 2009 and four authors CAI (135.27) recorded in 2008 while five and more than five authors CAI was (109.44) recorded in the year 2018 during the period of study.

In order to calculate the pattern of Co-Authorship Index (CAI) and how it has been different from the marked period of study, the following formula of Co-authorship Index was used (Subramaniam, 1983)<sup>8</sup>.

$$CAI = \{(N_{ij}/N_{io}) / (N_{oj}/N_{oo})\}$$

Where,

$N_{ij}$  = number of papers having j authors in block i

$N_{io}$  = Total output of block i

$N_{oj}$  = number of papers having j authors for all blocks

$N_{oo}$  = Total number of papers for all authors and all blocks

J = 1, 2, 3.....

**Table 7.** Co-authorship Index in Information and Communications research publications

Year	Single Author	CAI	Two Authors	CAI	Three Authors	CAI	Four Authors	CAI	4< Authors	CAI	Total
1999	55	265.20	33	148.90	10	57.43	7	73.08	140	79.95	245
2000	91	306.27	54	170.07	18	72.15	7	51.01	181	72.15	351
2001	94	258.85	70	180.37	29	95.11	13	77.51	223	72.73	429
2002	133	248.61	80	139.93	43	95.73	20	80.94	356	78.81	632
2003	155	229.17	107	148.04	50	88.05	29	92.84	458	80.20	799
2004	147	179.96	127	145.48	55	80.19	36	95.42	600	86.99	965
2005	218	172.49	170	125.87	107	100.83	55	94.22	943	88.37	1493
2006	214	151.56	221	146.46	116	97.85	62	95.07	1055	88.50	1668
2007	241	135.25	261	137.06	147	98.25	78	94.78	1378	91.59	2105
2008	291	110.86	359	127.98	236	107.08	164	135.27	2051	92.54	3101
2009	277	118.73	299	119.93	234	119.46	109	101.16	1837	93.26	2756
2010	344	112.11	373	113.75	269	104.41	146	103.02	2493	96.22	3625
2011	311	109.18	325	106.77	267	111.64	133	101.09	2329	96.84	3365
2012	305	93.03	324	92.48	297	107.89	156	103.02	2791	100.83	3873
2013	345	91.28	369	91.36	337	106.19	173	99.10	3241	101.56	4465
2014	302	82.99	357	91.80	309	101.13	189	112.45	3142	102.26	4299
2015	308	73.70	395	88.44	339	96.61	189	97.92	3706	105.03	4937
2016	300	68.50	369	78.84	360	97.90	186	91.95	3959	107.06	5174
2017	327	68.95	369	72.80	374	93.92	169	77.15	4364	108.98	5603
2018	275	53.89	396	72.62	377	87.99	265	112.44	4715	109.44	6028
<b>Total</b>	<b>4733</b>	<b>100.00</b>	<b>5058</b>	<b>100.00</b>	<b>3974</b>	<b>100.00</b>	<b>2186</b>	<b>100.00</b>	<b>39962</b>	<b>100.00</b>	<b>55913</b>

### Lotka's Law of Scientific Productivity

Table 8 depicts the Lotka's law of scientific productivity in information and communication technology research literature during the period (1999-2018). Alfred J. Lotka was a mathematician, a supervisor of mathematical research in the Statistical Bureau of the Metropolitan Life Insurance Company from 1924 to 1933 (Debus, 1968)<sup>12</sup>. It was around this time, that his definitive work, later called Lotka's law originated. Lotka's law is based on a correlation between the numbers of authors and their publications. On the observation of the particular table, it was found that in single-authored paper no. of observed authors and no of expected authors were same i.e. 4733 (8.46%) while the two authored research papers were observed 5058 (9.05%) and 4431 (7.93%) authored expected and three authors observed 3974 (7.11%) and 4264 (7.63%) author expected. So it is analysed that the numbers of authors observed are somehow different from the numbers of authors expected.

Where,

X = Number of Publications

Y = Relative Frequency of Authors with X publications

C = Constants depending on the specified field

Putting the value in above equation,

X = 1, Y = 4733 then,

We get,  $4733 = C / 1^n$

$$C = 4733 \times 1^n$$

$$C = 4733$$

Again putting the value of

X = 2, Y = 5058, and

$$C = 4733$$

$$5058 = 4733 / 2^n$$

$$2^n = 4733 / 5058, \quad = 0.936$$

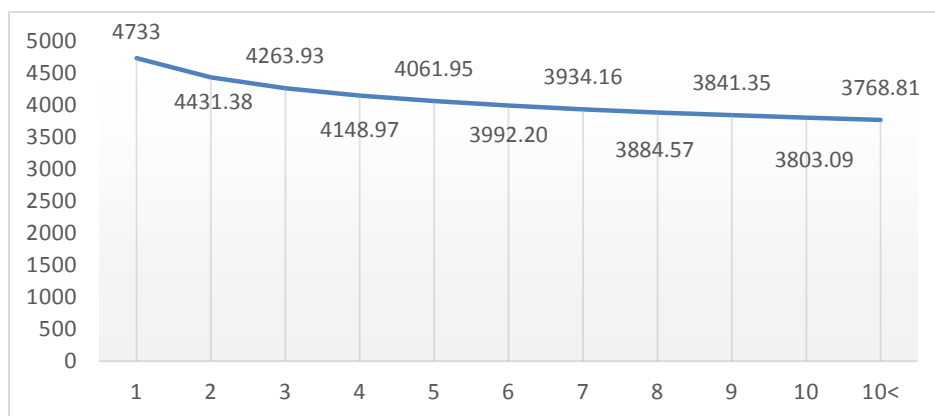
Taking Log on both sides,

$$n \log 2 = \log 0.936$$

$$n = 0.095$$

**Table 8.** Lotka's Law of Scientific Productivity

No. of Articles (X)	No. of Authors Observed (Y)	Percentage (%) (Observed)	No. of Authors Expected (n=0.095)	Percentage (%) (Expected)
1	4733	8.46	4733	8.46
2	5058	9.05	4431	7.93
3	3974	7.11	4264	7.63
4	2286	4.09	4149	7.42
5	1141	2.04	4062	7.26
6	663	1.19	3992	7.14
7	379	0.68	3934	7.04
8	234	0.42	3885	6.95
9	141	0.25	3841	6.87
10	113	0.20	3803	6.80
10<	37191	66.52	3769	6.74

**Figure 8.** Lotka's Law of Scientific Productivity

## Conclusion

The present study analysed and evaluated the information and communication technology research publications during the period (1999-2018). Information and Communication Technology covers all the area of any discipline subjects. According to (O'Connor & Voos, 1981)<sup>13</sup>, "The promise of providing a theory that will resolve many practical problems. It is claimed that patterns of author productivity, literature growth rates and related statistical distributions can be used to evaluate authors, assess disciplines and manage collections." The study examines and applied various scientometrics parametersto find the objectives. After the analysis, it has been found that out of a total 18382 publications, a large number of share (8.82%) were published in the year 2017, followed by 2018 with (8.79%) of contributions by the authors while the maximum annual growth was (51.30) recorded in 2000. In the field of computer



science, the maximum (7345 papers) were published and the maximum 9623 (52.35%) type of publications were an article, followed by conference papers with 5557 (30.23%) while the most common keyword was Information and Communications Technology. In the geographical distribution, a maximum 256 research papers were contributed by Japan National Institute of Information and Communications Technology while the maximum publications contributed by the United States with (22%) of the whole publications. The most famous authors were Toyoshima, M. with 55 papers contributions in ICT research. The relative growth was shown in the decreased year by year while the doubling time was increased. The overall citations were 209919 recorded in the whole of the publications and the highest 20548 of citations were found in 2010. The maximum papers were contributed by joint-authored, followed by single authored in which a single-authored paper was 4733 while the multiple authored publications were 51180. The average degree of authors collaborations, collaboration coefficient, modified collaboration coefficient and the collaborative index was (0.92), (0.69), (0.69), (4.21) recorded respectively. After the calculated Lotka's law of scientific productivity, it was found that the observed authors are somehow different from the numbers of authors expected during the period of study.

## References

1. Gupta, B. M. and Dhawan, S. M. (2018). Artificial intelligence research in India: A scientometric assessment of publications output during 2007-16. *DESIDOC journal of library and information technology*, 38(6), 416-422.
2. Kumar, R. S and Kaliyaperumal, K. (2015). A scientometric analysis of mobile technology publications. *Scientometrics*, 105(2), 921-939.
3. Majid, S., Yun-Ke, C., Khine, H. N. A. M. M. W., and Wai, S. Y. (2015). Analyzing publishing trends in information literacy literature: A bibliometric study. *Malaysian Journal of Library and Information Science*, 20(2), 51-66.
4. Selvi, M. and Dhanavandan, S. (2014). A scientometric study on research output and literature growth of information literacy. *International Journal of Library and Information Studies*, 4(4),
5. Kumar, K. (2014). A scientometric study of digital literacy in online library information science and technology abstracts (LISTA). *Library Philosophy and Practice (e-journal)*.
6. Mahapatra, M. (1985). On the Validity of the Theory of Exponential Growth of Scientific Literature. In *Proceeding of the 15th IASLIC Conference, Bangalore*, 61-70.
7. Beatie, S. T., & Acol, P. (2009). Population and Demographic Measures: Concepts and Definitions for Basic MDG Indicators. Kingston Georgetown, Guyana: Bureau of Statistics. Retrieved from file:///C:/Users/welcome/Desktop/ Concepts\_and\_Definitions.pdf
8. Subramanianm, K. (1983). Bibliometrics Studies of Research Collaboration: A Review. *Journal of Information Science*, 6, 33-38.
9. Ajiferuke, I., Burrell, Q. & Tague, J. (1988). Collaborative Coefficient: A Single Measure of the Degree of Collaboration in Research, *Scientometrics*, 14, 421-433.

10. Karki, M.M.S. &Garg, K.C. (1997). Bibliometrics of Alkaloid Chemistry Research in India. *Journal of Chemical Information and Computer Sciences*, 37, 157-61.
11. Lawani, S.M. (1980). *Quality, Collaboration, and Citations in Cancer Research: A Bibliometric Study* (Unpublished Doctoral Thesis).Florida State University School of Information Studies, United States.
12. Debus, A.G. (Ed.) (1968). World Who's Who in Science: A Biographical Dictionary of Notable Scientists from Antiquity to the Present, Western Publishing Company: Hannibal, MO.
13. O'Connor, D. and Voos, H. (1981). Empirical Laws, Theory Construction and Bibliometrics. *Library Trends*, 30(1), 9-20.

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# Open Standards and Protocols for Sustainable Digitization, Preservation and Retrieval

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## Abstract

Knowledge resources have been documented and preserved in the form of books, monographs, manuscripts, etc. and they are collected and managed by libraries, archives, and museums. Providing access to a larger community and preservation are the biggest challenges for these organizations. Digitization seems to offer the solution to secure these resources for future generations. This motivates libraries to create a digital information services platform. However, sustainable digitization, long-term preservation and retrieval largely depend on the application of standards and protocols in the digital process. This paper focuses on the importance of standards and protocols used for digitization in building digital library systems. With this aim it analyzes existing and established standards and protocols used for digitization and building a digital library system. It argues for critical examination of these with the aim of developing sustainable standards and protocols through open standards and tools to facilitate long-term preservation and retrieval in view of the challenge of technology. It is argued that Open Access Software and interoperability, together with these standards and protocols are the key to meeting this challenge.

## Keywords

Sustainable Digitization; Interoperability; Digital Library; Open Standards and Protocols; Metadata Standards

## Introduction

In the last few decades, the focal point of the libraries has been computerization of information services and creation of digital libraries. The integrated library software (ILS), until recently, provided access to bibliographical detail to locate the document physically. A digital library collection is developed by integrating born-digital contents such as online journal articles,

digital books and digitizing available print content through scanning as images or text by Optical Character Recognition (OCR).

Standards and protocols for digitization, preservation, and retrieval of digital contents are essential tools for a digital library system. When preserving and exchanging knowledge resources, these standards play an important role to make metadata interoperable and help in assisting unwanted variations in the metadata. Also, when an internet user retrieves these records in standard format it allows for a link to these records to directly harvest these in their database and linking its various indexing and abstracting library services. Therefore it is important that sustainable digitization and interoperability for data preservation and exchange are and should be achieved only by applying established standards and protocols.

As digital information is fragile in nature and at a high risk of loss, access to digital resources hugely depends on the preservation of the images/ text and the metadata (BRTF: 2010)<sup>2</sup>. Sustainable digitization broadly deals with the digital preservation of digital images and electronic resources constantly, till its continued accessibility is ensured along with the conservation of metadata (Calzolari, Marco Camisani: 2016)<sup>3</sup>. While data is searched across computer systems, interoperability facilitates search and harvesting of metadata from the repository system. These are very important elements in creating digital library systems to make resources accessible across the globe (Mukhopadhyay, Parthasarthi: 2015)<sup>10</sup>.

### ***Standards and Protocols***

Standards are accepted norms in relative assessment and enable sharing, collaborating, and exchange of information and products. There is need for a technical document such as Guidelines or a Handbook which may be prepared by wide consultation with interested parties and modified repeatedly till consensually accepted in their working by both producers and users. While software standards deal with communication interfaces and data exchange, operates remotely on secure network achieving interoperability among the systems. (CEN, European Committee for Standards). There are standards which are followed by and at national, regional, international and professional association levels such as 'Institute of Electrical and Electronic Engineer (IEEE)', 'International Organization for Standards (ISO)', 'US National Information Standards Organization (NISO)'.

While protocols are prescribed, various steps are to be followed by organizations associated with digital resource building in order to achieve uniformity. Computer protocols deal with computer hardware and software application to communicate with each other and exchanging information across. When these protocols are accepted by a large section, especially by international organizations these emerge and are considered to be setting the standards. On the whole, the objective of standards and protocols is to work together to achieve interoperability and sustainability.

Open Source Initiatives (OSI) have aimed to promote increase in the usage of open-source software, open data, and open standards to make use, modify, and distribution of the original design to achieve transparency and enable learning of new technologies by the community over two decades. Similarly, open standards are technical standards which are open and accessible to the community to review and make use of them. 'Open standards' are 'standards made available

to the general public and developed (or approved) and maintained via a collaborative and consensus-driven process'. These Open Standards facilitate interoperability and data exchange among different products or services and are intended for widespread adoption' (International Telecommunications Union, 2013)<sup>7</sup>.

### **Advantages of Standards and Protocols**

As earlier mentioned, the adoption of standards enhances sustainability and interoperability of the products, services, and process. They also help to adopt best practices among prevailing similar activities. Adoption of Open Standards (OS) by organizations varies; with some of the following reasons being common and important:

- Cost is the main reason especially for a small organization to adopt and use open standards;
- OS being accessible to all removes many barriers and allows various partners to adopt them;
- OS are found to be more efficient, modifiable and free from bugs;
- Since OS are developed and designed by the community, they are and can be further improved on the basis of feedback by the larger community.

### **Objective of the Research Paper**

Digitization of knowledge resources is taking place on a large scale all over, especially by heritage organizations. These resources are available in a wide variety of formats. The digital library system is created for digital preservation, management, and retrieval. This paper seeks to explore ways in which these digital resources can be preserved for a longer period even as digital technology changes rapidly. It examines what are the ways in which open standards and tools for digitization, preservation and retrieval can allow for creating a sustainable digital library system. It also aims to explore standard output formats that can be further utilized for exchange and building up these resources and information services.

### **Literature Review**

Standards for digitization, metadata, and tools for access facilitate sharing of heritage resources as also their preservation for future generations to make use of. Application of these standards in the process of digitization of cultural heritage is very important for organizations i.e. libraries, archives, and museums to facilitate compliance and interoperability with newer technology of hardware and software. Adherence to the standards also enables organizations to be audited and certified (Madanan, Mukesh; Hussain, Nomila and Adeel Ahmad Khaliq: 2018)<sup>9</sup>.

This paper attempts to review the research work carried out in the field of digitization, preservation, and retrieval of knowledge resources and the applications of the open standards and tools. For this purpose selective and significant studies in the Indian context have been identified and reviewed with reference to the following aspects:

### ***Digitization Standards and Practices***

In India, many organizations have taken initiatives to digitize their knowledge resources for better and wider access to its users. While reviewing these initiatives, it was found that several problems, barriers and challenges are faced by Indian organizations. This is with regard to digitization policy which should be inclusive of issues of technical infrastructure, standards, benchmark and guidelines. Sustainability issues need to be addressed by preparing long term strategies concerning technical, social, financial and manpower issues (Dasgupta, Kalpana: 2005)<sup>4</sup>.

The process of digitization starts with the scanning of documents which involves making it digital through OCR or image format. Various types of hardware, such as a scanner or digital cameras and software for supporting scanning process of image or text are used, along with the output file format type such as HTML, SGM, PDF, etc. To manage data with reference to the digital document, the Dublin Core metadata standard is a preferred choice in the Indian context (Swan, Dilip K: 2009)<sup>14</sup>.

There is a workflow process and steps such as scanning, editing, analyzing, and OCR are followed to make the entire process systematic. Further, there are issues related to digital preservation such as obsolescence of technology, hardware and software infrastructure. Skilled manpower and capacity building should also be addressed as part of the whole process of digitization (Bandi, Sekhar; Angadi, Mallikarjun, and Shivarama, J: 2015)<sup>1</sup>.

### ***Standards for Digital Preservation***

Digital preservation is defined by the 'Digital Preservation Europe Project as a set of activity required to make sure digital objects can be located, rendered, used and understood in the future. Digital preservation has to address two major problems i.e. physical deterioration and digital obsolescence'.

Along with the digital resources, metadata also needs preservation. Heritage resource metadata is multifaceted and complicated because of the diversity of documents, in which many of them are digitized while some are born digitally. A majority of metadata standards have been created and the majority of them are based on Dublin Core. Some advanced metadata schemas have developed in view of the development of web technologies such as 'Encoding Archival Coding (EAD)', 'Metadata Object Description Schemas (MODS)' etc. but all these schemas are different in scope and based on different information needs (Papatheodorou, Christos: 2012)<sup>11</sup>.

To ensure long term preservation and access in the future, standard metadata is mandatory in this process. 'Science and Technology in Archeology Research Centre (STARC)' metadata schema is divided into three major categories: initially in descriptive metadata - general information of



each type of documents with file format, file size, resolution, height, width etc. While in official data it provides internal and external record data such as name, external source catalogue, ID, metadata provenance, editor of metadata, editing data, language, and rights etc. (Ronzino, Paola and Hermon, Sorin: 2014)<sup>13</sup>.

A large scale of heritage collection has already been digitized and hosted for wider access and a majority of them are not accessible through Internet. These are in 3D format, picture, visuals, and audio and making OCR is an expensive task which is sometimes not financially affordable. It is advisable that major heritage aggregators make re-use of the indexed techniques applied by the Internet search engine. This can bring down sustainability costs and will increase access to the user across nations over the Internet (Freier, Nuno; Calado, Pavel and Martins, Bruno: 2018)<sup>5</sup>.

### ***Standards and Tools for Retrieval***

Searching and retrieving digital heritage resources need standard and capable protocols on the Internet. It requires development and use of metadata standards, without which finding these resources would be next to impossible. In the present scenario, the user expects both bibliographical catalogue and along with it full-text content retrieval.

Standards play a very important role in all four types of metadata for different reasons, especially for search and retrieval system. Qualitative and standards metadata ensure that the user gets maximum data to meet the users' requirements. Its output from metadata also needs to have a standard output layout with consistency (Pfister, Robin)<sup>12</sup>.

Also, there are prevailing Internet information retrieval protocols such as WWW and Gopher. These protocols facilitate users to search the information from web-servers to meet their information requirements. Apart from this, there are information retrieval standards such as Z39.50 which provide many more features which are available in Internet protocols (Kong, Qinzhen and Gottschalk, John)<sup>8</sup>.

There are two newly evolved standards i.e. Metadata Object and Description Scheme (MODS), a MARC compatible XML scheme for encoding descriptive metadata along with the source document; and Metadata Encoding and Transmission Standards (METS), based XML scheme for encoding descriptive metadata which enables the retrieval and preservation of digital reservation (Guenther, Rebecca and McCallum, Sally: 2003)<sup>6</sup>.

## **Standards and Tools for Digital Library Management**

The success of any digital library system depends largely on the application of standards and protocols and the quality and consistency make possible sustainable digitization, interoperability, exchange of resource records between the digital libraries systems. Therefore uniformity in standards and protocols are essential qualifications to meet the above objectives. This paper discusses various standards and protocols, which are important for any digital library system. It

explains three major standards and protocols related to digitization and file formats, preservation of metadata, and information retrieval.

### ***Digitization and standard formats***

The most important part of any digital library system is to develop digital resources. These digital data are either born-digital such as e-journals, e-books, and e-databases or drawn from a library's print collection that has to be digitized. Digitization is basically a reproduction of the print material into digital form. Digitization of available resources in the library collection is a fundamental and essential job for the development of a digital library.

Conversion of a print document into digital format can be saved as image or text-file using Optical Character Recognition (OCR) method. Both the file formats have their pros and cons. Text-file supports searching within the documents and occupies less disk space, while image conversion is simple and economical and neatly maintains the original look of the document but occupies larger disk space. When an image is captured through a scanner or digital camera, image quality depends on resolution, the bit depth of the image, the enhancement of image and the compression applied. Some of the specifications for scanned images follow:

Type of Material	Raw Master Image	Bit depth	Clean Master Image	Access Image
Manuscripts	TIFF (Uncompressed) 300 dpi minimum	24	TIFF (Compressed) 300 dpi (output) Group 6 CCITT	JPEG/ PDF-A
Printed Books	Tiff (Uncompressed) 300 dpi (output)	24 bit	TIFF (Compressed) 300 dpi (output) Group 6 CCITT	JPEG/ PDF-A
Photographs b/w Photographs	Tiff (Uncompressed) 300/ dpi (output)	24 bit 8 bit	TIFF (Compressed) 300 dpi (output) Group 6 CCITT	JPEG/ PDF-A

### **NAMAMI Guidelines for Digitization of Archival Material<sup>15</sup>**

Tagged Image File Format (TIFF) is de facto standard for grey, black and white and a color image is a preferred format as a master file for preservation. Joint Photographic Experts Group (JPEG) is the file format which is normally used by photographic cameras and easy for uploading but the drawback of JPEG is that it loses some data when it is compressed. PDF-Archive (PDF-A) is a standard file format for archiving purpose. CCITT is a standard compression scheme for images. All these standards mentioned above are developed by the International Standards Organization (ISO), the International Telecommunications Union (ITU).

## ***Metadata and Preservation Standards***

The digital preservation standard metadata is necessary for long-term accessibility and interoperability among the digital library systems. It enables capturing of the metadata in structure format to describe the digital resource, along with relevant information along with technical information of file format, structure, etc. for access and preservation e.g. MARC21 and Dublin Core standards.

### ***Dublin Core***

It is the widely used metadata format which is internationally recognized as ISO standards and is XML-based format. Dublin core has a set of 15 core elements which includes: 'Title, Creator, Subject and Keywords, Description, Publisher, Contributor, Date, Resource Type, Format, Resource Identifier, Source, Language, Relation, Coverage, Rights Management'. These are subject metadata but in addition there is technical metadata which describes the feature of the digital image such as date on which created, image format, width, height, color mode etc.

### ***Metadata Encoding and Transmission Standard (METS)***

METS is the structure metadata standard and said to be the best format to be used for long-term preservation. It is also XML-based open standard and easy for applying as it supports various metadata preservation formats such as PREMIS (PREservation Metadata: Implementation Strategies). The METS have seven major sections such as Header, Descriptive Metadata Section, Administrative Metadata Section, File Section, Structural Map, Structural Link, and Behaviour Section.

### ***Metadata Object Description Scheme (MODS)***

MODS standards format is very popular and adopted generally by the user community because it is based on XML. It can contain more detailed and rich description than Dublin Core and other factors for its attractiveness are that it is also based on MARC21 so records from MARC21 formats are easily created in MODS format. This format is also reasonable usable and provides good descriptive metadata for digital .objects and is therefore preferred format for digital library system as it allows more specification with clarification.

## **Search and Retrieval Standards and Protocols**

Searching and retrieving digital heritage resources needs standard and capable tools on the Internet. It requires developing and using metadata standards without which finding these resources would be next to impossible. In the present scenario, users expect not only

bibliographical catalogue but along with that also full-text contents retrieval in the output format which can be re-used.

### **Z39.50**

Z39.50 protocol which is used for searching and retrieving bibliographical information from groups of databases. Since it searching library databases it is more powerful than the Internet searching engines. It is the official standard of ANSI/ NISO for information searching and retrieval which works under client and server environment it means the user must have installed it at the client machine before using. Z39.50 was originated as a protocol to search and retrieve records from the Library of Congress and OCLC bibliographical databases.

### ***Search/Retrieve Web Service (SRW) and Search/Retrieve via URL (SRU)***

These protocols are web-based services which essentially send requests for information from a client to a server and the server processes the query and generates output in an XML file format for the client. The Contextual Query Language (CQL) is used by SRU and SRW for sending the query to the server via URL. The output generated by the server in XML format is usage Representational State Transfer (REST) and Simple Object Access Protocol (SOAP).

### ***Open Archives Initiatives – Metadata Harvesting Protocol (OAI-PMH)***

It is widely accepted that metadata harvesting protocol enables digital library system interoperable. It is a service that facilitates streaming of metadata from source to the users' repository. It is very helpful for libraries, archives, and museums to develop their own in-house repository database using OAI-PMH protocol and provide current awareness services to its clientele. The main disadvantage of this protocol is that it lacks exact analysis of each field, which may cause inconsistency.

## **Conclusion**

The process of digitization and preservation of heritage knowledge is growing. For the sustainability of any digitization projects it is important that these be based on using standards for digitization, preservation and retrieval that makes it possible for organizations to provide for survival and migration or passage of data from one generation to another generation through compliance with new hardware and software while preserving resources for future generations. It is also important to understand the challenges and benefits of applying standards and protocols in the digital library system.

## References

1. Bandi, Sekhar; Angadi, Mallikarjun; Shivarama, J. (2015). *Best Practices in Digitization: Planning and Workflow Process*” IN Emerging Technologies and Future of Libraries: Issues and Challenges. pp. 332-339
2. Blue Ribbon Task Force on Sustainable Digital Preservation and Access (2010). *Sustainable Economics for a Digital Planet: Ensuring Long-term Access to Digital Information*.- La Jolla: The Organisation. 110p.
3. Calzolari, Marco Camisani (2016). *Digital Sustainability*. Technology. December 2016. <https://www.infrastructure-channel.com/technology/digital-sustainability/>
4. Dasgupta, Kalpana (2005). *Digitization, Sustainability and Access in the Indian Context*. Paper Presented at 71th IFLA General Conference and Council “World Library and Information Congress: Libraries - A Voyage of Discovery”, August 14th - 18th 2005, Oslo, Norway.
5. Freire, Nuno; Calado, Pavel; Martins, Bruno. (2018). *Availability of Cultural Heritage Structured Metadata in the World Wide Web*. HAL Ouvertes, June 2018, 11p.
6. Guenther, Rebecca and McCallum, Sally (2003). *New Metadata Standards for Digital Resources: MODS and METS*. Bulletin of the American Society for Information Science and Technology. December/ January 2003. pp.12-15
7. International Telecommunications Union (2013). *Definition of Open Standards*. Retrieved from <http://www.itu.int/en/ITU-T/ipr/Pages/open.aspx>
8. Kong, Qinzhen and Gottschalk, John (n.d.). *Information Retrieval Standards and Applications*.- Brisbane: CiTR, The University of Queensland. 11p.
9. Madanan, Mukesh; Hussain, Normaila and Adeel Ahmad Khaliq. (2018). *A study of the digitization process to preserve the culture and heritage of a civilization using natural language process and it's impact on the social, economic and scientific aspect*. Journal of Theoretical and Applied Information Technology, 96(16), 2018, pp.5550-5568.
10. Mukhopadhyay, Parthasarathi (2015). *Interoperability and Retrieval*.- Paris: United Nations Educational, Scientific and Cultural Organization. 160p.
11. Papatheodorou, Christos. (2012). *On Cultural Heritage Metadata*. International Journal of Metadata, Semantics and Ontologies, 7(3); pp. 157-161.
12. Pfister, Robin (n.d.). *The Role of Metadata Standards in EOSDIS Search and Retrieval Applications*.- Greenbelt: NASA/ Goddard Space Flight Center. 3p.
13. Ronzino , Paola; Hermon, Sorin. (2014). *A Metadata Schema for Cultural Heritage Documentation*”, 6p. Conference Paper, ResearchGate, [www.researchgate.net/publication/259786414](http://www.researchgate.net/publication/259786414)
14. Swan, Dilip K. (2009). *An Overview of Digitization of Information Resources*. Researchgate, <https://www.researchgate.net/publication/40910531>
15. Tripathi, Dipti S [Ed.]. (n.d.). *Guidelines for Digitization of Archival Material*.- New Delhi: National Mission for Manuscripts. 36p.

# Design and Development of Digital Archives for Bio-bibliographic Representation

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## Abstract

History of the Institute, especially information about people who inhabited will be of interest for everyone to read or listen to. When history holds archival importance, it gives pleasure to understand, as it has a pivotal role in future development. RRI (Raman Research Institute) founded by Sir CV Raman in 1948, embraces the history of the archival significance of the past 70 years. As science historians one may approach history in different ways, using different ideas and methods and prioritizing different aspects. To think on these lines of the history of RRI, Library has tried capturing the 3 'P' s - Profile, Publications, and Photographs of the early students of Raman Research Institute, who had the privilege to work with Sir C V Raman from 1948 to 1970. The paper describes the journey in capturing, collating and presenting the archival data in digital format on research students during Raman's era in the form of a bio-bibliographic database.

## Key Words

Raman students, Archival Data, Imprints collection, Digital Repository, Bio-Bibliographic database, Best Practices

## Introduction

Libraries are treasure houses of knowledge. Libraries around the globe are full of resources which include books, journals, manuscripts, films, images audiovisual materials etc. These materials of knowledge which are documented by individuals, experts, scientists, eminent writers and famous personalities in various fields have archival value. Archiving of this knowledge is the essence of all libraries and Information Centers.

The purpose of archiving is served only when the archived knowledge is read or used by the users. To increase the visibility and readability of archived resources, libraries and information centres need to showcase them in better ways to reach the targeted audience. In today's scenario, many libraries and knowledge centres use Information technology to maintain their websites on which all kind of material is made accessible along with its bibliographic details and also to promote the service they offer. This paper is an effort to showcase how important archival resources can be made to reach users across the globe with the help of a digital repository and library webpage.

The paper epitomizes the journey of capturing, collating and presenting the bio-bibliographic data on research students of Raman's era, which has high archival value. Sir C V Raman is considered as an iconic personality even today for his scientific temper and achievements both during pre and post independent era. This paper aims to capture the career trajectory of his research students and also describe the challenges involved in building a database to showcase the bio- bibliographic details of each one of them.

## History of RRI

Raman had a vision of a private Institute in which he could continue his scientific research after retirement from the Indian Institute of Science in 1948. To quote in Raman's words 'The Raman Research Institute was created by me in 1948 to provide a place in which I could continue my studies in an atmosphere more conducive to pure research than that is found in most scientific institutions. To me, the pursuit of science has been an aesthetic and joyous experience. The Institute (meaning RRI) has been to me a heaven where I could carry on my highly personal research work'<sup>2</sup>. Raman went about gathering people around him who would help him in realizing his dream.

Raman established the Institute named after himself in 1948 with a gift of his personal wealth, adjacent to the Indian Academy of Sciences which was established in 1934. Both Raman Research Institute and Indian Academy of Sciences were established by Raman for two different purposes in the land gifted by the Maharajah of Mysore.

Raman Research Institute embraces the history of the archival significance of the past 70 years. History of the Institute, especially information about people who inhabited will be of interest for everyone to read or listen to. When history holds archival importance, it gives pleasure to understand, as it has a pivotal role in future development.

As an extension of these requirements, we at Raman research Institute have designed and developed a database called 'Imprints Collection' in 2012 which is of archival value. This is done for the scientists who superannuate from RRI and this is still an ongoing activity. There was a proposal from a student of Sir C V Raman to build a Bio-bibliographic database exclusively for '**Students of Sir C V Raman**' on similar lines of 'Imprints Collection' during one of his visits to RRI in 2014. So, a project was initiated in this direction in 2016.

### ***Research Students of Sir C V Raman during 1948 to 1970 at RRI***

The Council of Scientific and Industrial Research granted several research scholarships namely, senior and junior scholarships carrying a stipend of Rs.200 and Rs.100 per month. Raman was looking for students to work at the institute supported by these scholarships. In 1950, Raman recruited seven research scholars, T.K. Srinivasan, a geologist with M.Sc. in geology from Mysore University; K.S. Viswanathan with a Master's degree in mathematics from Madras University; D. Krishnamurti with a B.Sc. (Hons.) degree in physics, also from Madras University; S. Chandrasekhar with an M.Sc. in physics from Nagpur; A.K. Ramdas and M.R. Bhat with B.Sc. (Hons.) in physics from Poona University; and S. Venkateswaran with a B.Sc. (Hons.) physics from Madras University and a professional certificate in communication engineering. Later in 1952, S. Pancharatnam with M.Sc. in physics from Nagpur joined as SRF. During the initial days at Raman Research Institute, there were 8 students and a Research Assistant and a technical assistant who are as represented in Table 1.

**Table 1.** List of Raman's Associates

<b>Name</b>	<b>Date of Joining</b>	<b>Positions held</b>	<b>Degree</b>	<b>Date of Leaving</b>
J Padmanabhan	1949	Technical Assistant		1984
A Jayaraman	1949	Research Assistant	B.Sc (Chemistry) Pachaiyappa's College, Madras	1960
T K Srinivasan	1950	Senior Research Scholar	M.Sc.(Geology), University of Mysore	1953
D Krishnamurti	1950	Senior Research Scholar	B.Sc. (Honors), Madras University	1961
K S Viswanathan	1950	Senior Research Scholar	MA (Mathematics), Madras University.	1961
S Chandrasekhar	1950	Senior Research Scholar	M.Sc (Physics), Nagpur University	1954
M R Bhat	1950	Junior Research Scholar	B.Sc (Physics), Pune University	1954
A K Ramdas	1950	Junior Research Scholar	B.Sc(Physics), Pune University	1956
S Venkateswaran	1950	Senior Research Scholar	B.Sc.(Physics), Madras University	1951
S Pancharatnam	1952	Senior Research Scholar	M.Sc.(Physics), Nagpur University	1961

S Venkateswaran and T K Srinivasan left RRI to pursue their career elsewhere within a short while. J Padmanabhan who was technical assistant did not publish any research paper although he contributed immensely to the science at RRI. So, his contribution could not be captured in this database. During 1948-70, number of research paper published were 99 by the 7 students of Raman. The data is represented in the below Table 2.

**Table 2.** List of Raman's Research Students

<b>Name</b>	<b>Research papers</b>
<b>D Krishnamurti</b>	27
<b>A Jayaraman</b>	19
<b>K S Viswanathan</b>	16
<b>S Pancharatnam</b>	15
<b>A K Ramdas</b>	11
<b>S Chandrasekhar</b>	7
<b>M R Bhat</b>	4



A bio-bibliographic database is designed and developed for the 7 students of Sir C V Raman. This is a prequel to 'Imprints –Collection' and hence it was named as 'Imprints Collection – Raman's Era'. Below paragraphs will describe the challenges, layout design and the technology in building a novel database of this kind to uphold the history of science in RRI since its inception, soon after Indian Independence.

## Collection of Information

Science historians one may approach history in different ways, using different ideas, methods and prioritizing different aspects. Thinking on the lines of the history of RRI, the project has captured the 3 'Ps' - Profile, Publications, Photographs of the early students of Raman Research Institute, who had the privilege of working with Raman from 1948 to 1970.

The project of building the bio-bibliographical database was started in 2016. Since this project is associated with students of Sir C V Raman who were a part RRI family up to 1970, data collection had to be dated back to seven decades. The publications data was available in RRI digital repository. That was the basic building block for the project to grow in multi directions. Information required for building the profile page was hard to collect. Also, access to current photographs and publications depended on various other factors. Out of the seven students who are considered here, four are deceased. Authors had to look for contacts who would give more information about them to build the database. One of the early students, Prof A Jayaraman, who is currently residing at the USA, visited RRI in 2016. Authors of this paper used this opportunity to explain to him about the project and its usefulness. He was willing to extend his support in building this database as he found the depth of archival value. He introduced authors to Prof. A K Ramdas and Dr. M R Bhat who are also current residents of America. So it was possible to get all the information from these three students of Sir C V Raman without much difficulty. However, a lot of back and forth emails had to be exchanged, doubts clarified and layout was designed.

Prof. Jayaraman introduced authors of this paper to the daughter of another student late. Prof. K S Viswanathan. Authors contacted her to get information and photographs for inclusion in the database. Late Prof. D Krishnamurthy's son was also contacted through an acquaintance to gather all the information required for the project. Information and Photographs of Prof. Pancharatnam were provided by their extended family members.

Prof. S Chandrasekhar who was the student of Sir CV Raman during (1950-1954), joined RRI in 1972 as a faculty and he was responsible for building a vibrant Liquid Crystals Research Group. He served up to 1999 and superannuated from RRI. Library of RRI had all the Information to build his profile page.

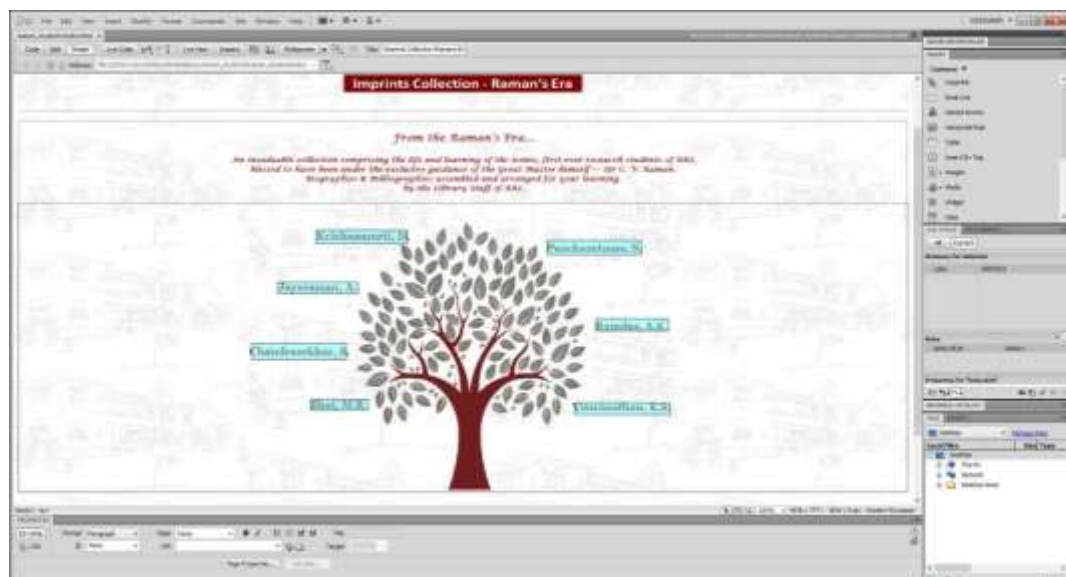
## Design of Digital archives for bio-bibliographic representation

The decision was taken to design the digital archives of the students of Sir C V Raman for bibliographical representation as a web based information retrieval tool. The baseline for designing the database is the digital repository of RRI. The database is named as 'Imprints collection – Raman's Era'. This information product has a unique style of representing the title page with a tree structure, which is designed using the Dreamweaver software.

Adobe Dreamweaver is proprietary software allowing the creation and development of Web sites. Dreamweaver is a WYSIWYG (What You See Is What You Get) compatible software which helps in seeing the results of formatting instantly, instead of the using the markups for formatting. This is quite similar to Microsoft word, unlike HTML which requires knowledge of coding. However, it also allows hand code HTML. Dream weaver supports CSS and Javascript as well as other languages including ASP and PHP. Dreamweaver makes it easy to upload an entire Web site to a Web server. Preview of the site can be viewed locally. Using this software template for the Web site can be created which can be modified and reused again and again.

Dreamweaver version CS5.5 is used for developing the title page of Imprints collection-Raman's Era. The title page is made interactive by using image map technique. An image map is an image that has been divided into regions, or 'hotspots'. An image map allows a regular image to serve as a type of navigation system. When a hotspot is clicked, an action occurs, for example, a new file opens. All the links in one image can be taken to the respective pages related to those items.

The image map created using a tree structure is depicted in Figure-1 given below. The purpose of choosing a tree structure as an image was indicative of Raman's strength as a teacher and researcher in molding the scholarship in his research students. Steps for creating the image map are given below.



### Figure 1. Image Mapping

### ***Steps involved in creating a title page using an image map***

- To create an image map, image has to be inserted (Insert → Image) (Tree in this case) on the Dreamweaver base file and select in Design View.
- Rectangular Hot spot areas were created to bring in the names of Students of Sir C V Raman represented with green colour in the image.
- Multiple links were created. Then the image should be named and saved for additional use. One can also choose the oval or polygon hotspot tool to make the selection. The image map tools are available in the Properties Inspector as shown below in Figure 2



**Figure 2.** Properties Inspector

- In the properties window for the hotspot, 'type in' or browse to the page to which the hotspot should be linked. This creates a linkable area. Further, the link takes the navigator to the individual profile page.

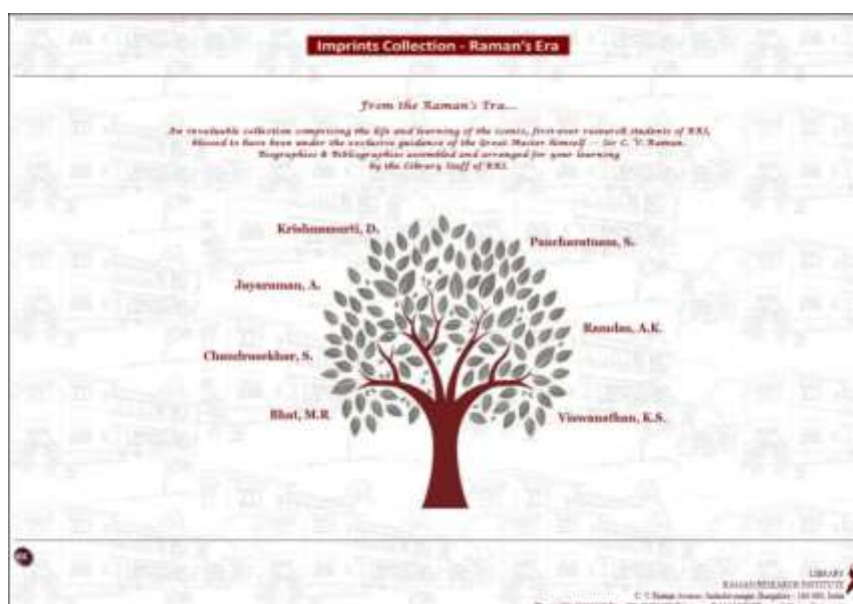


**Figure 3.** Properties to linkable area

- The above steps were repeated to create the links to the profile pages of the other students considered in this database. The linked pages are normal webpages with tables, columns and hyperlinks designed using CSS rules and other editing menus available in the software.

## Layout of 'Imprints Collection - Raman's Era'

The title page of 'Imprints collection – Raman's Era' has the Tree structure with names of Raman's Students inscribed around the branches and appears as seen in Figure-4. This page can be accessed at [http://www.rrri.res.in/htmls/library/raman\\_era/](http://www.rrri.res.in/htmls/library/raman_era/)



**Figure 4 .** Title Page

Each name on the title page has a link to the second page i.e. Profile Page of the student as shown in Figure 5.

Figure 5. Profile page

Profile page provides basic information such as year and place of birth, parent's names, educational details, career, scientific work performed and any honors awards bestowed upon them. This page has links to the subsequent pages namely List of publications, Research guidance, Photo gallery etc. The tabs to access subsequent pages are on left hand corner of the profile page. Quite similar to Wikipedia, the right hand corner of the profile page has a separate column with photograph and a brief self-explanatory biographic profile for quick reference.

A click on the tab 'Publications' will take the viewer to the next page shown below in Figure 6.

Figure 6. Publications Page

List of publications, while they were in RRI, is provided with links to the full text of the articles available in the digital repository of RRI. However, a list of publications after they moved out from RRI is also provided to make the database complete in itself.

A click on the ‘Research Guidance’ will take the viewer to the list of students who worked under the academic lineage of Sir CV Raman through his students. A screenshot of this page is given below in Figure 7.



**Figure 7.** Research guidance

Next tab is a link to the Photo gallery. ‘A picture is worth a thousand words’, is a famous saying. So photographs were included as an important component in this database. This page portrays the various moments and memorable pictures of students of Sir C V Raman during their early academic days at RRI. To build this photo gallery, J-album, a user friendly tool to upload and customize photographs has been used. J-album has the advantage of getting uploaded to any place on the internet and helps in storing, sharing and showcasing images. J-album has easy to use interface. Drag and drop facility can be used to add photos. Folders can be created, photos can be captioned and they can be organized. Editable features of J-album include cropping, straightening, fine tuning with 'Gamma and level'. Text on the images can be added, which is popularly known as ‘watermarking’. Copyright notices can be added to the metadata of the image. This feature was found very useful at RRI in protecting the images from being downloaded by unauthorized users (Wikipedia). (Meera; 2013).

Below is the screenshot of Photo gallery page. **Figure No.8**





**Figure 8.** Photo-gallery

In the case of deceased persons, an Obituary section is added. Obituaries are an account of the person's life and information re written generally for people who have made significant contributions in their respective fields. Obituaries appeared in Newspapers and Journals are linked here through this tab.

Below Figure-9 is the screen shot showing the obituary links.



**Figure 9.** Obituary

## Conclusion

A bio-bibliographic database of this kind with archival value engraved in it will be an important source of information in the years to come. Raman and his students have laid a strong foundation in Indian science and the scholarly world. Some of the papers published during 1948-1970 under RRI affiliation are still being cited by scientists across the world. Building a database with the defined novel features to the students of Sir C V Raman is a small step in paying tributes to the hard work of each one of them seven decades ago when modern science in India was still in infancy. This is an attempt to unfold the history of science happened soon after Independence at a premier research Institute in India. This is a value addition to the library services in a science library.

## Acknowledgement

Authors would like to acknowledge the contributions and suggestions of Prof. A Jayaraman, Mrs. Kausalya Ramaseshan, Dr. MR Bhat, Prof. A K Ramdas, Prof. Sujatha, and Mr. Chandrasekhar.

## References

1. Bhat (M R) 2013. *Journey of a Konkani Family (Eka Konkani Kutumba Pravasu)*, New York, Ajjalkani Books, 644
2. Jayaraman (A). 2017. *Chandrasekhara Venkata Ramana memoir*, Bengaluru, Indian Academy of Sciences, 241
3. Kyrnin Jennifer, *A Beginner's Guide to Adobe Dreamweaver CC* , <https://www.lifewire.com/adobe-dreamweaver-review-3467158>
4. Meera, B.M. 2013 *Long term preservation of multimedia objects through digitization : Exploratory study at RRI*. In *International Conference on Digital Libraries (ICDL) 2013: Vision 2020: Looking back 10 years and forging new frontiers* Edited by Shantanu Ganguly and P K Bhattacharyapp, Place: New Delhi, Teri Press, pp.1015  
[Proceedings of International Conference on Digital Libraries (ICDL) 2013: Vision 2020: Looking back 10 years and forging new frontiers, held at New Delhi, from 27-29 November 2013 , Organized by TERI ]
5. Rachana. *Dreamweaver Image Maps*. [https://www.entheosweb.com/website\\_design/image\\_maps.asp](https://www.entheosweb.com/website_design/image_maps.asp)





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# Digital Content Research and Migration: A case study with biggest reality company of India (DLF)

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## Abstract

The present case study discusses in detail, different steps and approach adopted by DLF while migrating digital content to MS SharePoint environment. Detailed approach to reorganize the existing digital content into new hub sites for better search and security has also been discussed. The challenges and benefit of migrating digital content through migration accelerator has also been envisaged.

## Introduction

DLF Limited is the largest real estate developer in India. The company is specialized in the development of commercial, retail and residential properties through the country. The reality product offerings of the company are of highest standard. The safety and security standard maintained at DLF are at par with world standards and because of this most of the fortune companies are housing their establishments in DLF premises. It continues to see exceptional growth in a highly competitive expanding reality market especially in commercial and retail segment.

The content and document management of the company is being done since its inception in 1947. The Centralized Documentation Centre (CDIC) of the company is of world class which manages both physical and digital documents for more than a decade.

DLF took the decision to implement SharePoint Online to achieve granular management of their digital content and information, provide staff and external stakeholders with the flexibility of a centralized Content Services solution, and to reduce the overall cost of ownership of their infrastructure. With over 2.4 million content items held in an ageing DMS System to be migrated in full-fidelity to SharePoint Online. In order to minimize business downtime during the migration process; the company chosen Proventeq's Migration Accelerator software to discover, analyze, enhance, classify and migrate their content portfolio.

## Considerations

The business challenges that the customer was experiencing, prior to solution implementation in view of huge data having different data formats and content distributed to different electronic stores, following consideration were made prior to formalizing strategies to start the job of data migration

- The existing content portfolio which has been accumulated over a long period, meaning that a thorough assessment of source content was required to identify errors, inconsistencies, and the relationships surrounding content.
- The team's concern to the content, which are distributed across multiple Object Stores and folders in existing DMS, meaning that content was often not correctly filed, related or in context.
- Documents based on lots of classes and metadata stored in DMS required segregation and migration to consolidated content types and different site collections in SharePoint Online.
- A complete review of source and target information architecture, necessary mapping and transformation rules based on parent metadata needed to be completed prior to migration.
- The security to be applied at a granular level to individual folders as well as restricting view, read and print permissions for respective department users.
- Team requirement of full audit trail and metadata-based reports for the entire migration, to ensure all the items in the scope of the migration had been transferred to SharePoint Online successfully.

## Strategy

To ensure that the all considerations and challenges there of digital content research and migration to SharePoint, and that the organization could move forward with a flexible centralized content services platform to meet the needs of the business, the agency M/s Proventeq developed a strategy based on both the specific challenges faced by DLF, and extensive experience in migrating content from IBM FileNet P8 to SharePoint. To achieve these aims, M/s Proventeq proposed a six-step migration strategy:

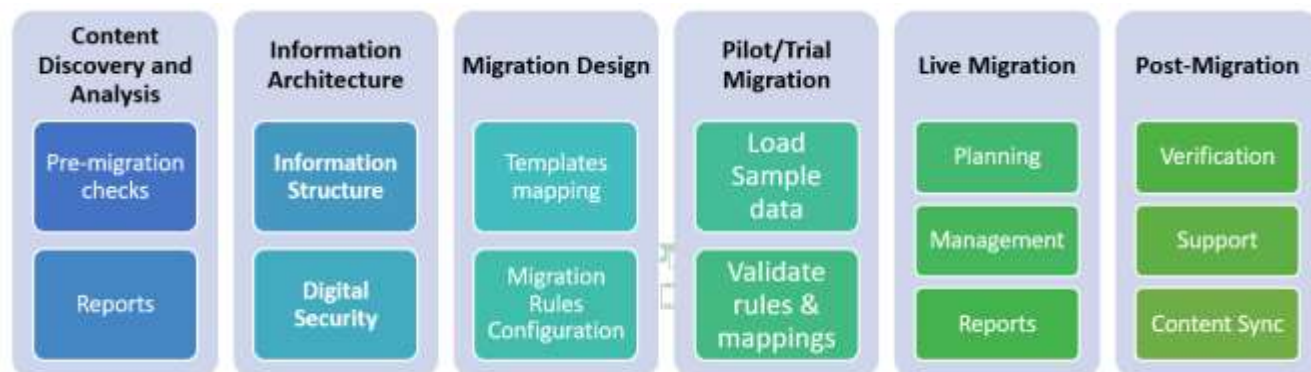


- Discovery & Analysis
- SharePoint Information Architecture
- Migration Design & Configuration
- Pilot Migration

- Incremental Live Migration
- Post-Migration Support

The detailed description of all the above-mentioned steps have been discussed under solution.

## Solution



### Discovery & Analysis

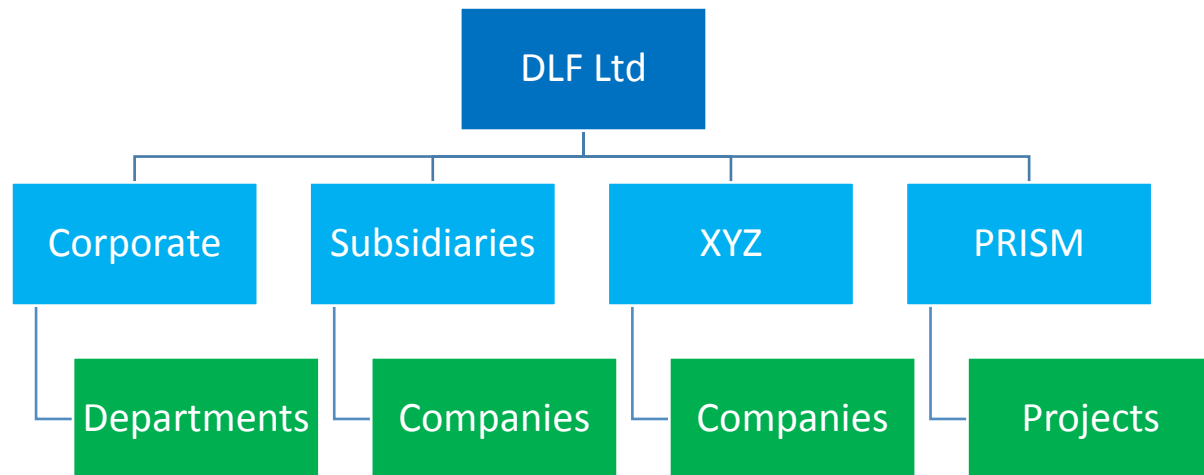
Proventeq Migration Accelerator's discovery and pre-migration analysis reports helped to identify detailed content structure and potential migration issues. These reports helped to decide on the most suitable migration strategy and also helped to establish an effective target information structure. This allowed the team to identify the following potential issues when migrating digital content from FileNet to SharePoint:

- Compound documents and multi-content documents within FileNet.
- Invalid characters in folder and file names that are not allowed in SharePoint.
- Duplicate item names, long item names and item names having no extensions.
- Differing Mime type across document versions, e.g. .docx and .pdf
- Unfiled documents and too many child items in container or folder
- Invalid file types and checked-out files.

### SharePoint Information Architecture

As digital content was spread across object stores due to FileNet's storage and information structure limitations, the migration team arranged a workshop to develop a full understanding of DLF's organization structure and different functions to decide the target information architecture structure and security model.

At the highest level, DLF had Corporate, Subsidiaries, Promoters and Projects functions which have their own departments, companies and sub functions to manage the respective business operations. The migration team proposed a target information structure to match DLF's organizational structure and functions, as shown in below figure.



Corporate, Subsidiaries, Promoters and Project functions had their own functional and security requirement, so they will be configured as a Hub Sites in SharePoint at a very top level.

Then each department, sub function or subsidiary or XYZ company were configured as a Site Collection in SharePoint.

Then content structure was maintained within these site collections by defining document libraries based on document classification like Vouchers, Customer Files, Agreements, Inventory, Purchase Orders, Legal Docs, Invoices, Trackers etc.

To secure the content in the new target information structure, the migration team created SharePoint groups based on different DLF user entities. This gave flexibility in allowing permissions to be applied at granular level by adding these groups in site collections, libraries and folders along with respective permissions.

As this target information structure and security model was bit complex to configure and deploy in SharePoint, an automated provisioning tool was developed for faster and accurate deployment. This automated provisioning tool referred a simplified excel spreadsheet to capture the target SharePoint information structure (sites, document libraries, folders, content types and metadata) and user permissions, which are to be deployed in SharePoint Online.

### ***Migration Design & Configuration***

Proventeq Migration Accelerator's custom content classification and target structure mapping feature addressed the requirement to classify the content accurately and migrate related documents together into site collections and document libraries in SharePoint Online. By following this procedure, expedited migration to SharePoint Online with the ability to migrate all relevant metadata were made possible.

### ***Pilot Migration***

To demonstrate how the production migration would work and give an opportunity to test existing data in a production-like SharePoint environment, migration team carried out a pilot migration exercise. To achieve this, mapped Content from one of IBM FileNet's object stores were made by applying necessary target information structure, classification and metadata rules & were migrated to specific site collections, document libraries and folders in SharePoint Online.

### ***Incremental Live Migration***

Following a successful pilot migration, by utilizing Proventeq Migration Accelerator's incremental migration features to stage the production migration process. This means that the impact to DLF's business-processes were minimized. The Migration partner set up additional migration rules to consolidate and classify the high volume of source content types using PowerShell extensions. These rules were used to map respective content types and metadata in SharePoint. Metadata values were then transformed to comply with SharePoint restrictions, based on metadata rules in order to handle invalid characters and URLs. Duplicate item names and mime type mismatches were handled by Migration Accelerator's in-built rules. Finally, the migration team generated custom reports to ensure the entire content portfolios of respective corporate departments, subsidiary companies and PRISM functions were migrated successfully.

### ***Post-Migration Support***

To ensure that users can find the newly restructured and migrated content in the SharePoint platform and to help DLF with SharePoint adoption, the data migration partner arrange a special task force to provide post-migration support.

## **Results**

### ***Smooth Transition to SharePoint with Minimal Business Downtime***

The adoption of pilot migration was made in order to ensure that migration strategy met the needs of the project. The staging the migration over a 90-day period helped DLF avoid any costly or time-consuming technical issues and also ensured that departments across the organization would be able to access content and information as needed both during the project and after completion of migration. By following this up with an extended period of support, migration team eased the transition to SharePoint, helped identify & remedy any user-centric and information management issues with using the new platform. It also ensured that all DLF's initial goals and long-term goals are addressed & achieved by adopting SharePoint.

### ***Improved User Productivity Via Secure Centralized Search***

By empowering DLF's users with a secure centralized search platform which allows restriction of search to specific content types and metadata for specific users within their customized SharePoint Online instance, the migration team has helped reduce the time spent across the organization searching for and working with content. This measure has also helped to negate the

impact of having to replicate effort in storing and managing documents and rich media across disconnected on-premise platforms, allowing content to now be distributed to both internal staff and external stakeholders quickly and easily.

### ***Flexible Content Distribution, Management and Collaboration***

With a large volume of staff spread over corporate departments and subsidiaries, combined with the need to distribute large complex content types to external stakeholders such as Architects, Contractors, Local Government Administration, Developers and Clients; DLF needed a digital content services platform which provided flexible distribution, management and collaboration. SharePoint Online answered all of these needs, thanks to its extensible nature, SharePoint now forms the central hub for DLF's information management infrastructure; encouraging productivity and real-time collaboration through Office 365's range of productivity tools.

### ***Reduction in total cost of ECM infrastructure ownership***

Due to an existing investment in Microsoft's Office 365 platform DLF have found that, by moving the content out of IBM FileNet P8 and decommissioning the IBM system, there has been a significant reduction in the total cost of ownership of their ECM infrastructure. These savings have not only been generated by lower licensing cost of Office 365 compared to the FileNet product, but by negating the need for expenditure on modernizing and upgrading FileNet P8 to provide the effective digital content management functionality the organization required.

### ***Robust Information Protection(Digital Rights)***

While overarching control over complex granular permissions had proved problematic in FileNet P8, the adoption of Microsoft's Azure Information Protection allows DLF to achieve a key goal of achieving granular control of view, read, download and print permissions on externally shared content. Provenetq Migration Accelerator has given DLF the ability to apply AIP security to content in real-time; allowing the organization to meet the security challenges of managing high volumes of content across internal and external users.

## **Conclusion**

The digital content migration of huge important data upto bit and byte level accuracy was a big challenge. The systematic approach coupled with pilot migration approach gave both DLF and Migration Team confidence to do the required job in timely and very professional manner. The process also ensured that the switchover to Microsoft's digital content management platform was efficient and that each of the challenges of the project had been met. The case can further be researched & referred for future work.



## References

1. <https://www.proventeq.com/products/migration-accelerator>
2. <https://www.proventeq.com/products/content-analyser>
3. <https://www.proventeq.com/migration-solutions/ibm-filenet-to-sharepoint>
4. <https://www.proventeq.com/migration-solutions/sharepoint-office-365-implementation>
5. <https://www.proventeq.com/services/content-migration-service>
6. <https://docs.microsoft.com/en-us/sharepointmigration/migrate-to-sharepoint-online>
7. <https://docs.microsoft.com/en-us/sharepoint/dev/apis/migration-api-overview>
8. <https://docs.microsoft.com/en-us/sharepointmigration/sharepoint-online-and-onedrive-migration-speed>
9. <https://docs.microsoft.com/en-us/sharepoint/introduction>
10. <https://docs.microsoft.com/en-us/sharepoint/planning-guide>
11. <https://docs.microsoft.com/en-us/sharepoint/authentication>
12. <https://docs.microsoft.com/en-us/sharepoint/guide-to-sharepoint-modern-experience>
13. <https://docs.microsoft.com/en-us/sharepoint/planning-hub-sites>
14. <https://docs.microsoft.com/en-us/sharepoint/overview-of-search>
15. <https://docs.microsoft.com/en-us/sharepoint/manage-search-center>
16. <https://docs.microsoft.com/en-us/sharepoint/control-access-based-on-network-location>
17. <https://docs.microsoft.com/en-us/sharepoint/what-is-permissions-inheritance>
18. <https://docs.microsoft.com/en-us/sharepoint/understanding-permission-levels>
19. <https://docs.microsoft.com/en-us/sharepoint/sharing-permissions-modern-experience>
20. <https://docs.microsoft.com/en-us/sharepoint/safeguarding-your-data>
21. <https://azure.microsoft.com/en-gb/services/information-protection/>

# **An analytical study of level of awareness of patrons of information services provided via information communication technology in university library and information centres of Delhi and NCR**

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## **Abstract**

The purpose of this paper is to survey the university library information centres of Delhi andNCR (National Capital Region) and find out the level of awareness of patrons of the information services provided by their respective university library information centres ( ULICs) with the help of ICT (Information communication technologies) and web 2.0 tools. Survey method was used with the help of structured questionnaire and review of earlier studies done in the area.

## **Design/Methodology/Approach**

A structured questionnaire was prepared with the help of reviewing earlier studies to decide the various information services to be included in the study. Ten information services provided through ICT were used for data collection and evaluation. Level of awareness was evaluated on the scale of three. University ranking of NIRF (National Institution Ranking Framework) 2017 of MHRD (Ministry of Human Resource Development) was used to select ULICs of Delhi and NCR (National Capital Region) for data. Two research questions were developed and answered.

## **Findings**

The study revealed that overall 77.8% patrons of selected and sampled ULICs under study are aware of selected information services provided with ICT. To be exact, the number is 55.3% patrons are aware find ICT information services useful. 22.5% patrons are aware but do not find them useful. 22.2% patrons are not even aware of these services.

## **Research implications**

Review of the literature revealed that no analytical study has been done to find level of awareness of patrons of information services being provided by the ULICs of Delhi and NCR through ICT. The research was conducted to provide an idea and insight on the type of ICT information services facilitated by the ULICs under study and patrons' awareness of those services. This study shall help the other ULICs in providing and marketing ICT information services in a better way and increase the level of awareness of patrons of these services.

## **Originality/ Value**

This study provides a unique insight of the ICT information services offered by selected and sampled ULICs of Delhi and NCR and level of awareness of their patrons about these information services. To what extent ICT information services are welcomed by their patrons needs to be studied. While the literature is replete with information on ways in which academic libraries are using ICT to serve their patrons, this paper offers a brief overview of the awareness level of patrons in ULICs of Delhi and NCR.

## **Recommendation**

It is recommended that ULICs provide traditional services in web environment as well as initiate new web enabled information services to satisfy the active as well as passive demands of their patrons. They also need to market their web enabled services actively so as to make patrons aware of them and get more benefits out of these services.

## **Keywords**

Universities, University library information centres, ULIC, Web enabled information services, Information communication technology, ICT, User awareness, OPAC, Digital library, Institutional repository.

## **Introduction**

Libraries have changed into LICs (library information centres), providing various ICT information services. LIC professionals are trying to provide various ICT information services and web enabled services through web. Revolutionary changes in ICT has changed physical library and collection into virtual or digital library. LIC professionals need to learn ICT skills to initiate new services, improvise and maintain the existing services.

Traditionally library was the storehouse of books and used to provide facilities to their users to use books and disseminate information as per patrons' need. These facilities are technically known as library services. Classification, Cataloguing, new arrivals, CAS (Current Awareness Service) and SDI (Selective Dissemination of Information) etc. are various traditional library services provided by them. These services are being changed into information services by the implementation of ICT and varied tools of web 2.0, and LICs are being known as library 2.0.

### ***Information services***

Revolutionary development in ICT has converted traditional library services into information services. The library information centres are moving towards new communication paradigms, from paper to electronic or digital delivery, from text to multimedia and the shift from human to human contact into human machine interaction, and from physical presence to virtual presence. More web enabled information services are being provided through ICT and varied web 2.0 tools. These services become very convenient to patrons as they need not visit the LIC physically and save their time. (Madhusudhan and Nagabhushanam 2012)

### ***User awareness***

ULICs are expected to acquire, process and make available the much needed information to their patrons who are either faculty or students. They require it for their various assignments, projects, teaching and research activities. ULICs need to make patrons aware of their collection, products and services and need to promote LICs through study tours, orientation and user education.

## **Review of literature**

(French 1990), (Arif and Meadows 1994), (Roberts 1995) elucidated that if user is not aware of source or service it would be underutilised. It is fundamental duty of LICs to make provision of creating users' awareness. Patrons must be informed of the availability of varied information sources, services and products and how these are useful

(Drake 1982), (Neelameghan 1985), (Knapp 1996), (Schumacher 1996), (Mugyabus 1999) (Lougee 2002), (Poopla 2008) deliberated that information sources and services are under utilised. Even faculty is unaware of LICs collection and services. It is due to the absence of communication between users and LIC personals, lack of marketing of information and user education efforts. It was elucidated that user education is a tool to educate patrons on how to use the LICs resources effectively and efficiently.

In view of the above it can be said that patrons will drive maximum benefits from ILICs if they are taught to sharpen their information handling skills. LICs user services assist patrons to use library resources effectively without any intervention of LIC staff. With the advent of ICT and digital environment has become an important part of the modern LICs. In many instances, information can now be accessed from a website and other online platforms and so the traditional library services are becoming obsolete.

The shortfall of promotion programmes in ULICs lead to patron being unaware of ULICs resources and services. It is in the light of this, the researcher is interested in investigating user awareness of information services provided by ULICs of Delhi and NCR.

## Objectives

All the modern ULICs are trying to provide the same type of online or web enabled information services for the patrons. Main objective of this particular research is to study the level of awareness of patrons of various ICT information services provided by the selected ULICS. Two research questions of this particular study are:

*RQ1-* To find out the various ICT information services facilitated by the selected ULICs of Delhi and NCR and select some services for research question 2 (RQ2)

*RQ2-* To find out level of awareness of the patrons of the selected information services being facilitated by the ULICsselected for study along with their usefulness.

## Populations

There are more than 46 universities in Delhi and NCR available on the UGC (University Grants Commission) website. The list includes state, deemed, central, and private universities. It is humanly impossible to study all the ULICs. For timely completion of the research study, the scope of the study is confined to the following limitations:

- Delhi and NCR: The NCR encompasses the entire NCT (National Capital Territory) of Delhi and several districts surrounding it.

- Universities of Delhi and NCR were selected from the NIRF of MHRD. NIRF university ranking of year 2017 was used to filter and select the universities to be included in the study.
- In the list of top 100 universities of NIRF of 2017, there are only eight universities of Delhi and NCR. Only Central, state and Deemed, in all 7 universities were included in the study. Private university is not considered for the study. List Of universities Of Delhi And NCR with NIRF rank included in Study are:

S. No	University	NIRF rank	Type of University	Abbreviation
1	JawaharlalNehru University, Delhi	2	Central University	JNU
2	University of Delhi, Delhi	8	Central University	DU
3	JamiaMilliaIslamia, Delhi	12	Central University	JMI
4	Indian agricultural Research Institute, Delhi	12	Deemed University	IARI
5	JamiaHamdard Delhi	26	Deemed University	JH
6	Jaypee Institute of Information Technology, Noida	81	Deemed University	JIIT
7	Guru Gobind Singh Indraprastha University, Delhi	82	State University	GGSIIP

**Table 1.**List of universities with NIRF ranking

## Methodology

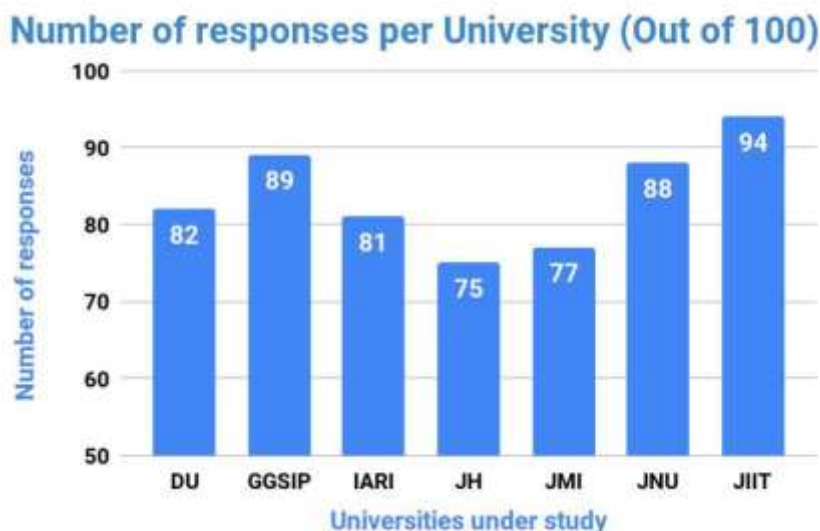
All the selected universities had official working websites. The method of Content analysis was used to study the websites to collect data on the variables of the study. By studying websites, review of literature and interview of librarians, ICT information services provided or feasible to provide were selected for the study. A structured questionnaire was prepared to collect the primary data. Hard copy of questionnaires were distributed to the patrons randomly. The link of online form was also given to the patrons and responses were directly submitted on the web, later on hard copy data was merged with it. The study of websites commenced in January 2018 and was completed by June 2018. Primary data through user questionnaire was collected during March 2018 to August 2018. Researcher personally visited the ULICs to get the questionnaires filled by patrons.

## Findings

In all the ULICs, hundred (100) questionnaires were distributed and later recollected for collection of primary data. Patrons community consisted of students, faculty and other staff randomly. Patrons were observed and interviewed to find out their perception about the ULICs, its services and problems being faced by them.

### Response Rate

Response rate of questionnaire received back is as follows:



**Figure1.** Response rate

(**Figure. 1**) highlights that highest number of responses were received from **JIIT** (94 out of 100), and lowest were from **JH** (75 out of 100). Overall 83.71% (586 out of 700) responses were received.

### Research question (RQ1)

Based on the previous researches and studies, researcher studied websites of each ULIC and also interviewed librarian to identify various web enabled information services facilitated by them. Some traditional services which can be provided to patrons by implementing ICT were also selected for the research purpose through studying earlier studies.

Total ten information services being provided by all ULICs were included in the study to find out the level of awareness of patrons and usefulness of the services. Service studied for the above objective are as follows:

- Online Public Access Catalogue (OPAC);
- Current awareness service;
- Circulation;
- Reference/ Consultancy;
- User Orientation/Education;
- User feedback/Suggestion/Recommendation;
- Digital Library
- Interlibrary loan (ILL);
- Institutional repository (IR);
- and Online databases.

**Research question (RQ2)**

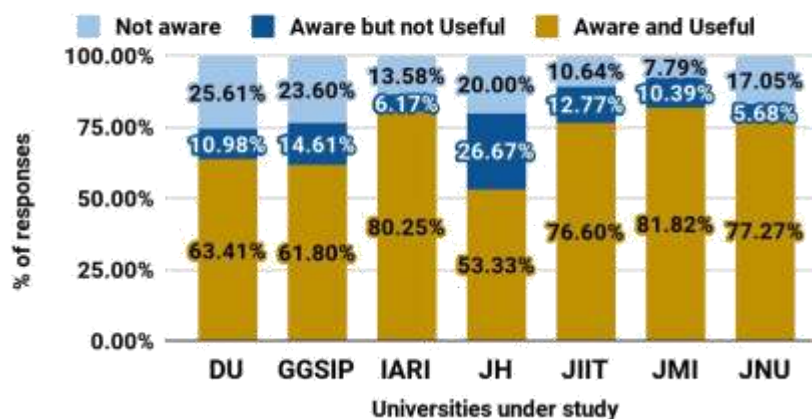
The structured questionnaire was used to find out the awareness of the patrons of the selected ULICs about the varied information services provided in their respective ULICs using various ICT. Ten services (selected in research question 1) are studied to find out the awareness of the patrons on the scale of three, which is **Aware and useful; Aware but not useful; and Not aware.**

**Online Public Access Catalogue**

Catalogue is the mirror of the library collection and basic service to connect patrons with the ULIC collection. With the advent of ICT and www, the catalogue has changed into OPAC or Web OPAC which is available on web, accessible remotely.

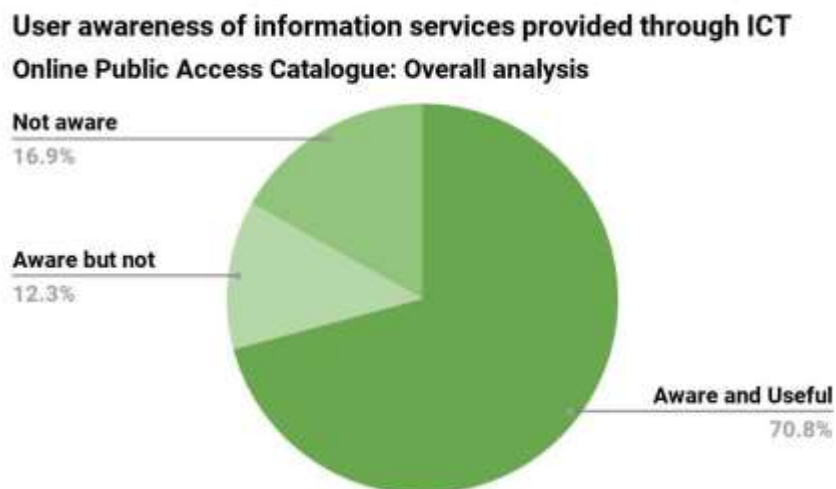
<i>ICT Information service [OPAC]</i>	DU	GGSSIP	IARI	JH	JIIT	JMI	JNU	Total
Aware and Useful	52	55	65	40	72	63	68	415
Aware but not Useful	9	13	5	20	12	8	5	72
Not aware	21	21	11	15	10	6	15	99
<b>Grand Total</b>	<b>82</b>	<b>89</b>	<b>81</b>	<b>75</b>	<b>94</b>	<b>77</b>	<b>88</b>	<b>586</b>

**Table 2.** OPAC-Number of responses

**User awareness of Information services provided through ICT****Online Public Access Catalogue**

**Figure. 2A**



**Figure. 2B**

Data analysis of (Table: 2 & Figure: 2A) shows that the highest number of patrons (81.82%) of **JMI** and *Lowest* (53.33%) of **JH** are **aware** of OPAC and find it **useful**. *Highest* Responses in category **Aware but not useful** were submitted by (26.67%) patrons of **JH** and *Lowest* by **JNU** (5.68%) patrons. *Highest* number of patrons of **DU** (25.61%) and *Minimum* of **JMI** (7.79%) are “**Not aware**”. which is quite high, considering the infrastructure and facilities provided by the centre.

**(Figure: 2B) Overall analysis displays that (70.8%) users are aware of OPAC and find it useful, (12.3%) are aware but do not find it useful and (16.9%) are not even aware of the service. Collectively (83.1%) patrons are aware of the service.**

#### Current Awareness Service

It is a service provided by the ULICs to make patrons aware of new arrival, new collection, resources, services, products, technologies and events of the centre. Most convenient tool is e-mail but now through interactive websites and integration of varied web tools, it has changed drastically. CAS to specified group of patron is known as SDI.

<i>ICT Information service [CAS]</i>	DU	GGSSIP	IARI	JH	JIIT	JMI	JNU	Total
Aware and Useful	31	24	62	35	71	40	34	297
Aware but not Useful	11	31	10	30	13	16	17	128
Not aware	40	34	9	10	10	21	37	161
<b>Grand Total</b>	<b>82</b>	<b>89</b>	<b>81</b>	<b>75</b>	<b>94</b>	<b>77</b>	<b>88</b>	<b>586</b>

**Table 3.** CAS-Number of responses

### User awareness of information services provided through ICT

#### Current Awareness Service

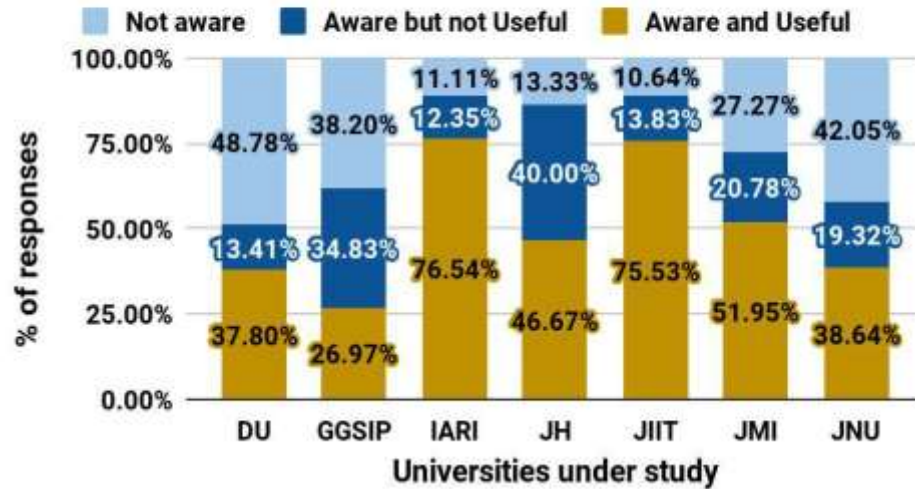


Figure. 3A

### User awareness of information services provided through ICT

#### Current Awareness Service: Overall analysis

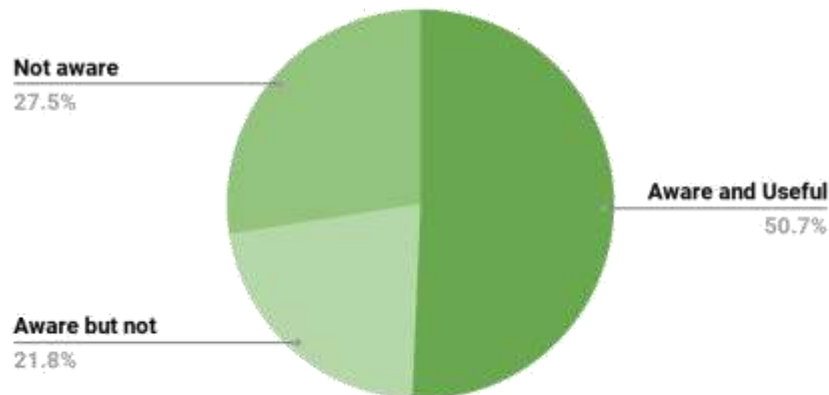


Figure. 3B

Analysis (Table: 3 & Figure: 3A) reflects that maximum (76.54%) patrons of **IARI** and Minimum (26.97%) of **GGSIP** are **aware** of ICT enabled CAS and **find it useful**. Maximum (40%) patrons of **JH** and Minimum of **IARI** (12.35%) are **aware** but **do not find it useful**. Maximum (48.78%) patrons of **DU** and Minimum (10.64%) from **JIIT** are **not aware** of this service.

**(Figure: 3B) Highlights that total (50.7%) patrons are aware of this service provided through ICT and also find it useful. While (21.8%) are aware but do not find it useful. (27.5%) are not even aware of this service. Collectively (72.5%) patrons are aware of the service.**

#### Circulation

Dr. Ranganathan's law of library science propounded on various information services to be given to the users so that documents are put to maximum use. This service helps in implementing these laws by lending documents to the users. ULICs strive to provide personalized, comprehensive services to patrons through ICT.

<b>ICT Information service [Circulation]</b>	<b>DU</b>	<b>GGSIP</b>	<b>IARI</b>	<b>JH</b>	<b>JIIT</b>	<b>JMI</b>	<b>JNU</b>	<b>Total</b>
Aware and Useful	71	69	60	50	79	54	58	441
Aware but not Useful	2	9	12	15	8	18	17	81
Not aware	9	11	9	10	7	5	13	64
<b>Grand Total</b>	<b>82</b>	<b>89</b>	<b>81</b>	<b>75</b>	<b>94</b>	<b>77</b>	<b>88</b>	<b>586</b>

**Table 4.** Circulation- Number of responses

### User awareness of information services provided through ICT Circulation (Issue/Return)

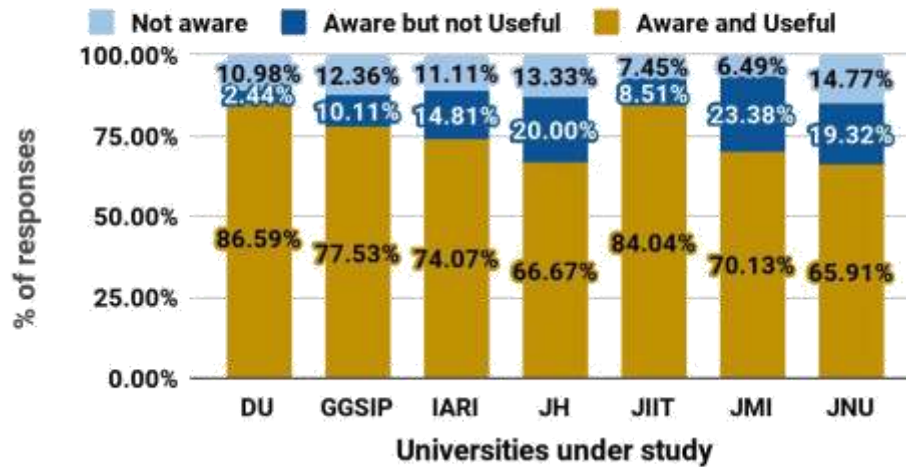


Figure.4A

### User awareness of information services provided through ICT Circulation (Issue/Return): Overall analysis

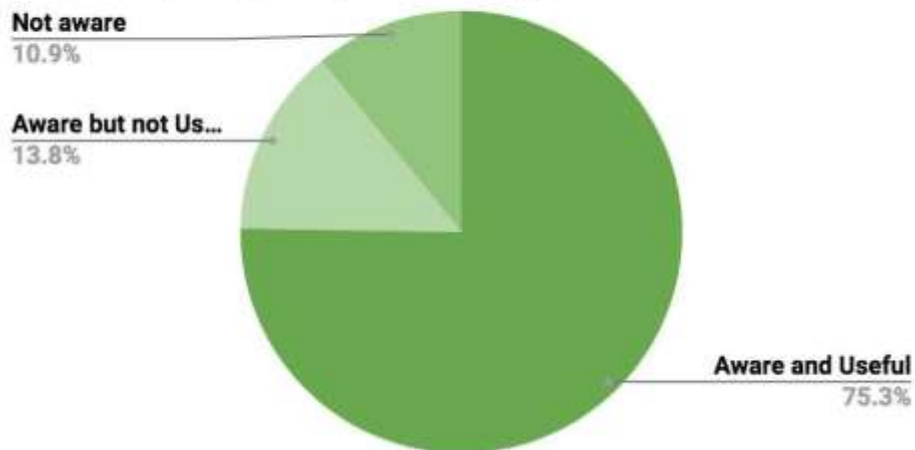


Figure.4B

Analysis of (Table: 4 & Figure: 4A) highlights that Highest (86.59%) patrons of **DU** and Lowest (65.91%) of **JH** are **aware** of the ICT enabled Circulation service and find it **useful**. Highest (23.38%) patrons of **JMI** and Lowest (2.44%) of **DU** are **aware but do not find it useful**. Highest (14.77%) patron of **JNU** and Lowest (6.49%) of **JMI** are **not even aware** of the service.

**(Figure: 4B) Analysis reflects that overall (75.3%) patrons are aware of the service and also find it useful. (13.8%) patrons are aware but do not find it useful and only negligible (10.9%) members are not even aware of it. Collective awareness percentage is (89.1%).**

#### Reference / Consultancy

Reference services help the patrons in identifying the information in various subject areas as per their need. The reference personnel explain which sources to look for and seek the information. ICT and web are being used to provide virtual reference service and is popular with techno savvy net generation.

Ask-a-Librarian service, an Internet based question and answer services is one such service facilitating communication between patrons and ULICs.

<i>ICT Information service [Reference/ Consultancy]</i>	<b>DU</b>	<b>GGSIP</b>	<b>IARI</b>	<b>JH</b>	<b>JIIT</b>	<b>JMI</b>	<b>JNU</b>	<b>Total</b>
Aware and Useful	60	54	53	30	73	49	54	373
Aware but not Useful	7	9	16	45	13	23	15	128
Not aware	15	26	12		8	5	19	85
<b>Grand Total</b>	<b>82</b>	<b>89</b>	<b>81</b>	<b>75</b>	<b>94</b>	<b>77</b>	<b>88</b>	<b>586</b>

**Table 5:** Reference/ consultancy-Number of responses

### User awareness of information services provided through ICT

#### Reference/ Consultancy

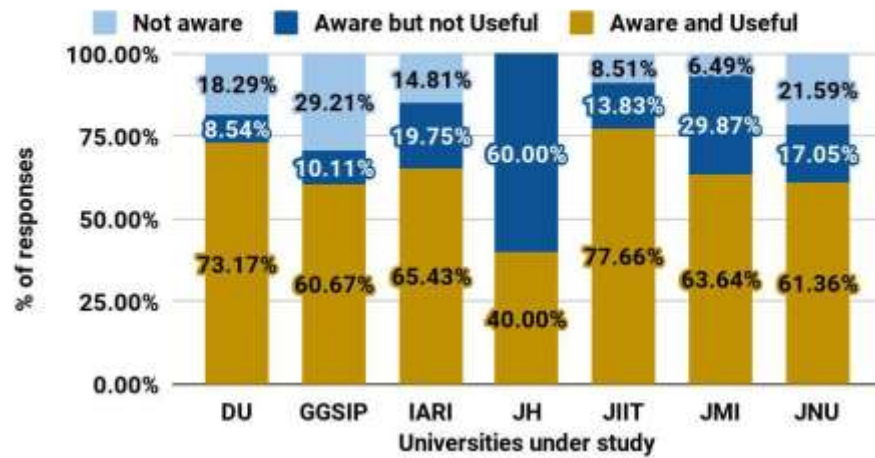


Figure. 5A

### User awareness of information services provided through ICT

#### Reference/ Consultancy: Overall analysis

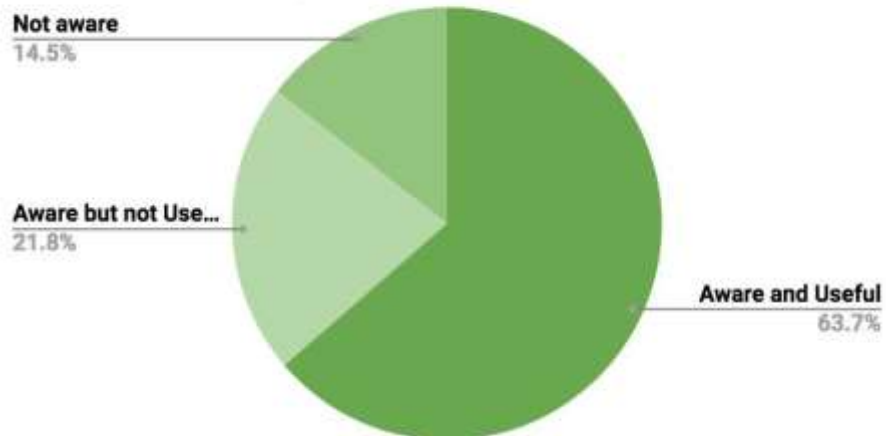


Figure. 5B

Study (Table: 5 & Figure: 5A) shows that highest (77.66%) patrons of **JIIT** and Lowest (40%) of **JH** are **aware** of ICT enabled reference service and find it **useful**. Highest (60%) patrons of **JH** and Lowest (8.54%) of **DU** are **aware** but **do not find it useful**. Highest percentage of **not being aware** responses are from (29.21%) of **GGSSIP** while minimum (6.49%) is of **JMI**. No responses were received in this category from patrons of **JH**, which is quite surprising.

(Figure: 5B) shows that overall (63.7%) patrons are aware of the service and find it useful. (21.8%) patrons are aware of the service but do not find it useful. (14.5%) patrons are not even aware of the ICT reference service. Overall (88.5%) patrons are aware of the service.

#### User Orientation/Education

This service is to educate or teach the users about their ULICs, resources, services, products and system procedures. ICT has made a big impact on this service. Now a days other than interactive websites, varied web 2.0 tools like blogs, instant messenger, social networking sites are being used to provide this service.

<i>ICT Information service [Orientation/ User Education]</i>	DU	GGSSIP	IARI	JH	JIIT	JMI	JNU	Total
Aware and Useful	35	45	54	20	74	31	40	299
Aware but not Useful	14	23	10	50	11	31	18	157
Not aware	33	21	17	5	9	15	30	130
<b>Grand Total</b>	<b>82</b>	<b>89</b>	<b>81</b>	<b>75</b>	<b>94</b>	<b>77</b>	<b>88</b>	<b>586</b>

**Table 6.** User orientation/ education-Number of responses

**User awareness of information services provided through ICT  
User Orientation/Education**

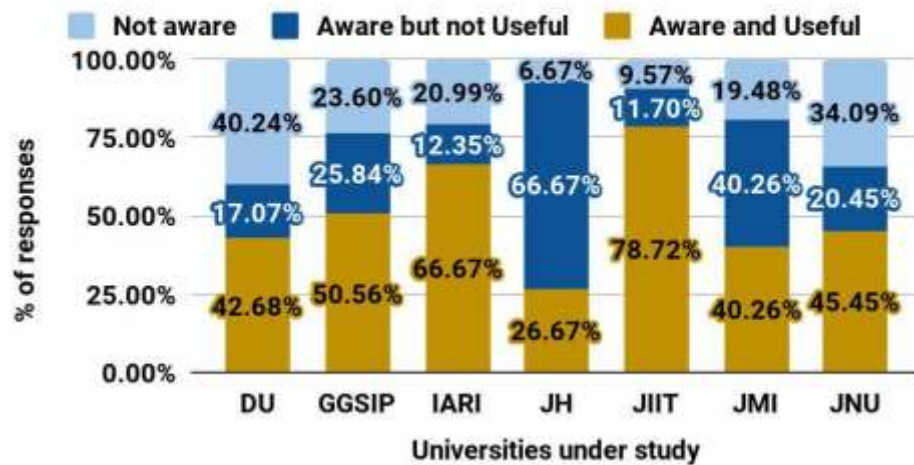


Figure. 6A

**User awareness of information services provided through ICT  
User Orientation/Education: Overall analysis**

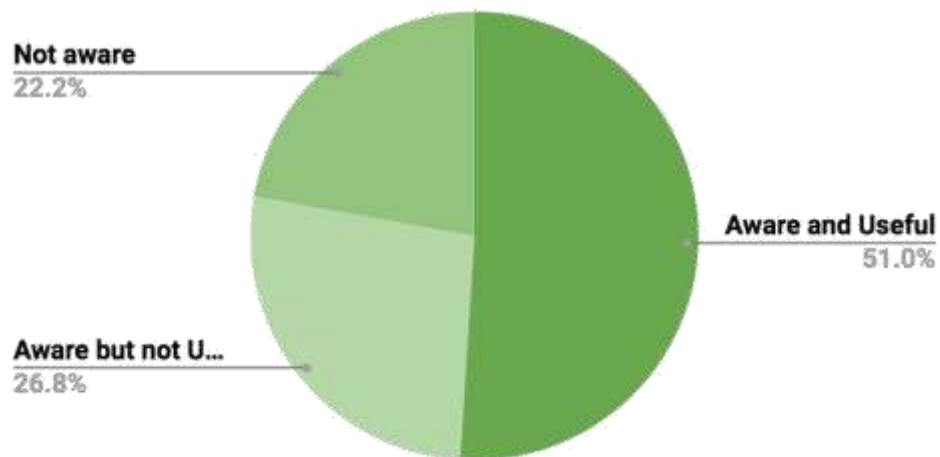


Figure. 6B



Analysis (Table: 6 & Figure: 6A) presents that maximum (78.72%) patrons of **JIIT** and Minimum (26.67%) of **JH** are **aware** of the service and find it **useful**. Maximum (66.67%) patrons of **JH** and minimum (11.70%) of **JIIT** are aware but do not find it useful. Highest (40.24%) patrons of **DU** and Lowest (6.67%) of **JH** are not even aware of the service.

(Figure: 6B) presents that overall (51%) patrons are aware and also find it useful, (26.8%) are also aware but do not find it useful while (22.2%) are not even aware of the service. Collectively (77.8%) patrons are aware of the service.

#### User Feedback/ Suggestion/Recommendation

User feedback, suggestions and recommendations of patrons are needed to improve the existing collection, products and services and to acquire new resources, initiate new services and products. ICT plays an important part in getting feedback from their patrons. Various web tools like interactive websites, Blogs, Social networking sites etc may be used to get the same from the patrons.

<i>ICT Information service [User feedback/</i>								
<i>Suggestion/ Recommendation]</i>	DU	GGSSIP	IARI	JH	JIIT	JMI	JNU	Total
Aware and Useful	24	26	54	20	59	28	26	237
Aware but not Useful	21	36	12	30	21	29	17	166
Not aware	37	27	15	25	14	20	45	183
<b>Grand Total</b>	<b>82</b>	<b>89</b>	<b>81</b>	<b>75</b>	<b>94</b>	<b>77</b>	<b>88</b>	<b>586</b>

**Table 7.** User feedback-Number of responses

### User awareness of information services provided through ICT

#### User feedback/Suggestion

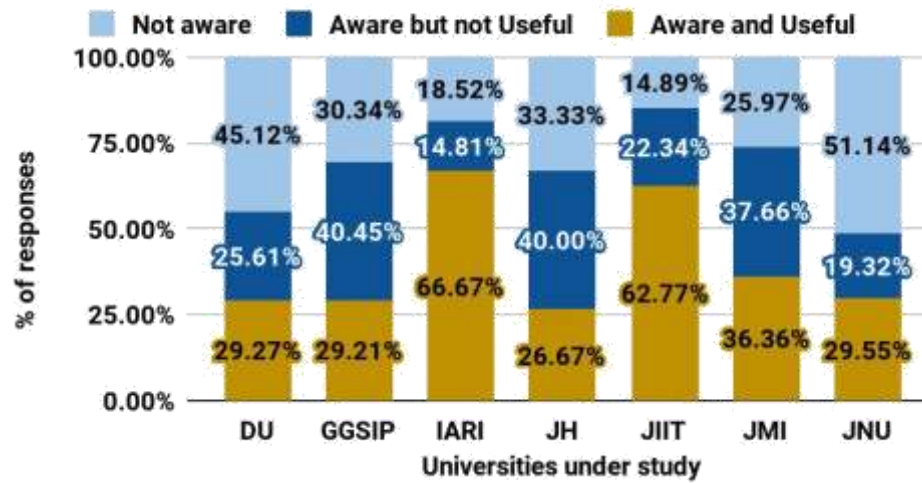


Figure.7A

### User awareness of information services provided through ICT

#### User feedback/Suggestion: Overall analysis

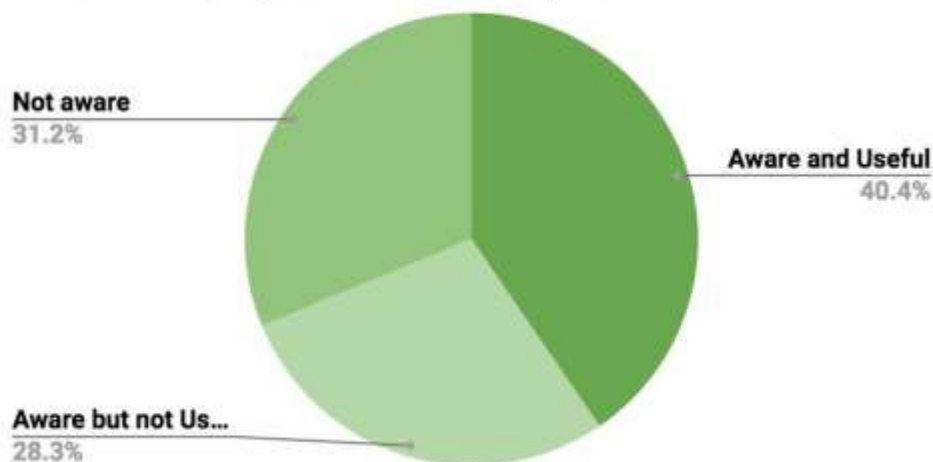


Figure. 7B

Analysis (Table: 7 & Figure: 7A) displays that *highest* (66.67%) patrons of **IARI** and *Lowest* (26.67%) of **JH** are **aware** of the service and find it **useful**. *Maximum* (40.45%) patrons of **GGSIP** and *Lowest* of **IARI** (14.32%) are **aware** but do **not find it useful**. *Highest* (51.14%) patrons of **JNU** and *minimum* (14.89%) of **JIIT** are **not even aware** of the service.

(Figure: 7B) exhibits that (40.4%) patrons are aware of the service and find it useful, (28.3%) patrons are aware but do not find it useful. (31.2%) patrons are not even aware of the service. It reflects that ULICs are not bothered about taking the feedback from their patrons and taking action on it or working on their complaints and suggestions. Collectively (68.7%) patrons are aware of this service.

#### Digital library

Digital library synonymously also known as electronic library or virtual library is not a library in physical terms as it has digital resources created through digitization or created in digital form. There are various benefits of digital library as it facilitates online access from anywhere at any time.

<i>ICT Information service [Digital library]</i>	DU	GGSIP	IARI	JH	JIIT	JMI	JNU	Total
Aware and Useful	44	49	57	25	76	58	61	370
Aware but not Useful	13	25	9	40	14	10	15	126
Not aware	25	15	15	10	4	9	12	90
<b>Grand Total</b>	<b>82</b>	<b>89</b>	<b>81</b>	<b>75</b>	<b>94</b>	<b>77</b>	<b>88</b>	<b>586</b>

Table 8. Digital library-Number of responses

#### User awareness of information services provided through ICT

##### Digital library

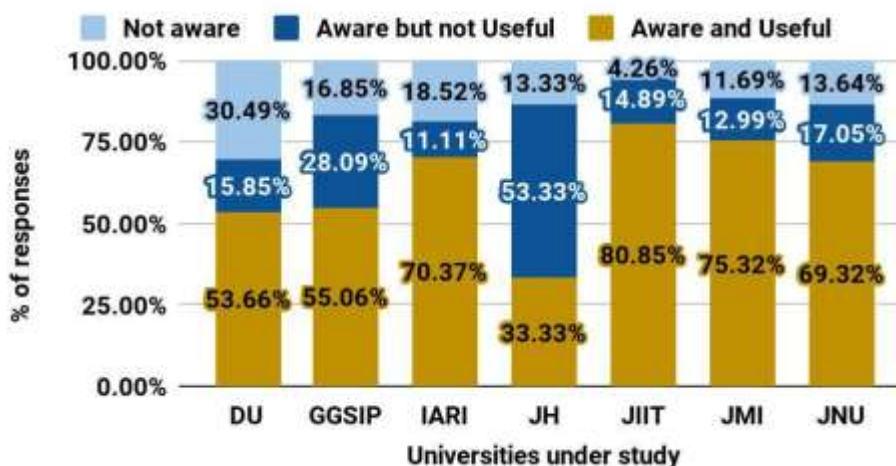


Figure. 8A

### User awareness of information services provided through ICT

#### Digital library: Overall analysis

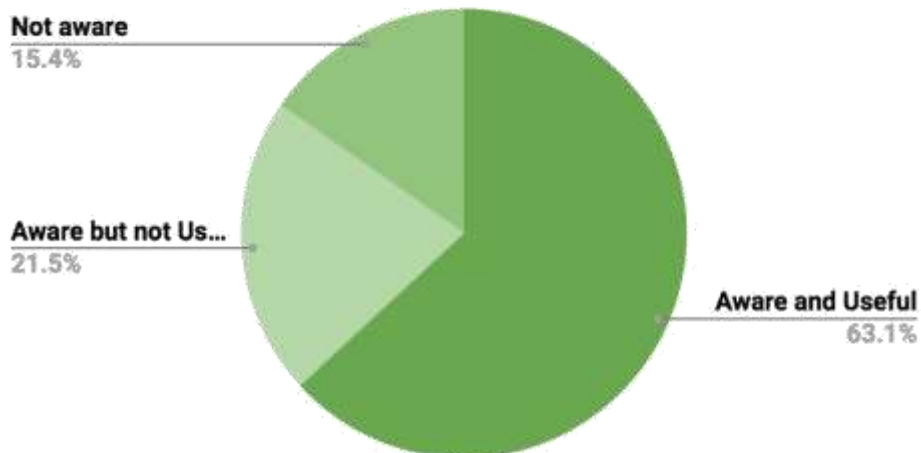


Figure. 8B

The analysis (Table: 8 & Figure: 8A) presents that *highest* (80.85%) patrons of **JIT** and *Lowest* (33.33%) of **JH** are **aware** and find it **useful**. *Highest* (53.33%) patrons of **JH**, and *Lowest* (11.11%) of **IARI** are **aware** but **do not find it useful**. *Highest* (30.49%) patrons of **DU** and *Minimum* (4.26%) of **JIT** are **not even aware** of it. DU in this category is shocking as the Delhi University Library System provides access to a large number of digital resources.

(Figure: 8B) depicts that overall (63.1%) patrons are aware of digital library and find it useful also. (21.5%) patrons are aware but do not find it useful while (15.4%) are not even aware of the same. This figure may be improved upon by holding more user orientation and education programmes, other information literacy tutorials and marketing resources to make patron aware of its benefits in study & research. (78.5%) users of all ULICs are aware of the service, which is quite appreciable.

#### Interlibrary Loan

ILL is a service for a patron of one LIC to borrow books, DVDs, etc. and/or receive photocopies of documents that are owned by another LIC. It is a cooperative arrangement among LICs and is also known as resource sharing and includes union catalogue, web form for ILL request, along with electronic document delivery. ULICs facilitate this service to provide relevant documents or information to the patrons.

<i>ICT Information service [ILL]</i>	DU	GGSSIP	IARI	JH	JIIT	JMI	JNU	Total
Aware and Useful	18	28	33	25	58	31	25	218
Aware but not Useful	21	23	17	35	23	23	23	165
Not aware	43	38	31	15	13	23	40	203
<b>Grand Total</b>	<b>82</b>	<b>89</b>	<b>81</b>	<b>75</b>	<b>94</b>	<b>77</b>	<b>88</b>	<b>586</b>

Table 9. Interlibrary loan-Number of responses

### User awareness of information services provided through ICT Interlibrary Loan

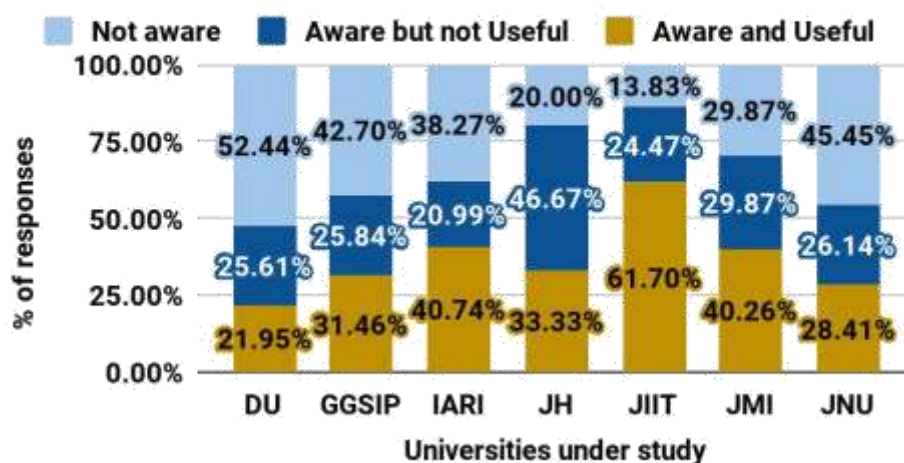
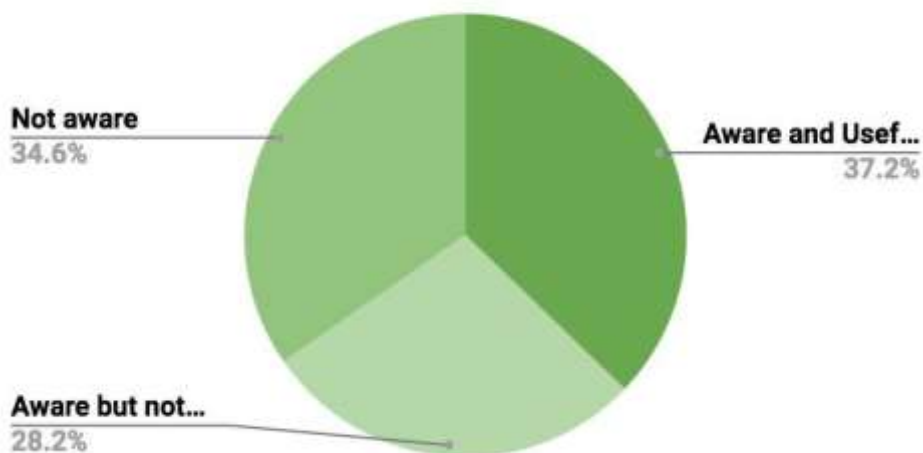


Figure. 9A

**User awareness of information services provided through ICT  
Interlibrary Loan: Overall analysis**



**Figure.9B**

Analysis (Table: 9 & Figure: 9A) shows that highest (61.70%) patrons of **JHIT** and Minimum (21.95%) of **DU** are **aware** of ILL facility and also find it **useful**. Highest (46.67%) patrons of **JH** and Minimum (20.09%) of **IARI** are **aware** but do **not find it useful**. Maximum (52.44%) patrons of **DU** and Minimum (13.83%) of **JHIT** are **not even aware** of it.

(Figure: 9B) Overall analysis presents that (37.2%) patrons are aware of the service and find it useful. Overall (28.2%) patrons are aware but do not find it useful, while (34.6%) patrons are not even aware of it, which is quite high in number. ULICs need to make more efforts in making user aware of the service as well as its usefulness. Overall only (65.4%) patrons are aware of the service.

### Institutional Repository

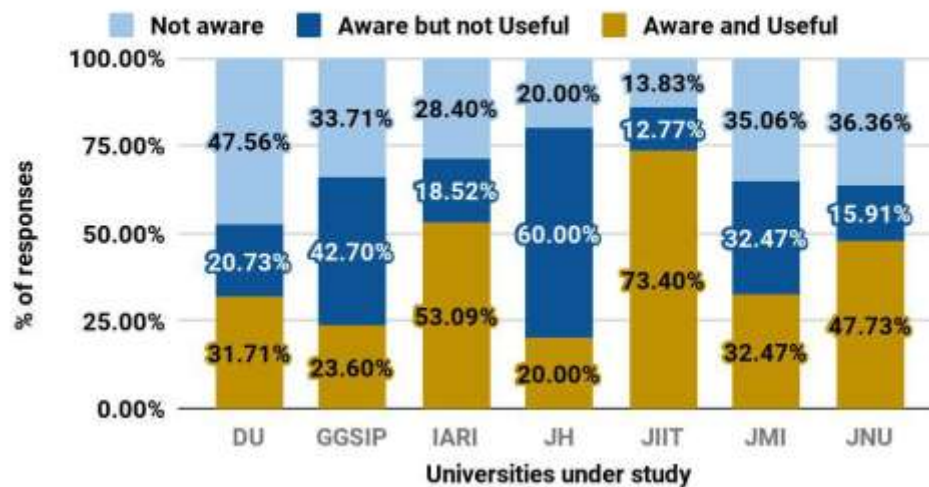
IR, the digital collection of any library information centre includes thesis, articles or papers, e-books, newsletters, research reports, news clippings, faculty publications, syllabus and question paper archive and other institutional publications as well as some external publications.

<i>ICT Information service [IR]</i>	DU	GGSI P	IARI	JH	JIIT	JMI	JNU	Total
Aware and Useful	26	21	43	15	69	25	42	241
Aware but not Useful	17	38	15	45	12	25	14	166
Not aware	39	30	23	15	13	27	32	179
<b>Grand Total</b>	<b>82</b>	<b>89</b>	<b>81</b>	<b>75</b>	<b>94</b>	<b>77</b>	<b>88</b>	<b>586</b>

**Table 10.** IR- Number of responses

### User awareness of information services provided through ICT

#### Institutional Repository



**Figure.10A**



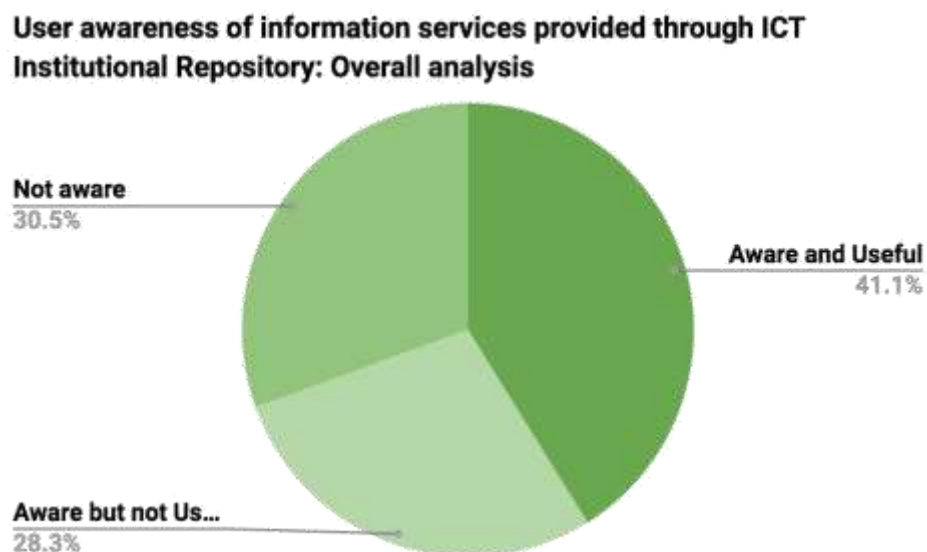


Figure. 10B

The analysis (Table: 10 & Figure: 10A) reveals that *highest* (73.40%) patrons of **JIT** and *Lowest* (20.0%) of **JH** are **aware** and find it **useful**. *Highest* (60.00%) patrons of **JH** and *Minimum* (12.77%) of **JIT** are **aware** but do **not find it useful**. *Highest* (47.56%) patrons of **DU** and *Minimum* (13.83%) of **JIT** are **not aware** of the service.

(Figure: 10B) presents that overall (41.1%) of patrons are aware of the service and find it useful, (28.3%) patrons are aware but do not find it useful. A very high (30.5%) patrons are not aware. ULICs need to make more efforts in publicizing the service and educate the user about its usefulness. Overall (69.4%) patrons are aware of the service.

#### Online Databases

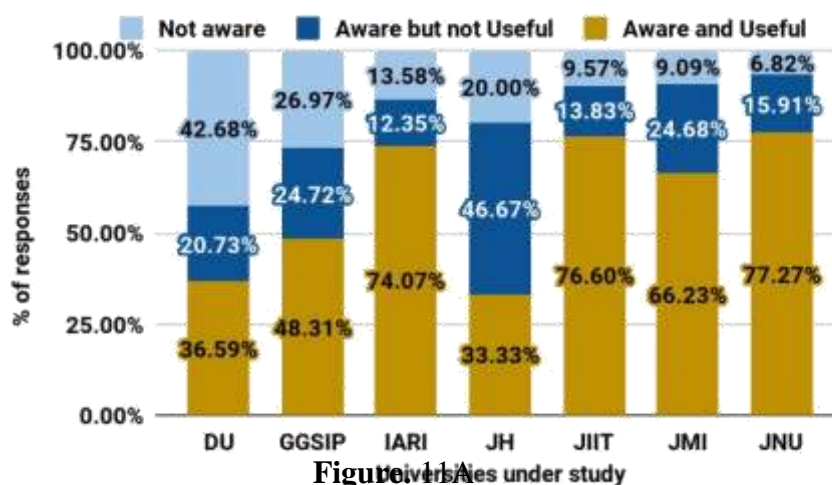
A database (collection of records) is an online database if it can be accessed on LAN or through internet. It is different from databases which are stored on a local individual computer or on a storage device. These may be accessible for free or paid through subscription.

<i>ICT Information service [Online Databases]</i>	DU	GG SIP	IARI	JH	JIT	JMI	JNU	Total
Aware and Useful	30	43	60	25	72	51	68	349
Aware but not Useful	17	22	10	35	13	19	14	130
Not aware	35	24	11	15	9	7	6	107
<b>Grand Total</b>	<b>82</b>	<b>89</b>	<b>81</b>	<b>75</b>	<b>94</b>	<b>77</b>	<b>88</b>	<b>586</b>

Table 11. Information service Online databases-Number of responses

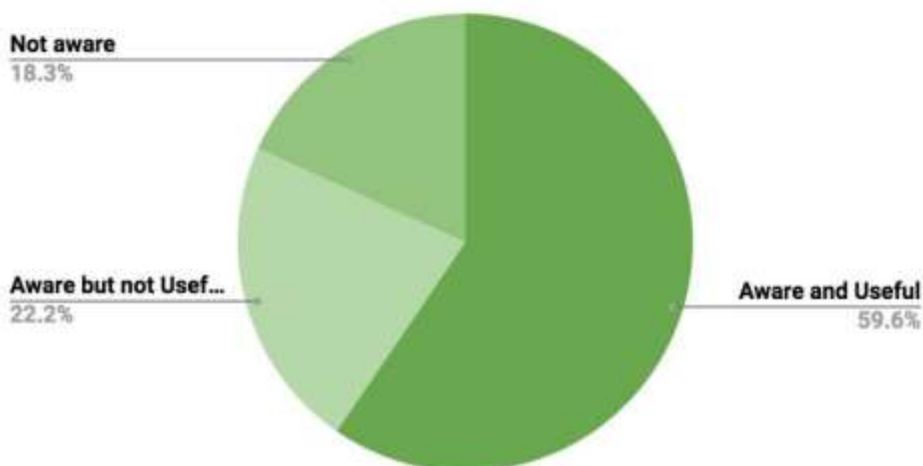


**User awareness of information services provided through ICT  
Online Databases**



**Figure.11A**

**User awareness of library services provided through ICT  
Online Databases: Overall analysis**



**Figure. 11B**

**Figure.11A**

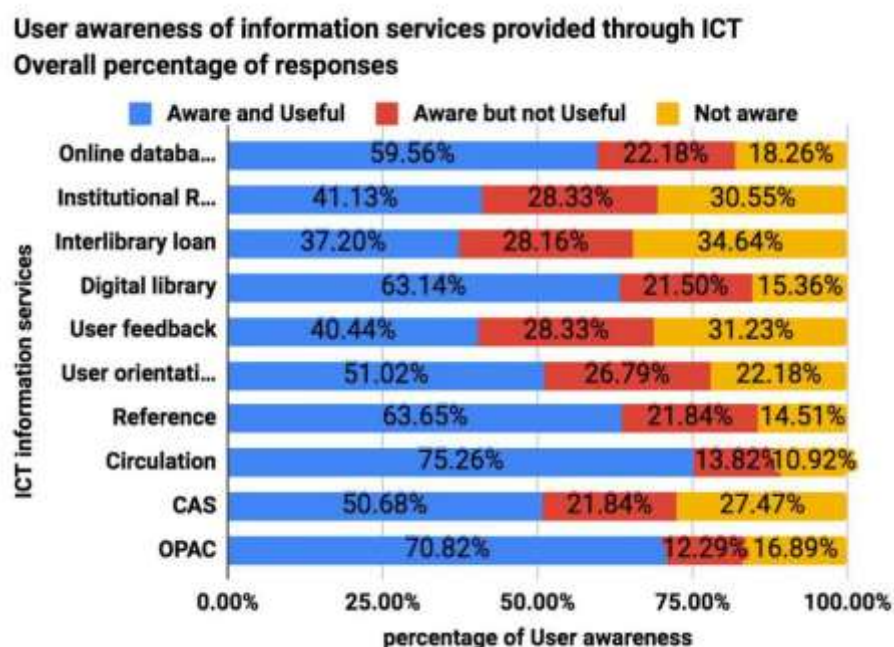
**Figure 11B**

The data analysis (Table: 11 & Figure: 11A) shows that highest (77.27%) patrons of **JNU** and minimum (33.33%) of **JH** are aware and find it useful. Highest (46.67%) patrons of **JH** and Minimum (12.35%) of **IARI** are aware but do not find it useful. Highest (42.68%) patrons of **DU** and Minimum (6.82%) of **JNU** are not aware. It is crucial for **DU** to make solid efforts in making digital resources popular.

(Figure: 11B) depicts that overall (59.6%) patrons are aware of the online databases find them useful. (22.2%) patrons are aware but do not find useful while (18.3%) patrons are not aware of it. ULICs are spending a huge amount of money in subscribing the online databases and they need to take more pain in making efforts to educate user about them and also about their usefulness. Overall (81.8%) patrons are aware of the online databases.

## Discussion

### Overall User awareness: Information services analysis



**Figure. 12A**

Overall analysis of data (Figure: 12A) highlights that the highest number of respondents are **aware** of Online databases, digital library (e-resources), Reference, circulation, CAS, and OPAC ICT information services and find them **useful**. While IR, ILL, user feedback/ suggestion, and user orientation/education, are some of the services, for which more patrons responded as **not being aware** of services provided by their respective ULICs.

## Overall User awareness of ICT Information services: University analysis

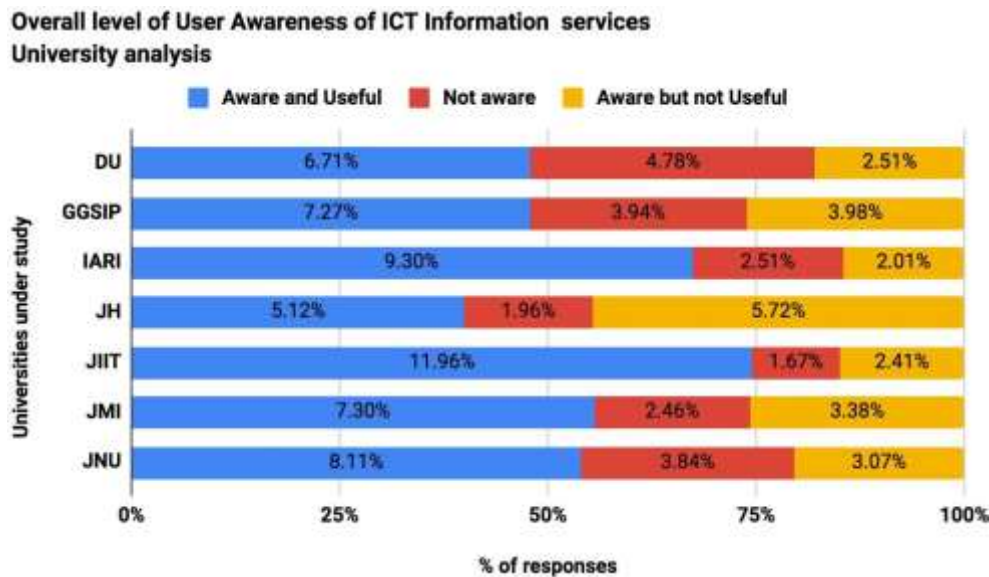


Figure. 12B

Overall analysis of the above (Figure: 12B) shows that Highest number of patrons of **JIIT** (11.96%), and Lowest of **JH** (5.12%) are **aware** of ICT information services and find them **useful**. Highest percentage of patrons from **JH** (5.72%) and Lowest (2.01%) of **IARI** are **aware** but do **not find them useful**. Highest percentage of patrons (4.78%) of **DU** and lowest (1.67%) of **JIIT** are **not aware**.

## User awareness of ICT Information services: Overall analysis

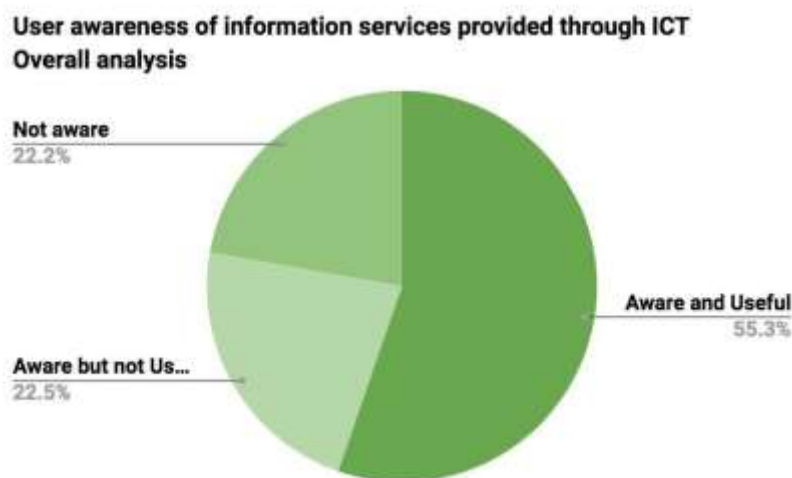


Figure. 12C

The data analysis (Figure: 12C) shows that overall (55.3%) respondents are **aware** of ICT services and find them **useful**. (22.5%) respondents are **aware** but find them **not useful**, while (22.2%) respondents are **not even aware**. Overall **(77.8%)** patrons are aware of the ICT information services.

It can be highlighted through this analysis that **JIIT** and **IARI** are putting in good efforts in making their patrons aware of information service provided through ICT. **JH** is at last rank, despite having infrastructure and provision of services, their patrons are not aware of the ICT information services facilitated by them. Highest percentage of patrons of **DU** and **JNU** in category of **Not aware** is quite surprising and a matter of concern as these are central universities, having good infrastructure, staff and other resources are not successful in making their patrons aware of ICT services.

## Conclusion and Suggestion

It can be concluded that ULICs need to make efforts to market their information services provided through ICT to bring awareness to the unaware patrons. ULICs under study are suggested to use web 2.0 tools and social media to market or promote their services as well as organise more user orientation and education programmes along with information literacy tutorials. Apart from this, regular feedbacks must be taken from the patrons to check the usefulness of the service and make appropriate changes as per the need or innovate new services to satisfy the user and fulfill their needs. More orientation needs to be given for the very important and valuable services like IR, ILL, Document delivery, SDI and CAS so that patrons become aware of them and use to get the pin pointed exhaustive information in a timely manner.

## References

1. Arif, M. and Meadows. A.K.J. 1994. **The Provision of Information to industry: A comparative Study of Saudi Arabia and U.K.** *Journal of Librarianship and Information Science*. Vol. 26, Issue no. 1: 29-34.
2. Drake, M.A. 1982. **Information Management and Special Librarianship.** *Special Libraries*, Vol. 73, Issue no. 4: 225-237.
3. French, B.A. 1990. **User needs and Library Services in Agricultural Science.** *Library Trends*. Vol. 38, Issue no. 3: 415-441
4. Knapp, P.A. 1966. **The Monteith College Library Experiment.** *Scarecrow. New York, NY*, p. 30-32
5. Lougee, W.P. 2002. **Diffuse Libraries: Emergent Roles for the Research Library in the Digital Age.** *Council on Library and Information Resources*, Washington, DC.
6. M. Madhusudhan and V. Nagabhushanam 2012. **Use of Web-based library services in select university libraries in India: A study.** *International Journal of Library and Information Studies*, Vol. 2, Issue no. 1: ISSN: 2231-4911

7. Mugyabus. J.F.L. 1999. **User Education and Information Skills. A Need for a Systematic Programme in African University Libraries.** *African journal of Library Archives and Information Science*, Vol. 9, Issue no.2: 129-141
8. Neelameghan, A. 1985. **User Orientation in Library and Information Studies Curriculum: Some Aspects with Special Reference to Developing Countries.** *African Journal of Library, Archives and Information Science*, Vol. 10, Issue no.1: 53-65
9. Popoola, S.O. 2008. **Faculty awareness and use of library information products and services in Nigerian universities,** *Malaysian Journal of Library & Information Science*, Vol.13, Issue no.1:91-102  
<https://mjlis.um.edu.my/article/view/6974/4635> (accessed on 15.01.2018)
10. Roberts, J.M. 1995, **Faculty Knowledge About Library Services at the University of West Indies.** *New Library World*, Vol. 96, Issue no.119: 14-23
11. Schumacher, A. 1996. **A Small College Information System: An Analysis and Recommendations.** *Hamline University St. Paul, MN*, p. 111-112
12. <https://www.nirfindia.org/UniversityRanking.html> (accessed on 15.01.2018)
13. <https://www.ugc.ac.in> (accessed on 15.01.2018)

# E-Resource Selection Process at Libraries in Bangladesh: A Study

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## **Abstract**

Libraries of the modern world are spending a great portion of their budget to subscribe e-resources even though it has been observed especially in Bangladesh; most of the libraries never follow a unified or any e-resource selection criteria. Therefore, due to the lack of systematic selection procedure libraries have been miscarried to select proper e-resource to satisfy their users. The main purpose of the current study is to find out all important criteria that are being followed in selecting e-resources by some selected university and special libraries of Bangladesh. This study reveals types and usage rate of e-resources by library and library users. This study was conducted based on the survey method. 17 libraries including private university libraries, public university libraries, and special libraries have been selected as a sample area for the study. Data collected through the questionnaire to analyze types and frequency of use of e-resources, rationality in rendering e-resources services to users, e-resource selection criteria such as researching e-resources, content evaluation, depth of indexing, searching, cost, customer relations and support, documentation, training and continuous assessment. The result of the study depicts that about 89% of libraries under the survey always provide e-books to their users. More than 80% of libraries under the survey are strongly agreed that they are providing e-resource services to users for “increasing the resource of the library”. About 77% of libraries under survey check the evaluative reviews of the product before selection. Comparing the stated subject coverage with available subjects of the product is a very important aspect of the content evaluation to 76.47% respondent libraries.

## **Keywords**

E-resources, Selection Criteria, University, and Special Library, Bangladesh.

## Introduction

Library with modern support and facility is now a day an essential part for any organization. The emerging technology has been made an impact on the function and activities of the library largely. To keep pace with these modern technologies libraries have been renovating its mode of the transaction from traditional to digital or electronic one. Users of the libraries are now being habituated to get their library services in digital and electronic ways. Therefore, the utility of electronic resources and its selection process in libraries are now being treated as a burning issue. Rao, Rao and Kumar (2015) addressed that with the advent of e-resources the selectors have to focus new selection criteria such as easy and quick accessibility, continuous content, technological and legal issues beyond the traditional selection criteria like quality, relevance, use and cost.

Kenchakkanavar (2014) urged that the selection of e-resources should be done based on the demand of users. Besides this, he mentioned several things that should be considered during e-resource selection such as scope, quality, and search facility of e-resources, cost-effectiveness, genuine license copy, compatibility, and training support, etc. Okogwu and Achebe (2018) treated "satisfying user needs" as the core objective of the e-resource selection process. Yu and Brevold (2008) observed that the selection process of e-resource should be done in collaboration with users by getting their feedback.

In Bangladesh, several studies have been found on the current development of e-resources practices and services in different categories of libraries (Habiba and Chowdhury 2012; Mostafa 2013; Islam and Mostafa 2013). Even there are few works highlighting users' perceptions or awareness towards e-resources (Nasiruddin, Islam and Islam 2012; Haque and Hoq 2018; Islam and Habiba 2015). However, not a single work has been found on selection criteria of e-resources followed by librarians of Bangladesh. There is a severe gap of knowledge in this sector where librarians have to play a key role in developing a unified e-resources selection criteria.

## Objectives

The main purpose of this research was to explore e-resource selection criteria followed in the libraries of Bangladesh. Besides the general objectives there are also some other specific objectives to carry out the work listed below:

- To examine the types of e-resource used by libraries of Bangladesh;
- To explore the rationality in rendering e-resource service to users;
- To identify basic evaluative criteria for selecting e-resource before procurement.

## Methodology

The current study adopts the survey research method to select the libraries purposively. A structured questionnaire was designed based on the evaluation criteria for electronic resources prescribed by Beck (2010), by emphasizing nine sections such as researching a product, content

evaluation, depth of indexing, searching, cost, documentation, training, customer relations and support and continuous assessment. A structured questionnaire was distributed to 17 libraries including six public university libraries, seven private university libraries and four special libraries of Dhaka and Rajshahi city of Bangladesh shown in table 1. A five-point Likert scale was used to depict the frequency, importance and agreement level of criteria followed by selected libraries. Qualitative terms for Likert scale have been arranged in ascending order for example from 'Always' to 'Never' expressed by 1 to 5 numerical value. Therefore, the lower the mean ( $\bar{x}$ ) is the greater in frequency, importance and agreement level of the data item. The SD ( $\sigma$ ) value of the data items was also analyzed to show whether the data point tends to be close to the mean or spreading over a large range of values.

**Table 1.** Areas of Research

SL no	Name of the university library	Types of library
1	Dhaka University Central Library	Public University Library
2	Rajshahi University Central Library	Public University Library
3	Bangladesh University and Engineering and Technology Library	Public University Library
4	Rajshahi University of Engineering and Technology Library	Public University Library
5	Bangladesh University of Professionals Central Library	Public University Library
6	Sher-e Bangla Agriculture University Library	Public University Library
7	North South University Library	Private University Library
8	Ayesha Abed Library, BRAC university	Private University Library
9	East West University Library	Private University Library
10	Independent University Library	Private University Library
11	University of Liberal Arts Bangladesh Library	Private University Library
12	United International University library	Private University Library
13	Daffodil International University Library	Private University Library
14	Bangladesh National Scientific and Technical Documentation Centre Library	Special Library
15	SAARC Agriculture Information Centre library	Special Library
16	Bangladesh Centre for Scientific and Industrial Research Library	Special Library
17	International Centre for Diarrhoeal Disease Research Bangladesh Library	Special Library



## Data Analysis

### *Types of e-resources*

Respondent librarians were asked what types of e-resources were being used and the frequency of usage by their library and users. They were given 14 options of e-resources types through the questionnaire including E-book, E-journal, E-database, E-magazines, E-thesis, E-article, E-reports, E-referencing sources, E-newspaper, E-dictionary/encyclopedia, multimedia products, CD-ROM, E-clippings, video, image and sound, and E-research monograph. The result in Table 1 shows that 88.24% libraries always used the e-book, which is ranked one based on their mean value, and 82.35% libraries used e-journal as e-resource, which is ranked two based on their average.

**Table 2.**Types and frequency of e-resources usage

Types of e-resources	5	4	3	2	1	$\bar{x}$	Rank	$\sigma$
E-book	-	-	5.88	5.88	88.24	1.18	1	0.53
E-journal	-	-	5.88	11.76	82.35	1.24	2	0.56
E-database	5.88	-	5.88	11.76	76.47	1.47	3	1.07
E-magazines	11.76	-	11.76	23.53	52.94	1.94	4	1.34
E-thesis	11.76	-	17.65	17.65	52.94	2.00	5	1.37
E- articles	17.65	5.88	5.88	-	70.59	2.00	5	1.66
E- reports	17.65	-	5.88	17.65	58.82	2.00	5	1.54
E- referencing sources	11.76	-	5.88	41.18	41.18	2.00	5	1.27
E-newspaper	23.53	-	-	11.76	64.71	2.06	6	1.71
E-dictionaries/encyclopedia	17.65	-	11.76	35.29	35.29	2.29	7	1.45
Multimedia products	23.53	-	29.41	17.65	29.41	2.71	8	1.53
CD-ROM	17.65	5.88	29.41	29.41	17.65	2.76	9	1.35
E- clippings	29.41	-	23.53	23.53	23.53	2.88	10	1.58
Video, image and sound	23.53	5.88	29.41	23.53	17.65	2.94	11	1.43
E- research monograph	35.29	5.88	11.76	23.53	23.53	3.06	12	1.68

**Note.** 1= Always, 2=Often, 3= Sometimes, 4= rarely, 5= Never (the cell value of Likert scale indicates percentage of each row);  $\bar{x}$ = Mean,  $\sigma$ = SD

It is also notable that a high percent of libraries (35.29%) never use e-research monograph as an e-resource. In the case of types and frequency of using e-resources, the mean values and SD of the data were also analyzed. The mean value for the types and frequency of "E-book" is lowest ( $\bar{x}$ =1.18) which indicates "always" in the Likert scale. The mean score for types and frequency of use e-research monograph is highest ( $\bar{x}$ =3.06) which indicates sometimes in the Likert scale. In the present study, the SD value for the "E-book" as types of e-resources was the lowest (0.53) which signifies less variability over the values. Whereas the SD value for the "E-newspaper" was the highest (1.71) which indicates the data point more spread out over a large number of data.

***Rationality in rendering e-resources***

The respondent libraries under survey were also asked why they provide e-resource service to users. They were given 10 best possible options for selection of rationality in rendering e-resource services to users. The result of the data is shown in table 2.

**Table 3.** Rationality in rendering e-resources services to users

<b>Rationality</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b><math>\bar{x}</math></b>	<b>Rank</b>	<b><math>\sigma</math></b>
Increasing the resource of the library	-	-	-	11.76	88.24	1.12	1	0.33
Improving the service standard of the library	-	-	-	17.65	82.35	1.18	2	0.39
Increasing the access of more journal title	-	-	5.88	23.53	70.59	1.35	3	0.61
Can be accessible 24x7 hours to larger audiences	-	-	11.76	17.65	70.59	1.41	4	0.71
Save library space and better management	-	-	11.76	23.53	64.71	1.47	5	0.72
Reducing the cost of e-journal subscription	-	11.76	5.88	23.53	58.82	1.71	6	1.05
Incorporating to meet user demand	5.88		11.76	23.53	58.82	1.71	6	1.10
Easy incorporation of resources with other libraries	-	5.88	5.88	41.18	47.06	1.71	6	0.85
More intuitive in searching and retrieval	-	-	23.53	29.41	47.06	1.76	7	0.83
Reducing the overall cost of the library budget	11.76	17.65	-	41.18	29.41	2.41	8	1.42

**Note.** 1= Strongly agree, 2= Agree, 3= Neutral, 4= Disagree, 5= Strongly disagree (the cell value of the Likert scale indicates percentage);  $\bar{x}$ = mean,  $\sigma$ = SD

More than 80% libraries under survey are strongly agreed that they are providing e-resource services to users for “*increasing the resource of the library*” ( $\bar{x}$ = 1.12;  $\sigma$ =0.33) and “*improving the service standard of the library*” ( $\bar{x}$ = 1.18;  $\sigma$ =0.39). About 71% of the respondent libraries have strong faith in “*increasing the access of more journal title*” ( $\bar{x}$ = 1.35;  $\sigma$ =0.61) and “*accessible 24x7 hours to larger audiences*” ( $\bar{x}$ = 1.41;  $\sigma$ =0.71) as the logic to provide e-resource service to users. More than half of the respondent libraries thought that e-resource service can “*save library space and ensure better management*” (64.71%;  $\bar{x}$ = 1.47;  $\sigma$ =0.72), “*reduce the cost of e-journal subscription*” (58.82%;  $\bar{x}$ = 1.71;  $\sigma$ =1.05), and “*incorporate to meet user demand*” (58.82%;  $\bar{x}$ = 1.71;  $\sigma$ =1.10). The highest mean of the rationality option for “*Reducing the overall cost of library budget*” ( $\bar{x}$ = 2.41;  $\sigma$ =1.42) also indicates the ‘Agree’ in Likert scale.

**E-resources evaluative criteria**

To explore the e-resource selection criteria followed in the libraries, the respondent libraries were given 9 broader criteria under which there were several aspects of the checklist to get respondent libraries opinions. The broader heading of criteria includes Researching a product (e-resources), Content evaluation, Depth of Indexing, Searching, Cost, Documentation, Training, Customer Relations, and Support, Continuous Assessment. Before going to select an e-resource for the library, librarians often inquire the product for verifications such as checking the evaluative reviews, consultation with experienced users and verifying the several aspects of the product.

**Table 4.** Researching a product (e-resources)

Criteria/ Aspects of Checklist	5	4	3	2	1	$\bar{x}$	Rank	$\sigma$	F	UF
To check evaluative reviews of the product before selection	-	-	-	23.53	76.47	1.24	1	0.44	100	-
To check the list of experienced customers and current users of the product	-	-	-	35.29	64.71	1.35	2	0.49	100	-
To verify product related queries available such as collection development, licensing issue, public service issue and technical issue	-	-	5.88	35.29	58.82	1.47	3	0.62	88.24	11.76

**Note:** 1= Very important, 2= Important, 3= Neutral, 4= Less important, 5= Unimportant;  $\bar{x}$ =Mean,  $\sigma$ =Standard Deviation, F= Followed, UF=Un-followed (The cell value of the Likert scale and followed and un-followed indicates percentage).

The result of table 3 shows that about 77% libraries under survey check the evaluative reviews of the product before selection ( $\bar{x}$ = 1.24;  $\sigma$ = 0.44) and the cent percent libraries always follow this pre-selection criterion before going to select a product. Discussion with experienced users/librarians often helps the librarian to play an important role in product selection. About 65% of libraries under survey treat the “*opinions of experienced users*” as important pre-selection criteria being followed ( $\bar{x}$ = 1.35;  $\sigma$ = 0.49). The highest mean score for researching a product is “*to verify product relates queries*” such as inquiries in relating to collection development policy, licensing issue, public service issue, etc. of the product ( $\bar{x}$ =1.47;  $\sigma$ = 0.62) which denotes ‘important’ in the Likert scale.

**Table 5.** Content evaluation

Criteria/ Aspects of Checklist	5	4	3	2	1	$\bar{x}$	Rank	$\sigma$	F	UF
To examine reputation and reliability of publisher, agency, vendor or producer	-	-	-	23.53	76.47	1.24	1	0.44	100	-
To compare the stated subject coverage with available subjects of the product	-	-	5.88	17.65	76.47	1.29	2	0.59	88.24	11.76
To examine the current information stored in the database	-	-	5.88	23.53	70.59	1.35	3	0.61	94.12	5.88
To test the level of audiences (e.g. teachers, researchers, students, etc.) of the e-resources	-	5.88	-	23.53	70.59	1.41	4	0.80	88.24	11.76
To ensure the years of data (time covered) in the database	-	-	-	41.18	58.82	1.41	4	0.51	100	-
To check the product availability on the web	-	-	5.88	35.29	58.82	1.47	5	0.62	88.24	11.76
To check authority and user documentation of e-resources	-	-	5.88	41.18	52.94	1.53	6	0.62	100	-
To check the availability of abstract, full text and images of the product	-	-	11.76	29.41	58.82	1.53	6	0.72	82.35	17.65
To check whether any geographic restrictions of the e-resources	-	-	11.76	47.06	41.18	1.71	7	0.69	76.47	23.53
To verify time lag between publication date and appearance in the index	-	5.88	5.88	41.18	47.06	1.71	7	0.85	76.47	23.53
To check the types of materials (e.g. journal articles, book, etc.) and quantity of materials being covered	-	-	17.65	35.29	47.06	1.71	7	0.77	82.35	17.65
To check the frequency of the product being updated	-	-	17.65	41.18	41.18	1.76	8	0.75	88.24	11.76
To verify the significant content overlap of e-resource providers	-	-	17.65	47.06	35.29	1.82	9	0.73	82.35	17.65
To examine citations and abstract available in English in the case of multiple languages	-	5.88	17.65	41.18	35.29	1.94	10	0.90	70.59	29.41
To examine searching interfaces, display options, and output option of the product	-	5.88	23.53	29.41	41.18	1.94	10	0.97	88.24	11.76

**Note:** 1= Very important, 2= Important, 3= Neutral, 4= Less important, 5= Unimportant;  $\bar{x}$ =Mean,  $\sigma$ =Standard Deviation, F= Followed, UF=Un-followed (The cell value of the Likert scale and followed and un-followed indicates percentage).

Content evaluation of e-resources is an important pre-selection criterion shown in table 3. The hundred percent librarian under survey must follow to examine the reputation and reliability of publisher ( $\bar{x}$ = 1.24;  $\sigma$ = 0.44). Comparing the stated subject coverage with available subjects of the product is a very important aspect of the content evaluation to 76.47% respondent libraries ( $\bar{x}$ = 1.29;  $\sigma$ = 0.59). Before going to subscribe e-resources maximum libraries under survey test the level of audiences (e.g. teachers, researchers, students, etc.) of the e-resources ( $\bar{x}$ = 1.41;  $\sigma$ = 0.80). Checking updated e-resources, the availability in web, and available of authority and user documentation, abstract, full text and images of the products are important aspects of content evaluation to be considered while selecting e-resources. In our survey more than half of the respondent libraries treated the criteria like “*years of data in the database*” (58.82%,  $\bar{x}$ = 1.41;  $\sigma$ = 0.51), “*product availability on web*” (58.82%,  $\bar{x}$ = 1.47;  $\sigma$ = 0.62), “*available user documentation and authority*” (52.94%,  $\bar{x}$ = 1.53;  $\sigma$ = 0.62), and “*available of abstract, full text and images of the product*” (58.82%,  $\bar{x}$ = 1.53;  $\sigma$ = 0.72) as very important aspects of content evaluation. Nowadays librarians are often to check the types and quantity of materials being covered ( $\bar{x}$ = 1.24;  $\sigma$ = 0.44), significant content overlap ( $\bar{x}$ = 1.82;  $\sigma$ = 0.73) and the frequency of product being updated ( $\bar{x}$ = 1.76;  $\sigma$ = 0.75) before going to subscribe e-resource. The criteria like examining searching interfaces, display options, and output option of the product is ranked highest by mean ( $\bar{x}$ = 1.94;  $\sigma$ = 0.97) which also denotes important in the Likert scale.

**Table 6.** Depth of Indexing

Criteria/ Aspects of Checklist	5	4	3	2	1	$\bar{x}$	Rank	$\sigma$	F	UF
To check the indexing quality accuracy	-	-	5.88	17.65	76.47	1.29	1	0.59	82.35	17.65
To verify the components of the record, full-text searching capability, and types of fields to be searched	-	-	11.76	23.53	64.71	1.47	2	0.72	76.47	23.53
To verify the quality control procedure maintained by the producer	5.88	-	5.88	41.18	47.06	1.76	3	1.03	82.35	17.65
To examine all facets of the content of each article indexed	5.88	-	5.88	41.18	47.06	1.76	3	1.03	88.24	11.76
To check the accuracy of the bibliographic citation	5.88	5.88	11.76	29.41	47.06	1.94	4	1.20	76.47	23.53
To check unique access points, available of controlled vocabulary, and linking between a thesaurus and set of articles	-	5.88	17.65	41.18	35.29	1.94	4	0.90	70.59	29.41
To check the journals indexed subject-wise or alphabetically	11.76	-	11.76	35.29	41.18	2.06	5	1.30	82.35	17.65
To check types of index terms assigned to each record	17.65	-	17.65	52.94	11.76	2.59	6	1.28	82.35	17.65

Note: 1= Very important, 2= Important, 3= Neutral, 4= Less important, 5= Unimportant;  $\bar{x}$ =Mean,  $\sigma$ =Standard Deviation, F= Followed, UF=Un-followed (The cell value of the Likert scale and followed and un-followed indicates percentage).

Respondent librarians were asked to mention some criteria on the depth of indexing for selecting e-resources. They were given eight possible options of checklist on the depth of indexing. The result of the responses shows in table 4. Checking the “accuracy of indexing” is a very important criterion to be checked by maximum respondents of the survey (76.47%,  $\bar{x}$ = 1.29;  $\sigma$ = 0.59). At the time of selecting e-resources, librarians should verify the components of the record, full-text searching capability, and the types of fields to be searched (64.71%,  $\bar{x}$ = 1.47;  $\sigma$ = 0.72). In practice the majority percent librarians under survey (82.35%) must follow few criteria before subscribing e-resource as “checking the indexing quality accuracy” ( $\bar{x}$ = 1.29;  $\sigma$ = 0.59), “verifying the quality control procedure maintained by the producer” ( $\bar{x}$ = 1.76;  $\sigma$ = 1.03), “checking the journals indexed subject-wise or alphabetically” ( $\bar{x}$ = 2.06;  $\sigma$ = 1.30), and “checking the types of index terms assigned to each record” ( $\bar{x}$ = 2.59;  $\sigma$ = 1.28). Though less than half of the respondents (47.06%) treat the criteria like “examining all facets of the content of each article indexed” as very important yet the highest number of the respondent (f= 88.24%) follow this criterion before selection ( $\bar{x}$ = 1.76;  $\sigma$ = 1.03). The mean value ( $\bar{x}$ = 1.94) for the criteria like “checking the accuracy of the bibliographic citation”, “checking unique access points, available of controlled vocabulary, and linking between a thesaurus and set of articles” indicates important criteria to the respondents.

**Table 7.** Searching

Criteria/ Aspects of Checklist	5	4	3	2	1	$\bar{x}$	Rank	$\sigma$	F	UF
To check the searching interface ease of use	-	-	-	17.65	82.35	1.18	1	0.39	100	-
To check the availability of general and advanced search interface	-	-	11.76	11.76	76.47	1.35	2	0.70	88.24	11.76
To access the full text from citation	-	-	-	47.06	52.94	1.47	3	0.51	94.12	5.88
To examine the types of searching options (e.g. Boolean searching, keyword searching, full-text searching, Weighted searching, proximity searching, term truncation, word steaming)	5.88	-	5.88	23.53	64.71	1.59	4	1.06	76.47	23.53
To check the availability of online tutorials	-	-	29.41	17.65	52.94	1.76	5	0.90	76.47	23.53
To verify the product easy to download, print, e-mail and save	5.88	-	17.65	17.65	58.82	1.76	5	1.15	64.71	35.29
To examine the availability of search limits (Limit by full text, abstract, language, dates, publication types, and single field)	-	-	31.25	25.00	43.75	1.88	6	0.89	76.47	23.53
To verify the search screen attractive, easy to read, tailored to user needs	5.88	-	5.88	52.94	35.29	1.88	6	0.99	70.59	29.41

Criteria/ Aspects of Checklist	5	4	3	2	1	$\bar{x}$	Rank	$\sigma$	F	UF
To check the result display ease of use, easily understandable and operable	5.88	5.88	11.76	41.18	35.29	2.06	7	1.14	82.35	17.65
To verify the easy set for display limit and citation included in the full text	5.88	5.88	5.88	52.94	29.41	2.06	7	1.09	82.35	17.65
To verify the hyperlinked searching capabilities	-	5.88	23.53	52.94	17.65	2.18	8	0.81	88.24	11.76
To check selected items be marked for later use or search results and search strategy be saved for reuse	5.88	-	29.41	35.29	29.41	2.18	8	1.07	82.35	17.65

Note: 1= Very important, 2= Important, 3= Neutral, 4= Less important, 5= Unimportant;  $\bar{x}$ =Mean,  $\sigma$ =Standard Deviation, F= Followed, UF=Un-followed (The cell value of the Likert scale and followed and un-followed indicates percentage).

Maximum librarians (82.35%) consider the criteria like “checking the searching interface ease of use” as very important which is also ranked one based on their mean value ( $\bar{x}$ = 1.18) while cent percent libraries under survey follow this criterion. Librarians under survey were also eager to get the facility of advanced search option together with general search interface (76.47%,  $\bar{x}$ = 1.35;  $\sigma$ = 0.70). In the advanced searching interface, the librarians under survey preferred various types of searching options like Boolean searching, keyword searching, full-text searching, Weighted searching, proximity searching, term truncation, word steaming (64.71%,  $\bar{x}$ = 1.59;  $\sigma$ = 1.06). More than half of the respondents treat the criteria like “verifying the product easy to download, print, e-mail and save” (58.82%,  $\bar{x}$ = 1.76;  $\sigma$ = 1.15), “checking the availability of online tutorials” (52.94%,  $\bar{x}$ = 1.76;  $\sigma$ = 0.90), and “accessing the full text from citation” (52.94%,  $\bar{x}$ = 1.47;  $\sigma$ = 0.51) as very important in Likert scale. The “search screen attractive, easy to read, tailored to user needs” ( $\bar{x}$ = 1.88;  $\sigma$ = 0.99) and “verifying the easy set for display limit and citation included in the full text” ( $\bar{x}$ = 2.06;  $\sigma$ = 1.09) and “the verifying hyperlinked searching capabilities” ( $\bar{x}$ = 2.18;  $\sigma$ = 0.81) are important criteria to about 53% respondent libraries under survey.



**Table 8.** Cost, documentation and training criteria

Criteria/ Aspects of Checklist	5	4	3	2	1	$\bar{x}$	Rank	$\sigma$	F	UF
<b>Cost</b>										
To examine cost can be reduced by aggregation (e.g. consortia)	5.88	-	-	29.41	64.71	1.53	1	1.01	94.12	5.88
To verify the pricing structure and determination of product	5.88	-	-	41.18	52.94	1.65	2	1.00	88.24	11.76
To verify the cost based on the number of the user being served, the number of ports available to the users, and the number of use	-	-	17.65	41.18	41.18	1.76	3	0.75	94.12	5.88
<b>Documentation</b>										
To verify the documentation accurately, easy to use, comprehensive and free	-	5.88	5.88	35.29	52.94	1.65	1	0.86	82.35	17.65
To check the availability of documentation and navigational aids	5.88	5.88	5.88	64.71	17.65	2.18	2	1.01	94.12	5.88
<b>Training</b>										
To verify product usage training offered for staff and users	-	-	11.76	29.41	58.82	1.53	1	0.72	88.24	11.76
To check the online training program free for users	5.88	-	5.88	52.94	35.29	1.88	2	0.99	82.35	17.65

Note: 1= Very important, 2= Important, 3= Neutral, 4= Less important, 5= Unimportant;  $\bar{x}$ =Mean,  $\sigma$ =Standard Deviation, F= Followed, UF=Un-followed (The cell value of the Likert scale and followed and un-followed indicates percentage).

The table 6 shows that about 65% respondent libraries think that affiliation with consortia like aggregation for reducing cost ( $\bar{x}$ = 1.53;  $\sigma$ = 1.01) is very important and 94% libraries under survey follow this criterion before selection. Respondent libraries (52.94%) gave more priority on accurate documentation ( $\bar{x}$ =1.65;  $\sigma$ =0.86) rather than availability of documentation (17.65%,  $\bar{x}$ =2.18;  $\sigma$ =1.01). Product usage training offered for staff and users is to be treated very important criteria to around 59% respondent libraries ( $\bar{x}$ = 2.06;  $\sigma$ = 1.09). About 53% of libraries treat "free online training program for users" is an important criterion to be considered before the subscription of e-resource.



**Table 9.** Customer relations, support and continuous assessment

Criteria/ Aspects of Checklist	5	4	3	2	1	$\bar{x}$	Rank	$\sigma$	F	UF
<b>Customer relations and support</b>										
To verify when a problem occurred how long does it take to solve	-	-	-	29.41	70.59	1.29	1	0.47	100	-
To check the technical support through the website or user advisory group	5.88	-	-	23.53	70.59	1.47	2	1.01	76.47	23.53
To verify the availability and kinds of use statistics	5.88	-	-	35.29	58.82	1.59	3	1.00	94.12	5.88
To check the availability of product demonstration and trial	5.88	-	5.88	29.41	58.82	1.65	4	1.06	88.24	11.76
To verify the sufficient back-up of the product	-	5.88	5.88	52.94	35.29	1.82	5	0.81	94.12	5.88
To verify the product change informed by Listserv or newsletter	5.88	-	5.88	70.59	17.65	2.06	6	0.90	82.35	17.65
<b>Continuous assessment</b>										
To determine an assessment (useful, continued demand, etc.) cycle (Weekly, monthly, and yearly)	-	-	-	23.53	76.47	1.24	1	0.44	100	-

Note: 1= Very important, 2= Important, 3= Neutral, 4= Less important, 5= Unimportant;  $\bar{x}$ =Mean,  $\sigma$ =Standard Deviation, F= Followed, UF=Un-followed (The cell value of the Likert scale and followed and un-followed indicates percentage).

Table 7 shows that when a problem in relating to e-resource occurred how long it takes to solve is important criteria to be addressed by majority percent libraries (70.59%). Technical support in that issue can be provided through the website or user advisory group ( $\bar{x}$ = 1.47;  $\sigma$ = 1.01). Moreover, product demonstration and trial can be a more attractive feature for choosing the right type of e-resource ( $\bar{x}$ = 1.65;  $\sigma$ = 1.06). If any service-related change occurred the majority percent libraries under survey expected to get that news through Listserv or newsletter ( $\bar{x}$ = 2.06;  $\sigma$ = 0.90).

## Conclusion

E-resources have transformed the concept and service pattern of libraries. These resources have also changed the selection procedure and made the selection process crucial (Holleman 2000). It has been observed from the current study that e-book ( $\bar{x}$ =1.18) and e-journal ( $\bar{x}$ =1.24) is the most popular types of e-resource in the libraries of Bangladesh. The result of the study revealed that e-resource can increase the resource ( $\bar{x}$ = 1.12) and standard ( $\bar{x}$ = 1.18) of the library. Maximum libraries under survey must check the evaluative reviews of the product before selection ( $\bar{x}$ =1.24) and examine reputation and reliability of publisher, agency, vendor or producer ( $\bar{x}$ =1.24). Ease of use of searching interface ( $\bar{x}$ =1.18) and accurate indexing quality ( $\bar{x}$ =1.29) are two important prevailing criteria in selecting e-resources.

## References

1. Beck S J. 2010. **“Evaluation criteria for electronic resources”**.  
[https://www.libraries.rutgers.edu/rul/staff/collection\\_dev/reports/eval\\_criteria\\_e-resources.shtml](https://www.libraries.rutgers.edu/rul/staff/collection_dev/reports/eval_criteria_e-resources.shtml) (accessed on 30 June 2018).
2. Habiba U. and Chowdhury S. 2012. **Use of electronic resources and its impact: a study of Dhaka university library users**.*The Eastern Librarian* 23(1): 74-90
3. Haque M A. and Hoq K M G. 2018. **Student perception of electronic resources use in Rajshahi university library: a case study**.*International Journal of Library and Information Science* 10(7): 78-84.
4. Holleman C. 2000. Electronic resources: are basic criteria for the selection of materials changing? *Library Trends* 48(4): 694-710.
5. Islam S, Mostafa SM. 2013. **A review of digital resources among different types of libraries in Bangladesh**.*International Journal of Humanities and Social Sciences* 2(1):109-120.
6. Islam M, Habiba U. 2015. **Using Pattern of Internet and E-resources by the Students and Faculty Members of a Private University in Bangladesh**. *American Journal of Educational Research* 3(5):541-546.
7. Kenchakkanavar A Y. 2014. **Types of e-resources and its utilities in library**. *Indian Journal of Information Sources and Services* 1(2): 97-104.
8. Mostafa S M. 2013. **Use and impact of e-resources at some selected private universities in Bangladesh**.*Research Journal of Library Science* 1(1): 10-13.
9. Nasiruddin M, Islam M H, and Islam M N 2012. **E-resource practice at some leading private university libraries in Bangladesh: user attitude survey towards digital Bangladesh**.*World Digital Libraries* 5(2): 71-82.
10. Okogwu F I. and Achebe N E. 2018. **Selection and acquisition of electronic resources in university libraries in Southeast Nigeria: challenges**.*Library Philosophy and Practice*.<https://digitalcommons.unl.edu/libphilprac/1833> (accessed on 30 June 2019).
11. Rao K S., Rao N V. and Kumar P S. 2015. **Professional attitudes towards selection of e-resources in engineering college libraries in Andhra Pradesh**, pp. 303-314. In: *Innovation driven librarianship: creating future landscape for the new generation libraries and LIS professionals*, edited by D G. Oh, K. Burnett, and Y J. Nam. Tamil Nadu, India: SRM University. 303-314pp.
12. Yu H. and Breivold S. 2008. **Electronic resource management in libraries: Research and practice**. New York: Information Science Reference.

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# Implementation and Application of Six Sigma in Libraries

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## Abstract

The paper discusses about introduction and implementation of Six Sigma in Libraries. Libraries can be considered as a service organization and caters for the needs of users. It is hence, required that libraries must adopt methodologies for quality improvements from time to time, Six Sigma plays a important role here. Six Sigma is a quality improvement initiative which involves substantial use of statistical tools for continuous improvement of service processes, which has also been discussed in detail in this article. A true Six Sigma organization will not only provide excellent services and products but also improves the management activities of the Library including other service processes. This paper focusses on six sigma applications in the Library.

## Introduction

Libraries are nowadays more focussed on providing quality services to users so as to have maximum customer satisfaction. It is known that well developed services can be provided if libraries systematically improve their processes by eliminating all defects. Library being a growing organism there is always a pressure on it to improve quality and giving better customer satisfaction with decreasing costs and increasing work output. The reasons for implementing Six Sigma in libraries are:

- Six Sigma not only helps in enhancement of quality of services but at the same time help deleting defects in all areas of service. With these applications libraries can locate the defects in the system and effective remedies can be implemented.
- Reader is the customer of the Library. Meeting the customer's demand is the duty and responsibility of any Library and Six Sigma is a process by which the whole process of customer satisfaction can be suitably addressed.
- Six Sigma can improve the number of satisfied customers and reduce customer complaints.
- Black belts and Green belts are the key players in the Six Sigma improvement initiative of the library. With the defect removing system their mortal can be raised and they can do their job in a better way.
- In this system, Libraries can pay attention at not only perfection in services but at knowledge creation in all spheres of activity.
- While going for computerization the Six Sigma can help to eliminate delays and defects in the overall system and improve the work efficiency

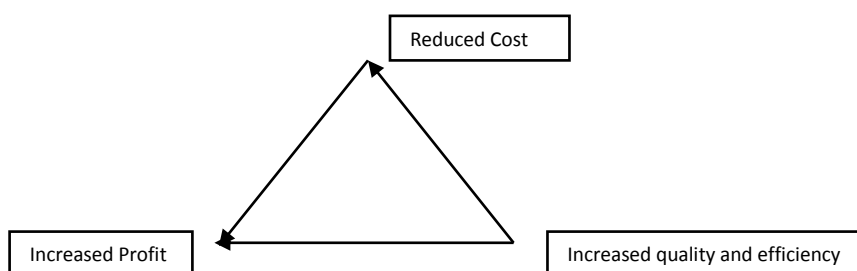
Key to success of Six Sigma is its Customer Focus. Focusing on the customer is absolutely essential to drive healthy growth and impact the level of prosperity of a library. Customer satisfaction can be achieved through operational excellence which in turn can be achieved only if processes are of high quality. If we do not measure, we can not control and cannot improve. Measurement and improvement of processes is essential to achieve operational excellence and leads to higher customer satisfaction

## History of Six Sigma

- Concept of quality is as old as the human civilization. In ancient times, it was a one-man show – same person was responsible for procurement of material, manufacturing and selling of the product. At each stage he used to take care of the quality requirements and the customers also used to look for quality in the product.
- During the Industrial Revolution in U.K. in the eighteenth century, large scale manufacturing industries came up. One-man show gave way for large number of people working together in an organized way in different groups or departments, each looking after a specific functional area. One of the departments, namely inspection was responsible for sorting good and bad items. This was so called Quality control
- The inspection was a costly process due to high cost of rejections and inspection. With the invention of Control Chart by W. A. Schewhart (1924), the Statistical Process Control (SPC) came into being. Aim of SPC was to control the process suitably so that defectives are not produced at all and need for inspection is eliminated. This was beginning of the era of the modern Quality Control
- Total Quality Control (TQC) – an integrated holistic approach, was introduced by A. V. Feigenbaum (1960) which introduced a company-wide totalitarian approach involving all processes and all departments.
- Total Quality management (TQM) which builds in the management aspects of quality into TQC, came into being in late 1970s ruled the industrial scenario for over a decade. Many libraries adopted this with great benefit.
- Six Sigma came into being when Bill Smith at Motorola introduced the concept in 1980. The thrust was on process improvements and quality innovations based on statistical concepts along with systematically conducted personnel training and quality improvement activities as a management strategy.

The roots of Six Sigma as a measurement Standard can be traced back to Carl Fredrick Gauss who introduced the concept of normal curve which has a crucial role in six sigma. The word sigma has been used by Mathematicians and Engineers as a universally accepted standard for variation in measurement data which denotes the discrepancy in product quality. In 1979 an extensive statistical study was done by Bill Smith, an Engineer at Motorola Communication Sector who studied the correlation between the products field life and number of times the product was repaired during the manufacturing process by many measurement standards (Cpk, Zero defects etc.). In Mid 1980's Engineers in Motorola Inc in the USA used six Sigma as informal name for in-house initiative for reducing defects in production processes. In 1984 Dr Mikel Harry a senior staff at Motorola created a detailed roadmap of problem solving through

statistical analysis to improve the design of the product and reduce the production time and costs. In 1991 Motorola certified its first 'Black Belt', six sigma experts which indicate the beginning of formalization of the accredited training of six sigma methods. By the year 2000, six sigma was effectively used as an industry in its own right involving the consultancy and implementation of six sigma methodology in all sorts of organizations around the world. Six Sigma has evolved over the time. It is much above the TQM and ISO. Figure 1 shows how six sigma process takes place and process of enhancing profits.



**Figure 1.** Process of Six Sigma

## Literature Review

**Dong-Sug Kim (2010)** implemented Six Sigma in Sungkyunwan University Library and determined its success factors. He also states the advantages and disadvantages of six-sigma in university libraries. **Mohamed Gamal Aboelmaged (2010)** finds the characteristics and trends of Six Sigma literature over 17 years, from 1992 to 2008. **Ahmad Ali Al-Zubi and Basha (2010)** implemented Six Sigma in Library Management for quality control. **MahipalDutt (2013)** has tried to find how six sigma can be implemented in Libraries and identifying the key functional areas to achieve user's satisfaction. **Pradeep Rattan and Payare Lal (2012)** try to find out the pros and cons of implementing Six sigma in Libraries. The paper also presents its reservations on the benefits of Six-Sigma for modernize library and information services for user satisfaction.

**Abhijit Chakrabarti (2014)** tries to find the outcome of implementing Six sigma in academic libraries. The paper analyses the various ways by which six sigma can be useful for the satisfaction of users of Academic libraries. **Elizabeth Nelson (2015)** reviews the literature on Lean and Six Sigma as they are used in business and then as they have been used in libraries.

## Six Sigma Approach

The aim of any Six Sigma initiatives is to improve the processes to such an extent that the defect level is reduced to almost nil and achieve a near perfection in quality. Six Sigma is a disciplined

Step by Step approach (DMAIC) for continual improvement of Quality. It is a data driven approach for eliminating defects in any process. These tools include various statistical and management tools as well as quality management tools developed by Japanese scientists and practitioners. Special emphasis is given on developing skill, knowledge and awareness among staff at different levels through structured training programs.

With the successful implementation of six sigma an organization can cut down costs drastically. Hence, six sigma can be considered very beneficial from libraries point of view because the final outcome of any library should be customer satisfaction and high end quality services to the users and they have to achieve this under severe cost constraints. At a library if all activities are done with little or no faults or defects every day then quality services can be delivered to the users more efficiently, without delay and with reduced cost. The basic approach here is to improve upon the already existing customized process. Therefore, the basic approach in six sigma is to measure the performance of existing process, compare it using various statistical tools and eliminate any defects so that ultimately the customers are satisfied and delighted. Dr. Mikel Harry observed that the approach of six sigma changed over time. Accordingly, he classifies the period into Generations. In generation 1 (G1SS) the thrust was on defect prevention (1986 to 1993). In Generation 2 (G2SS) the thrust shifted to cost reduction (1993 to 2000). In generation 3 (G3SS) the thrust was shifted to value creation. In generation 4, he contemplates to shift the emphasis to our personal life.

## Metric of Six Sigma

The common Metrics of Six sigma are: Defects per unit (DPU), Defects per Opportunity (DPO) and defects per million Opportunity (DPMO). Of course, the most important metric is the Sigma Rating (also known as Sigma Capability or simply Sigma). Defect is a way the service provided by the library is unsatisfactory to the user. Opportunities are the various possible defects in the service. If the service provided is issue of book, the various defects may be – delay, misbehaviour, issue of wrong book etc.

(i) Defects per unit (DPU) =  $\frac{\text{Number of defects discovered}}{\text{Number of units checked}}$

Number of units checked

(ii) Defects per million opportunities (DPMO) or parts per million (ppm)

$\text{DPMO} = \frac{\text{Number of Defects discovered} \times 10,00,000}{\text{No. of units checked} \times \text{Opportunities per unit}}$

No. of units checked x Opportunities per unit

Sigma Rating is expressed as a number in the sigma scale running up to the maximum of 6. A 6 sigma process is the best in class and produces only 3.4 ppm (parts per million) defects. A 4 sigma process can be considered as an average process and produces 6210 ppm defects.

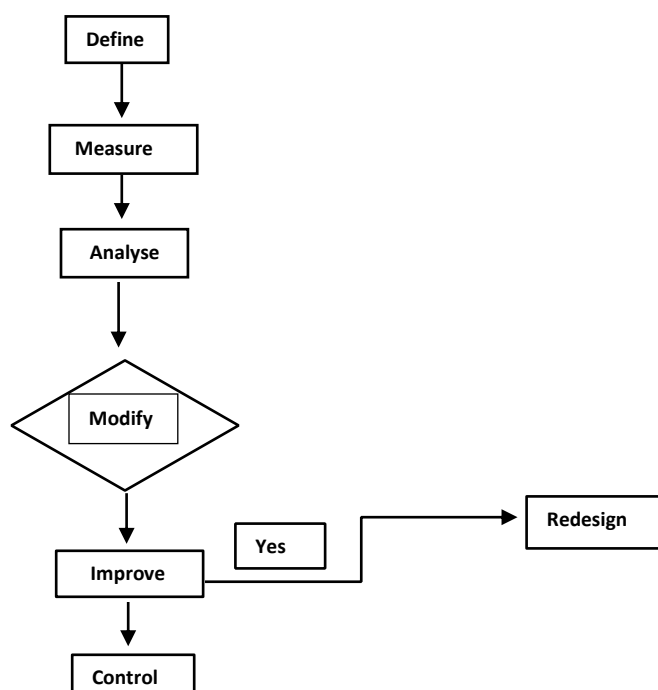


Processes with sigma rating 3 or less are considered as poor. A 3 sigma process will produce as many as 66,807 ppm defects.

## The Road Map of Six Sigma Problem Solving

For six sigma problem solving there are basically two types of methodologies or step by step procedure (also termed as road map) (a) DMAIC: define, measure, analyse, improve and control (b) DMADV: define, measure, analyse, design and verify. In Libraries perspective, the DMAIC can be used for improving the existing service processes whereas, DMADV can be used for designing new processes, which when implemented, can render defect free services.

- The DMAIC design can be followed in the library as follows:
  - Define (D): Consider the customers ultimate focus is and demand from the library. Determine the voice of the customer or customer needs. Define the team, training needs and scope of the six sigma project. Choose an appropriate title and define the problem. Set target to be achieved and a time schedule for completion of the project.
  - Measure (M): The team will measure the various parameters of the processes and service, gather baseline (current status) data on defects and evaluate the existing metrics. In Libraries we may have to gather data on, say, number of books missing, delay in issuing books, how many books are issued daily etc. depending on the project taken up. The data is summarised to determine the current status.
  - Analyse (A): The team will analyse the defects and their causes and try to determine conditions or level of process parameters through further analysis using statistical or other six sigma tools. Which will minimize the defects in the system
  - Improve (I): After analysing the defects the team can improve the quality to satisfy the users. This also help us to find out new ideas, plans and ways to make the already existing services better
  - Control (C): One has to keep a check on the final outcome provided to the users for continuous improvements and providing high quality services to the users. This step helps us to review and update the process. (Fig.2)



**Figure 2.** Flowchart to show the DMAIC Model (Source: N A Siddiqui and Abhishek Dwivedi)

- The DFSS Design: This design also relates to six sigma quality process. DFSS is deployed via framework known as DMADV (Define, Measure, Analyze, Design and Verify). DMADV helps one to aim at creating projects for developing new products or process designs.

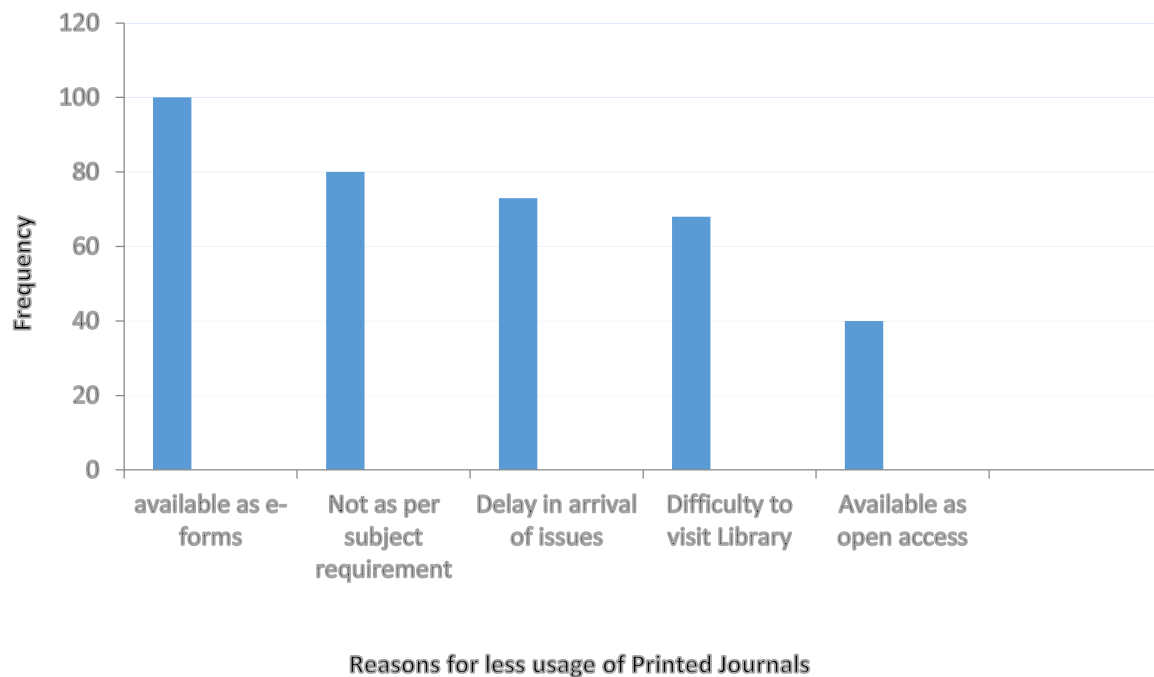
The main aim of Libraries in providing excellent services and efficacy of the services and how quickly it can be provided to the users but it should also analyse how effectively the services are being used by the users. Hence, Six sigma is insisting to have continuous improvement, assessment and guide to bring excellent services to library users to satisfy them at the maximum.

## Statistical Techniques for Six Sigma

The process of Six sigma heavily relies on the various statistical and mathematical tools. The paper tries to understand some of the basic statistical tools that can be used and can be easily followed by the Librarians to draw a detailed and concise picture of the problems plaguing their systems. Statistics offers a range of methods for the compilation, arrangement and investigation of data. The simplicity of statistics allows one to determine development and examine the process within the organizations. Six Sigma relies a lot on statistics and data analysis for improving quality and user satisfaction. The most commonly used statistical tools which are applicable for implementing Six Sigma in libraries are explained below:

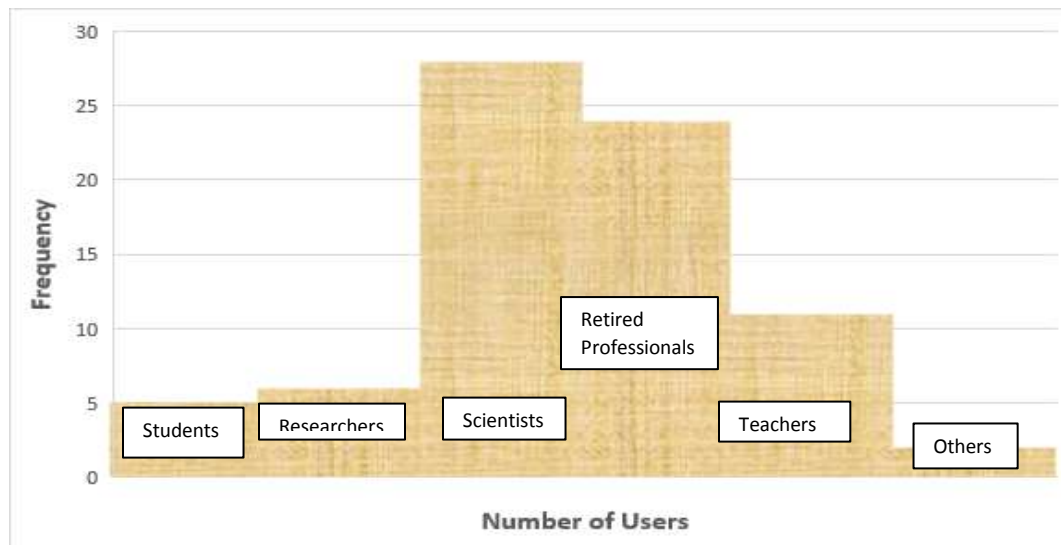
**Pareto Chart:** In Pareto Charts lengths of bars represent frequency and are arranged with longest bars on the left and the shortest on the right. The Pareto chart helps one to understand

and differentiate between the most significant issues, solving which can provide solutions to the problems. Hence, Pareto charts helps us focus on issues that are quite often occurring in the library and helps us to minimize those issues. An example from the library has been taken where the reasons for less usage of printed periodicals in the library has been depicted through a bar graph as shown in Graph 1.



**Graph 1.** Pareto Chart to show usage of Printed Journals in a Library

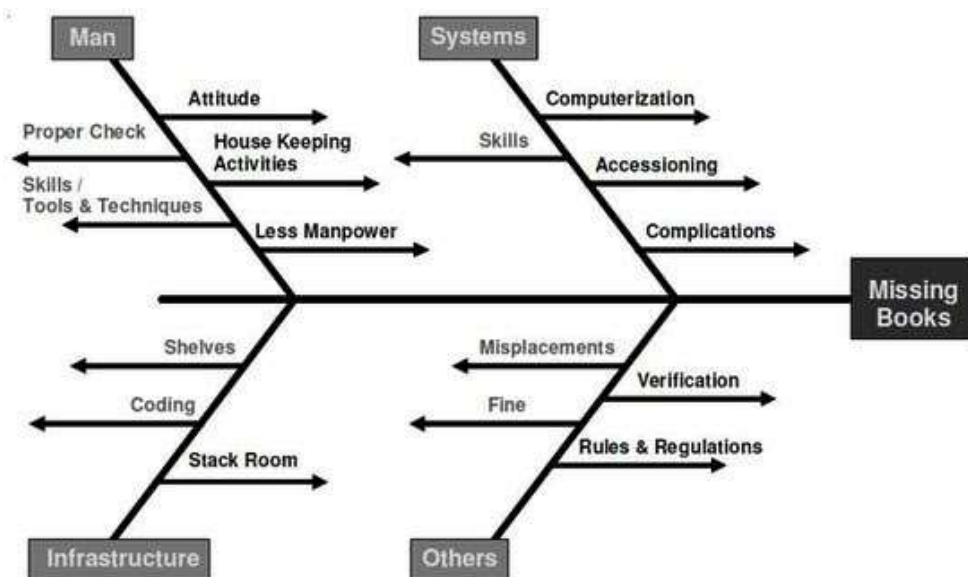
**Bar Charts:** A bar chart is a sort of showing a set of definite records. The bar chart is a way of representing bars to show data, with each bar signifying a known category. An example has been taken from the library to show the frequency of users visiting the library and the types of users (Graph 2).



**Graph 2.** Frequency of Users in the Library

**Histogram:** A histogram is shows numeric data in comparison to bar chart which shows categorical data. The typical form of a histogram is a bell-shaped structure where the minimum data falls on the left and right and the maximum data in the middle of the graph.

**Ishikawa Diagram:** Also called as Fishbone diagram or cause and effect diagram is a popular statistical representation of main causes of a problem and finally identifying the root cause of the problem. Dr. Kaoru Ishikawa, a Japanese quality control expert has designed this model. This diagram can be very helpful in Libraries also where the real bottlenecks or weaknesses can be identified in the system. An example has been taken from Case study of College of Engineering and Management Library, where the reason for missing books were analysed based on various cause and effects method.



**Figure 3.** Cause and Effect Diagram (Source: [www.whatishumanresource.com/](http://www.whatishumanresource.com/))

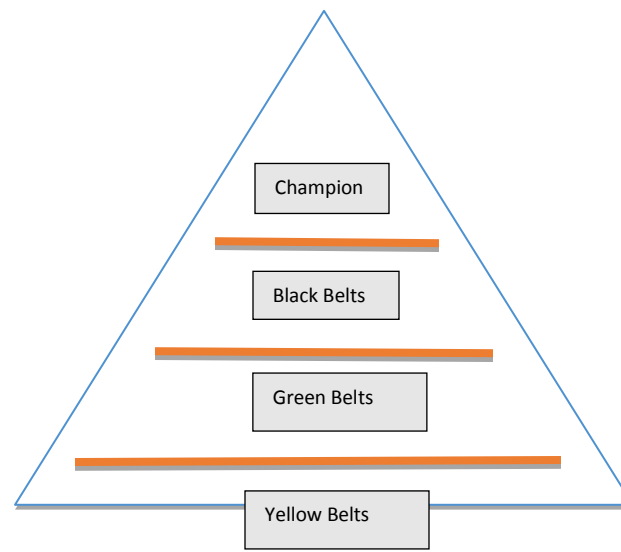
**Attribute Agreement Analysis:** Every time a person needs to make a decision it has to be collectively agreed upon by a team of members so as to make the decision fault free. For example, choosing a candidate for a job post, selection of a suitable applicant is not based upon the decision of a single member, a group of members come together to select the most suitable applicant for the job.

**Process Capability:** To reach the goal of any desired process needs a set of actions and arrangements. Each process or step adds to the next to attain a goal or the anticipated result. An example for book selection in Libraries can be taken as we understand books in a Library are elected based on certain policies and procedures however, every library has a slight variation in the same process to make the overall procedure easier.

Other important statistical tools are New seven tools, Process mapping, Failure mode and Effect analysis (FMEA), Poka-Yoke and 5S (Japanese tools). These are all important tools for Six Sigma and can be used in Libraries also.

## Role Players of Six Sigma

Six Sigma depends a great deal on group of people working together, not on any one individual. (Figure 3). The different role players working in a Six Sigma are:



**Figure 3.** Role Players of Six Sigma

**Executive Leaders-** It is the top leader of the organization who is responsible for setting up the vision of Six Sigma.

**Champions-** They are responsible for taking care of Six Sigma implementation across the organization.

**Master Black Belts-** They are working under Champions are responsible for training Black belts and Green belts

**Black Belts-** They are working for some specific projects and work under Master Black Belts

**Green Belts-** They are specially trained for implementing Six sigma in an organization along with their other job responsibilities. They work under Black Belts

**Yellow Belts-** They are the other members in a team. Yellow members are the members, administrators, operations personnel or others.

## Steps of Implementing Six Sigma for Libraries

Six Sigma is a quality control method that is used in organizations to improve quality and remove variations. Based on DMAVC or DFSS model Six Sigma can be planned and analysis can be done on the basis of statistical tools. However, Six Sigma process through very beneficial still has a number of difficulties.

There are basically eight steps in Six Sigma which are required for executing it in Libraries. These steps are discussed in brief below:

- *Create a Proposal*: A team has to be selected by the organization for implementing Six Sigma. A leader will plan and execute the proposal, he will be responsible for the progress and analyse the underperformance, if any.
- *Keeping Track of Finance/Budget*: This is the most important phase for any project. The successful implantation of Six Sigma is only possible if there is a steady inflow of resources.
- *Understanding the Methodology*: The organization top management must plan beforehand the various training requirements of the staff.
- *Supervise the Performance*: Activities must be assessed to ensure that they are meeting the organizations goals and targets.
- *Leadership Proposal*: The leader will be responsible for the entire team. Whenever, there are defects in the process the leader must decide to work on it and find out the corrective measures.
- *Using required measurements*: Correct measurements provide solutions to problems and things that need improvements.
- *Govern the Programme*: Regular meetings and follow-up are very important for successful implementation of Six Sigma.
- *Recognition*: Rewards and recognizations play an important role. These rewards can be the top level or grass root level.

## Conclusion

Six Sigma is a management approach with total quality control that uses statistical measure called Sigma to measure the quality levels in any process and providing quality improvement and user satisfaction. A Library is a service house, it is also measurable. With the help of Six Sigma, a library can improve its services, remove the defects, and make its readers more satisfied. The planned framework and focus on process improvement are the major strengths of Six Sigma.

This paper tries to analyse the different methodologies of Six Sigma and the statistical methods that can be used for implementing Six Sigma in Libraries. Although the approach of sustenance of Six Sigma is simple, it is by no means easy but the results justify that organizations that successfully sustain Six Sigma.

## References

1. Chitra Kaushik and AshuShokeen, Six sigma application for Library Services, *DESIDOC Bulletin of Information Technology*, 27 (5), September 2007, pp.35-39
2. Dong-Suk Kim, A Study on Introducing Six Sigma Theory in the Library for Service Competitiveness Enhancement, IFLA, 2006, pp. 1-16.
3. Agrawal, Pawan, Application of 'Six Sigma' in Libraries for Enhancing Service Quality, *International Journal of Information Dissemination and Technology*, 1(4), October-November 2011, pp. 203-206.
4. Kumi,S. and Morrow, J., Improving Self Service the Six Sigma way at Newcastle University Library and Information Systems, *Program*, 40 (2), pp. 123-136.
5. Nelson, Elizabeth. Using Six Sigma and Lean in the Library, *College and Undergraduate Library Journal*, 22 (3-4), 2015, pp. 312-324.
6. Rattan, Pradeep and Lal, Pyare. Pros and Cons of Six Sigma: A Library Perspective, *International Journal of Digital Library Services*, 2 (4), 2012, pp. 24-33.
7. [www.isixsigma.com](http://www.isixsigma.com) (accessed on 05-9-2019)
8. [https://en.wikipedia.org/wiki/Six\\_Sigma](https://en.wikipedia.org/wiki/Six_Sigma) (accessed on 15-09-2019)
9. <http://leansixsigmadefinition.com> (accessed on 15-09-2019)
10. <https://asq.org/quality-resources/six-sigma/belts-executives-champions> (accessed on 23-09-2019)
11. <https://www.sixsigma.com/> (accessed on 01-10-2019)
12. <https://www.sixsigmadaily.com/> (accessed on 01-10-2019)



# **Global challenges for library consortium: An analytical view with DeLCON Consortium**

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In current scenario, it has been very difficult for the libraries to procure, subscribed & provide all the resources required by their users due to the funds lacking and costly information & resources. The immediately resolution to the above problem is library consortium exclusively in relevant to the electronic resources. Several initiatives steps have been taken in India for the setup of library consortia. Various library consortia in India are doing quite well and many libraries are benefited and at the same time library consortiums are having various issues & problems. Problems & issues for consortium such as interruption of online access, perpetual access to back issues, pricing, licensing, copyright and archival solutions etc. are identified and need to be deliberately undertaken and well addressed to get the best out of the Library consortia.

The paper describes about the problems, challenges & issues of the DBT's Electronic Resources Consortium (DeLCON).

## **Keywords**

Consortia; Resource Sharing; Networking, Electronic Journals; Problems, Challenges, Issues, Library Cooperation & Cooperation; DeLCON

## **Introduction**

The consortia is an association among various libraries to accomplish a common objective, i.e. to improve services and facilities for the users. The definition of Consortia is given in the Cambridge Dictionary as "Consortia" meaning several libraries/special libraries joining hands together to achieve their objectives and goals. The consortium are a group of libraries joining hands together to achieve a common objective & goal of information services.

The information explosion through print; non-print and special resources gain much responsibility through the rising world literature, to store organized generate and broadcast massive amount of information is a current challenge to the libraries and information centres. The libraries cannot equip with the latest sources of information due to the irregular mounting print and non-print materials. The traditionally library services, and facilities Increased user needs; Low library budget provisions, and Increase spiral of library costs.

Never get the user satisfaction, and can't equip with latest sources of information. Previous studies print out that the growth of average academic library collections, increasing in size, and its total expenditures have been also increased more than doubled.

The efficiency and the existence of libraries are completely depending upon their capability to combat rising costs and to provide increased services. This implies that resource sharing and cooperation is important.

The resource sharing in new ways now made possible by advances in computer and communication technologies. But substantial cost saving from resource sharing requires also the communication between libraries that computer networks provide. The advances in networking technology has the potential to offer lower unit costs and strengthen services, with the cooperative efforts of a group of libraries.

Benefits have also been resulted from the introduction of technology into individual libraries. And it is only when collaboration is combined with technology as in the case of computer networks, and the total outcome, expectable may be significant.

The technology and the art of networking are current developments in computer networking must be acknowledged as an important step in the cooperation and resource sharing. The resource sharing and networking is an actual substitute to be given serious consideration.

Library consortium is a network (a steady) of at least two libraries which have formally consented to work together, synchronize, compose, participate or unite certain capacities to accomplish joint targets. As per Oxford Dictionary, consortium implies transitory relationship of various nations, foundations, associations, organizations, banks and so forth for a typical reason. The term is currently utilized perhaps too extensively, and incorporates everything from formal lawful items, (for example, consolidated or administrative organizations) to casual gatherings that meet up only to accomplish better estimating for obtaining electronic data.

Regardless of definitions and implications, the hidden motivation continues as before: the sharing of progressively costly library assets in the most financially savvy way for common advantage and general cost reserve funds. There are several library consortia around the globe arranged along a wide range of lines.

Joint effort between foundations for sharing their library assets is being polished for a considerable length of time. Customarily, the basic role of establishing a consortium is to share physical assets including diaries/periodicals and books among individuals. Nonetheless, the method of collaboration has under run a change with implantation of new data innovation from customary (print-based) condition to advanced condition. The presence of Internet, especially, the World Wide Web (WWW) as another media of data conveyance activated proliferation of Web-based full-content online assets. Expanding number of distributors are utilizing the Internet as a worldwide method to offer their productions to the universal network of researchers. The innovation gives an unparalleled media to conveyance of data with more prominent speed and

economy. The libraries and data focuses, as overwhelming buyers of electronic diaries and online databases, remain to profit extraordinarily from this innovation driven insurgency.

Joint membership or consortia-based membership to electronic assets through the consortia of libraries, on one hand, licenses fruitful arrangement and work area access to electronic assets at profoundly limited rates of membership and then again, it meets with the expanding weights of reducing spending plan, expanded client's interest and expanding cost of diaries. The library consortia, based on absolute quality of the quantity of foundations, offer sound business development chances to the electronic distributors and along these lines draw in the most ideal cost and terms of assentions.

## **Benefits of Consortium for Libraries**

There are various advantages of consortium for libraries, for example, Resources Sharing – Access to non-bought in diaries, plausibility for electronic documents positively for future, accessibility of utilizations measurements, better discount on account of joint–subscriptions, reduced storage costs, ability to develop joint resource databases, effective document delivery systems via single inter face, enhanced search facilities, scope for union catalogue preparation and benefits arising out of larger scale of process.

## **Growth and Future of Library Consortia**

The huge data upset and expansion have achieved extraordinary changes to the capacity and administration in a wide range of libraries in India amid most recent two decades. Numerous libraries in India till today are not in a situation to stand to gain all records and buy in to basic diaries in real trains. Following are Scenario for the Library consortia development in India for e-Journals subscription.

In India, the biggest academic library consortium was the UGC-INFONET with a membership of 142 Universities. The largest science, engineering & technology consortium in the country was the INDEST (Indian National Digital Library in Engineering Sciences and Technology), which was funded and fueled by the Ministry of Human Resource Development (MHRD), Government of India. INDEST was had 120 Institutions participating members in it. There were Indian Institute of Management (IIMs) Consortium, Indian Institute of Science Education & Research (IISERs) Consortium, which were also funded by MHRD, Govt. of India.

By and by, the most recent and biggest Library Consortium is 'e-Shodh Sindhu', which was molded by Ministry of Human Resources and Development (MHRD) with converging of these significant library consortia, to be specific UGC-INFONET Digital Library Consortium, NLIST, ISSERs, NITs, IISCs, IIMs and INDEST-AICTE Consortium. The 'e-Shodh Sindhu' is giving current just as recorded access to in excess of 15,000 center and companion evaluated diaries and various bibliographic, reference and truthful databases in various controls from an extensive number of distributors and aggregators to its part organizations including unified supported specialized foundations, colleges and universities that are secured under 12(B) and 2(f) Sections of the UGC Act.

The 'eSS consortium' currently providing access to current and archival 15,000 e-journals and databases and extending the benefit to 139 – State universities, 40 - central universities, 22 – deemed universities, 15 - law universities, 6 of IUCs of UGC, 72 – AICITE funded colleges, 4000 colleges and IITs, IIMs, IISc etc. Available in the e-Shodh Sindhu Collection 1,35,000 e–Books, 40 Resources, 16 databases and 15000+ electronic resources.

At present, there are many other Library Consortium working at national level (e.g. NKRC-CSIR (National Knowledge Research Consortia) Consortium, DAE (Department of Atomic Engineering) Consortium, DRDO Consortium, DeLCON Consortium, HELINET (Health Sciences Library and Information Network) Consortium, FORSA Consortium for the Astronomy & Astrophysics Library, MCIT (Ministry of Communication and Information Technology) Library Consortium, ISRO (Indian Space Research Organization) Consortium, ERMED Consortium, CeRA Consortium, Rajiv Gandhi University of Health Sciences and the ICICI etc.). A number of regionally focused (some as in metropolitan areas e.g. ADINET in Ahmedabad, and PUNENET in Pune) and city level consortia are also scheduled to occur, having been convinced of the success rates of the ongoing library consortia in the Country.

There are a limited consortia in India being operated by different organizations. Some of them are as given below:

- e-ShodhSindhu Consortium : Consortium for Higher Education (Website: <https://www.inflibnet.ac.in/ess/> )
- UGC-INFONET Consortium [Website : <http://www.inflibnet.ac.in>] (Now merged with eSS)
- INDEST Consortium (Indian National Digital Library in Science and Technology) [Website: <http://paniit.iitd.ac.in/indest/>] (Now merged with eSS)
- DRDO Consortium (Defence Research and Development Organization) [Website : <http://dsl.drdo.gov.in/ejournals/index.htm>]
- DeLCON Consortium (DBT's Electronic Library Consortium) [Website : <http://delcon.gov.in>]
- NKRC Consortium (National Knowledge Resource Centre) / CSIR e-Journal Consortia, [Website : <http://nkrc.niscair.res.in/>]
- FORSA Consortium (Forum for Resource Sharing in Astronomy) [Website : <http://www.iiap.res.in/library/forsa.html>]
- IIM Library Consortium [Website : <http://www.iimb.ernet.in/>]
- ICICI Knowledge Park Consortium [Website : <http://www.iciknowledgepark.com>]
- DAE Library Consortium [Website : <http://www.tifr.res.in/~libws/>]
- ICMR Library Consortium [Website : <http://www.jccc-icmr.informindia.co.in/about/about.asp>]
- HELINET Consortium (Rajiv Gandhi University of Health Sciences, Karnataka) [Website : <http://www.rguhs.ac.in/>]

### ***Establishment of DeLCON***

The setting up of a different Department of Biotechnology (DBT), under the Ministry of Science and Technology in 1986 gave another impulse to the improvement of the field of present day science and biotechnology in India. In excess of a period of its survival, the division has advanced and quickened the pace of improvement of biotechnology in the nation. Through a few R&D activities, showings and making of infrastructural offices a reasonable unmistakable effect of this field has been seen. The division has made significant accomplishments in the development and utilization of biotechnology in the wide territories of farming, medicinal services, creature sciences, condition, and industry.

To meet the developing R&D data prerequisites of the DBT Institutes, the DBT's Electronic Library Consortium (DeLCON), a noteworthy task of the Department of Biotechnology (DBT) to acquire subjective modification its examination foundations was propelled in January 2009. It is a national activity for giving access to academic electronic assets including full-content and bibliographic databases in all the existence science subject controls to DBT organizations in the nation to enhance instruction through educating, learning and research.

The entrance to all real e-Resources was given to 10 DBT Institutions in the start of the year 2009. It was reached out to 17 more DBT Institutions in the second stage in the year 2010 and another 7 individuals were included the third stage the year 2011. The DeLCON gives current just as chronicled access to in excess of 917 center and friend checked on diaries in various controls from 20 distributers and some of aggregators and one bibliographic database (SCOPUS).

The resources, researchers, analysts, understudies and task aides of foundations secured under DeLCON are the essential recipients. DBT supports the whole costs for DBT associations for giving e-diaries access through DeLCON. The 34 part foundations of DeLCON is given in Table1.

The DeLCON Consortium currently contains the following 34 Institutions in Table- :

**Table 1 : Covered Members of the DeLCON Consortium**

<b>Name of Institutions</b>	<b>Place / City</b>	<b>State</b>	<b>Country</b>
National Brain Research Centre	Manesar	Haryana	India
Department of Biotechnology	New Delhi	Delhi	India
National Institute of Plant Genome Research	New Delhi	Delhi	India
National Institute of Immunology	New Delhi	Delhi	India
National Centre for Cell Science	Pune	Maharashtra	India
Institute of Life Sciences	Bhubaneswar	Orissa	India
Institute of Bioresources and Sustainable Development	Imphal	Manipur	India
Centre for DNA Fingerprinting and Diagnostics	Hyderabad	Telangana	India

Rajiv Gandhi Centre for Biotechnology	Thiruvananthapuram	Kerala	India
International Centre for Genetics and Engineering Biotechnology	New Delhi	Delhi	India
Biotechnology Industry Research Assistance Council	New Delhi	Delhi	India
National Agri-Food Biotechnology Institute	Mohali	Punjab	India
National Institute of Biomedical Genomics	Kalyani, Kolkata	West Bengal	India
National Institute of Animal Biotechnology	Hyderabad	Telangana	India
Dibrugarh University	Dibrugarh	Assam	India
Assam University	Silchar	Assam	India
North Eastern Regional Institute of Science & Technology	Nirjuri	Arunachal Pradesh	India
North East Institute of Science & Technology	Jorhat	Assam	India
Mizoram University	Aizawl	Mizoram	India
D. M. College of Science	Imphal	Manipur	India
Sikkim University	Sikkim	Gangtok	India
College of Veterinary Science Assam Agricultural University	Khanapara, Guwahati	Assam	India
St. Anthony's College	Shillong	Meghalaya	India
Gauhati University	Guwahati	Assam	India
Manipur University	Imphal	Manipur	India
College of Veterinary Science & Animal Husbandry Central Agricultural University	Aizawl	Mizoram	India
Rajiv Gandhi University	Doimukh	Arunachal Pradesh	India
Nagaland University	Lumani	Nagaland	India
North-Eastern Hill University	Shillong	Meghalaya	India
Indian Institute of Technology Guwahati	Guwahati	Assam	India
Regional Centre for Biotechnology	Gurgaon	Haryana	India
Tezpur University	Tezpur, Sonitpur	Assam	India
Transnational Health Science & Technology Institute	Gurgaon	Haryana	India
Sikkim State Council of Science and Technology	Gangtok	Sikkim	India

As far as number of clienteles, the DBT's Electronic Library Consortium (DeLCON) is the biggest Consortium in India in the term of Life Sciences and Biotechnology Subject zone with a

dream and plan to connect with all DBT Institutions offices, Research Institutions, Universities, and their schools subsidiary to the DBT, over some undefined time-frame.

## **Need of DeLCON Consortium**

Prickly issues like contracting spending plans, developing supporter requests, increasing expenses of books and periodicals prompted the crystallization of such an idea for the Library and Information Systems. The main role of Library Consortium is to share data assets, which implies the Books, Periodical, e-diary, digital books so, etc. Advances in Computer, data and media transmission advances have changed the manner by which data is obtained, put away, got to and exchanged. Sharing electronic assets has quickly turned into another critical objective for library consortia.

Clients of Library and Information Services Systems of Biotechnology are generally spread all through India and situated in various areas. Various innovative work works are going on routinely and the clients require every day refreshes. Howsoever, they get the data after a major hole of time in the printed version frame.

## **Objectives of DeLCON Consortium**

The primary goal of the DBT's e-library Consortium (DeLCON) is to give access to subjective electronic assets including full-content and bibliographic databases to DBT foundations at lower rates of membership. The significant points and destinations of the DBT's e-Library Consortium (DeLCON) are as per the following:

- To give access to high caliber and academic electronic assets to an expansive number of DBT foundations including research organizations, colleges and schools at considerably bring down rates of membership and at most good terms and conditions;
- To advance correspondence and between library collaboration among the taking an interest DeLCON individuals;
- To assess the utilization of the bought in assets and to recognize new assets that are required to be bought in under DeLCON;
- To acquire subjective change instructing, learning and research with an expect to address the consistently developing difficulties of globalization of advanced education;
- To increment the exploration productivity of the establishments both as far as quality and amount of distributions.
- To advance expedient and effective access to insightful substance to the clients and to make and advance utilization of DeLCON in instructing and learning in research associations, colleges, and schools in India;

- To stretch out the benefit of Consortium to its partner individuals;
- To bestow preparing to the clients, custodians, look into researchers and employees of the organizations being used of electronic assets with an intend to upgrade their use; and
- To advance utilization of e-Resources with steady decline in print membership;

## Highlights of DeLCON

The consortia-based membership to e-Resources is a doable answer for rising the entrance to electronic assets crosswise over DBT establishments at a lower rate of membership. Significant advantages of DeLCON are as per the following:

- The DeLCON goes about as a solitary window benefit for countless Institutions with their different research and scholastic intrigue;
- The DeLCON, with its aggregate quality of taking an interest organizations, pulls in exceedingly limited rates of membership with most great terms of assention for a more extensive scope of e-Resources. The majority of the e-distributors have reacted decidedly to the call of the Consortium. The rates offered to the consortium are bring down by 60% to 99% contingent on the classification of DBT organizations;
- The DeLCON is relied upon to trigger stunning increment in sharing of electronic assets among taking an interest DeLCON individuals;
- The inquire about effectiveness of DBT establishments is relied upon to advance with expanded access to global full-content assets (diaries and databases);
- Users have quick access to material prior not bought in to, at no gradual expense for getting to back documents;
- It enhances the current library benefits and decreased the membership cost;
- The DeLCON has been opened-up to include more DBT organizations through its next period of augmentation and other DBT establishments can likewise join the DeLCON and get the advantage of very limited rates of membership as well as the good terms and conditions;
- The DeLCON is offered better terms of understanding for use, chronicled access and preservation of bought in electronic assets, which would not have been workable for any single establishments;
- Members of the DeLCON have the advantage of top on the yearly increment in the rates of membership. While the typical increment in cost of e-Resources differ from 15 % to 20%, yet the DeLCON individuals have the top on increment in cost extending from 5% to 7%; and



- Since the bought in assets is open online in electronic organization, the DBT foundations have less weight on space necessity for putting away and overseeing print-based library assets. In addition, all issues related with print media, for example, their mileage, area, racking, official, sorting out, and so forth are not an issue for electronic assets.

## e-Resources under DeLCON Consortium

The DeLCON buys in to e-Resources covering most critical life science and biotechnology subject controls being educated in the DBT explore organizations, colleges and schools. It incorporates wide assortment of materials for example e-diaries, bibliographic databases, surveys distributed by insightful social orders, college presses, institutional and business distributors. Right now the DeLCON acquires in to 1172 full-content e-resources and 01 bibliographic database from 22 famous International distributors and some of aggregators. The part foundations are given differential access to these assets dependent on their requirements and movement profile according to the suggestion of the National DeLCON Steering Committee. The complete list of full-text resources (e-Journals) and bibliographic databases subscribed under the DeLCON is given in Table 2.

**Table 2 : Covered Journals under DeLCON Consortium**

Sl.	Name of Publishers / Journals	Hyperlink of the publishers Website	Covered Journals
1	American Association for Advancement of Science	<a href="http://www.sciencemag.org">http://www.sciencemag.org</a>	(3 Journals)
2	American Association for Cancer Research	<a href="http://www.aacr.org">http://www.aacr.org</a>	(9 Journals)
3	American Chemical Society	<a href="http://pubs.acs.org">http://pubs.acs.org</a>	(47 Journals)
4	Annual Reviews	<a href="http://www.annualreviews.org">http://www.annualreviews.org</a>	(23 Journals)
5	American Society for Biochemistry and Molecular Biology	<a href="http://www.jbc.org">http://www.jbc.org</a>	(2 Journals)
6	American Society For Microbiology	<a href="http://www.asm.org/">http://www.asm.org/</a>	(17 Journals)
7	Cold Spring Harbour Laboratory Press	<a href="http://www.cshl.edu">http://www.cshl.edu</a>	(4 Journals)
8	Informa Healthcare / Taylor & Francis	<a href="http://www.informaworld.com">http://www.informaworld.com</a>	(40 Journals)
9	Lippincott William & Wilkins/ Wolter Kluwer	<a href="http://ovidsp.ovid.com">http://ovidsp.ovid.com</a>	(11 Journals)
10	Marry ANN Liebert	<a href="http://www.liebertonline.com">http://www.liebertonline.com</a>	(92 Journals)
11	Nature Publications	<a href="http://www.nature.com">http://www.nature.com</a>	(36 Journals)
12	Oxford University Press	<a href="http://www.oxfordjournals.org">http://www.oxfordjournals.org</a>	(22 Journals)
13	Springer	<a href="http://www.springerlink.com">http://www.springerlink.com</a>	(339 Journals)
14	Society for General Microbiology	<a href="http://mic.sgmjournals.org">http://mic.sgmjournals.org</a>	(3 Journals)
15	American Society for Hematology	<a href="http://bloodjournals.hematologylibrary.org">http://bloodjournals.hematologylibrary.org</a>	(1 Journal)
16	Wiley-Blackwell	<a href="http://www3.interscience.wiley.com/cgi-bin/home">http://www3.interscience.wiley.com/cgi-bin/home</a>	(84 Journals)
17	Elsevier Science	<a href="http://www.sciencedirect.com">http://www.sciencedirect.com</a>	(432 Journals)
18	American Society of Plant Biologist	<a href="http://www.aspb.org/">http://www.aspb.org/</a>	(2 Journals)

19	American Association of Immunologist	<a href="http://www.aai.org/">http://www.aai.org/</a>	(1 Journals)
20	Scopus Database	<a href="http://www.scopus.com">http://www.scopus.com</a>	(1 Database)
21	The New England Journal of Medicine	<a href="http://www.nejm.org">http://www.nejm.org</a>	(1 Journal)
22	Proceedings of National Academy of Sciences	<a href="http://www.pnas.org">http://www.pnas.org</a>	(1 Journal)

**Table 2.** explain about the List of Publishers, Link of their website and covered number of Journals

### ***Selection processes of resources under DeLCON***

So as to comprehend the assemblage base in DBT part organizations, gatherings of DBT Directors and DeLCON Nodal Officers were held in various parts of the nation and their perspectives and inputs were acquired. The print and online gathering base accessible in DBT examine establishments libraries and their needs were overviewed with an expect to perceive and decide e-Resources to be bought in under the DeLCON. In view of the inputs got from DBT individuals, e-Resources of different distributors were perceived and assessed before arranging permitting courses of action. Keeping in view the variety of research programs sought after by DBT organizations, each endeavor was made to buy in to e-Resources that are multidisciplinary in nature with wide extension and inclusion.

All e-Resources were assessed for their i) subjective and quantitative substance; ii) inclusion; iii) their accessibility on various stages and their relative focal points/disservices; and iv) rates pertinent for these assets to singular foundations just as to other consortia.

The electronic assets proposed for consortia-put together membership were chosen based with respect to the accompanying real criteria:

- Resources from academic social orders, college presses and not-revenue driven ventures were favored over business distributors;
- Well-set up multi-disciplinary assets with wide inclusion were favored over exceedingly concentrated sources focused for authorities;
- Electronic assets as of now on membership in the DBT inquire about Institutions were favored over those which are not being utilized in any of them;
- Resources that are 'electronic-just' were favored over those that are print-based;
- Resources that are imperative yet exceedingly cost-escalated were favored over those which are less critical or less-utilized yet minimal effort;
- Resources where electronic forms are made accessible free on membership to their print renditions were kept away from beyond what many would consider possible; and
- Selections were made on utilization/reasonableness of e-Resources to DBT Institutions.

### ***Subject inclusion under DeLCON***

The DeLCON secured all the branches of knowledge falling under life-sciences, microbiology, physiology, brain science, biotechnology, bioinformatics, natural chemistry, chemical biology, computational science, cell science, cell biology, immunology, neuroscience, plant genome, plant science, physiotherapy, psychotherapy, gene, genome, genetics, mathematics, material science, radiology, medicines, computational neuroscience, system neuroscience and so on.

### ***Procurement Process of e-Resources under DeLCON***

The electronic assets got ready for membership are perceived, recommendations welcomed from the distributors of e-Resources/their approved delegates. The distributors and their delegates are likewise welcomed for formal arrangements on their items and administrations. In the developmental long stretches of the DeLCON, the 'DeLCON Steering Committee' arranged the most reduced rates of membership and good terms of understanding.

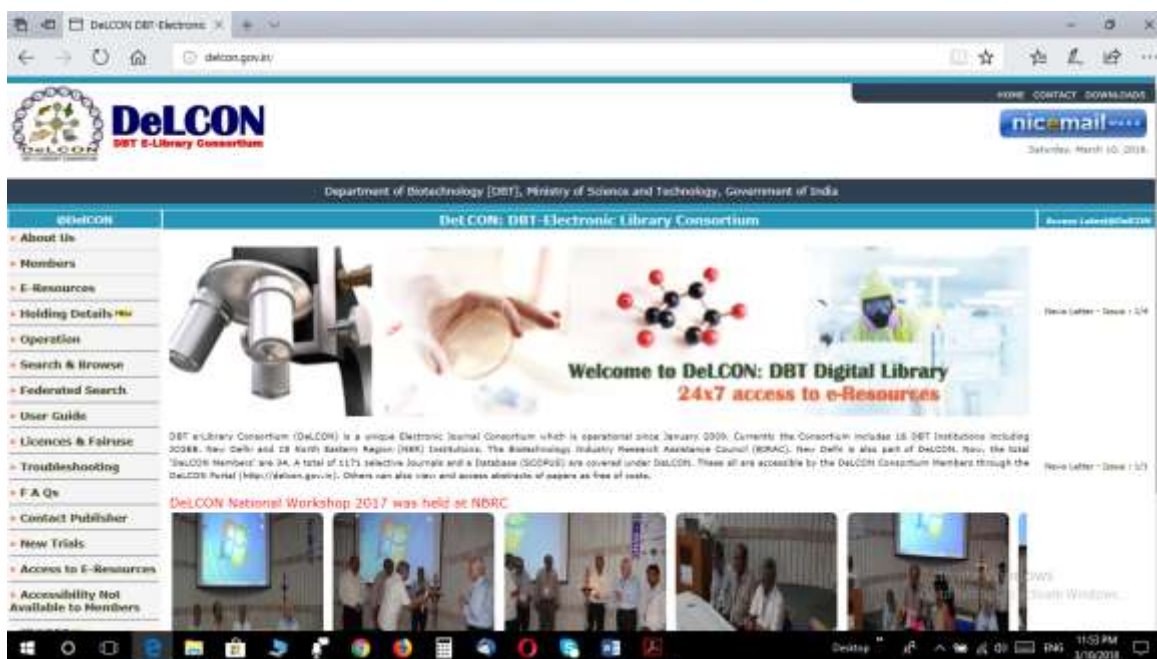
Transaction for membership to e-Resources perform by a Negotiation Committee which established by the Department of Biotechnology (DBT) according to the buy arrangements and the guidelines.

While the DeLCON Steering Committee takes arrangement choice concerning consideration of part establishments, e-resources, and so forth the Negotiation Committee is responsible for arranging rates of membership to e-Resources with different distributors for all DBT Institutions. When e-resources and members from DeLCON are settled, the DeLCON submitted the request for membership for e-Resources to the distributors according to the purchase rules. The DeLCON is likewise responsible for consenting to permit arrangement in the interest of the quantity of DBT Institutions secured under the DeLCON. The DeLCON underpins the hierarchical administration of Consortium from National Brain Research Center, Manesar.

### ***Operational Execution of DeLCON Consortium***

The DBT Institutions have been completely financed by DBT for availability under DeLCON and will have organize network. Singular Institutions will at that point have special static IP address through which get to is given by the distributors for which memberships made. Anyway whole program will be regulated, checked and kept up by 'DeLCON Nodal Center (NBRC)' and 'DeLCON National Steering Committee'..

Website of 'DeLCON Consortium': <http://delcon.gov.in>



## Issues & Challenges of DeLCON Consortium

The following Issues & Challenges occurred during the constitution of DeLCON Consortium and the DeLCON Consortium dispensed with these problems:

- Funding and Budget issues
- Cost / Pricing issues
- Payments related issues
- Access Issues
- Perpetual Issues
- Archival right issues
- Resources identification
- Print-Independent Subscription
- Licensing and copyright issues
- Limitation for Price Increase / Annual Cap Limitations
- Usages and usability issues
- Sustainability issues
- Technology infrastructure
- Training & Awareness Issues
- Egos & Attitudes
- Synchronization among partners
- Efficient staffs availability
- Overcoming with the political objections

## Major Challenges

### ***Budget & Funding Issues***

Establishing the DeLCON Consortium which required enough budgets that can be devoted to cover the total operation costs among the cooperating libraries, this include funds to purchase new reading materials, library software's, training of library staff and the users, cost relating to the maintenance of the equipment such as computers, scanners, printers, and subscription funds to enable users and staff of the member libraries to have access to various e-journals published all over the world. This has been the serious challenge towards the formation of DeLCON Consortium among the DBT member Libraries.

## Pricing Issues

There are no standard practices or strategies being trailed by larger piece of the distributors of scholarly composition and subsequently this is a foggy territory all together. The distributors have distinctive arrangement of activity and assessing for their advantages. Distributors are invited for courses of action and asked for to offer their best expenses to the consortia. Different methods for esteeming are sought after, anyway what is basic is that finally the expense offered by the distributor should be financially appropriate for the sharing libraries. In addition, it should similarly ensure consistent and unending access to the e-assets.

### ***Subscription Payment issues***

The distributors continually requesting the installments ahead of time of membership, which ought to be examine and consulted by the distributors according to the Consortium strategy.

### ***Access related issues***

There are different access strategies given by the distributors towards getting to their online assets and it fluctuates upon case to case. Access confirmation could be User ID/Password based or IP based which are well known among them. Continuous and bother free access to the academic substance is a definitive target of the consortium.

### ***Perpetual Access Issues***

In the event of end of the assention or on the expiry of the understanding, licensor ought to stretch out ceaseless access to e-assets for the paid time of membership alongside their back records offered amid the membership time frame.

### ***Archival Issues***

This is a zone which required extraordinary consideration and sadly this is yet to be taken care of by the different consortium in India. Long haul safeguarding of the in important abundance of data being gathered by the consortium is to be documented and protected for family. As the innovation is quick creating and furthermore getting obsolete nearly at a similar pace, ample opportunity has already past that these exorbitant data assets are cautiously chronicled and protected on a long haul premise.

### ***Resources Identification***

Recognizing the most reasonable item which is settled upon by every one of the individuals from the consortium individuals are pretty much a troublesome recommendation. This is for the most part on the grounds that every single part will have their very own craving rundown of data items and administrations, however the cover between the items will be on the higher side on account of a perfect homogeneous gathering.

### ***Print-Independent Subscription***

Subscription to e-assets must be print-free and no print is necessary. Discontinuation of print subscription which is available through consortium should not be binding to member Institutes.

### ***Licensing and copyright issues***

Consortia permitting is a lawful procedure of securing use privileges of the licensed innovation represented by the copyright laws for a network of individuals. There are different focuses that must be considered and consolidated in permitting concurrence with the distributors. The standard permit understanding must be tended to the accompanying focuses :

- Authorized clients
- Restriction of business use
- Course packs
- Electronic holds

- Fees, Members, secure system, membership period, use rights, ILL and different terms and conditions and so forth.

### **Limitation of Price Increase / Annual Cap**

There should be limitation for annual increase of the price. Annual increment or Annual cap of the price should be restricted or limited to less than 2%-3%.

## **Use and Usability Issues**

The ROI (Return on Investment) of the consortium is estimated regarding the expanded utilization, convenience of the exorbitant data items which is at last reflected in the logical yield of the host foundations. It is the genuine endeavors of the consortium, the administration, the scientists and personnel and the curators which decide the achievement or generally of any consortium.

## **Sustainability issues**

Structuring and starting a library consortium is maybe the simpler part when contrasted with its long haul sustenance and life span. The administration and the individuals from the consortium need to endeavor hard in planning and setting up strong models towards accomplishing the above objectives.

## **Technology Infrastructure**

Long range arranging and sourcing of the fitting IT and Communication foundation helpful for legitimate conveyance of data assets is essential for each partaking part library.

## **Training and Awareness**

Training to the clients is another issue that one needs to give appropriate pondering. Generally the clients are well-known to deal with the conventional assets of data. They are hesitant to sudden change in the treatment of data. In this way, the library needs to prepare the clients to confront the new media, feature the advantages through introduction and preparing programs.

## **Ego and Attitudes**

Egos and frames of mind of people, experts, officers or associations can bigly affect the achievement or disappointment of a consortium.

## Conclusion

The DeLCON was established by DBT as the libraries of DBT organizations were confronting difficulties in giving data to meet the clients. Since 2009, the consortium has developed as far as the quantity of assets and clients. The consortium is set to become further in the coming years and conceives taking into account all the biotechnology and life science organizations in the nation. The DeLCON consortia is truly helping the understudies, specialists, resources to recover the data and spare their time. It benefits the part libraries to acquire increasingly electronic assets in the library with spending plan and this is the thing that the part libraries require in the present situation. Development of the DeLCON Consortium and aggregate and sensible arrangement with the distributors to get the most extreme required assets at the base cost is a path by which part libraries can improve the utilization of secured assets. There are different issues required with DeLCON consortia, however these issues have been handled by embracing right methodology and right techniques with the planned methodology of the individuals and models standards setup by the Department of Biotechnology, Govt. of India.

## References

1. Arora J, Managing electronic resources through consortia: an overview. In: Library and Information Networking – NACLIN – 2005: Proceedings of the National Convention on Library Information networking, held at PES Institute of Technology, Bangalore, 22 – 25 August 2005, Edited by Kaul, H.K and Sen, Gayathri. New Delhi: DELNET, pp.145-170.
2. Alexander A, Why do we do it? *The Journal of Electronic Publishing*, 3 (3) (1998)  
<http://www.press.umich.edu/jep/03-03/index.html>
3. Birdie C, New acquisitions with new partners. Are we ready for it? IATUL Proceedings (New Series), Vol.12, Kansas City, USA, 2-6 June 2002, Available at: <http://www.iatul.org/conference/proceedings/vol12/>
4. Bawdekar N, FORSA: A historical review and future possibilities in resource sharing: Paper presented during the workshop on Forging Collaborative Partnerships: Consortium of Libraries and Department of Atomic Energy Institutions and FORSA Libraries meet organized by TIFR, Mumbai during 28-30 July 2003.
5. Consortium for e-Resources in Agriculture-2008. IARI, New Delhi, 2008. pp.1-2. <http://cera.iari.res.in/>
6. Lal, D. D, Consortia Based Electronic Information Resource Sharing in Department of Biotechnology Institutes in India. *Annals of Library and Information Studies*. 59, (2012) 181-186.
7. Lal, D.D., Use of e-Resources of DeLCON Consortium : Its Impact on DBT Libraries in Delhi-NCR Region” in the “Library Technologies, Services & Resources : Current Global Trends”, 2017; pp. : 404-412 at Management Library Network & Jaipuria Institute of Management, at Noida on 15-16 Sep. 2017.
8. Lal, D.D., Consortia Based Resource Sharing for DBT Institutions In India : A Developmental Perspectives of ‘DeLCON Consortium’ in the 2nd International Conference of Asian Libraries (ICAL-2017) which was jointly organized by “Asian Library Association” and “Dr. Zakir Husain Library, Jamia Millia Islamia”, New Delhi on 26th – 28th Oct. 2017.

9. Lal, D.D., A National Biotechnology Consortium of 'Department of Biotechnology (DBT)' : A Historical Perspectives about the 'DeLCON Consortium'" in the "63rd Annual Conference of Indian Library Association (ILS) i.e. International Conference (ICSIDL-2017) on "Sustainable Development of Library and Information Science Profession" jointly organized by Indian Library Association (ILA) and Babasaheb Bhimrao Ambedkar University, Lucknow at Babasaheb Bhimrao Ambedkar University, Lucknow on 23rd – 25th Nov. 2017, pp 823-837.
10. Lal, D.D., Planning, Development and Management of a Digital Library : An Experience From Special Scientific Library" in the "National Conference on "Changing Digital Landscape in SMART Environment" (NCCDLSE-2018)" jointly organized by United Nations Information Centre for India & Bhutan and Ansal University, at Ansal University, Gurgaon, Haryana, on 8th – 9th, Feb. 2018. pp 174-190.
11. Lal, D.D., DBT's Electronic Library Consortium (DeLCON) : A Role Model & Smooth Functioning Consortium in India. National Seminar on Access & Availability of Medical Literature in Electronic Environment (AMLEE-2018). pp. 41-50. (17<sup>th</sup> April 2018). Dr. B.B. Dikshit Central Library, AIIMS, New Delhi.
12. Murthy, G. Narasimha., Consortia For PG College Libraries In Andhra Pradesh: A Proposal. National Seminar on Library Consortia. 2004. pp. 279-284. (Hyderabad. 22-23 March, 2004) : Indian Library Association & Osmania University, Hyderabad.
13. Murthy, T.A.V.. UGC – INFONET : e-Journals Consortium in Nutshell. INFLIBNET Newsletter; January-APRIL 2006, 13(1): 11-13.
14. Das, Adwaita Kumar, Das, Keya & Das, Amit. Access in the future tense: problem and prospects of consortia initiatives of e-journals in India. In: Bandyopadhyay SS, Sutradhar B, Pathak SK, editors. Proceedings of the National Conference on Information Management in Digital Libraries (NCIMDiL), 2-4 August 2006. Indian Institute of Technology, Khagagpur. Kolkata: Radical Impression, 2006:443-46.
15. Gaur R C, Reengineering library and information services: process, people and technology. Mumbai: Allied Publishers, 2003, pp. 112-114.
16. Goudar I R N, E Journals: Breaking the pricing barrier. Paper presented at the Round Table on Consortia Models in India, held at Bangalore, 2002.
17. Goudar IRN and Narayana P, Emerging pricing models for E-Journals Consortia and Indian Initiatives' Proceedings of the International Conference on Digital Libraries, (ICDL 2004). New Delhi. 24-27 February 2004, 333-341.
18. Hiremath U, Electronic consortia: resource sharing in the digital age, *Collection Building*, 20 (2) (2001) 80 – 88.
19. Janakiraman S, Thoughts on Library Consortium, Proceedings of the Round Table on Sharing of E-journals through Consortia in Indian Libraries, Bangalore. 28-29 November 2002, 23-35.
20. Jalloh B, A plan for the establishment of a library network or consortium for Swaziland: Preliminary Investigations and Formulations. *Library Consortium Management: An International Journal*, 2(8) (2000) 165-176.
21. Louis C and Vagiswari A, PAM-APF (Physics, Astronomy and Mathematics - Asia/Pacific Forum): Network for Resources sharing and Consortium formation. Proceedings of conference on Recent Advances in Information Technology, held at Kalpakkam, India, 1999, 182-194.



22. Murthy T A V, Kembhavi A and Cholin V S. Access to scholarly journal and databases : UGC-Infonet: E-Journals Consortium, *University News*, 42 (34) (2004) 1-5,8.
23. Mahajan P, Academic libraries in India: a present-day scenario, *Library Philosophy and Practice*, 8(1) (2005) 1-4.
24. Moghaddam G G and Talawar V G, Library consortia in developing countries: an overview, *Program: electronic library and information systems*, 43 (1) (2009) pp.94 – 104
25. Nfila R B and Darko-Ampem. K, Developments in academic library consortia from 1960 to 2000: a review of literature, *Library Management*, 23(4/5) (2000) 203-212.
26. Patil Y M, Birdie C, Bawdekar N, Barve S and Anilkumar N, Indian consortia models: FORSA libraries experiences. Paper presented at the LISA V Conference: Common challenges, unknown solutions. Cambridge, Massachusetts, U.S.A., 18-21 June 2006.
27. Patil Y M, Consortia efforts: an experience with FORSA Libraries. In: Workshop on – Forging collaborative partnerships – consortium of libraries of DAE Institutions, 28 – 30 July 2003, Mumbai, TIFR.
28. Patil Y M, Resource sharing through consortia: an experience with FORSA Libraries. In: Proceedings of the Symposium on consortium approach to resource sharing: issue and policies, ed. By Madalli, Devika,P. Bangalore: DRTC, Paper N pp.14, 2004.
29. Patil Y M, Managing change: consortia efforts in IT environment. In: Dr. P. S. G. Kumar Festschrift – Library and Information profession in India, Vol.1 (Part II): Reflections and redemptions, ed by Vashishth, C. P. And M.P.Satija. New Delhi: B.R.Publications, 2004, pp. 465 – 486.
30. Satyanarayana N V, Krishnan S and Arora J, Library consortia and resource sharing initiatives in India: A White Paper. Bangalore, Rajiv Gandhi University of Health Sciences, 2004, pp.54.
31. Srivastava JP, Verma VK. Library Consortia: Issues and Challenges with SpecialReference to INDEST-AICTE. 9<sup>th</sup> Convention Planner, Dibrugarh University, Assam, INFLIBNET, pp. 103-112. 25-27 Sep. 2014.
32. Sreekumar M G and Sunitha T, Library capacity building through E-Journal Consortia'. 7<sup>th</sup> MANLIBNET 'Digital Libraries in Knowledge Management : Indian Institute of Management Kozhikode, 5-7 May 2005.
33. Sinha, Manoj Kumar., Murthy, T.A.V., & K, Manoj Kumar. (2006). Developing E-Journals Consortium In India : A New Approach For Resource Sharing In Digital And Network Environment. 4th International Convention CALIBER-2006. pp. 350-363. (Gulbarga. 2-4 February, 2006) : INFLIBNET Centre, Ahmedabad
34. Veenapani S; Singh, Khomdon & Devi, Rebika,. Use of E-Resources and UGC-Infonet Consortium by the Teachers and Research Scholars in Manipur University. International CALIBER-2008. 6th International CALIBER-2008. pp. 563-568. University of Allahabad. (Allahabad. February 28-29 & March 1, 2008) : INFLIBNET Centre, Ahmedabad.
35. Xenidou-Dervou C, Consortia journal licensing: experiences of Greek academic libraries, *Interlending & Document Supply*, 29 (2001) 120-125.

# **Perception of users and library staff towards effective library service quality: A survey**

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## **Abstract**

The study aims to identify the users and employees perception of library effectiveness with regard to service quality of a university library. An attempt is also made to recognize the factors they consider essential in indicating the effectiveness of a library. Two separate questionnaires that listed indicators of effectiveness for library service quality were administered to employees as well as users of Delhi University Library System during the month of August 2019. The findings have shown slight differences in the perception of the two stakeholders group i.e. users and library staff, as to what indicators they deem necessary to consider their library effective.

## **Keywords**

Library Users; Library Effectiveness; Academic Library; Indicators of Library Effectiveness.

## **Introduction**

Performance measurement is an essential component of any service organization. However assessing the effectiveness of any public service undertaking such as libraries is hazy because there is no clear cut demarcation of profits which may certain the organizations to determine if their library is meeting its goals or not. Assessing library's performance through different approaches is being conducted in different types of organizations. Effectiveness is a

multidimensional concept which means that no single measure is enough to describe the whole system. Many authors have penned that quality and effectiveness are found to be the interchangeable terms in which the main objective is to find out the working scenario of the organizations taken under study, especially library systems. Thus, whenever we talk about judging the service quality of libraries, we indirectly mean its effectiveness. An effective library is a library that performs well in comparison with other libraries given the milieu in which it functions. (Glorieux,2007). In simpler terms an effective library can be defined as one that satisfies the information and research needs of the users in the most proficient manner, gives most efficient outcomes in regards to fiscal returns and in general helps to achieve the goal and objectives of the institution involved. The functioning of University Library is primarily dependent upon its employees and its potential users. It was Lancaster (1978) who presented one of the most universally accepted criteria for evaluation which includes three essential aspects i.e. effectiveness, cost effectiveness, and cost-benefit. It has also been concluded from past research studies that library effectiveness is not well defined by a narrow range of dimensions because effectiveness is a multi-dimensional construct (Cullen and Calvert, 1995). Hence, library effectiveness must be measured by considering the viewpoints of the employees as well as its users.

## Review of Literature

The present research study is an attempt in series of few past studies covering the national and international settings. The study was conducted at Visvesvaraya Technological University (VTU) to focus on user's attitude about the effectiveness of library resources and services. It was revealed that the overall effectiveness is good. Moreover, library services in the VTU research center libraries is effective enough for their users with the existing printed journals, e-journals, books, thesis/dissertations/project resource, abstracts, indexing resources conference/workshop/seminars proceedings resources, etc. These resources found to be around 50% effective whereas government publications, patents/standards resources, CD ROM database resources are not so effective in library services (Chandrashekara, Adithyakumari and Mohan, 2016). Abdallah and Bilal (2015) conducted a research study based on quantitative research method and a survey design to assess the nature and effectiveness of information resources and library services given at four academic libraries in Lebanon from the users' perspectives. A total of 1100 survey questionnaires were disseminated to students at Beirut Arab University (BAU), the Lebanese University (LU), the Lebanese American University (LAU) and the Holy Spirit University of Kaslik (USEK) getting a response rate of 78.63%. The findings of this study exposed more differences than similarities among the four university. Ezeala and Yusuff (2011) has conducted an analysis of effectiveness of agricultural research institute libraries with special reference to user satisfaction with library resources and services and revealed that out of 340 researchers from all the 14 agricultural research institutes in Nigeria, received the response rate was 73.5%. The main objective was to assess its effectiveness and recommended measures to improve it by finding out its inadequate services and underfunding by its parent organizations. Lu (2010) conducted a study to assessing public library effectiveness at Taipei municipal library in Taiwan to examine the features used by librarians and users to evaluate public libraries. It was

revealed that there are significant differences between the views of librarians and users on criteria like statistics, access to materials and staff service, whereas the least chosen dimensions are public relations and traditional statistics. Users' library habits show a positive correlation such as age affects librarians' preferences for some dimensions and the analysis of correlations shows sex, age and occupational groups with dissimilar preferences. Investigator proposed ways to identify possible perfections for library staff based on the results. Ezeala (2009) has conducted another similar study to assess the effectiveness of library resources only in Nigerian Agricultural research institutes and highlights the factors which causes the library ineffective such as poor funding, infrastructure and lack of technology. Majid, Anwar and Eisenschitz (2001) studied those factors that contribute in influencing users' perception of library effectiveness. They conducted a survey in five major agricultural libraries in Malaysia .It was revealed that the adequate collections, services and facilities were highly regarded in perceptions of library effectiveness. Other factors were effectiveness of library promotion, participation of users in selecting library collections, well-located library, involvement in user's education programs etc. It also proposes that for any trustworthy library effectiveness study, all factors related with user's satisfaction must be carefully checked.

The above review of the literature clearly shows that over the past decade, various national and international studies have been conducted to assess the effectiveness of library services and resources through user satisfaction and their preferences. But so far, no research has been conducted in the central universities in the country. In this study, employees and users of Delhi University Library System (DULS) have to be ranked their preferences based on few indicators as suggested in the questionnaire instrumented by Cullen and Calvert (1995) for assessing the public library effectiveness.

## Objectives

The specific objectives of the study are as follows-

- To examine the key indicators of library effectiveness as perceived by different user categories of Delhi University Library System (DULS);
- To determine what indicator of library effectiveness is given the highest rank by the users and employees of Delhi University Library System (DULS).
- To map the difference among the employees and users group in their preferences of indicators of library effectiveness in Delhi University Library System (DULS).

## Research Methodology

In the present study, Investigators consulted an already tested and established questionnaire created by Cullen and Calvert (1995) and further it was adapted and refined after observing the local needs, expectations and satisfaction of the users and assessed the effectiveness of library services, infrastructures and resources from the employees' point of view. Investigators has created two separate questionnaires, each consists of 30 indicators each for library users and employees of the library after reducing the overall 99 indicators as mentioned in the questionnaire (Cullen and Calvert, 1995). Respondents were asked to indicate on a Likert scale of 1-5 (1-Strongly disagree, 5-Strongly agree) on how strongly they agreed with each of 30 indicators derived from the already tested questionnaire to judge the effectiveness of a university library. The random sampling method was adopted by the investigators to carry out the study. A total of 200 and 50 questionnaires were circulated among the library users and employees of Delhi University Library System respectively in the month of August 2019. The library users consist of Research Scholars and PG students while Staff comprises of University librarian, Deputy librarian, Assistant librarian, Professional Assistant, Semi-Professional Assistant and Library Attendants. A total of 200 questionnaire were administered among library Users and 50 were distributed among library staff, out of which, 216 questionnaires (180 questionnaires from library users and 36 from the employees of the central library) were completed and returned by the both group of respondents showing an overall response rate of 86.4 percent. The collected data was then coded and inserted in the Statistical Package for Social Sciences (IBM SPSS, Version 20.0) and analyzed through descriptive and inferential statistics.

## Data Analysis

The responses were entered into the SPSS (Version 20) and analyzed by producing ranked lists of indicators for each group i.e., Library Staff and Library Users. Each ranked list was based on means of scores as given by all respondents from both the groups, the ranking of indicators thus showing how important each indicator was to both the group under study. Table 1 and Table 2 shows the mean ratings and standard deviation chosen by the group of library users and library staff respectively, in order to denote a ranked list of indicators. The similarities between means and the large standard deviations propose that small differences in ranking are not significant in top ten indicators of the ranked lists, but in the mid of the ranked list.

**Perception analysis of Library Users towards library effectiveness:-****Table 1.** Ranked Indicators of Library Users

Rank	Statements	Mean	Std. Deviation
1	Need of the expert Reference Staff in the library	3.82	1.180
2	Quietness of study environment	3.81	1.176
3	Availability of reference staff when needed	3.61	1.121
4	State of repair of materials (books, journals, etc.)	3.61	1.106
5	Staff is helpfulness and courteous	3.57	1.094
6	Smooth access to library catalogues throughout the campus	3.55	1.100
7	Consistent maintenance is essential for all library equipment	3.50	1.297
8	Special Provision made for disabled users	3.49	1.292
9	Maximum library services are available whenever library is open	3.49	1.126
10	Ease of use of library catalogues	3.48	1.011
11	Provision of multiple copies of items which are in high use	3.47	1.084
12	Display of new books and new periodical issues	3.46	1.203
13	Sufficient number of library staff per full-time equivalent student	3.41	1.199
14	Consistently consider the needs of the user groups	3.37	.975
15	Currency of library materials need to be checked	3.36	1.064
16	Able to answer reference questions	3.35	.974
17	Availability of online searching from different databases	3.34	1.068
18	Adequacy of library collection compared with other institutions	3.32	1.011
19	Speedy acquisition of new materials	3.31	1.115
20	Provision of personal study carrels	3.31	1.078
21	Provision of photocopiers/printers in all divisions of library	3.28	1.414
22	Availability of printed periodical indexes	3.27	1.167
23	Equitable and effective fines policies	3.24	1.250
24	Comfort and appealing library building structure	3.24	1.262
25	Access to CD-ROMs, databases, via networks throughout the campus	3.23	1.259
26	Speedy provision of items through inter-library loan	3.22	1.177
27	Availability of sitting space for users near reference collection	3.03	1.262
28	Provision of microfilm and microfiche readers	2.74	1.201
29	Provision of group study cabins	2.73	1.425
30	Receives regular notification of new materials added to stock	2.73	1.335

From these ranking, it is apparent that highest mean with rank 1 indicator is the “need of the expert reference staff in the library” whereas the “quietness of study environment” (ranked 2<sup>nd</sup>), availability of reference staff when needed (ranked 3<sup>rd</sup>), state of repair of materials (ranked 4<sup>th</sup>), and staff is helpfulness and courteous as ranked 5<sup>th</sup>. This concludes that users feel the need of the expert reference staff in the library and the study environment is quiet. In the results we can see the highest rank is achieved by indicators who are laying emphasis on the information services and sources. It may be justified as in current scenario more emphasis is given on the immediate information need of the user. Users have also placed great emphasis on competent staff, in particular reference staff as their critical thinking skills are highly beneficial in connecting the user to his information needs. Library OPAC is the guide to library resources and without a well constructed catalogue it gets very difficult for the users to discover and make full use of the resources that the library has to offer, therefore” Ease of use of library catalogues” was amongst the top 10 ranks. It is highly refreshing to see that “Special Provision made for disabled users” indicator was also ranked among the top 10. Their inclusion is very important as libraries are expected to provide equal opportunities and services to all library users without discrimination. Currency of information resources was also given emphasis by the users, which is fully justified in today’s ever changing information driven world. It is important to note here that the least effective indicator in the library is the “provision of group study cabins” (Rank 29<sup>th</sup>) followed by the statement “receives regular notification of new materials added to stock (Rank 30<sup>th</sup>).

### Perception analysis of Library Staff towards library effectiveness:-

**Table 2.** Ranked Indicators of Library Staff

Rank	Statements	Mean	Std.Deviation
1	Expert staff assistance to users available when needed	4.61	.964
2	Facility for users to recommend items for purchase	4.61	.494
3	Proper allocation of division in expenditure (such as books and periodicals)	4.56	.504
4	Speed and accuracy of re-shelving of materials	4.39	.494
5	Proper use and implementation of collection development policies	4.33	1.014
6	Library has achieved its goals and objectives	4.33	1.014
7	Flexibility of budget to acquire new subject area	4.29	.970
8	Staff made our users aware of services available in the library	4.28	1.003
9	Frequent evaluation of library collection	4.22	1.098
10	Speedy provision of items through inter-library loan	4.22	.797
11	Need of the expert Reference Staff in the library	4.22	.722
12	Adequate and pleasant workspace for library staff	4.22	.989
13	Library expenditure per full-time equivalent student is sufficient	4.17	.609
14	Reporting back to users who recommend items for purchase	4.11	.667

15	Existence and Quality of written management policies for staff and library	4.11	1.304
16	Percentage of potential users actively using library is high	4.11	.747
17	Transparency in management procedures of the library	4.06	1.094
18	Currency of library collection need to be checked	4.06	1.040
19	Cost-benefit analysis or cost effectiveness strategy is required	4.00	1.121
20	Provision of photocopiers/printers in all divisions of library	3.94	1.241
21	Safeguards against mutilation and theft	3.94	1.286
22	Proportion of library budget spent on staff	3.94	1.040
23	High level of staff work load	3.83	.775
24	Library staff involvement in organizational life of university	3.78	.989
25	Equitable and effective fines policies	3.78	.722
26	Regular evaluation of library building	3.72	1.003
27	Job rotation of the library employees	3.61	1.225
28	Provision of multiple copies of items which are in high use	3.56	.969
29	Regular communication with user groups	3.50	1.183
30	Provision of microfilm and microfiche readers	2.78	1.333

Similar approach has been employed to assess the library's effectiveness from the view point of library staff, which comprises of a complete hierarchy from higher position to the bottom one. It is notable that library staff surveyed have quite different priorities as that from their users. The highest mean rating regarding the effectiveness of the library agrees with the "expert staff assistance to users available when needed" (ranked 1<sup>st</sup>), followed by "facility for users to recommend items for purchase" as the next effective indicator (ranked 2<sup>nd</sup>) and proper allocation of division in expenditure (such as books and periodicals) as the 3<sup>rd</sup> effective indicator in the library, according to the employees of the library. These ranking resonates with the fact that libraries are user oriented organizations and there prime objective is so satisfy the needs of the users. Keeping this motto in mind they have regarded users' recommendation for any resource due importance. Also it is a known fact that budget is a bottleneck for most of the libraries and staff needs to justify their expenditure to the parent organizations; hence they have placed "Proper allocation of division in expenditure" as ranked 3<sup>th</sup> in order to prove library effectiveness. A good collection development policy is essential to fulfill the information requirements in a efficient manner therefore it was ranked 5<sup>th</sup>. The least effective indicator in the library is "regular communication with user groups" (Ranked 29<sup>th</sup>) followed by "provision of microfilm and microfiche readers" (Ranked 30<sup>th</sup>).



## Conclusion

In today's internet age the library must prove its relevance by providing the best possible services and information to its patrons. There is a dire need of constantly assessing, monitoring and evaluating the library effectiveness through designed indicators. Libraries often conduct the mistake of restricting the effectiveness of libraries on functions without giving due consideration of stakeholders who are actively involved with the day to day working of a library. In other words perception of the organization effectiveness as held by different users must be taken into account when assessing the effectiveness of a library. Also it is very important to know the difference of perception of library users and employees so that they may be brought at a common ground so there is a smooth transfer of library information services from the source to the receivers as well as better fulfillment of organization's objectives and goals.

## References

1. Abdallah, F and Bilal, D. (2015). Exploring the Effectiveness of Library Services and Resources in Academic Libraries in Lebanon from Users' Perspectives. IFLA WLIC Conference, Capetown, South Africa. Retrieved from <https://www.researchgate.net/publication/282328998>
2. Cameron, Kim. (1978). Measuring Organizational Effectiveness in Institutions of Higher Education. *Administrative Science Quarterly*, 23(4). 604-632. Retrieved from <https://www.jstor.org/stable/2392582>
3. Chandrashekara, J., Adithyakumari, H. & Mohan, B. S. (2016). Researchers Opinion about Effectiveness of Library Resources and Services in VTU Research Center Libraries, India: A study. *International Journal of Information Dissemination and Technology*, 6(4), 268-275.
4. Cullen, R. J. and Calvert, P. J. (1995). Stakeholder Perceptions of University Library Effectiveness. *The Journal of Academic Librarianship*, (November). 438- 448.
5. Ezeala, Lily Oluebube and Yusuff, Eunice Olufunmilola, (2011). User Satisfaction with Library Resources and Services in Nigerian Agricultural Research Institutes. *Library Philosophy and Practice* (e-journal). 564. Retrieved from <http://digitalcommons.unl.edu/libphilprac/564>
6. Ezeala, L. O. (2009). Effectiveness of Library Resources in the Libraries of Agricultural Research Institutes in Nigeria. *Library Philosophy and Practice*, 21(2), 1-6
7. Glorieux, I., Kuppens, T., & Vandebroek, D. (2007). Mind the gap: Societal limits to public library effectiveness. *Library & Information Science Research*, 29(2), 188–208. doi: 10.1016/j.lisr.2007.03.003
8. Lancaster, F.W. (1978), "The cost-effectiveness analysis of information retrieval and dissemination systems", in King, D. (Eds), *Key Papers in the Design and Evaluation of Information Systems*, Knowledge Industry Publications, Inc., White Plains, NY, (reprinted from *Journal of the American Society for Information Science*, January/February, 1971, pp. 13-27), 23-8.
9. Lu, W. (2010). The study of indicators and dimensions for assessing public library effectiveness: a case study of Taipei Municipal Library. *Bulletin of Library and Information Science*, 16(32), 75-90.

10. Majid, S., Anwar, M. A. and Eisenschitz, T.S. (2001). User perceptions of library effectiveness in Malaysian agricultural libraries. *Library Review*, 50 (3 & 4), 176-186.
11. Nwalo, Kenneth Ivo Ngozi. (1997). Measures of library effectiveness in Nigerian polytechnic libraries with emphasis on user satisfaction (Doctoral Thesis). University of Ibadan.
12. IBM Corp. IBM SPSS Statistics for Windows. 2011, Version 20.0. Armonk, NY: IBM Corp.

# **A Study on student utilization of Silent and Independent Library study space in Ansal University Gurugram**

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## **Abstract**

In the year of 2016, Ansal university library stated planning for the renovation for increase the study space in one of its library and reduced the another one, in order to maximize the functional area of the reduced study space, a survey was conducted to better understand the particular space needs of library users. The study shows the contrast in the use of library among the users from various scheme of study science student, medical students and Architecture students. The outcome from the study provided the useful information. How to achieve targeted improvements? Which functions of library space and service to be highlighted? When did we explore library services of various departments?

## **Keywords**

Academic Library, Library usage, Bachelor students, College Premises

## **Introduction**

Space has always been issue in college and university, how it is designed? How it is utilized? Where services are located, materials are stored as well as displayed, and accessible where service and staff is placed for the growth needs of the collection, furnishing and resources needs.

Lucknow library statics shows a few numbers of visits and decrease in borrowing activities and the number of question received for query is minimum in the last ten to fifteen years. This deficiency in the library visitors and use of library services inspire and encouraged us to consider the role of library study spaces and other services like computers and printing facilities. A Survey was conducted in Ansal University Gurgaon in which Students and library Professionals involves in the procedure of redesign the library study space to create rapport across the campus.

Respondents gave their suggestion for improvement. We can categorize their responses in three categories:

- Technology support like Tech rich spaces
- Furnishings and Facilities like flexible spaces
- Silent Study Area

## Objectives of the study

What are the new activities that new library study spaces intended to support?

- How are the new activities to be designed to achieve learning and information process?
- What type of problems faces while designing the new spaces?
- Is spaces renovation fulfilling Student population learning needs?
- What new facilities to be added to endorse the new library space.

## Literature Review

The study provides the terms such as learning centers, learning spaces, information commons, learning commons, and collaborative spaces. Are they the same? If not, what are the main differences? How do these concepts affect space planning and provision? Therefore, in order to place the answers in a logical context, we need to delve into the history of library buildings, more specifically. The roles, structures, and spaces were meant to accomplish, because as Hickerson (2013) well expressed “spaces and roles are two sides of the same coin” (p.15). However, the focus of this book is not to describe in detail the building styles but rather, to discuss the roles represented by the spaces they provided.

For at least two more decades, these styles served their role: print collection, fixed function, and modular design. Academic library buildings well into the early 80s planned their spaces, by counting volumes owned and projecting their annual purchases into the future. Seman (2006) noted as he described the University of Colorado's Norlin library. As print collection grew, stacks had randomly replaced user space, hiding key services behind shelving. The result was dark, uncomfortable, illogically arranged library. There was very little space for users, technology had not thoroughly integrated into the building, and there was no electronic classroom space. (p.7)

This highlights a typical university library of the 40s and far into the 70s and early 80s. These structures prevailed, because historically, academic libraries were associated with the storage of print. It is interesting to note that in the middle of 2012, both Scholfield, and Tiffen (2012) still warned librarians to “extend the purpose of the library from merely a storehouse of books” (p. 42). During most of the twentieth century, staff workspaces, display of furniture, traffic flow, and storage of the collection and access were the main concerns of the librarians planning and designing academic library spaces. According to Seal (2015), “the

typical academic library of the mid to late twentieth century was quite but sterile place.”(p. 559)

## Population of Study

Ansal University Located in India. Gurgaon and Lacknow, has its two campuses, each has its own separate library. Ansal University Gurgaon serves its maximum of student body. Gurgaon is a home department of Sushant School of Architecture (SSAA), Sushant School of Design (SSD), School of Engineering and Technology, School of Tourism and Hotel Management, School of Allied health Sciences. Ansal university offers graduate , masters Courses PhD D. in Architecture , Design , Law, Engineering, Management , Tourism & Hotel management, Liberal Arts and Allied and Health sciences.

## Research Question

- Usage of library space by respondents (Frequency of library use)
- What are the reasons for visiting the library?
- What is the area for improvement?
- Importance of various types of study spaces.
- Comfort and light
- Importance of various Equipment and Technologies.

## Research methodology

It was decided to adopt both the quantitative and qualitative methods for the research. A questionnaire is to be prepared with 20 questions, in which five questions answered in the form of comments if the respondent desired. The questionnaire includes all types of questions like which existing library patterns used, needed improved. Existing library space is satisfactory. Is different type of study spaces works in library? Email id of users, registered in any program offered by the university received from IT department Questionnaire had been sent to students via email. Due to duplicate email id, the sample size was smaller than expected. It estimated that questions were sent to 2000 individual emails id. There were 475 feedbacks: 428 complete feedbacks and 24 imperfect responses. There are 23 are disqualified responses. Only the 452 complete and partial responses evaluated.

## Result and Discussion

All survey respondents registered at the minimum. Therefore 80% of the respondents had the majority of programs enrolled from Gurgaon. Out of these respondents, 72% were between 18 to 22 years, which is all most to 45% of the overall Ansal student community.

The study shows habit and study space requirement varies from their different discipline. Student from certain discipline might use the space more than others. Figure first shows the proportion allocation of programs among survey respondents, registered in the programs runs by Ansal university premises, and the actual proportion distribution of all students enrolled for these programs. The Architecture graduate were over –represented in the survey. 49% of respondents in the survey based at architecture departments while 35% of Ansal University campus students registered in different department. The survey shows that the architecture students are more motivated for the utilization of the library study space rather than the other departments. Hence, Architecture student’s participation in this group is more active.

**Table: 1.** Segregation by programs, the students enrolled in Ansal premises and survey responses.

Department	Actual	Percentage	Survey respondent	Percentage
Architecture	270	57%	266	56%
Design	55	11%	48	10%
A. Health Sc.	43	9%	40	8%
Tourism	27	6%	25	5%
Management	12	2.60%	10	2.10%
Engg.& Tech.	24	5%	23	4.80%
Law	30	6.40%	27	5.60%
Hotel Mgt.	14	3%	13	2.70%

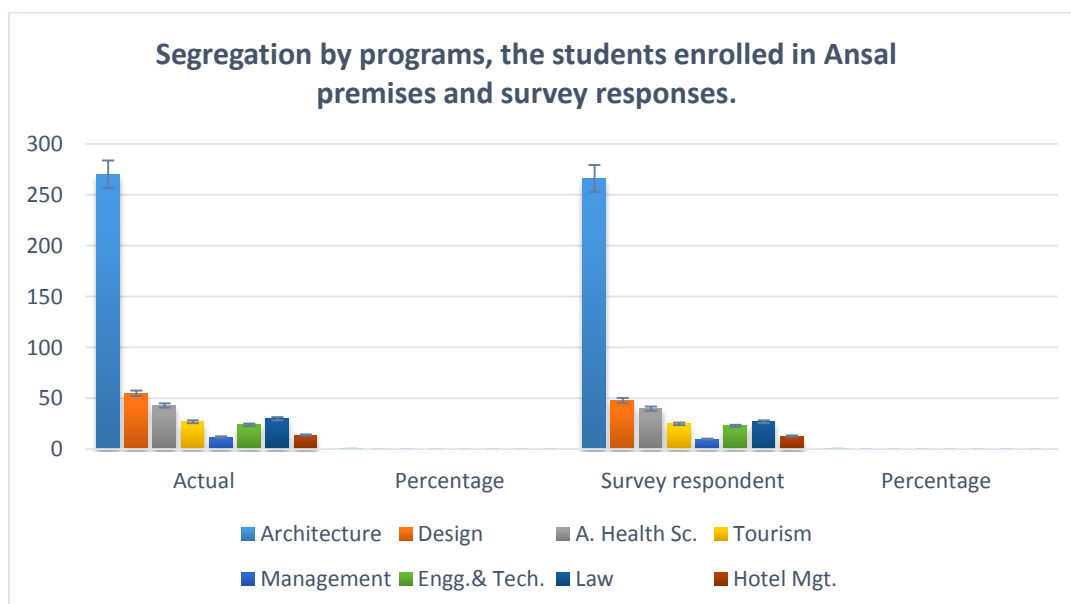
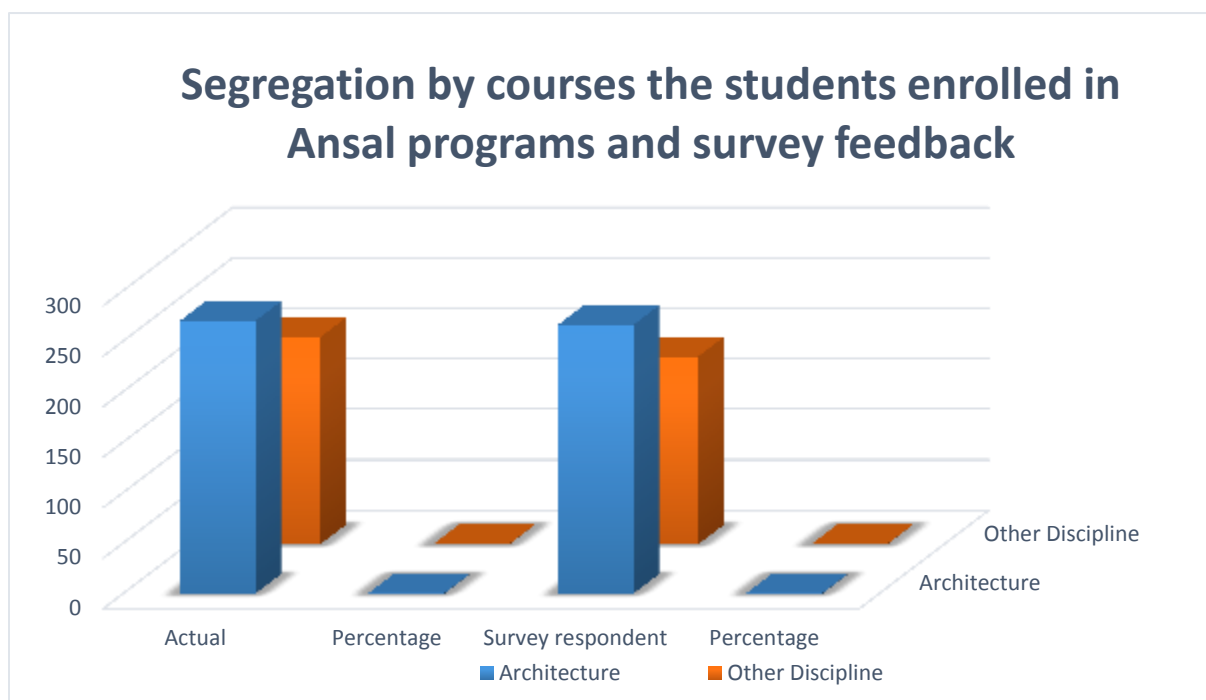


Figure shows that 56% of the respondent from the Architecture department 56% and second highest ratio of the design students 10% and health sc. Respondent are 8% Tourism 5%

management respondents 2.10 percentage Engg & Technology 4.80%, Law respondents 5.60% and Hotel management 2.70%

**Table: 2.** Segregation by courses the students enrolled in Ansal programs and survey feedback

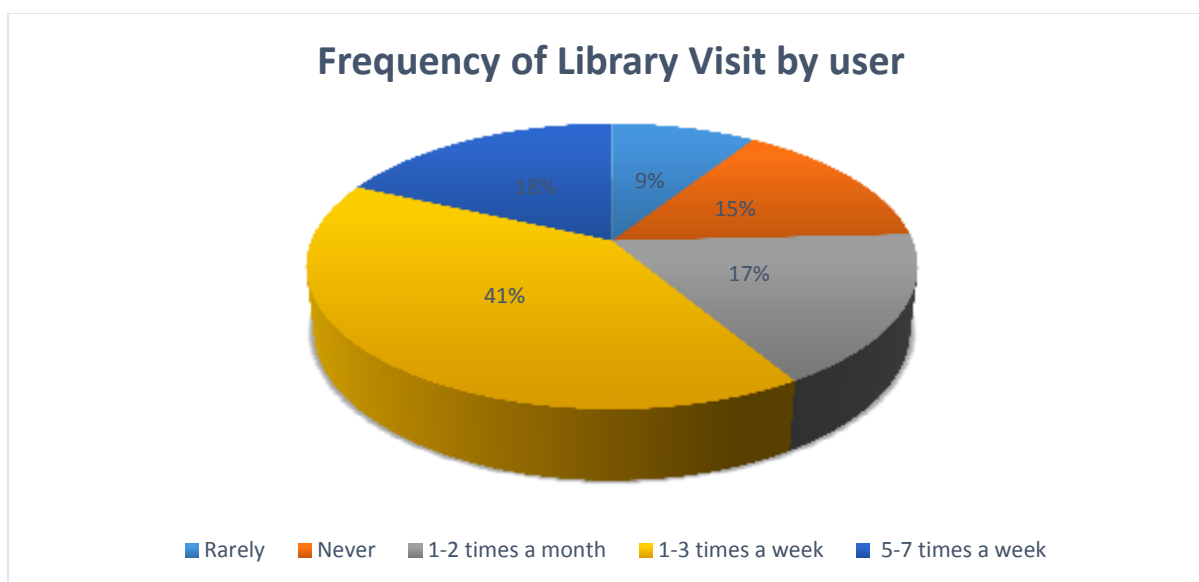
Department	Actual	Percentage	Survey respondent	Percentage
Architecture	270	57%	266	56%
Other Discipline	205	43%	186	38%



Graph shows that architecture students are more concern and aware of the library study space and facilities as compare to the other discipline.

**Table: 3** Frequency of Library Visit by user

Duration	percentage
Rarely	9%
Never	15%
1-2 times of the month	17%
1-3 times of the week	40%
5-7 times of the weekweek	18%

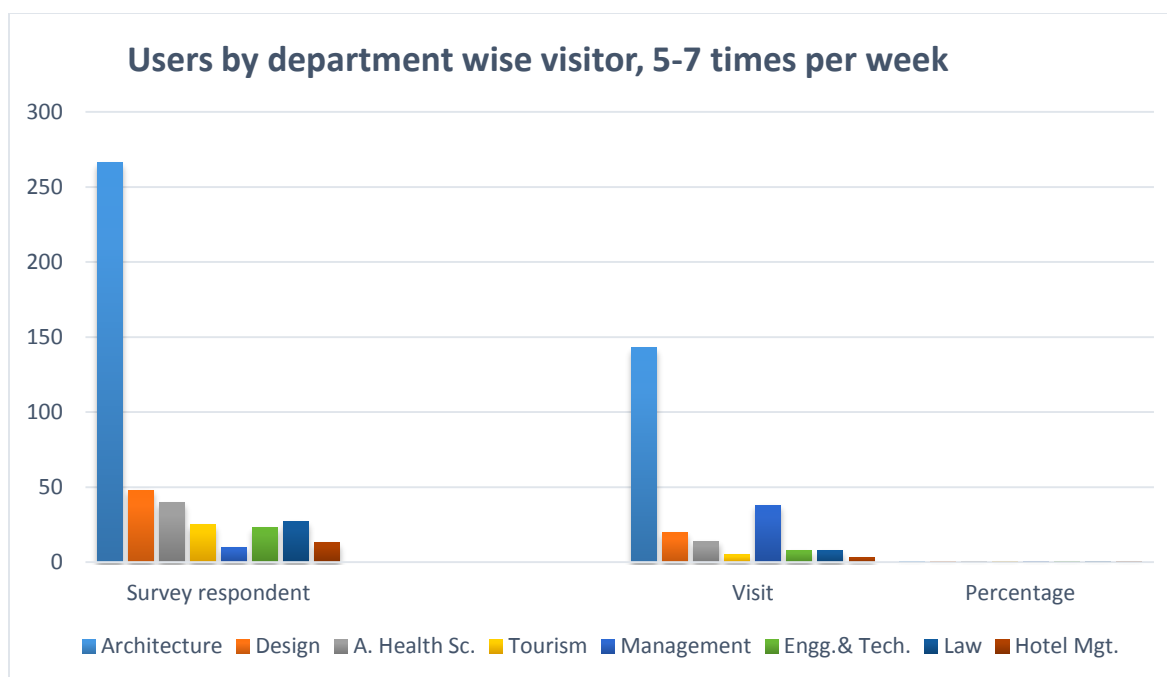


In the fig. 58 percentage of survey respondents, use the library study space at least once per week. The least number of respondents are who are using the library rarely.

**Table 4.** Users by course wise visitor, 5-7 times per week

Department	Survey respondent	Visit	Percentage
Architecture	266	143	54%
Design	48	20	42%
A. Health Sc.	40	14	36%
Tourism	25	5	20%
Management	10	38	38%
Engg.& Tech.	23	8	35%
Law	27	8	30%
Hotel Mgt.	13	3	23%





Respondents use patterns differ from one another, when analyzed by course. Figure result shows that 54% of Architecture respondents and 42% of Design respondents use the library almost, daily basis as compared with the respondents registered in other program only 20% of minority respondents visit library daily. The study shows that access of library by Architecture students is more as compared to other stream.

**Table 5.** Reasons for visit the library

Reasons for visit the library	Architecture	Design	A. Health Sc.	Tourism	Management	Engg.& Tech.	Law	Hotel Mgt.	Total response	Percentage
Utilize silent Space	80	10	14	4	1	4	5	0.75	118.75	26%
Using Printer & Scanner	32	6	3	2	0.5	3	1.5	0.5	48.5	11%
Search out for books & Articles	37	7	2	3	2.5	2	3.5	2	59	13%
Use Study room	25	4	5	4	1	2.5	2	0.5	44	10%
Issue Books, CD DVD	22	3	3	3	0.6	2	3.5	0.75	37.85	8.30%
Catch up with Friends	25	4	4	2	0.3	1.5	2.5	0.5	39.8	9%
Borrow laptop & I pad	12	3	1	1	1.35	2.5	1.7	1.5	24.05	5%
Query solution from librarian	3	2	2	1	0	0.5	2.6	2	13.1	3.30%
Query related to circulation	4	4	1	2	1	2	3.2	2	19.2	7%
Meet with librarian	2	1	2	0	1	2	0.5	1	9.5	2.10%
Consult from Rare Collection	21	1	2	2	0.25	1	0.75	1	29	6%
Other	3	1	1	1	0.5	0	0.25	0.5	7.25	2%

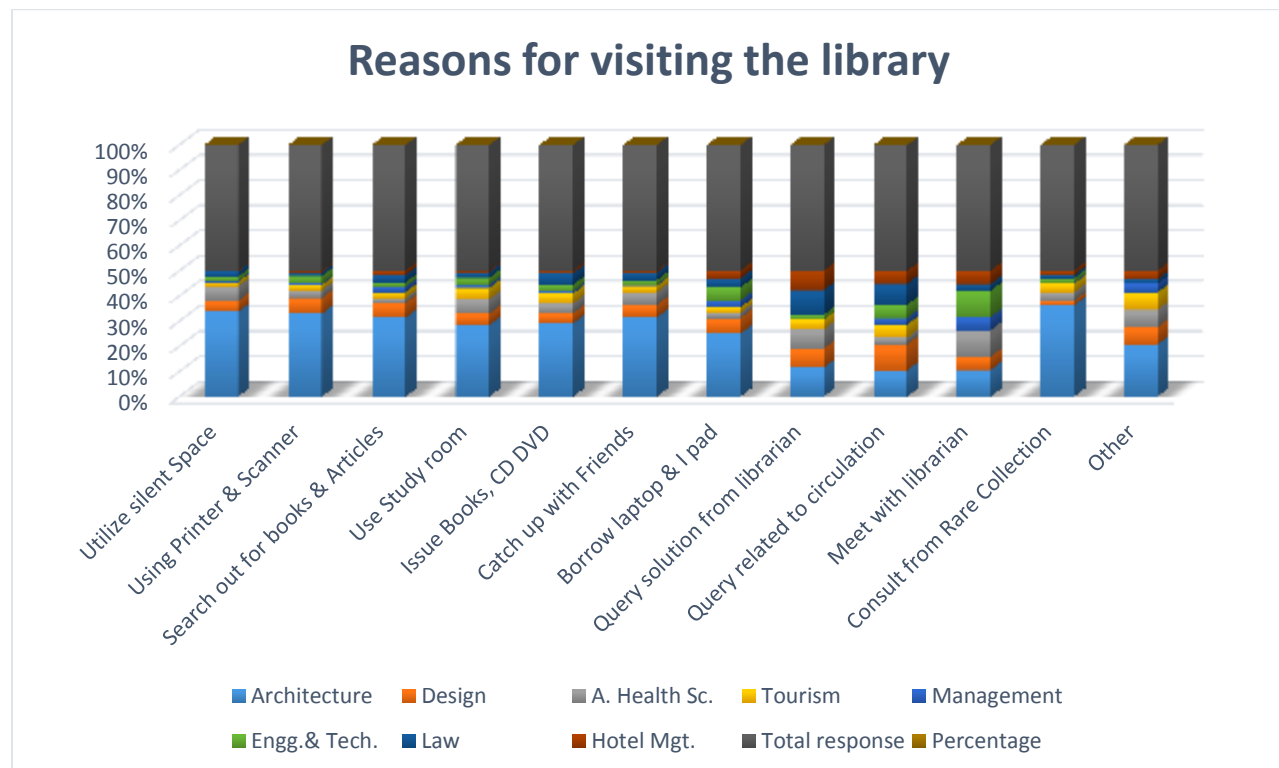


Figure 5 result shows that majority of students come to the library, to use the silent confined space 26% use the equipment such as printer or scanner 11% , use of study room is also quite high on the list 10% while 8.3 % of respondents come to library for borrow books this is less percentage of respondent. This large difference may be varies because users that borrow those books from the library do not use the library space. It is also note that use of the face-to-face interaction service was lacking 3.3% come to ask the question to the librarian 7% to asked the queries at the circulation counter and 2.10% to meet with the librarian.

## Need for improvement and reason for visit the library

Respondents have told to give their suggestion regarding improvement they would like to see or prefer in their library. Users suggest that they need the improvement in the following are

- Carpet area
- Study area
- Physical Appearance
- More sitting Space
- More computers
- More Cubical table

- More single study space
- More power outlets
- Wi-Fi connectivity

**Table 6.** Need for Improvements & reason for visit the library

Utilization	Response	Need Self-Improvement	Percentage Point
Utilize silent Space	118.75	68.5	57%
Using Printer & Scanner	48.5	3.4	7%
Search out for books & Articles	59	5.6	9.5%
Use Study room	44	10	23%
Issue Books, CD DVD	37.85	3.4	9%
use of computer	39.8	6.8	17%
Borrow laptop & I pad	24.05	1.7	7%
Query solution from librarian	13.1	0.3	2%
Query related to circulation	19.2	0.7	3.6%
Meet with librarian	9.5	0.095	1%
Attend Research class, Workshop etc.	29	0.87	3%
Other	7.25	0.072	1%

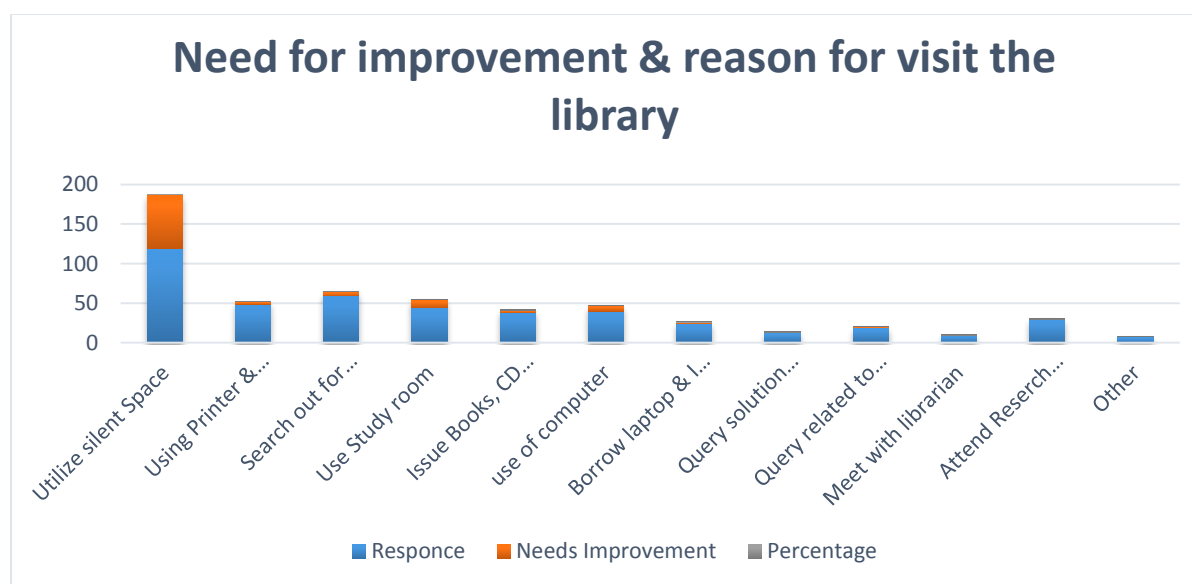


Figure shows the percentage point of respondents whose present a specific reason for visit the library, along with the percentage point of open views for suggesting improvement in the field of service as well as respondents demands for more computer to check their emails and taken out the print out of their documents. The respondent's opinion are express an urge for desktop computers; the opinion is not the lack of availability of laptops. However, there preference for desktop computers over laptops and second reason is to access the printing services and it acts

like a substitute of laptops. Respondents also preferred desktop computers, as there is almost with no issues with network access. Power supply and carrels with computers are much larger than the study tables.

**Table 7.** Importance of study spaces

Users were asked to rate the different types of study spaces. What are the choices they want to add on priority basis? Following output as shown below

Utilization	Respondent	Not Important	%	Neutral	%	Important	%
Quite Study Space	118.75	16.75	14%	7	6%	95	80%
Individual Study Carrels	48.5	10.6	22%	6.3	13%	31.5	65%
Group Discussion Rooms	59	11.21	19%	6.49	11%	41.3	70%
Space to access and consult Journals and Books	44	10.12	23%	9.68	22%	24.2	55%
Group Discussion room with presentation Equipment	37.85	10.21	27%	7.57	20%	20	53%
Computer Classroom	39.8	13.93	35%	5.97	15%	19.9	50%
Big study Hall	24.05	7.2	30%	2.4	10%	14.43	60%
Laptop free Study Space	13.1	7.86	60%	1.9	15%	3.2	25%

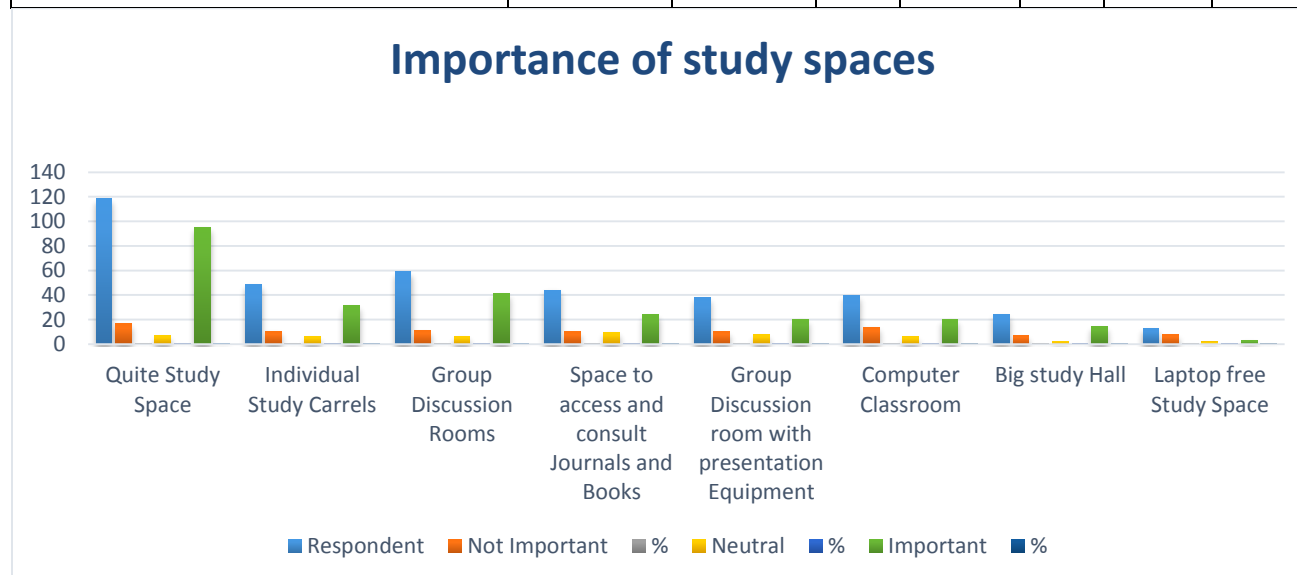


Figure no nine shows the different type of study spaces for library.

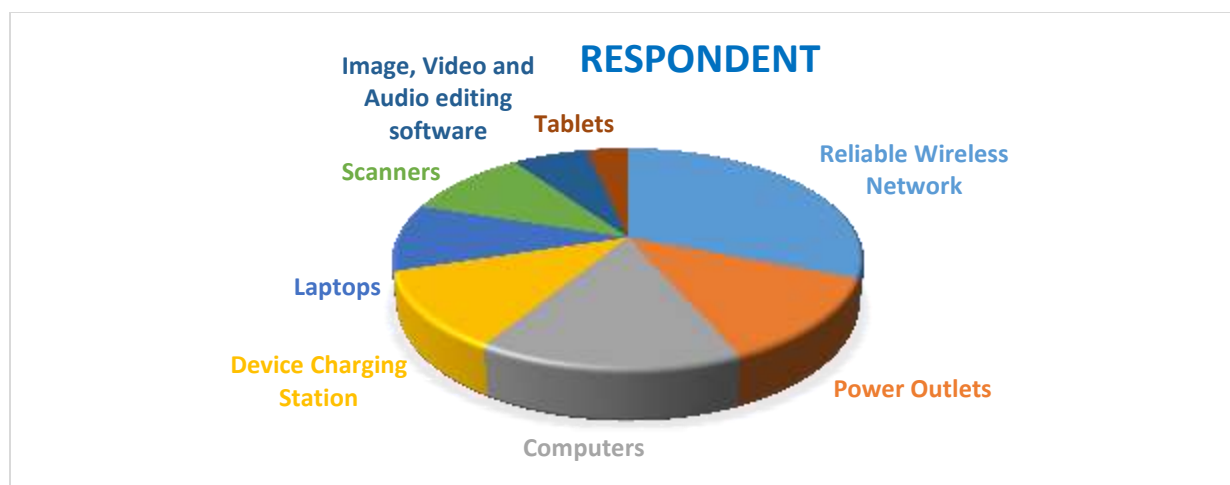
Atmosphere light and Furniture: Students mention their views as following

The environment should be comfortable, well-painted walls, with more chairs and tables to make a healthy environment. Plug outlets should be more. Environment should be open, clean and

health for comfort of long hours of study. Some students suggest that light should be adequate & bright (fluorescent light) to create a good environment. Some students suggest the daylight in study spaces and surrounded by greenery.

**Table 8.** Importance of various Equipment and Technologies:

Utilization	Respondent	Not Important	Important	Neutral
Reliable Wireless Network	118.75	4%	90%	6%
Power Outlets	48.5	12%	85%	3%
Computers	59	19%	70%	11%
Device Charging Station	44	23%	55%	22%
Laptops	37.85	27%	53%	20%
Scanners	39.8	30%	55%	15%
Image, Video and Audio editing software	24.05	33%	67%	10%
Tablets	13.1	25%	60%	15%



As figure shows that respondent more expectation for the wi-fi or wireless network so that they work without network break there is another reason for that there laptop can access the network may or may not be. Power switches provided at least with each table as well extra charging point should be there. Laptop facility should be there. Scanners Image, video and audio editing software facility has also given an equal importance.

**Table 9.** Other Desired Features

Utilization	Respondent	Not Important	Important	Neutral
Space where food is allowed	118.75	12%	85%	3%
coffee area	48.5	4%	90%	6%
Lounge Spaces	59	23%	55%	22%
Separate area for conversation and mobile access	44	19%	70%	11%
Charging Machine	37.85	30%	55%	15%
Food Vending Machine	39.8	27%	53%	20%
Lockers	24.05	33%	67%	10%

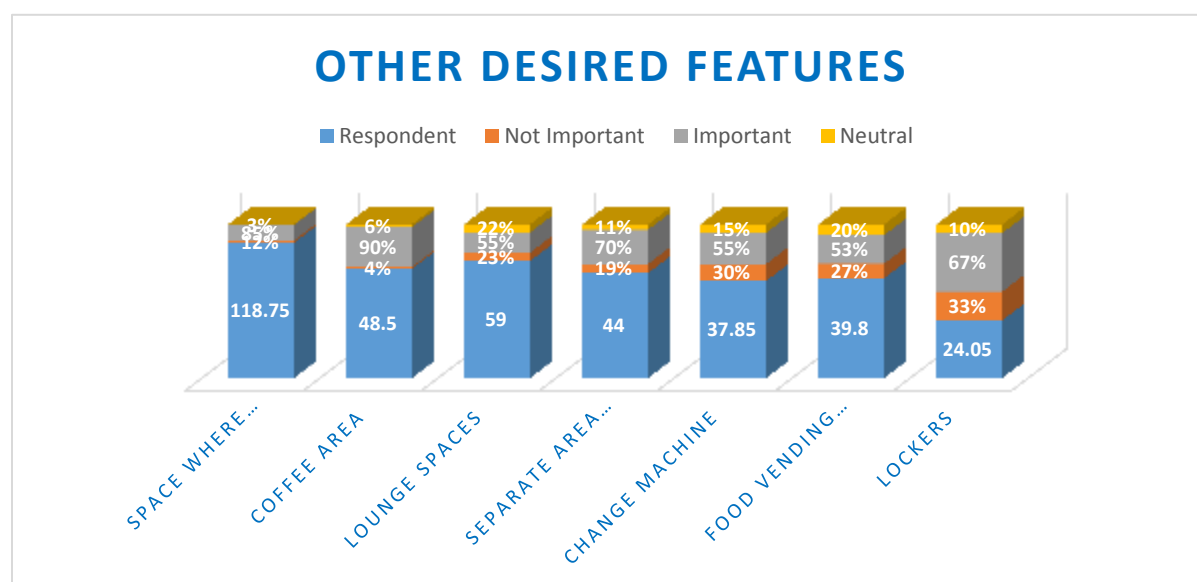
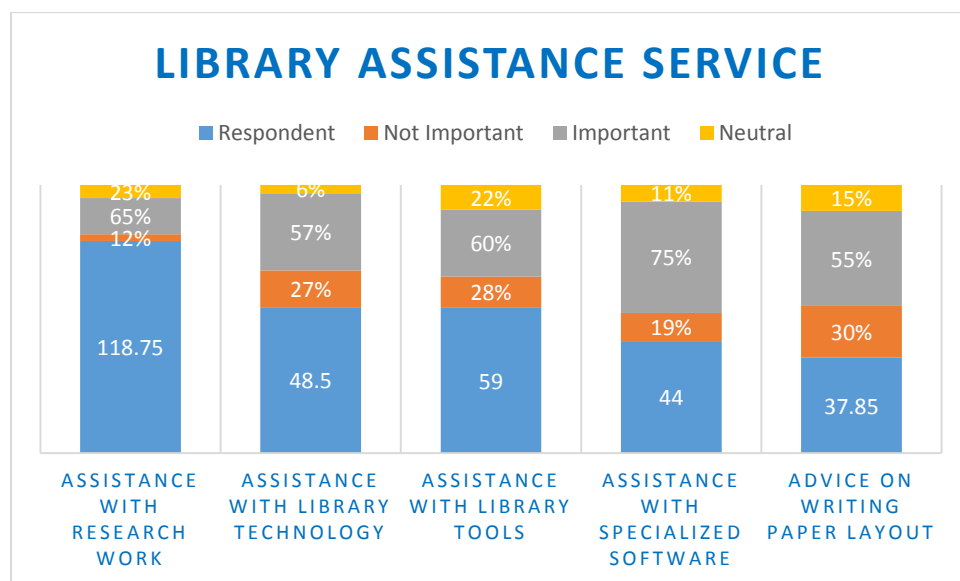


Figure shows that students have different desire and expectation from the library renovation. 90% highest demand was for the coffee area in the same building where the library exists the authority appreciates this demand can be fulfilled 85% of students demand that they need a space where food have to be allowed. However, it is hectic to manage this demand by the library staff. Third issue is their comfort they demand lounge sofa, comfortable chair so that they can lean when they get tired. As for the safety, purpose locker should be provided to avoid theft,

safety, and security of respondent's personnel. Respondents' demand (53%) for the food vending machine and 55% for the charging machine for mobile as well as for the laptop is also valuable

**Table 10.** Library Assistance Service

Utilization	Respondent	Not Important	Important	Neutral
Assistance with Research work	118.75	12%	65%	23%
Assistance with Library Technology	48.5	27%	57%	6%
Assistance with Library Tools	59	28%	60%	22%
Assistance with Specialized Software	44	19%	75%	11%
Advice on writing paper layout	37.85	30%	55%	15%



As the figure shown 75% users need assistant in specialized software Like OPAC, e-journal access, How to search a specific topic, article e- journal how to reach a particular book from the reference section. 65% of the user need assistance in their research work to search out specific article, thesis dissertation etc. 60% of the users need assistance with library tools. 57% of the users need assistance in library technology. 55% of users need advice how to write a paper. How to prepare a Bibliography as well as how to avoid the plagiarism in paper?

## Little Picture of Library renovation



## Summary and Improvement

The purpose and library study space for university campus is changing. Apart 55 % of survey respondents come to visit library to borrow or submit material like books, CD, DVD while 80% of library respondents visit the library to use the quiet library study space. The majority of respondents use and access the library respectively several times per week 58%.

The result also shows that the respondents who frequently use the library are not the respondents who use the study space the most. The study also shows that Architecture students use the library more frequently but other discipline uses the staff mediated services as well as group study rooms. The observation also shows that library staff perception of student needs based on their experience at service desk might miss a whole group of students such as architecture students for example who rarely use the mediated services.

The study also shows that respondents, who saw ambience as more important for the study, impress the authority for overall look as well as feel and comfort of the library as important



point, for creating a good study atmosphere like light(daylight)as well as the comfort of the furniture.

## **Study Spaces**

The study shows that respondent's access and desire more quiet library study spaces, the study spaces would require purchasing of new moveable furniture. Almost all study tables in the library seat four students however, the measurement and scale of the tables does not allow for comfortable private study spaces for four students.

## **Wi-Fi and computers**

Analyzing the result, it shows that IT department has installed the ideal and suitable Wi-Fi coverage and new access point installed where it is necessary. Computer workstation, power outlets were installed as well as one power outlet per study seat installed.

## **Food Area**

The results shows that the demand of for food area in the library building, a student –managed coffee shop opened in the building where the library situated and librarian decided that adding this one food area in the library building, library would not make much of an impact.

## **Conclusion**

We are able to use the outcome of survey, to make improvements in the library silent study space, Group study rooms, WI –Fi network, and computers as well as create area where food allowed. The changes we made a long process from satisfying all the desires of the student community expressed in the survey. The Survey findings are Interesting. The paper also highlights the important survey findings in respect of demographic profile of Respondents and highlighting their Library Study Space usage pattern.

## **Reference**

1. Antell K. and Engel D. "Conduciveness to Scholarship: The Essence of Academic Library as Place." College and Research Libraries 67.6 (2006).
2. Bailin, K. "Changes in the Academic Library Space: A case study at the University of New South Wales." Australian Academic & Research Libraries42.4 (2011).

3. Bedwell, L., and Banks, C. "Seeing through the Eyes of Student participant observation in an Academic Library." *Partnership: The Canadian journal of Library and Information Practice and Research* 8.1 (2013).
4. Chart, I. "Future Proff: Library by Design." (2014). Web 17 June 2019.
5. Child, S., Matthews, G. and Walton, G. "Space in the University library: An introduction", in *University Libraries and space in the digital world*, ed. Graham Matthews and Graham Walton, Surrey, England: Ashgate 2019, 1-18.
6. Eigenbrodt, O. "The Multifaceted Place: Current Approaches to the University Library Space." In *University Libraries and Space in the Digital World*, ed. Graham Matthews and Graham Walton, Surrey, England: Ashgate 2019, 35-50.
7. Feather, J. "Space in the University Libraries" An historical prospective" in the *University libraries and space in the Digital World*, ed. Graham Matthews and Graham Walton, Surrey, England: Ashgate. 2019, 19-34.
8. Al-Baridi, S.,and Ahmed, S.S(2000).Developing electronic resources at the KFUPM Library Collection Building 19(3), 109-117.
9. Garibay, A., Ikoja-Odongo, J.R.,Okello-Obura,C(2003).Electronic Information ResourcesUtilizationby Students in mbara university library. *Library Philosophy and Practice(e-journal)*.paper869.[Http://digitalcommons.Unl.edu/libphilprac/869](http://digitalcommons.Unl.edu/libphilprac/869).
10. Kennedy, I.V.R(2017).Awareness and Usage of E-Resources among Undergraduate students with special reference to ST John's College, Palayamkottai: A Case Study.ICCLIST174-177.
11. Tarik, H and Zia, M.W(2014).Use of Electronic Information resources by the Students of faculty of science, University of Karachi. *International Journal of Digital Library Services* 4.3.

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# Research Data Management Services in Technical University Libraries of Odisha: A Study

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## Abstract

Today, scholarly research is an important indicator of national development and reflects the potential of a nation to solve the problems of mankind. Researchers all over the world are generating large volume of data sets for their research purpose. The research data may be textual, quantitative, qualitative, images, recordings, musical compositions, verbal communication, experimental readings, simulations, codes and so on. So there is a challenge for the academic libraries to preserve and disseminate these large sets of data for future needs. Research data management concerns the organization of data, from its entry to the research cycle through to the dissemination and archiving of valuable results. In this context, this paper has studied the research data management (RDM) services implemented by different Technical university libraries of Odisha for managing, organizing, curating and preserving research data generated at their departments, laboratories and libraries for reusing and sharing. The study highlights perception of a research management (RDM) perspectives and explores the system development of RDM service by considering the data discovery services, academic scholarships, knowledge creation, discovery applications and sharing of information in the technical university environment. This paper reports on how the libraries at technical universities of Odisha are developing and integrating RDM services into institutional research workflows. This study examined the research data management services in technical institution libraries through a questionnaire based survey method among 545 research scholars of different technical university libraries in Odisha. It concludes with how further skills development within the library is being undertaken to support data services and some of the likely challenges for further development of the services.

## Keywords

Research Data, Research data management services, Data repositories, Data curation, Data sharing, Technical colleges

## Introduction

The advent of technology and world wide web has significantly changed the information landscape and the services around it. The growth and development of collaborative research and advanced Internet services are key drivers in the introduction of new research data management (RDM) services in university and research institutions across the world. The value of research data which is generated when the researchers execute any research activity or project has been increased tremendously. So many libraries are considering adding data services to help with the research mission of their institution. It provides a range of research management services to large-scale disciplinary projects and local researchers ,reflects the increasing data-intensive research process. Research data management includes a series of activities and processes in the research life cycle, including data construction and generation, storage, security, preservation, sharing and reuse, as well as technical, moral, legal and regulatory issues. It refers to embedding in the scientific research environment, collecting, sorting, excavating, classifying and storing research data and then sharing processed high-value data with scientific researchers to provide personalized information throughout the entire data life cycle and consulting services. A RDM system is based on three-tier architecture such as file-based data storage; a database of metadata and a web interface to facilitate access and use of data. There are many funding bodies and other international publishers who have mandated that the researchers must submit their raw data which they have generated during research findings by clearly defining their data management plans(DMP) .The sharing of data can help in re-evaluating and revalidating the research reports .In US, National Institute of Health(NIH),National Science Foundation(NSF),Department of Energy(DoE) and Environmental Protection Agency(EPA) have started sharing of research outputs and mandating data management plan. Similar mandates from funding agencies of other countries including UK, Canada, Australia(ARC) and India implanted DMP to collaborate and facilitate the researchers in publishing, sharing ,handling, de-identifying using and discovering datasets. The Digital CurationCentre(DCC) is a globally recognized center for capacity building in RDM and digital curation. In India, the Dept. of Science &Technology,Govt. of India supports open data through open government data (OGD).This portal is used by the government departments and ministries for publishing their datasets, documents ,services and tools for the general public to access and use.The Indian Council of Social Science(ICSSR) has set up a portal called ICSSR Data Service for researchers in social science to deposit, use, reuse and analyze data in order to support ,promote and strengthen research endeavors .

Research data management services are being implanted by the technical university libraries of Odisha globally in support of university research activities. This paper analyses the contribution of technical university libraries to research data management, its roles and relationships involved in RDM, identifies the main components of an RDM programme,evaluates the major drivers for RDM activities and identifies the key factors influencing the shape of RDM developments. The next section includes review of literature based on RDM .

## Review of Literature

The central theme of this literature study is to highlight the roles of academic and research libraries in RDM services, the drivers of RDM services in university libraries, the overall readiness of university libraries, skills and training needs of librarians as well as the state of RDM services in academic and research libraries worldwide. Research data has become a topic of increased concern for the library professionals over the past 15 years. Research data is a raw data directly produced from the lab or survey or it can be processed data which has been cleaned, refined, arranged and combined in a manner that it is useful in research. According to **Beagrie(2008)**, the term “research data” is defined as any organized digital data from any discipline, which academic researchers can use in their research as an evidence record. Research data includes analogue sources as well as discrete digital objects(text, files, images, audio, video), complex digital objects and databases; **Whyte and Tedd(2011)**. According to **Davidson et.al. (2014)** Researchers, librarians, administrators, ethics advisors and IT professionals all have a vital contribution to make in ensuring that research data require systematic and holistic approaches provided from complex environment. Furthermore, academic libraries play implicit roles in research through librarians’ involvement in the provision of access to data; advocacy and support; and managing data collections which are the key roles in RDM. Research data management concerns the organization of data, from its entry into the research cycle through to the dissemination and archiving of valuable results. **Wilson et.al.(2010)** explains research data management as a series of activities, which involves all the process that information from research inputs undergoes as it is manipulated and analyzed en route to become a research output. In a similar study of this, **Lewis(2010)** affirms that the storage, curation, preservation and provision of continuing access to digital research data constitutes the concept of RDM. He examined the roles and skills of university librarians in UK in the context of RDM and suggested upskilling of the existing library workforce through education and training on research data management. **Chiware and Mathe(2015)** conducted a study to establish the requirements for setting up RDM services at the Cape Peninsula University of Technology(CPUT) library in South Africa and found that there was a great need for structured RDM services and tools for setting up RDM platforms that include technology, staff and policies within the institution. **Kahn et.al.(2014)** also explored the awareness of RDM services in South Africa and concluded that the areas like policy, skill development as well as provision of resources require more attention. **Henderson and Knott(2014)** observed that the introduction and success of RDM services in academic libraries calls for the need to hire new staff or re-skilling and up skilling of librarians to take up new roles and responsibilities. As the creators and users of research data, researchers engagement is crucial in the design and development of RDM services. **Antellett. al. (2014)** observed that the majority of institutions affiliated with the Association of Research Libraries(ARL) are offering RDM services, and that while science librarians were uncertain of their data management skills they were optimistic about translating traditional librarian skills of applying metadata standards and providing access to information into RDM service development. According to **Carlson(2012)**,” the librarians who seek for data management and curation issues need to be addressed by two levels e.g. at the individual level(acquiring skills and confidence) and at the organizational level(creating a supportive environment) to develop data

services. **Pinfield, et.al.(2013)** explained RDM as “a number of different activities and processes associated with data life cycle, involving the design and creation of data ,storage, security, preservation, retrieval, sharing and reuse, all things taking into account technical capabilities, ethical considerations, legal issues and governance framework. He developed “a library-oriented model of institutional RDM”. This model consists of factors including drivers (why), components (what), influencing factors (how) and stakeholders (who). Researchers from various discipline such as academic staff, librarians, IT professionals, senior university managers, research support personnel are listed as stakeholders. **Fearson et.al. (2013)** defined RDM service as “providing information, consulting, training or active involvement in data management planning, data management guidance during research, research documentation and metadata ,research data sharing and curation of completed projects and published data”.**Gold(2007)** described the potential role of libraries in managing data, with a focus on social science data, geo referenced data and bioinformatics data. **Henty(2008)** surveyed Australian universities to identify the existing data management practices and trends and explored the roles of libraries and librarians in this context. **Tenopir et.al.(2017)** surveyed the prevalence of research data services among members of the association of European research libraries. The findings revealed that 45% of libraries surveyed provided services in the form of consultations with researchers and students regarding DMP,43.5% of libraries surveyed provided consultations on metadata standards for RDM and 36% provided reference support. He concluded that this gap between the provision of RDM services in the US and EU might be due to earlier adoption of DMP requirements.According to **Choudhury(2008)**, the new role of librarians in “supporting new forms of data-intensive scholarship” has transformed librarians into a “data scientist” or “data humanist”. In this role ,they act as the human interface between the library and eScience projects. **Tammaro and Casarosa (2014)** emphasized that an RDM service encompasses practices such as open publishing of research, campaigning for open access, encouraging scientists to practice open notebooks science, and generally making it easier to publish and communicate scientific knowledge.

## Scope and Objectives of the Study

The scope of the study is confined to the technical university libraries of Odisha. There are six nos. of technical universities in Odisha and the data were collected from the research scholars of these universities through questionnaire method. The specific objectives of the study included the following:

- To assess the level of awareness to develop RDM policy among the research scholars of the Technical Universities in Odisha.
- To analyze RDM services provides by the universities of Odisha and its contribution to the management of research through its lifecycle.
- To find out the users’ perception about the approaches of RDM implementation in the technical universities of Odisha
- To analyze the methods of data storage and sharing of research data at the university libraries of Odisha.



- To investigate researchers' awareness and usage of RDM policy that will influence the development of a university strategy for RDM;
- To determine the constraints that are faced by the library staff to adopt RDM .
- To analyze the key factors influencing the shape of RDM developments.

## Research Methodology

A questionnaire-based survey method is used in this study. The data were collected from six nos. of Technical universities in Odisha named as Siksha 'O' Anusandhan(SOA) University, BijuPattnaik University of Technology(BPUT), Kalinga Institute of Industrial Technology(KIIT), Veer SurendraSai University of Technology(VSSUT), C.V Raman University of Engineering & Technology and Centurian University of Technology & Management systematically selected for the study area. The questionnaire was designed and distributed to 650 nos. of research scholars of the Technical institutions such as Engineering, Medical and Dental colleges of Odisha state. Out of which 545 duly filled questionnaires were received back with the response rate of 83.84%.Table-1 shows the details of the respondents used in this study.

## Data Analysis and Findings

### *Profile of the Respondents*

The data were collected and analyzed by using statistical software SPSS. Table-1 presents the profile of the respondents along with the response rate from six technical universities of Odisha. It was found that out of six universities, SOA ranks first in order by reporting 94.54 percentage rate of response followed by BPUT (91.81%), KIIT (89.09%), CVRaman (72.28%), VISSAT (86.36%), and Centuraian (67.62%). The overall response rate comes to 83.84 percent.

**Table 1.**Profile of the Respondents

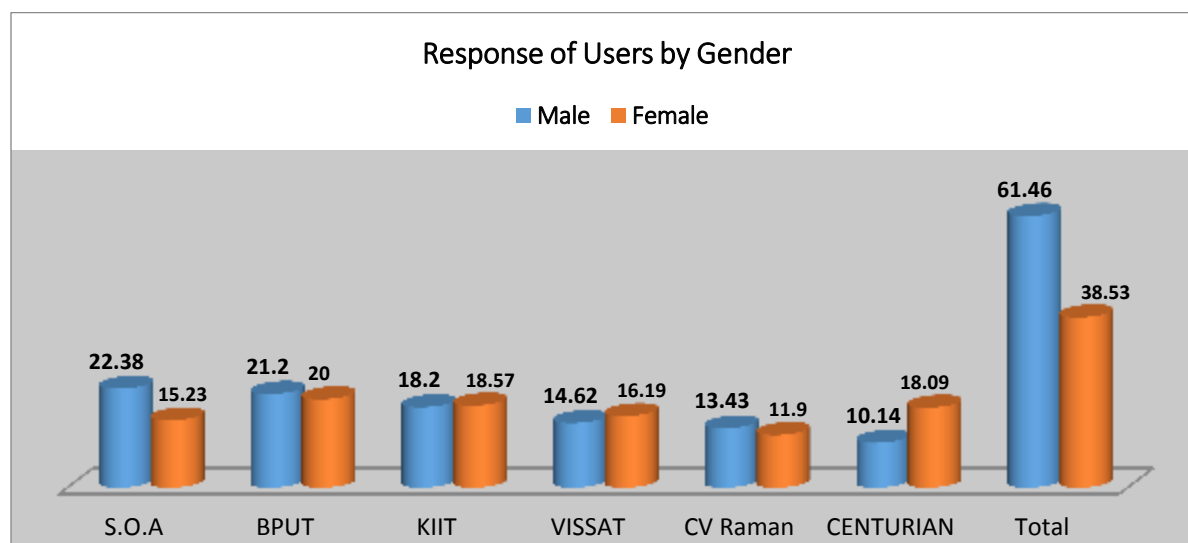
SL. No.	Name of the university	Questionnaire distributed	Questionnaire received	Response Rate
1.	S.O.A	110	104	94.54
2.	BPUT	110	101	91.81
3.	KIIT	110	98	89.09
4.	VISSAT	110	95	86.36
5.	CV Raman	105	76	72.28
6.	CUTM	105	71	67.62
	<b>Total</b>	<b>650</b>	<b>545</b>	<b>83.84</b>

### Respondents by Gender

Table 2 highlights the gender wise distribution of the respondents from six technical universities in Odisha state. The result indicates that out of 545 total respondents, 335(61.46%) are male and 210 (38.53%) respondents are female. The institution wise break up revealed that out of 335 male respondents, 75 (22.38%) are from SOA which ranks first in order followed by BPUT 71(21.2%), KIIT 61(18.2%), VISSAT 49(14.62%), CVRaman 45(13.43%), and Centurian34(10.14%). On the other hand, out of 210 female respondents, 42(20%) are from BPUT University which ranks first in order followed by 39(18.57%) are from KIIT University, Centuraian38(18.09%), VISSAT34(16.19%), SOA 32(15.23%), and CV Raman (11.9%). Fig-1 represents the gender wise distribution of the faculties in the technical universities of Odisha.

**Table2.**Response by Gender

Name of the University	Male		Female		Total	
	N	%	N	%	N	%
S.O.A	75	22.38	32	15.23	107	19.63
BPUT	71	21.2	42	20	96	17.61
KIIT	61	18.2	39	18.57	99	18.16
VISSAT	49	14.62	34	16.19	83	15.22
CV Raman	45	13.43	25	11.9	87	15.96
CENTURIAN	34	10.14	38	18.09	73	13.39
TOTAL	335	61.46	210	38.53	545	



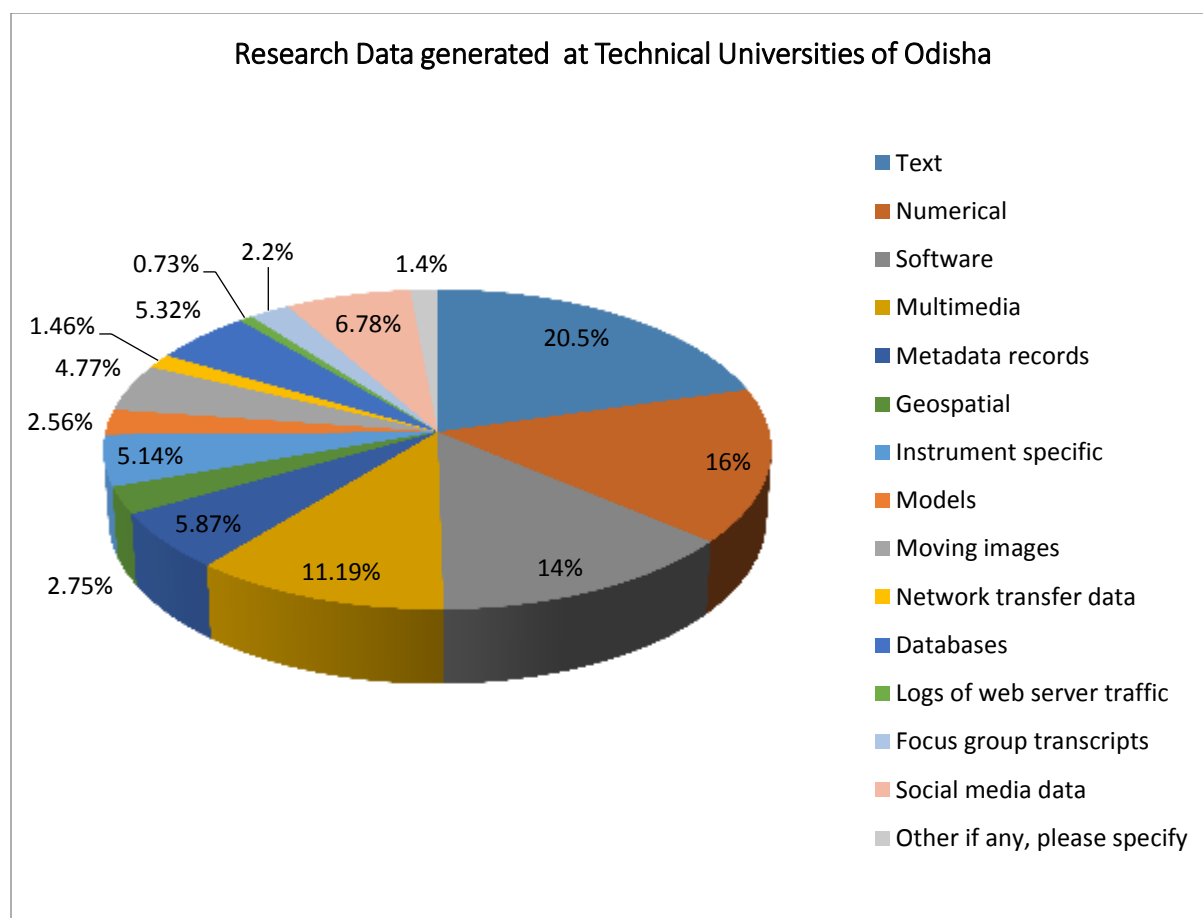
**Figure 1.**shows the response of the Research scholars in the Technical universities of Odisha by Genderwise

### **Types of Research Data**

The research scholars of technical universities of Odisha are using different types of research data. When the question “Which of the following best describes the type of research data you generate or use in a typical research project?” was asked, the result of the respondents is depicted in table-3. As shown in table, a majority of the respondents (n=112, 20.55%) choose text as types of their research data followed by numerical (n=85, 15.59%), software (n=74, 13.57%) and multimedia (n=61, 11.19%). While Logs of web server traffic or another activity (0.73%) and Network transfer data (1.46%) are the least chosen research data types. Fig(2) shows the types of research data generated at technical universities in Odisha.

**Table3. Types of Research data created**

<b>Types</b>	<b>N</b>	<b>Percentage</b>
Text(e.g. TXT,DOC,PDF,HTML,RTF)	112	20.55
Numerical(e.g. CSV,MAT,XLS)	85	15.59
Software(e.g. Java, C, Perl, PHP,R)	74	13.57
Multimedia(e.g. JPEG,TIFF,MP3,Bitmap)	61	11.19
Metadata records	32	5.87
Geospatial(e.g. raster, vector, grid)	15	2.75
Instrument specific	28	5.14
Models	14	2.56
Moving images	26	4.77
Network transfer data	8	1.46
Databases	29	5.32
Logs of web server traffic	4	0.73
Focus group transcripts	12	2.2
Social media data	37	6.78
Others, please specify	8	1.46



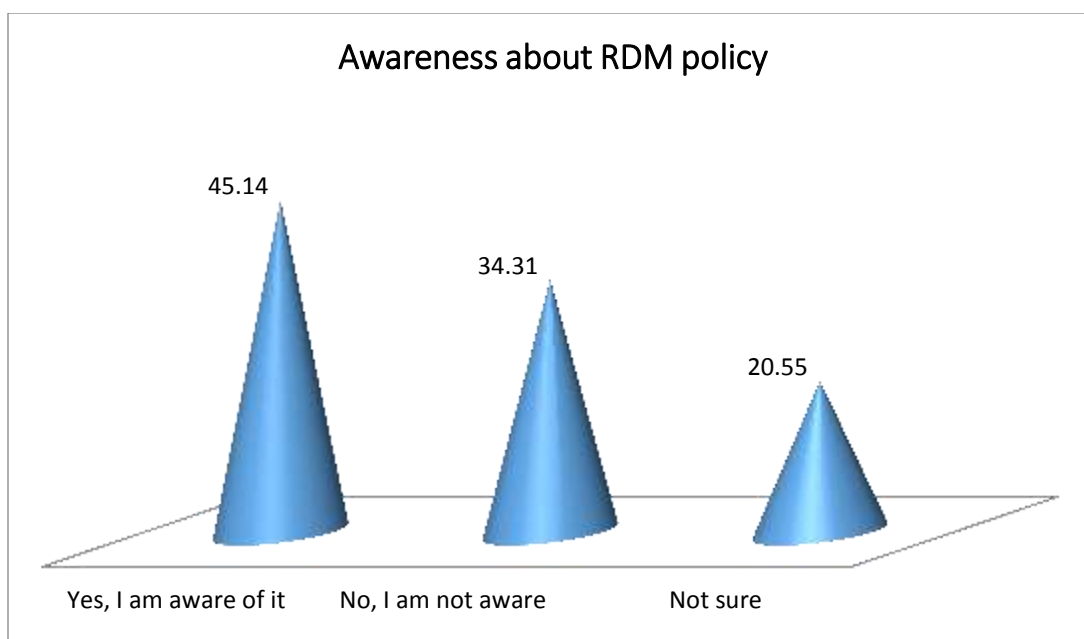
**Figure 2.** Types of Research data created at Technical Universities in Odisha

### ***Awareness about RDM policy by the Research scholars***

The development of RDM policies is an important building block in the delivery of services as they help in ensuring conformity among researchers, as well as the provision of standardized services by service providers like libraries in Odisha. The awareness about RDM policy among the research scholars in the technical universities of Odisha is shown in table-4. The majority of respondents (45.14%) in this study were aware of RDM policy while (34.31%) are not aware of it. Fig-3 shows the level of awareness among the research scholars of technical universities of Odisha about RDM policy.

**Table4.** Awareness level about RDM policy at Technical universities in Odisha

	N	%
Yes, I am aware of it	246	45.14
No, I am not aware	187	34.31
Not sure	112	20.55



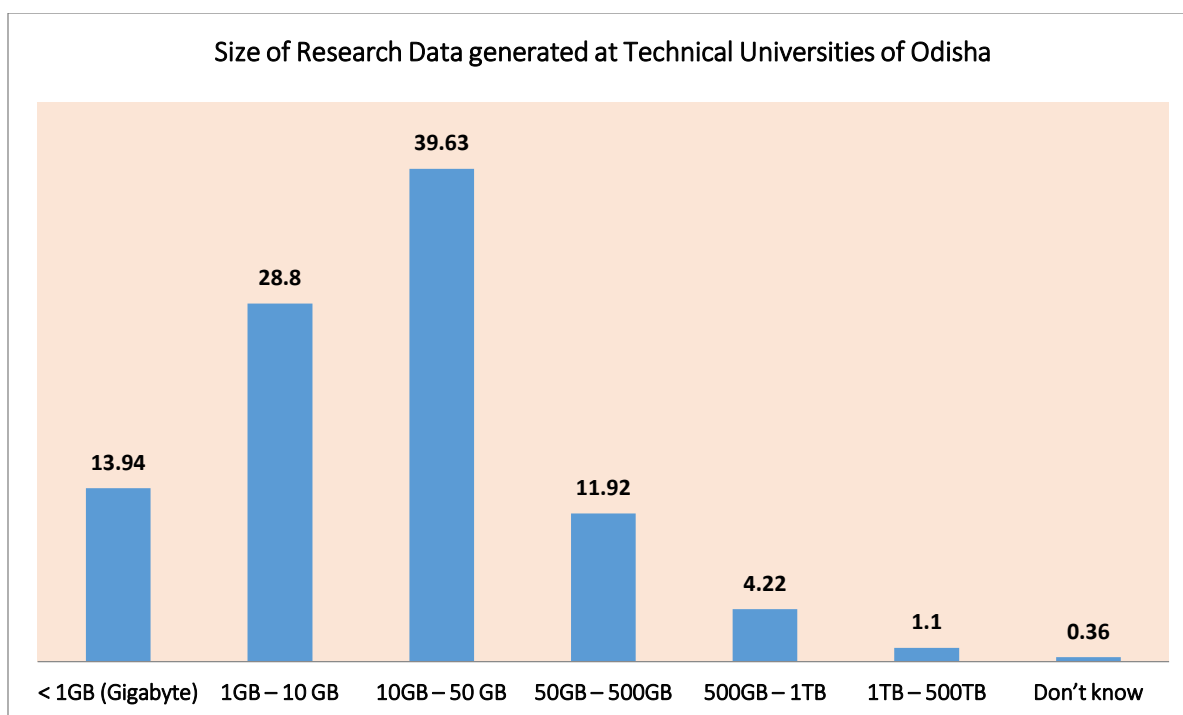
**Figure 3.** Level of awareness at technical universities about RDM policy

### ***Volume of Research data***

The storage volume used for the research project in technical universities of Odisha is presented in table-5 for the question “How much data storage do you estimate to use in a research project?” The number of responses indicates that majority of the research scholars used over 10GB upto 50GB ( $n=216$ , 39.63%) storage volume per project. The next highest storage volume is between 1GB-10GB ( $n=157$ , 28.8%) followed by <1GB (13.94%) of storage volume by the research scholars of technical universities in Odisha. Fig-4 illustrates the diagrammatic representation of the relationship between storage volume required for a research project.

**Table 6.** Size of Research data generated

	Count	%
< 1GB (Gigabyte)	76	13.94
1GB – 10 GB	157	28.8
10GB – 50 GB	216	39.63
50GB – 500GB	65	11.92
500GB – 1TB	23	4.22
1TB – 500TB	6	1.1
Don't know	2	0.36
TOTAL		545



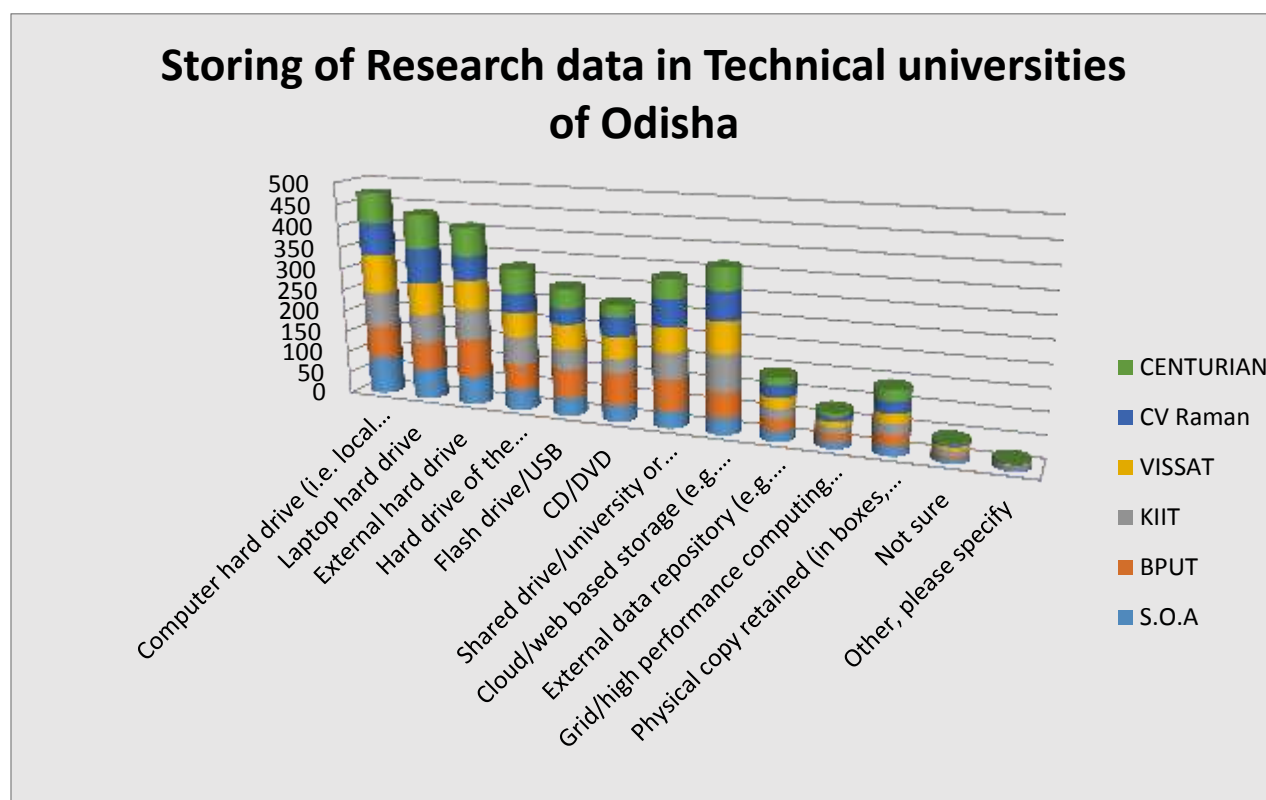
**Figure 4.** Size of Research Data Generated

### **Research Data storage method**

Survey participants were asked to indicate where they store research data from current projects. Table-6 shows the response rate of the research scholars of technical universities. The top five storage options chosen were; Computer hard drive (n=95,88%) followed by external hard drive (n=101,88%), Cloud/web based storage ((n=98,84%) , Laptop hard drive (n=76,82%) and CD/DVD (n=101,75%) .

**Table7.** Method of storing of research data at technical universities of Odisha

	S.O.A	BPUT	KIIT	VISSAT	CV Raman	CENTURIAN
Computer hard drive	85	76	82	88	75	69
Laptop hard drive	71	63	68	72	82	77
External hard drive	65	88	71	67	56	64
Hard drive of the instrument/sensor	49	58	65	54	44	57
Flash drive/USB	42	66	45	58	36	45
CD/DVD	37	75	33	49	45	26
Shared drive i.e. Dept. Server	40	70	61	55	63	43
Cloud/web based storage	38	58	84	71	66	49
External data repository	25	27	22	24	26	18
Grid/high performance computing center	16	18	14	12	11	9
Physical copy retained	22	25	23	21	27	24
Not sure	12	6	11	8	5	3
Other, Please specify	8	4	2	1	3	1



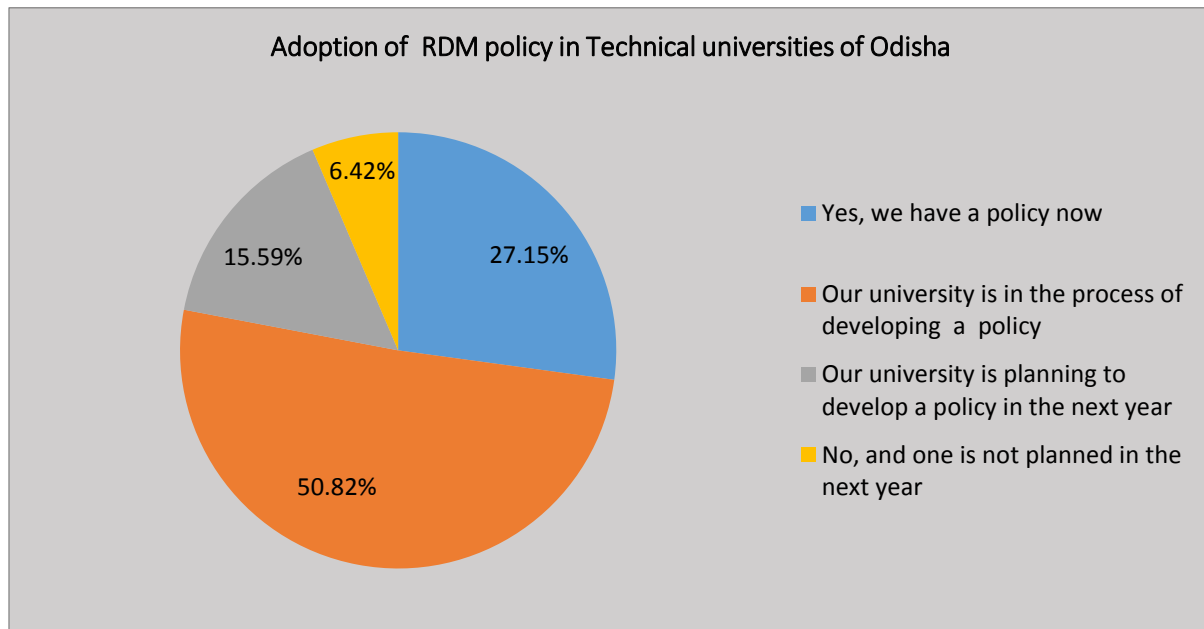
**Figure 5.** Method of Storage of Data in Technical universities of Odisha

### **Adoption of RDM Policy**

Table-8 shows that whether the technical universities of Odisha have adopted RDM Policy or not by the respondent? The result of the respondents in the sample shows that majority universities have in the process of developing RDM policy i.e. 50.82% and only 27.15% have RDM policy. Others showed that either they are planning to develop a RDM policy(15.59%) or they have no intention of developing a policy at the university level(6.42%). Fig-5 shows the diagrammatic representation of adoption of RDM policy in the technical universities of Odisha.

**Table8.** Adoption of RDM Policy in the Technical Universities of Odisha

<b>RDM Policy</b>	<b>Frequency</b>	<b>Percentage</b>
Yes, we have a policy now	148	27.15
Our university is in the process of developing a policy	277	50.82
Our university is planning to develop a policy in the next year	85	15.59
No, and one is not planned in the next year	35	6.42

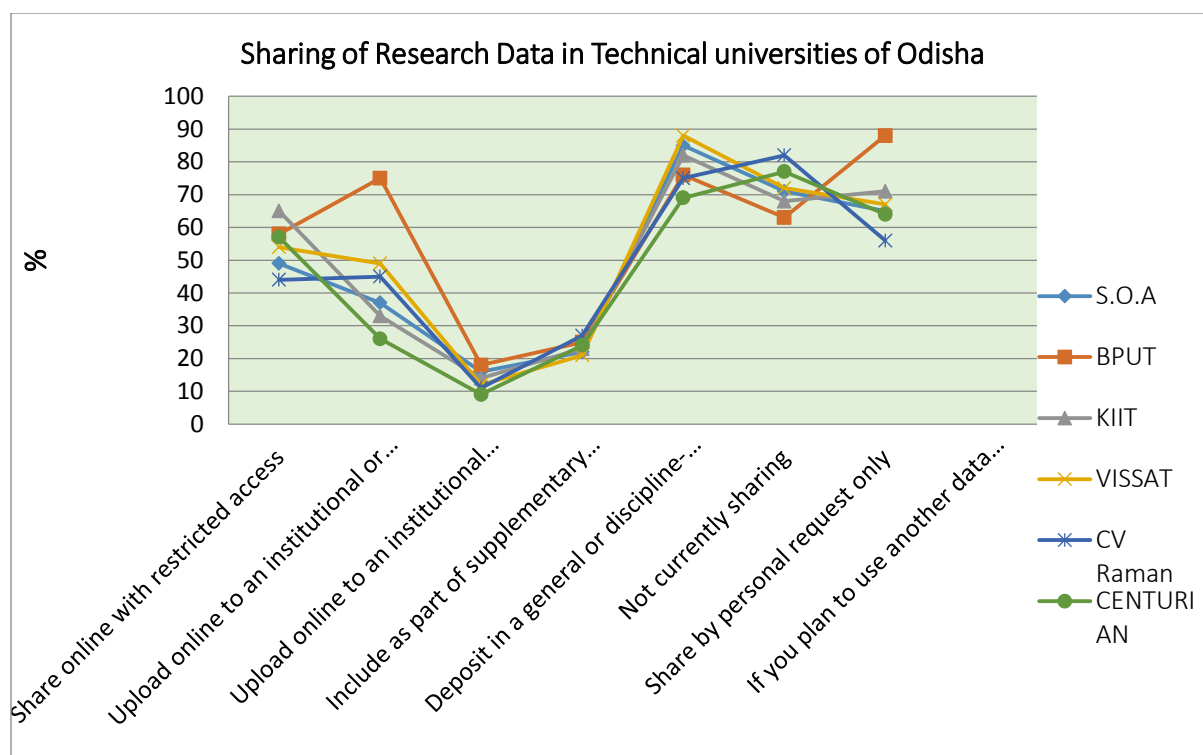


**Figure 6.** Adoption of RDM Policy in the Technical Universities of Odisha

### ***Data Sharing Method***

Figure 8 shows the method of sharing research data at the technical university libraries of odisha. Responses to the question (Q15) “Which methods of sharing your research data do you currently use?” by the research scholars indicates that ‘Share by personal request only’(87%) is highest among other methods of sharing research data followed by ‘Upload online to an institutional or personal website’(85%), ‘Share online with restricted access’(74%) and ‘Not currently sharing’(67%).





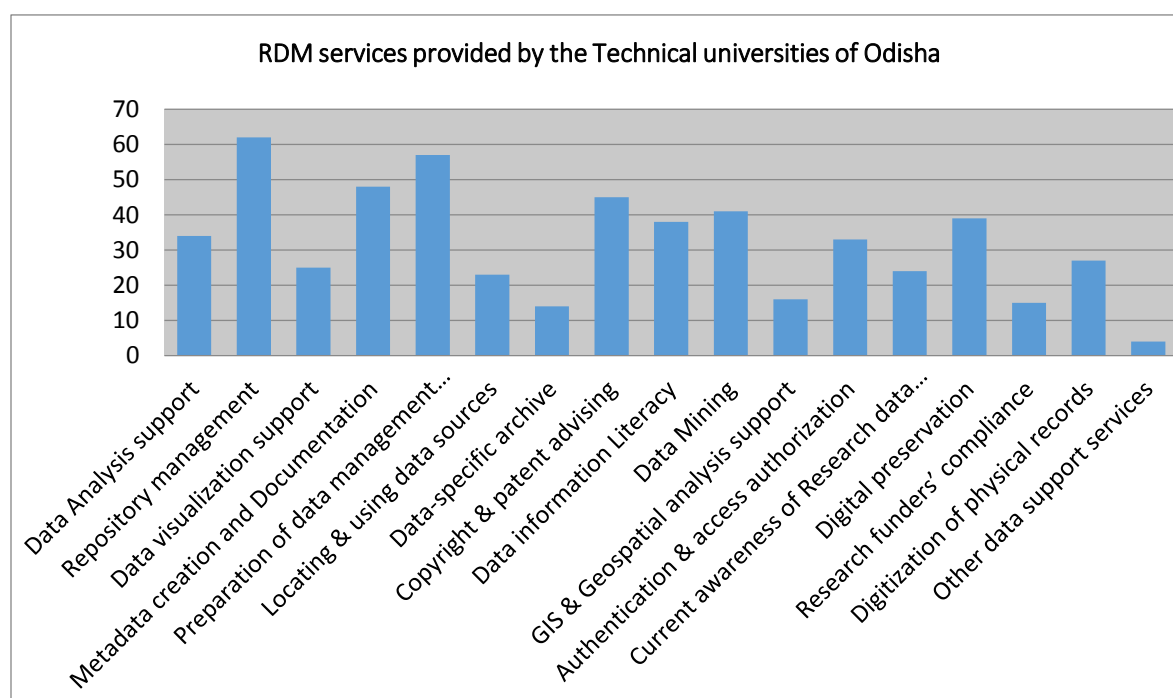
**Figure 7.** Data Sharing method in technical university libraries of Odisha

### ***RDM services provided by Libraries***

Table-8 shows the responses of the question “which RDM services are applicable in your institution?” at the technical colleges in Odisha. The highest rate of response is in Repository management (11.37%) followed by Preparation of data management plans and creation of policies (10.45%), Metadata creation and Documentations(8.8%) and Copyright & patent advising(8.25%). Fig-8 shows the diagrammatic representation of RDM services provided by the technical university libraries of Odisha.

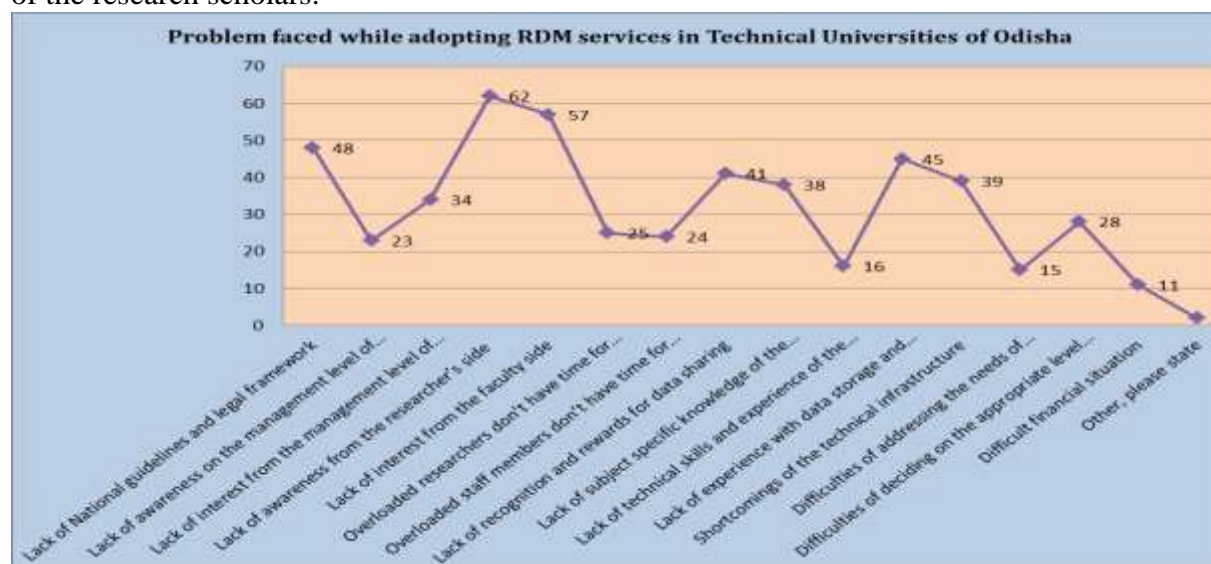
**Table8.** RDM services provided by the Technical University libraries of Odisha

Services	Frequency	Percentage
Data Analysis support	34	6.2
Repository management	62	11.37
Data visualization support	25	4.58
Metadata creation and Documentation	48	8.8
Preparation of data management plans and creation of policies	57	10.45
Locating & using data sources	23	4.22
Data-specific archive	14	2.56
Copyright & patent advising	45	8.25
Data information Literacy	38	6.97
Data Mining	41	7.52
GIS & Geospatial analysis support	16	2.93
Authentication & access authorization	33	6.05
Current awareness of Research data landscape	24	4.4
Digital preservation	39	7.15
Research funders' compliance	15	2.75
Digitization of physical records	27	4.95
Other data support services	4	0.73

**Figure 8.** RDM services at technical university libraries of Odisha

### Challenges in providing RDM services

In response to the question "What challenges does your institution face in offering RDM services" among the research scholars at technical university libraries in Odisha, the following responses were provided as some of the challenges that these libraries face in introducing and implementing RDM services. The most frequent theme is "Lack of awareness from the researchers' side" (62%), followed by "Lack of interest from the faculty side" (57%) and "lack of technical skills and experience of the staff" (n=45%). Fig 6 shows the categories of the responses of the research scholars.



**Figure 6.** Challenges faced by the respondents of Technical universities in Odisha

## Suggestion and Conclusion

The findings of the study revealed that most of the research scholars of the technical universities of Odisha have knowledge about research data projects, RDM services, data sharing and most are aware of the RDM mandates. Some university libraries are offering a variety of research data management services and more plan to do so within the next two years. The findings of the study also revealed that RDM at technical universities is currently underdeveloped but with immense potential growth. As RDM matures in universities, further quantitative and qualitative work will be needed to understand the shape of activities and the roles of different actors in order to inform ongoing development. Moreover, the results showed that few technical college libraries have started establishing institutional data repositories to cater for the storage and retrieval needs of their institutions. Another future development seen by several respondents is to embed the RDM librarian and the services they provide into research data life cycle. It needs to go through such links as policy formulation, infra-structure construction, service content design, service team formation, service user mining and service fund raising. These links together constitute the practice of research data management. Technical universities and their libraries need to have a deep understanding of the operational processes, best practices and influencing factors of each

link and in combination with their own development, establish a continuous and effective research data management service model to promote the further development of the open access movement.

Based on the findings and discussion of the study, the following recommendations are proposed for the development of RDM in the technical universities of Odisha.

- Library professionals should establish RDM programs on campus to support researcher's needs. In order to do this the libraries should form two teams. One team is responsible for sensitization, advocacy and policy development and second team should undertake the technical support of preparing data plans as well as the tasks involved in providing a data service. Technical university libraries need to inform researchers of the type of service they can provide with planning for data storage, protecting, archiving, storing and preserving the data as well as retrieval methods to allow further analysis.
- There are various university players in determining the appropriate governance structure to ensure efficient coordination, adequate security and regulatory compliance and scalable, sustainable and useful data management services to researchers. This is important for the university and also for libraries to firmly establish its support of the university's research mission.
- Identify the issues where key responsibilities had already been lodged and sharing of these would be beneficial for the entire technical universities.

## References

1. Antell, K., Foote, J. B., Turner, J., & Shults, B. 2014. **Dealing with data: Science librarians' participation in data management at Association of Research Libraries institutions.** *College & Research Libraries*, 75(4): 557-574. doi:10.5860/crl.75.4.557.
2. Australian Research Council (ARC). 2017. *ARC open access policy*. Retrieved from <http://www.arc.gov.au/arc-open-access-policy>
3. Beagrie, N., Chruszcz J., and Lavoie, B. 2008. **Keeping research data safe: a cost model and guidance for UK universities.** *Joint Information Systems Committee*. <http://www.jisc.ac.uk/media/documents/publications/keepingresearchdatasafe0408.pdf>.
4. Cox, A.M., & Pinfield, S. 2013. **Research data management and libraries: Current activities and future priorities.** *Journal of Librarianship and Information Science*, Online. Available at: <http://dx.doi.org/10.1177/09613492542>.
5. Chiware, E. R. T. and Mathe, Z. 2015. **Academic Libraries' role in Research Data Management Services: a South African Perspective.** *South African Journal Libraries and Information Science*. 81(2): 1-10.
6. Carlson, J. 2012. **Demystifying the data interview: Developing a foundation for reference librarians to talk with researchers about their data.** *Libraries Research Publications*, Paper 153. Retrieved from [http://docs.lib.purdue.edu/lib\\_research/153](http://docs.lib.purdue.edu/lib_research/153)

7. Choudhury, G. S. 2008. **Case study in data curation at Johns Hopkins University**. *Library Trends*, 57(2): 211-220. Retrieved from <http://hdl.handle.net/2142/10669> .
8. Davidson, J., Jones, S., Molloy, L. and Kejser, U.B. 2014. **Emerging good practice in managing research data and research information in UK Universities**. *Procedia Computer Science*, 33: 215-222.
9. Fearon, D., Gunia, B., Pralle, B.E., Lake, S., & Sallans, A. L., 2013. *Research data management services*. SPEC Kit 334. Washington, DC: Association of Research Libraries. doi:10.29242/spec.334.
10. Gold, A. 2007. **Cyberinfrastructure, data, and libraries, part 2: Libraries and the data challenge: Roles and actions for libraries**. *D-Lib Magazine*, 13(9/10). <http://www.dlib.org/dlib/september07/gold/09gold-pt2.html>
11. Henty, M. 2008. **Dreaming of data: The library's role in supporting e-research and data management**. *Australian Library and Information Association Biennial Conference*, Alice Springs. Available at: [http://apsr.anu.edu.au/presentations/henty\\_alia\\_08.pdf](http://apsr.anu.edu.au/presentations/henty_alia_08.pdf)
12. Henderson, M., Raboin, R., Shorish, Y., & Van Tuyl, S. 2014. **Research data management on a shoestring budget**. *Bulletin of the Association for Information Science & Technology*, 40(6): 14–17.
13. Kahn, M., Higgs, R., Davidson, J., and Jones, S. 2014. **Research data management in South Africa: how we shape up**. *Australian Academic & Research Libraries*, 45(4): 296-308. DOI:10.1080/00048623.2014.951910.
14. Lewis, MJ. 2010. **Libraries and the management of research data**. In: McKnight S, editor. *Envisioning future academic library services : Initiatives, ideas and challenges* ,London: Facet Publishing pp. 145–168.
15. Tammara, A.M. and Casarosa, V. 2014. **Research data management in the curriculum: an interdisciplinary approach**. *Procedia Computer Science*, 38: 138-142.
16. Tenopir, C., Talja, S., Horstmann, W., Late, E., Hughes, D., Pollock, D. & Allard, S. 2017. **Research data services in European academic research libraries**. *Liber Quarterly*, 27(1): 23-44. DOI: 10.18352/lq.10180.
17. Wilson, J. A. J., Fraser, M. A., Martinez-Urbe, L., Patrick, M., Akram, A., & Mansoori, T. 2010. **Developing Infrastructure for Research Data Management at the University of Oxford**. *Ariadne*, (65). Retrieved from <http://www.ariadne.ac.uk/issue65/wilson-et-al/>
18. Whyte, A., Tedds, J. 2011. *'Making the Case for ResearchDataManagement'*. *DCC Briefing Papers*. Edinburgh: Digital Curation Centre. Available online: <http://www.dcc.ac.uk/resources/briefing-papers> .

# **Study on Design of Ontology Approach for Improving Record Keeping Systems in a Document Management System**

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## **Abstract**

Ontologies are emerging framework in managing and organizing the semantic association between entities and attributes within a system. The semantics relationship acts as a knowledge management tool and provides information and data description manages the knowledge delivery by minimizing and removing ambiguity. In the article we have studied processes followed in record keeping system of a document management system. The standard operations and procedures are modified over the time however the growth in performance and efficiency was not significant because of traditional methods of implementation and exponential increase in data & its operations. The workflow processes of record keeping system are organized and an ontology construction model is proposed. The importance and implementation perspectives were discussed and new architecture is defined considering all operational and functional parameters.

## **Keywords**

Document management system, Record keeping system, Ontology Design, Conceptual Modeling, Database

## **Introduction**

Document management systems or DMS are very important segment in any industry where ever we are collecting data. Before the evolution of data management on computers in digital format, files and manual ways of record keeping systems were in place. The management of all the documents, and the process involved several activities, right from cleaning the information or files for any errors, maintaining a log, optimized storage location, maintaining the tractability etc. Over the time with more requirement and needs, many features in the DMS process, like multiple copies, storage at different locations, maintaining confidentiality etc. are added in process. The record keeping system or RKS is major aspect of DMS. The article discusses about

the processes in RMS and improvements over the time. Ontology defines a set of representational primitives that is used to model a domain of knowledge; these representational primitives are typically sets or classes, attributes, and relationships that exist within class members. The definition includes meaning and logical constraints w.r.t. system or application. Article is divided into seven sections, section 2 discusses about literature of document management systems, record keeping system and ontology. Section 3 presents ontology role in a record keeping system. Section 4 shows the approach of creating the ontology for improving a recording keeping system and section 5 proposes the new architecture with analysis. Section 6 gives the conclusion of the study and section 7 has the references.

## Literature

Ontology is a philosophical term which defines the terms and relations of a topic, concepts' vocabulary along with the rules so as to combine these terms and relationships to scale and extend the vocabulary [14]. An ontology can be created to assist any kind of communication system, knowledge management and extraction system and multi-disciplinary domains fitting to areas where we have data collected, recorded and analysis driven decisions are taken, thus covers almost all the domain. Ontology emphasizes on defining of system entities with all attributes. Some of these are quite closer towards direct features and others may be derived, however the structure of storage provides tools to query the system. An ontology defines the basic terms and relations comprising the vocabulary of a topic area as well as the rules for combining terms and relations to define extensions to the vocabulary, For example computer, monitor, mouse etc. are the terms and relationship between these terms exist as computer contains all these terms and all these devices are connected with wires to CPU etc and all are peripherals. To combine terms and relation, rules are defined, to have extended vocabulary. These extended vocabulary (or system details) is based on the rules for example, the ontology has two rules, all hardware devices are connected to computer and printer is a hardware device, hence it can be inferred that printer is connected to computer. Hence, we can say that an ontology is an explicit specification of a conceptualization [7] and these explicit definitions is done using the concepts, abstract terms i.e. attributes of the system considered, like in above example, attributes of computer, CPU has attributes like CPU speed, computer brand, manufacturing year etc., dell, HP make etc. Significance of Ontologies exist in different areas and domains of science, research, engineering and business etc. in modeling and simulation of knowledge transfer, understanding of the domain, and formal representation of concepts about their relationships. They are basis of an information system e.g. knowledge engineering, management, extraction, representation and modeling, language engineering, database design, information modelling, information integration and retrieval [2]. Use of ontologies improves computing systems and domain experts. Communication between humans, interoperability of computer systems, is one of the example, it improves the specification, reliability and reusability of computer systems [6]. The knowledge of domain is most important and is deeply involved to identify the key conceptualizations [13], the concepts are divided as a top level ontology that describes general concepts and domain ontology that has specific knowledge structure of a the domain. Domain ontology is considered as a specialized scenario of the system.

In this research, a Domain Ontology is constructed for a record keeping system in document management architecture. In the purpose of managing the knowledge complexity and semantic ambiguity which becomes serious nowadays. Ontology study has been elaborated in recent years and is a promising method of data description and knowledge representing knowledge, very useful tool to assist in problem identification, decisions making, and knowledge management. This paper illustrates essential concepts in context to a record management system in a document management system suggests a process that can be followed for development and handling new kind of attributes coming in to have an easy adaptation plan in the cases of new information and knowledge. Study on differences and common behaviors between ontology and one of a model [8] concludes that building block of a conceptual schema is ontology. Ontology strongly holds the base of that system. There is a difference between ontology and a conceptual schema in terms of their purposes [15][16]. Conceptual schema describes contents and structure of a database and ontology describes a domain. Ontology is an external segment of any information system unlike conceptual schema which is internal is aligned to one specific activity or work area however ontology matters to entire universal domain [12].

Ontologies are closer to cognitive model of a system as they are more expressive and semantically better than a database system. Schemas define structure for database storage. An ontology represents concepts in the real world. When two or more system needs to interoperate in a business, it is possible with a similar architecture and structure, and it may not be possible in businesses. The need of interoperability and migration to a common system is a costly affair and quality cannot be guaranteed. Ontology enables the interoperability i.e. it supports homogeneous and heterogeneous systems. Mapping of a database system into ontology, can be useful for interoperability, reporting and querying, improved knowledge bases and efficient overall system flow. While designing it emphasizes all precise details of business and many derived information is achieved through ontology. The mapping implies concepts of one ontology is associated with concepts of another ontology. Ontology mapping involves:

*Merging* : where two or more ontologies of homogeneous or heterogeneous systems are merged.

*Matching*: The concepts of ontologies are translated in a single ontology to remove inconsistency.

*Alignment*: Creates linkages between original ontologies with new ontology. Sources become consistent with each other but are kept separate and done with complementary domains.

*Refinement*: It is mapping from one ontology let say O1 to another ontology let say O2 so that every concept of ontology O1 has equivalent in ontology O2, however primitive concepts from ontology O1 may correspond to non-primitive (defined) concepts of ontology O2.

*Unification*: Involves one on one mapping of both ontology in a single ontology. All the ontologies are refined to the possible detailed level and unified.

*Integration*: In this process a single ontology is generated in one subject from two or more existing and different ontologies in different subjects.

Once ontology is ready, there are several mechanisms for operating for searching and repository creations. The modeling and other techniques have many open sources tools and applications. Likewise in analysis and search operations, we have three methods [11]. The various techniques involved in making the model efficient are:



- *Keyword Searching*: As the name of the technique explains, it searches based on keyword. It is dependent on knowledge of the keyword to be selected and used [8]. With the large number of keywords, the results can be narrowed down thereby user can opt for the document of report from narrowed down information quickly and review it in lesser time. The method works well when the document quantity is very small and user has precise knowledge of domain, concepts and keywords. The pruning techniques as used in tress based structure, use of synonyms and other is useful in improving the performance.
- *Data repository browsing*: The technique involves browsing the data and internal structure organizing it as a tree form and using the concept of binary tree. In case of loss of any information structure random forest and cart mechanisms can be used. The issue with the method occurs when categorization of document is not easy as a branch. The benefit is the approach and is preferred.
- *Filtering and browsing*: The keywords are filtered from the results of narrowing down the documents. Complex expressions are generated and contextual relations are established within a tree structure. The method uses the combination of both the above discussed methods. Semantic relationships are maintained and indexes are created. These indexes are better than traditional index mechanisms that are based on relational structure, unlike here, tree based semantic contextual structure.

### ***Document Management System or DMS***

A document management system or DMS manages and organizes digital documents. It is designed for effective management of physical documents by converting into a digital formulation and organize, store and perform relevant operations on the system. DMS is the knowledge hub of business and form a strong base of management information systems. They manage and sustain the internal knowledge of the company with a record keeping system, document retrieval system, access control, in minimum time and minimal error rates and significantly improve business performance [1]. The websites intranet or extranet, are interlinked with internal DMS of the company. The information retrieval and updates is backed by DMS of the company. The content management systems or CMS behind the dynamic web portals are linked with DMS. When a company acquires or merges with another company, DMS of the two companies should be adaptive enough to be integrated for acquisition of knowledge between two entities. In this article, we have studied record keeping systems of a document management system and proposed an ontological structure. The article proposes an architecture for RKS motivated by companies of multiple domains e.g. construction, healthcare, IT, Government etc. It also shows that ontology of a company can be cross collaborated and integrated for information extraction.

### ***Record Keeping System or RKS***

Record keeping systems or RKS, also called Record Management systems (or RMS), organizes the data records primarily for storage and other related operations on data. RKS has operational procedures for managing and maintaining documents and records. It involves creating and managing the records and the efficient way to have easy access maintaining the data security and data loss standards. RMS acts as the base of any Document Management System in an organization. Based on the RMS, all the documents are stored and organized in a way to have

efficient and effective access and operation. In case of any error at any stage, it may be reflected in other dependent functions or derived processes. The key activities are

- Document processing and management
- Reporting & information extraction

A document is a set of data instruction for any transaction that may be on physical files or digital documents. In the scenario, we are referring to the era, when digital formats of documents were not available and physical formats were used. In physical formulations, records have different ways:

- Binding of Document,
- Traditional file Management
- Photocopies and printouts

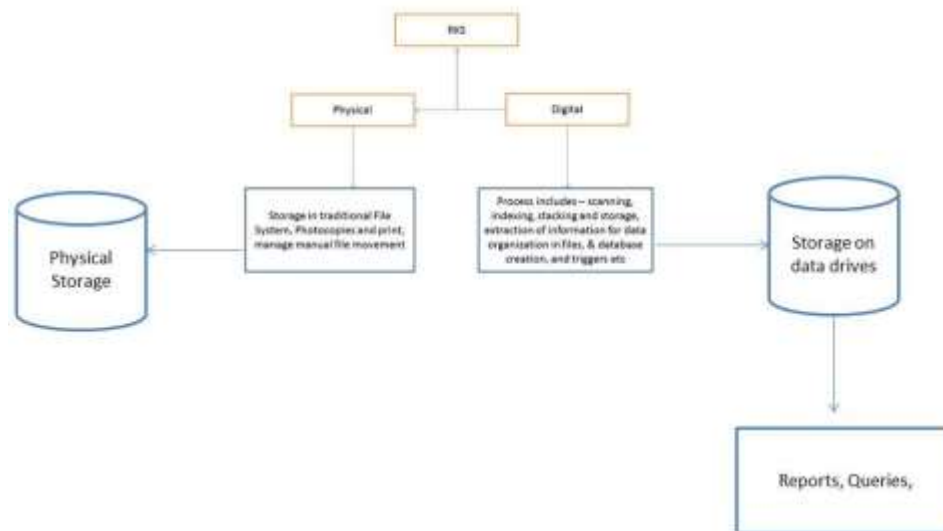
Standard process of documentation, filing etc as stated in above pointers is followed. The organization of documents follows approach of manual way assigning id, reference numbers, tags and multiple files are managed for same reference based on multiple department movement or to store at multiple location. The real time updates, when multiple users are holding up are impossible and it has to follow a sequential approach of update. These methods are in place since the usage of offline file systems and all the departments follow almost similar set of operational steps i.e.

- Maintenance of information or Data in File
  - Original and photocopy
  - Single file or bulk file
  - Assigning of control and reference numbers
- Inventory Process
  - Meta data entry
  - Bar coding and other referencing methods as is used in Library systems
  - QC checks - standard procedures vary with organizations requirements
- Stacking : Filing and organization of files
- Storage
- Report Management

The challenges of managing the records using manual process are its efficiency and time. The system is person dependent and there is probability of manual errors. The tedious process of doing tasks at all steps makes it tough to ensure quality. It takes time to establishing a system and it becomes a manual recurring system, which requires more manpower as the system size and documents and processing increases. The challenges were resolved by Digital record management. Digital records, made the processes very fast after removing manual interventions to the extent that operations are less man dependent and ensure better quality and efficiency in lesser time. The organization of data by capturing at stages and storing and executing the procedures as defined in any RKS, solved several challenges means pre-existing softcopy of a document designed or created in digital version manually or by a system or both. Other way is to create a softcopy by machines from a hardcopy version to a softcopy by scanning the documents. The digital version of documents follows below steps:

- Scanning
  - Quality of Scanning and if required re-scanning
  - Notification and logs for the process
  - Review for any manual or machine errors
  - Extraction of Meta Data
  - Scanning in a folder structure
- Indexing : Creating Indexes in the document for easy search, request and other file operations
  - Tagging or referencing in the scanned documents
  - Indexing of the documents based on references created
  - Meta data enrichment
  - Notify the users based on respective user rights
  - Uploading based on Index and sequence
  - Update the status of documents, issued, available etc
- Reports for multiple purposes like access, reviews and feedbacks, updates, information extraction, meta data management etc.

A standard structure of operation of recording keeping system is illustrated in figure 1. It shows a flow structure how the physical records and digital records are maintained in storage devices.



**Figure 1.** Structure of RKS

### ***Review, Drawbacks, Issues***

With the inclusion of ICT, DMS system migrated to new term called electronic document management system or EDMS. The key purpose was to sort the issues generated by fragmentation of data storage. The improvements involved data replication and storage at

multiple location or storage at a central location and access to separate centers based on roles defined to the users. The limitation existed for interoperability and compatibility between different systems thereby impacting the information flow. Bringing all the system on a same platform is not an easy task. However, one way identified is to have standardization of the processes. These systems are far away for an effective DMS. The RKS segment of DMS is thus affected and establishing the interoperability in improvise the query time etc. were to be solved. The classification and mere organization is one of the basic solution and based on that ISO 12006 series [3] for classification principals was developed. Uniclass [4], Lexicon [5], projects are examples of adaptations of ISO 12006.

## Ontology and Record Keeping System

The ontology is structured based on the inputs received and extracting the information from it, e.g. metadata, keywords, schema, attributes & entities etc. The metadata recorded after upload of the documents are representation of document structure and is structures in tree based structured. The indexes and other information of semantics are extracted from the data forms and is organized in same structure of the tree and keywords are maintained. Attributes are inherited from the ontology using the indexes and searches when required for queries or report generation. The dynamic structuring technique of any document forms the key strength of the system and thus ontology has advantage of ease in scalability and maintainability of the system. The metadata can be used to integrate with other systems via the ontology layer or ontology developed for the systems. Ontology development process includes

- Detail study and knowledge of domain
- Identification of relevant terms or identify the concepts to be included
- Identification of attributes related to the term/concepts
- Identification of relationships between the concepts
- Designing constraints or rules on the concepts and relationships
- Documentation of ontology
- Test the ontology
- Maintenance of the ontology

Consider the creation of Ontology for a construction business [4]. The entire project related information or activities have to be identified as categories, sub activities along that project. The activities are actors managing specialized sub domain within construction project and sub activities are handling specific important operation within a activity. Activities could be cost, contract documents, advance, design, quality, safety etc. Sub activities will be planning, documentation, records, etc. The activities and sub activities classifies the flow of operations in lifecycle of project with relationships and conceptual models. The metadata from derived from the concept models with different stages, activities and sub activities providing keywords,

querying and searching capabilities [10]. The metadata will be context related and content related. The context related metadata will be focused on semantics of document and content related, identifies the keywords, properties from the document. The context related shows all the relationship between the stages. In reference to construction business a document workflow with the document and metadata has:

- For content metadata: {identifier, status, version, creator, format, submit date, tender amount)
- For context metadata: {relationship between {activities& sub activities}, {stages}, {phases and stages} }

The concept model workflow combines both context and content metadata. And thus a detailed model can be presided.

## Approach

All the data is to be organized in a RDF or Resource description framework. RDF deals with the data relationships and metadata of a data. An RDF Schema or RDFS is a language for writing ontologies. It has laxonomic relations, data type and object relations. The modeling of RDBMS data to ontology [9] involves:

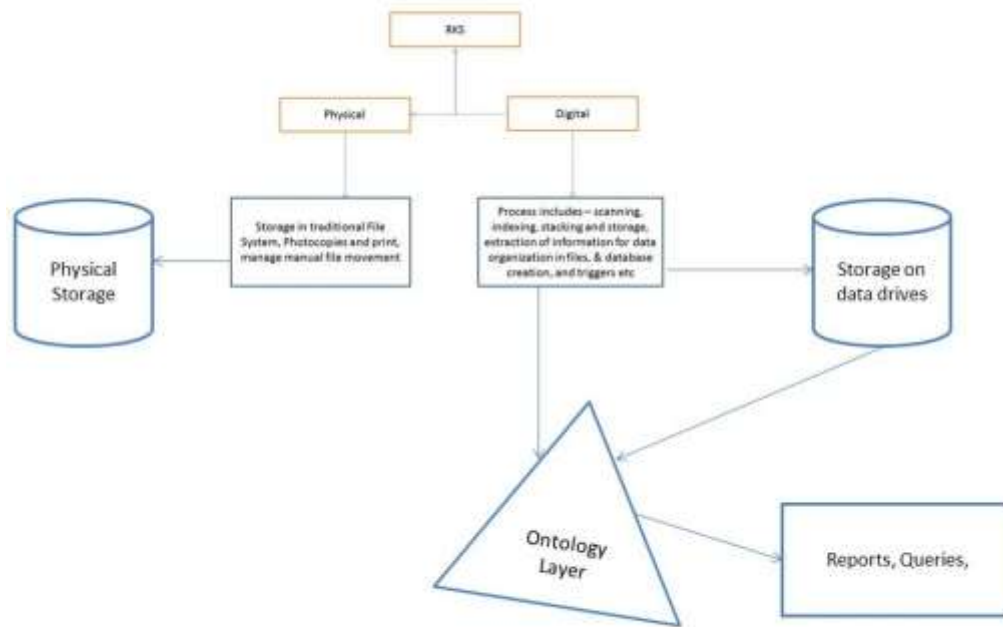
- Data Collection – collection from all the stages, data bases
- Data Mapping: Map all the data from internal storage from RDBMS to RDF using OWL or Sparql and create RDF schema, there are RDF software which does and stores it.
- Errors and Reconciliation: Fix the errors, issues etc. Match the keywords, remove non standard keywords and irrelevant characters.
- Validation of stored information using the standard procedures defined in the data access and concept models
- Data access, retrieval, report generation. Sparql can be used for querying and accessing the ontology.

The five steps define the workflow of the setting up any Ontology. Many open source tools and software can be used to model.

## Proposed system & analysis

With the evolution of Ontologies, and their performance in data organization enabling smart data management, the record keeping systems needs improvement. The purpose of the improvement is not only to manage the challenges but also to makes it better in terms of its design and future prospects. The design architecture provides structure to organize the system for any data related operations and reports and integrate with a new information management system. The data is collected in the RKS, in digital by uploading documents and records, and stored in the internal storage of the DMS. It may organize in an object oriented database due to improvement in storage operations, means storage can be independent of the DMS but must be able to support. All the reports and queries are executed on the storage system. We are referring in the article a main system that is the existing system and other system is the one that has to be integrated. Any

integration for information is in defined and possible accordance of storage compatibility. It may require tedious work of reorganizing the storage structure and data format to other compatible systems' structure for integration. One way to ease the process is to define and follow specifications and their procedures for management of data and restrict operations & related activities from other system on storage of main system, though restriction will be useful for basis data extraction but may impact as limited operations for the main system. In the proposed architecture, Ontology will be closely associated with the digital records at all the stages, right from creation, extraction, indexing and storage. The knowledge of the ontologies will keep on improving over the time with the interaction with data addition.



**Figure 2.** Proposed design of RKS

The Ontology layer is added to provide the context and semantics classification of the data. It also formulates the queries and follows two steps for query formulation i.e. classification of documents, files of the system and filtration of the data into categories. The more records are included in the system, the ontology will have better key words and knowledge to process. With the inclusion of an ontology system, the better data decisions can be taken, reporting process will be organized and dynamic reports based on evolution of new data, schema structure in the collected data in a document, it becomes more resilient for delivering the results. The domain and its terms are deeply involved in development of the ontology to classify and organize the system. The concepts of the domain i.e. all information of the particular domain for which ontology to be developed e.g. healthcare, construction etc, can be included in the ontology and accordingly the classification system(s) will be defined.

Relational database management system are used in storing and managing the data in RKS of a DMS. All data stored as entities and its attributes with the other capability of normalization in real time for document access, report creation etc. and in built indexing techniques. The storage mechanism is fine until the data quantity becomes huge. Further with more keyword searching and derived searching methods in database, RDBMS becomes inefficient. Once the searches go beyond the key words, reports to extract synonyms, hyponyms etc, the RDBMS is not capable and Ontological approach support is needed. Efficiently searching and retrieval of the documents, based on different techniques makes RKS effective, for the purpose, ontology fills the gaps. Data will be refined to precise keywords and schema structure and multiple refinements ensure the better strength of system. The RKS is liable to have data which keeps on increasing and with more increase and more attributes, the alignment of ontology will be driven.

## Conclusion

In the article a new model is proposed for improvement of a record keeping system in a document management system. The system proposed is based on the framework of a standard record keeping system. The purpose of integration and searching is emphasize and the drawback in the existing system, which created a need, is explained with Ontologies. The articles, explains about Ontologies and shows the aspects of record keeping system and presents how the knowledge can be utilized in planning and effective designing for the purpose of managing knowledge an operations of data availability in a homogeneous systems and heterogeneous systems. The knowledge of proposed system is designed in such a way that the integration of existing RKS with document resources is done through their own access mechanisms. We presented in this paper a new architecture that allows an easy integration of a semantic layer into a Document Management System. The semantics is added to the system through ontologies. The future work of the article will include identifying a domain and follow the modeling and development of the ontology for that domain. There are several tools to model SQL operation into RDF schema and other software languages like OWL that has large libraries of ontologies can be used. As conclusion one can say that the proposed architecture and implementation seems to overcome several of the major drawbacks of classical RKSs and can easily be integrated into en existing infrastructure.

## References

1. Sutton, M.: Document Management for the Enterprise: Principles, Techniques and Applications. John Wiley & Sons, New York, NY, USA (1996)
2. Guarino, N., 1998. Formal Ontology in Information Systems. Proceedings of FOIS'98, Trento, Italy, June 6-8, pp. 497-9.
3. International Organization for Standardization ISO 12006-22. International Organization for Standardisation. Building construction - Organization of information about construction works. Part 2: Framework for classification of information, 2001.

4. Construction Industry Project Information Committee (CIPIC). Available online at: <http://www.productioninformation.org/> Accessed on Jan. 25th 2007
5. Woestenek K. From lexicon to XTD. In Z. Turk & R. Scherer (eds), European Conference on Product and Process Modelling in the Building and Related Industries; Proc. eWork and eBusiness in Architecture, Engineering and Construction, Portoroz, Slovenia, 9-11 September, 2002. The Netherlands: Balkema
6. Uschold, M., and Jasper, R. 1999. "A Framework for Understanding and Classifying Ontology Applications," IJCAI-99 Workshop on Ontologies and Problem-Solving Methods: Lessons Learned and Future Trends, Amsterdam, The Netherlands
7. Gruber, T, "Toward Principles for the Design of Ontologies Used for Knowledge Sharing", Stanford Knowledge Systems Laboratory, 1993
8. Fikes R. & Farquhar A. (1999). Distributed repositories of highly expressive reusable ontologies, *IEEE Intelligent Systems*, 14, 73-79.
9. DISIT Lab (DINFO UNIFI), "<http://www.disit.dinfo.unifi.it>", ICECCS 2014, 5- 7 August 2014
10. Fuertes, A.; Forcada, N.; Casals, M.; Gangolells, M.; Roca, X; "Development of an Ontology for the Document Management Systems for Construction", Construction Engineering Department. Technical University of Catalonia, Spain.
11. Simon, E; Cior, J; Stoffel, K, "An Ontological Document Management System", Information Management Institute, University of Neuchâtel, Switzerland, <http://www.unine.ch/imi>
12. Bishr Y. A. & Kuhn W. (2000). Ontology-based modelling of geospatial information. Paper presented at the 3rd AGILE Conference on Geographic Information Science, Helsinki, Finland
13. Missikoff, M., Navigli, R., and Velardi, P., 2002. The usable Ontology: An Environment for Building and Assessing a Domain Ontology. First International Semantic Web Conference Sardinia, Italy, June 9-12, pp.39-53.
14. Neches, R., Fikes, R. E., Finin, T., Gruber, T. R., Patil, R., Senator, T., & Swartout, W. R. (1991). Enabling technology for knowledge sharing. *AI Magazine*, **12**(3), 16-36.
15. Fonseca F., Davis C. & Câmara G. (2003). Bridging ontologies and conceptual schemas in geographic applications development. *Geoinformatica*, 7(4), 355-378.
16. Cui Z., Jones D. & O'Brien P. (2002). Semantic B2B integration. *Issues in Ontology based Applications*. ACM SIGMOD Record Web Edition, 31(1), 43-48.



# **Biometric Authentication System in Academic Libraries: Advantages, Disadvantages and Prospects**

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## **Abstract**

The field of biometric technologies with a rapid development in the recent times has its impacts in various fields such as law enforcement, health, social service etc. The academic libraries are observed with the dynamic enhancements parallel to the evolving digital environment. This paper presents the fundamental principles and types of biometric authentication system. It can be used in efficient library operations and also in RFID library management system to ensure security and facilitate innovative services to users. This paper also highlights the benefits and key issues in order to achieve the successful implementation of biometric authentication system in academic libraries.

## **Keywords**

Biometric Technology, User Authentication, RFID, Academic Library.

## **Introduction**

Biometrics can recognize human beings by measuring various features of a person and comparing them. It deals with recognition of individuals on the basis of their physical or behavioral characteristics. The area of biometrics is all about measuring certain human characteristics that are saved to be compared later for proper identification. Biometric technologies are very important for identification and verification of persons and are used in various applications. Biometric technologies exploit unique biometric modalities or biometric traits for identification purpose. The considerable recognition traits include finger print, retina and iris patterns, facial features, hand geometry etc.

In the era of technological advancement, biometric authentication system can be used for library operations particularly in library entry/exit point, book circulation section and RFID library management system instead of password and RFID smart ID. The main aim of this paper is to implement the biometric authentication system in library management system and to provide security and facilitate innovative services to library users.

## Types of Biometric Authentication

There are basically two types of biometric traits, one is behavioral and the other one is physical. Behavioral biometric traits are selected on the basis of characteristics of individuals such as behavior of person, how a person walks, how a person moves or puts signature, etc. Physical features or traits depend upon physical characteristics of a person. Examples of these characteristics include face, iris, hand geometry, fingerprint, etc.

### Physical Biometrics

#### ***Fingerprint***

Fingerprint match is a globally used verification to recognize a particular identity. This work by matching the fingerprints, thumb or forefinger impression of an individual. It is recorded in the database and the matching takes place based on unique features of fingerprint.

#### ***Facial Recognition***

The facial images captured using either camera or any image capturing device is analyzed based on the features and characteristics of the images. The features may be of different types such as eye, nose, lips, etc.

#### ***Hand Geometry***

Hand scanning is another method of biometric recognition. Though uniqueness of hand is not equal to that of fingerprints, it is still used for verification. Several features of hand such as size, width, length, etc., are recorded in the database for comparison.

#### ***Iris Recognition***

Human iris is even more unique than the fingerprints. The image acquisition and capturing process is a little more complex than fingerprint scanning. Specific type of iris scanners are to be used in acquiring iris images to store in the database.

#### ***Retina Biometrics***

Retinal biometrics involves the scanning of retina only and not the iris. This is used by analyzing the layer of blood vessels behind the eye.

#### ***Vascular Pattern***

Vascular pattern biometrics involves measuring the characteristics related to the veins in a person's hand or face. Thickness and location of veins in hands and face are supposed to be unique in each person.

#### ***Deoxyribonucleic Acid (DNA)***

DNA is the genetic material that contains biological information about living organisms. A gene is a DNA sequence which carries information to express protein.

## Behavioral Biometrics

### *Voice Recognition*

Speaker recognition is used by recognizing the speech or voice of a person.

### *Signature Verification*

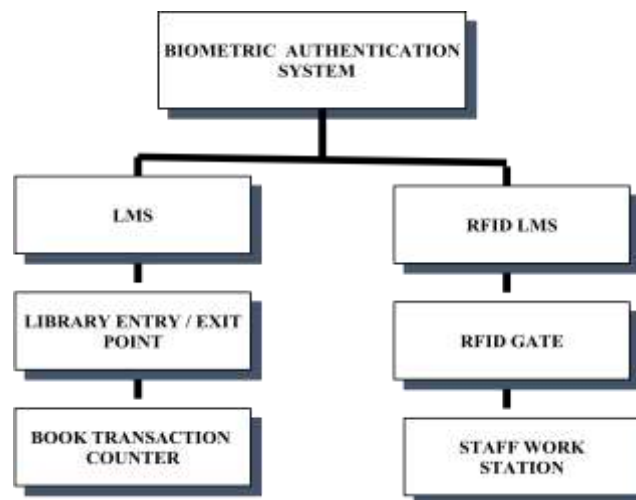
Signature of an individual has unique dynamics. For example, speed, style, orientation or angle, the amount of pressure, etc., are different for different individuals.

### *Keystroke Recognition*

People using keyboards of computers, or any other typing equipment, type of characters or numerals in their own ways, it is used as one of the biometric parameters for identification of the person.

## Biometric Authentication System in Academic Libraries

Biometric Authentication system can be used in the following library operations.



**Figure 1.** Biometric technology used for library operations

### **Controlled access into library premises**

Biometric authentication entry/exit system will allow authorized library member into the library premises. Library users can enter into library premises by scanning their fingerprint / iris. It helps to allow only authorized persons and prevent unauthorized entry into the library premises. During this authentication visitor's data is also registered in database. Library visitor's data may be used for library visitor's statistics instead of manual gate register and e-gate register. This system increases security

levels more than an ID card or ID badge system as the fingerprint / iris can't be lost or stolen. Library users need not worry about misplacing their ID cards. Biometric authentication can be implemented for the whole library or at least for the computer rooms and server/ network stations to avoid the access of the unauthorized person. In the biometric authentication, the library premises access devices can be networked together so that the system can be controlled and maintained from a central location by system administrator. The biometric authentication entry/exit reader may be mounted on a wall near the library main door.



**Figure 2.** Library entry / exit point using by biometric authentication

### **Circulation Section**

The library main service point is the circulation section and usually books will be issued on presenting ID cards of the library members. In the biometric system users need not to bring their ID card, instead they will scan the fingerprint / iris and borrow the books securely within few minutes. In the biometric system, exchange of ID cards between students or misuse by another ID card can be prevented. Biometric system reduces the amount of time required to perform circulation operations. The most significant time savings are attributable to the facts that information can be read from library user finger print / iris recognition much faster than barcodes.



**Figure 3.** Book circulation by using user fingerprint authentication

### **Biometric in Library Management System**

A library management system is built to handle the primary housekeeping functions of a library. The main purpose of library management system is to manage the daily operations like updating data and book transactions. Usually library management system admin will use the password or scan the ID to enter into LMS system. In the biometric system, admin can use fingerprint / iris scan to enter into library management system instead of user name and password for library collection updates. Biometric authentication is securing the library management system admin rights and prevents the misuse of password and stealing.

### **Biometric Authentication in RFID Library Management System**

The development of library automation, application in RFID library management system (Radio Frequency Identification) used in staff work station, drop chute, automated sorter, wonder wall, self service, RFID gates and stock control. The work station allows circulating multiple books at a time. In the RFID library management system there are two options for user authentication. One is RFID smart ID card and the other one is biometric authentication. Most of the libraries use RFID smart ID card to issue the books. In this authentication system students may misuse another ID and borrow the books. Because RFID smart ID verifies only the RFID tag and not the user physical identification. Therefore library administrator can prefer biometric authentication in circulation counter rather than RFID smart ID. It helps to prevent these issues and issue the books to the right user.

The RFID gate allows only library members in to the library premises and also counts the number of users visiting the library. The biometric authentication can be used in RFID gate instead of RFID smart ID. It helps to prevent misuse of ID card and controls the unauthorized person's entry.



**Figure 4.** RFID work station by using biometric authentication

## **Advantages of Biometric Authentication**

### **User Security**

Library user passwords or PINs can be guessed, stolen or hacked, but biometric identifiers can neither be counterfeited nor be stolen. Biometric technology has provided an advanced degree of security compared with traditional authentication methods. The physical presence of the authorized library members are required at the point of identification which means that only the authorized person can enter into library premises and borrow the books. Accessing a biometrically secured logical or physical facility requires the presence of an authorized student or faculty following a biometric scan. This generates reliable and auditable logs of accessing the facility. Users cannot deny these logs as they are a proof of willful access. It improves the user accountability.

### **User Convenience**

Library user and library staff convenience is another advantage with biometric identification. In recent times, we are using password and PINs for net banking, money transactions, social media, e- trading and even for ordering food. In these conditions, User identification with passwords and PINs is no less than a memory challenge these days. Users do not need to type the passwords again and again. Or even no need of remembering username and passwords. Sometimes numbers and special characters are set to escape your mind if you do not cram them like a multiplication table. Biometric authentication proves that it is filling the gaps of traditional identification methods instead of typing a password, PIN or swiping a pattern. Biometric identification methods eliminates all hassles associated with IDs, passwords and other possession or knowledge based identification methods, it is making identification a truly user convenient experience. A fingerprint or iris scan biometric system is much easier to use than a password, especially a long one. It only takes a second to recognize a fingerprint and allow a user to borrow books with security.

### **Circulation Operation**

In circulation operation library users need not to bring their ID card for book borrowing and returning. Library members can use their biometric authentication finger print or iris scan to borrow the books quickly. One of the major shortcomings associated with traditional identification methods is that the process of identification or identity verification can be painfully slow. Biometric identification system takes less processing time compared to the other identifying systems. Because in biometric authentication systems the information is compared to all data already stored in the database.

### **Accuracy of User Data**

Library member's biometrics validated systems are also more accurate since they only have to match an individual's data against his or her already stored data in the database and do not need hundreds, thousands or even if there are millions of comparisons like the identifying systems.

## **Disadvantages of Biometric Authentication**

### **Cost of Biometric Machines**

Biometric systems can still be expensive to implement for the specific use cases or smaller outfits. Owing to this fact, biometric authentication system may not be the best idea for applications where number of library users to identify is very less and can be managed with manual methods. Biometric systems maintenance is also important to ensure optimum performance, however, it also incur additional cost. Biometric identification machines are expensive to buy than traditional ones. In addition, some user members may reject biometrics as a whole, seeing it as an invasion of privacy.

### **Technical Complexity**

Biometric security cannot be remotely changed by a user. Biometrics, however, don't work like that the user have to be physically near the device to change its initial, secure data set. It requires integration and/or additional hardware for biometric installation. In the biometric system, most part of deployment and implementation is taken care by its vendor, biometric systems may require the administrator to have a certain level of technical friendliness to use, maintain and perform day-to-day back-end library operations. Some libraries may not be comfortable with that part and may find biometric systems too complex for them.

### **Biometric Authentication Error**

All technology based systems have their limitations and biometrics is not an exception. Biometric authentication systems are not 100% accurate. A library member illness such as cold can change a person's voice, making absolute identification difficult or impossible. Finger print authentication performance can be fluctuate to dry, wet, dirty fingers. And size of their fingerprint changes quickly. Also, biometric identification systems are not always entirely accurate. For example, a user with cold may not be able to identify himself using a voice identification device, and user who gain or lose weight may suddenly lose user access to a place protected by a system analyzing biometric physical features.

## Security of Biometric Data

A library member's biometric data may be easily retrieved by computer hackers. Technically, this is possible, but it is far beyond the scope of your average. User can change your password, but there's no way to modify your iris, retina or fingerprint. If somebody hacks your biometric traits, there's no way to use your biometric traits, other than switching to use another finger. In future, security researchers may discover weaknesses in operating system devices that allow them to remotely extract a user's fingerprint and other biometric traits, use backdoors in the software to hijack easily. They can do this remotely, without having physical access to the device.

## Conclusion

This paper analyzed the need of biometric authentication system in the academic libraries and provides best information security system for libraries. Biometric technologies have reduced the amount of library operation timings with security. The advantage that biometrics presents is that the information is unique for each user. In most cases, using biometric identification has proved to be more beneficial in long term. Biometric identification provides lot of benefits, however the disadvantages should also be kept in mind when taking biometric identification into account. Today library users are looking out for ease of access of information and services from libraries. Any ways by advancements in technology and security, many disadvantages of biometric systems are expected to cease to exist. This study will also give an idea for the academic libraries that are planning to implement biometric authentication system for library operations in future.

## Reference

1. Atul Bhatt, DevashriShastri. 2018. *Advanced Technologies for the User Authentication and Security of Library Collection*. International journal of Library and Information Studies, 8(1), 460-465.
2. Nirmalendu Pal, Ajay Kumar Sharma. 2017. *Implementation of RFID Technology in Library*. International Journal of Digital Library Services, 7(2), 70-79.
3. Manjunath R, Madan Kumar V C, Haritha S Kumar et al. 2017. *Integrated Library System Using Biometric Scanner and Distributed Information Access Based on RFID*. Proceedings of National Conference on Communication and Image Processing, Bangalore.
4. MahmudovaShafagat. 2016. *Applications Opportunities of Biometric Technology in Electron Libraries*. Communications, 4 (2), 8-11.
5. DayohomNanshak Monday, SangeethaElango, Henry Chuckwuemeka Paul. 2016. *Biometric and RFID Technology Fussion: A Security and Monitoring Measures to Enhance Attendance*. International Journal of Information System and Engineering, 4(1), 1 – 8.
6. Kadali Sridhar, Naga Divya K, SreeLakshimi . 2015. *A Fingerprint and RFID Tag Based Authentication System for Driving*. International Journal of Computer Science and Engineering, 3(9), 71-76.



7. Gayathri D, Uma Rani R. 2013. *A Prototype for Secure Digital Library Accessing System Using Multimodal Biometric System*. International Journal of Advanced Research in Computer and Communication Engineering, 2(4), 1704-1707.
8. Ramesh M R. 2012. *Biometric Recognition: New Approach for Library Patron Authentication*. International Journal of Library Science, 1(5), 72-74.
9. Raju Rajkumar, Kshetrimayun Nirmala Devi, Hema Chandran K. 2011. *"Finger Identification System in Library and Information Center"*. International Journal of Computer Science and Engineering, 3(12), 3681-3685.
10. Achintya K. Mandal, Subodh Gopal Nandi. 2009. *Biometric Recognition : Novel Approach for Library Patron Authentication*. 694-697. ICAL-2009.
11. Rathinasabapathy G, Mohana Sundari T, Rajendran. 2008. *Biometric Applications in Library and Information Centres: Prospects and Problems*. 6<sup>th</sup> International CALIBER 2008, 182-189.
12. Atul M Gonsai, Nilesh N Soni. 2007. *Biometric authenticated library network model for information sharing*. 491-497. 5th International CALIBER -2007, Panjab University, Chandigarh.
13. <https://www.gemalto.com/govt/inspired/biometrics> (Accessed on 12 may 2019)
14. <https://www.csoonline.com/article/3339565/what-is-biometrics-and-why-collecting-biometric-data-is-risky.html> (Accessed on 19 May 2019)



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# **Community Evolution in the Digital Space and Creation of Social Information Capital: A Case Study of Research Scholars of University of North Bengal**

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## **Abstract**

The paper “Community Evolution in the Digital Space and Creation of Social Information Capital: A Case Study of Research Scholars of the University of North Bengal” tried to delineate relationship between Community formation and social information capital. The community structure with fifty-six nodes and their response towards community formation, community merger, community splitting and generated information for the society is explored. Numerous elements of social capital were found from this community but not only specific to it. While the network formed by the community was lacking closure and weak ties existed a lot between the members as well as between the University and other community members, some types of social capital seemed to operate in a larger level. Moreover, the paper highlighted that Social capital not concentrated it is rather dispersed.

## **Formation**

Communities, a social homogeneous group can be formed irrespective to geo-spatial contiguity and research reveals that interaction through online communication fosters social behaviours like teamwork, ties, bonding and trust building as well as community building. Human interaction in digital space induces belongingness between human elements. Formation of social capital through online pathways takes a different path in regard to offline social connection (Williams, 2006a). Hence, any type of online community is capable of developing social information capital which may be regarded as knowledge capital for the contemporary society.

## Community evolution

Existing literature delineates community evolution through four synonymous phrases.

These are:

- *Social group evolution*
- *Temporal communities*
- *Evolutionary communities*
- *Changes of social groups*

**Stanisław Saganowski, Piotr Bródka and Przemysław Kazienko** tried to define the process of community evolution as a sequence of events (changes) follow each other in successive time frames in social temporal network. In other words, evolution is explained by the transformation of identified groups time  $T_i$  to  $T_i + 1$  ( $i$  is the period index). Literary warrants reveal that primarily three pioneers opined their intuitions regarding the community evolution process more or less in similar vocabularies. Comparative analysis of their prescriptions is;

Asur et. al	Pala et. al.	Bródka et. al.
•dissolve	•growth	•continuning
•form	•contraction	•shrinking
•continue	•merging	•growing
•merge	•splliting	•splitting
•split	•birth	•merging
	•death	•dissolving
		•forming

All three authors (A, P & B) propound common processes as **(form→birth→forming)**, **(dissolve→death(?)→dissolving)**, **(merge→merging→merging)** and **(split→splitting-**

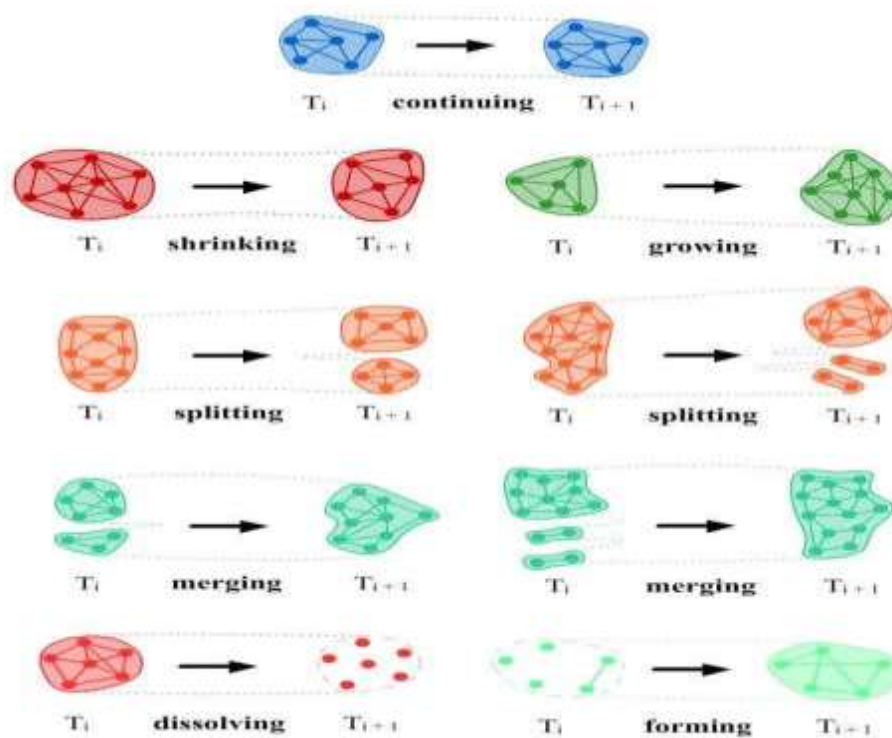


Figure 1. The events in community evolution [Bródka, 12].

→**splitting**). Asur's 'continue' seems 'growth' stated by Pala, though Brodkauttered 'continuing'.

Henceforth, summing up of their propositions Community Formation possess a series of activities however, the sequencing of the phases seems a bit irrational unless community formation is mutative in nature. It seems that all three authors tried to exemplify the existing community already formed and then only identified the process flow. The phases are as follows:

**Table 1.** Process flow of Community Formation

<b>Continuity</b>	the network proceeds with its reality when two groups in the continuous time frames are indistinguishable or when two groups contrast by just couple of hubs, however their sizes continue as before. Naturally, continuation happens when two networks are so much comparable that it is difficult to perceive any huge contrasts.
<b>Contraction or Shrinking</b>	the network contracts or shrinks when a few individuals have left the group, making its size littler than in the past time frame. A group can shrivel either marginally, losing just couple of hubs, or enormously, losing a large portion of its individuals.
<b>Growth</b>	the network develops when some new individuals have joined the group, making its size greater than in the past time window. A group can develop marginally just as essentially, multiplying or notwithstanding significantly increasing its size.

<b>Split</b>	the network parts into at least two networks in whenever window when not many groups from time period $T_{i+1}$ comprise of hubs of one group from time allotment $T_i$ . Two kinds of part can be recognized: (1) equivalent, which means the commitment of the groups in the split group is pretty much the equivalent and (2) inconsistent, in the event that one of the groups exceeds the others and takes an interest a lot higher in the splitter group. In the last case, the part may seem to be like contracting for the greatest group.
<b>Merge</b>	the network has been made by consolidating a few different groups, when one group from time period $T_{i+1}$ comprise of at least two groups from the past time span $T_i$ . A union, much the same as the split, may be (1) equivalent, if the commitment of the groups in the consolidated group is nearly the equivalent, or (2) inconsistent, in the event that one of the groups contributes into the combined group a lot higher than different groups. For the biggest group, the blending looks comparatively to developing on account of inconsistent combining.
<b>Dissolve</b>	happens when a network takes its life and does not happen in whenever window by any stretch of the imagination, for example its individuals have evaporated or quit keeping up their connections inside the group and dissipated among different groups.
<b>Form</b>	of another network happens when a group which has not existed in the past opportunity window $T_i$ appears in whenever window $T_{i+1}$ . Now and again, a group can be latent even more than a few time periods. At that point, such succession is treated as a dissolving of the principal network and its introduction to the world again as the second, new one.

A few distinct methodologies for network advancement discovery can be recognized:

- Identification of static networks in a given time span and coordinating the independently distinguished networks from the accompanying time frames.
- Discovery of worldly networks likewise called transformative networks mining.
- Transformative bunching, closely resembling network mining.

Community formation is conceivable likewise in the virtual space too. The group contemplated was observed to be a network in its customary sense while its individuals shared normal exercises and interests, even interests, and the group had a solid regular characteristic. While a few connections were progressively proficient, likewise relations of effect and solid kinships were made. It appears that with respects being dynamic in advancing network's central goal the enrolment is partitioned into two camps – the instructors and the students. This model fits well into Leave and Wenger's (1991) idea of a network of training with apprenticeship model and genuine fringe support. Each of the three kinds of social capital – **structural, cognitive and relational** – were found from this network. The



people group offers an asset or a stage for the system development however leaving the subsequent system very open and interlinked with numerous different networks.

The community group exhibited to have a collectivist group standard and a solid standard of correspondence was additionally obvious. Individuals related to the network and a typical character existed. The connection between a network and social capital is by all accounts an intricate and bidirectional one. While social capital can add to network development, network likewise makes new social capital over the span of its day by day life. Particularly holding social capital was thought to connect with the network.

## **Online Communities at University of North Bengal**

Before exhibiting the one community an attempt is made to set the ground by displaying the history and current territory of NBU's communities in an increasingly broad level so as to bring issues to light of the bigger picture this one Community has a place with. Data introduced in this section depends on numerous sources including NBU's inward data assets, for example, social network usage behaviour, blog entries, openly accessible assets. Chronological data has likewise been accomplished from dialogs with associates who have been with the University since the start of social figuring just as from discourses with some senior research work force engaged with numerous community related research ventures. There was an unmistakable hole still in the frameworks accessible while there was evident need to help wilful electronic networks of users who range associations and all the more officially established groups. Additionally, some dynamic network individuals and nerds felt that there would be a need to transparently announce that there is this sort of a Community working and teaming up to make it simpler for individuals to discover it and join the Community.

The greater part of the present communities is open for everybody to join however there are some that do choose their individuals. It may be that one needs to demand to be added to a Community or there might indeed, even be formal decision forms for communities that utilization, for instance, peer acknowledgment as a model for acknowledgment. Every Community additionally appears to have their very own character – some even have a mission. A couple Networks name themselves as Communities of Practice while others term themselves networks of Interest. Networks are likewise composed around a decent variety of themes. Some are sorted out around a specific item or item gatherings (for the most part programming items), in others the individuals share an equivalent calling or profile in the organization. There are additionally Communities for increasingly broad subjects, for example, open source registering or future patterns. Other potential subjects of intrigue can be explicit in strategies, specific enterprises, huge occasions, distinctive innovative stages, explicit undertakings, inside advancement activities, geological area or learning and courses. Additionally, non-proficient Communities can be discovered dependent on for instance ecological interests, sex, religion or pastimes. This classification would likewise incorporate Communities that offer help for example working moms and fathers. One perception made while acclimating myself with the Communities everywhere was that there were none that would-be alleged radicals (Meyerson, 2003) who transparently restrict a specific winning practice or perspective.

## Research Scholars Community

A single Community was chosen to think about so as to acquire exhaustive comprehension of the life in this Community. Determination criteria for a fitting Community included: **dynamic support from individuals, adequate minimum amount of individuals, a long enough history (from in any event one to two years) and an intriguing subject around which the Community was framed** so as to understanding and, to a fitting degree, engrossing some social parts of the Community. Despite the fact that only Research Scholars Community was observed, its reasonable fit with the previously mentioned criteria.

A number of scientists proposed utilizing **virtual ethnography** while looking into social marvels happening in the internet. Hine (2000: 10) asserts this specific system enables the analyst to pick up a reflexive comprehension of what it resembles to be a piece of the Internet. Fernback (1999) stresses the emblematic idea of online networks and respects a grounded hypothetical methodology, for example, ethnography, to offer the most adequate approach to address social issues happening in these totals. Ward (1999: 99) even ventures to pronounce digital ethnography the main possible route for achieving an exact introduction of a virtual network. While leading ethnography would require a longitudinal commitment, not reasonable or feasible for this work, I have chosen to utilize different subjective techniques drawing impact from ethnographic examinations.

Prime principle technique was chosen as participative perception. Progressively broad support fell into place without a hitch with time. Remarking on other's posts and sharing odds and ends of information had gained from different sources that would think different individuals would profit of. This psychological move enabled to truly encounter the Network life and to have the option to regard as a witness through client-reflection.

Despite the fact that every now and then different individuals were communicated and identified with the real focal point of the Community soliciting help from giving true perspectives on various subjects, the most piece of the connection was in the job of a scholar. Dialogs were had either by utilizing texting, Internet calls or a telephone. This enabled to hear perspectives on numerous kinds of individuals, the genuine eager, more current individuals or individuals who had not participated effectively. Singular discourses with around 56 network individuals just as community take part in a discussion with the network's driving characters. These increasingly formal discourses could be called unstructured subjective meetings, while other communication was essentially part of the regular day to day existence in the network.

## Social Capital

Social capital has been examined as both a normal for networks (Coleman, 1988) and a normal for people (Brehm and Rahn, 1997). In both research customs, social capital is an element of assets implanted in connections to other people (Lin, 2008) which can be utilized for individual advantage or aggregate great. At the end of the day, the idea of social capital perceives that there is some worth innate in one's associations with other network individuals (Shah and Gil de Zúñiga, 2008), regardless of whether those ties are feeble or

solid (Granovetter, 1973). Social capital is a staggered build including mental and sociological factors, and proof of it might be found at large scale, meso, and microlevels of estimation. Relational correspondence and trust are clear establishments of ties between people; this examination incorporates dialog system size as a different control variable. Be that as it may, this examination is concerned fundamentally with another key part of social capital: one's feeling of having a place with a network (Zhang and Chia, 2006). Social connectedness inside a network enables individuals to cooperate. Therefore, being an individual from a network does not establish investment in that network; rather, investigate proposes social connectedness is both an indicator and a precursor of municipal and political interest (Gil de Zúñiga, Jung, and Valenzuela, 2012; Gil de Zúñiga, Molyneux, and Zheng, 2014), and this examination reproduces and expands on this hypothetical connection.

"We look to pioneer new spaces, to make in them, to live in them. Furthermore, in those new spaces, we try to identify with each other. It speaks to our mankind, our opportunity." (Fernback, 1999: 214)

In the internet during the most recent decade. All the more frequently individuals go to online locales and spaces to associate with each other, to be dynamic in the region of their advantage and to make, examine, find and offer help and to just mingle. This change has been brought about by better approaches for communicating on the Internet that the supposed Web 2.0 has carried with it. People can make and distribute their very own substance, pursue and remark on other's substance and cooperatively arrange the huge measure of data accessible. Individuals are cooperating and teaming up in the Net and keeping in mind that doing as such, making alleged knowledge of the group.

These two hypothetical ideas – network and social capital – appeared to be strikingly conjoined and notwithstanding covering. A few specialists (for example Smith, 2008: 22) even suggest that the thought of social capital could be utilized in understanding the soundness of the network. While this offers a fascinating inquiry to handle after social capital has been revealed, it likewise offers a mind inciting question about the relationship of the two ideas. How could the relationship of these two ideas be portrayed and comprehended? Could the current network give a stage to social money to be made and subsequently offer an asset for its individuals' activities? I additionally chose to investigate this relationship inside the edges of this examination. What is the connection between social capital and a network?

## **The Relationship Between Social Capital and A Community**

During this examination a fascinating perception of the hypothetical closeness and even cover of the ideas of social capital and network has been made. Standards and personality that can be viewed as a major aspect of social capital are likewise qualities for a network. Likewise, informal communities, which can be believed to have a place with the basic social capital, are vital conditions for the arrangement of a network. Due to this cover and the fascinating entryways investigating it may open, I will examine here the relationship of the two dependents on writing and results from this examination. There have been various perspectives in the scholarly community of whether social capital is a reason or a result of informal organizations.

Despite the fact that informal organizations don't constantly rise to networks we can investigate how the relationship has been comprehended by different scientists. Williams (2006: 594) considers social to be as a result from informal organization and portrays the system to be a causal specialist for the measure of social capital accessible. Different specialists see social capital rather as a procedure and Newton (1997) has proposed social money to be recurrent speculating that social capital is contained standards, systems and the subsequent results, which again input into further standards and systems. The most well-known comprehension of the relationship is by all accounts that social capital is viewed as "social paste" that holds individuals and networks together (see for example Syrjänen and Kuutti, 2004: 21; Husyman and Wulf, 2004: 1). Smith's (2008: 22) recommendation is by all accounts gotten from this perspective while he proposes that social capital could be utilized in estimating the state or the wellbeing of the network.

The outcomes from this examination rather appear to help the patterned and increasingly complex relationship than unidirectional and causal relationship. Initially, in light of the discoveries it appears that network offers a stage where social capital can be delivered and from where it tends to be gotten to. This is shown by representatives joining the network to make connections, offer and discover help and support and to trade data. Over the span of this action connections develop and standards and personality are framed. These types of social capital again influence part's conduct, while they are influenced by the standards and new conduct prompts new sorts of social capital. The connections can't be simply causal such that network makes social capital in light of the fact that the cover in conceptualizations of social capital and network infers that network can't exist without social capital. Consequently, it appears that what at NBU is known as a Community, offers a stage for individuals to associate and shape interpersonal organizations and because of this collaboration social capital can be framed which again plots, yet does not really prompt the making of social marvels that portray a network. In the event that we think about the relationship of social capital and a network and bring the division of social capital exhibited in section 2.1 into talk, it tends to be suggested that the two extraordinary classes of social capital influence network development in an unexpected way. What Sandefur and Laumann (2000) call sociocentric see and what Putnam (2000) would refer to as holding social capital has a more prominent potential in influencing network development and advancement, while social capital concentrates more on group. In this perspective, social capital is considered more to be a side-effect by social connections with regards to bigger connections designs in the framework. The other view that Sandefur and Laumann call egocentric point of view and Putnam would call holding social capital spotlights on person's systems and the advantages she can draw from those systems. In this view an individual is viewed as a self-intrigued on-screen character who looks to utilize assets available through the system, however not having a place with her, as methods for driving her own advantages. This egocentric conduct does not expand communalism yet rather decreases it supplanting we wish I. It appears that as opposed to empowering network arrangement or making new social capital, the current social capital is devoured. While the relationship is anything but a straightforward one it appears that the components of social capital that could be arranged under holding social capital do affect network while crossing over social capital deter or if nothing else does not add to the making of a network. The paste allegory likewise appears to be sensible dependent on the

discoveries. Individuals' sentiment of connection to the network can at any rate incompletely be because of social capital existing in the network and accessible for the utilization of individuals. Notwithstanding this sort of a leave boundary that social capital structures, it additionally appears comprise a significant purpose behind joining the network. Numerous sources portrayed how they initially caught wind of this network from their associates who saluted how well network worked and how much advantages they had gotten from being a part.

The estimation perspective is likewise a fascinating one. While the Social capital is utilized as a structure to portray as opposed to gauge the public activity inside a network, Smith (2008) recommends that by estimating social capital, the state and wellbeing of a network could be assessed. To do this however, I would prefer to propose social money to me gauged on a network level as opposed to on individual level, which would imply that new estimation apparatuses would be required, while the current ones (Williams, 2006) just measure social capital from person's perspective. In future examinations concentrating on comparable issues I could prescribe the utilization of estimation perspective to investigate how and if social capital influences the wellbeing of the network, but instead than a preview of one network, a progressively longitudinal examination concentrating on a wide range of networks would be required. This sort of an investigation could empower us to adapt more on what makes a network effective and offer bits of knowledge to network pioneers and proprietors. On this kind of an investigation, I would prescribe the relationship not to be conceptualized as unidirectional and causal, yet rather bidirectional and complex. Network can be thought to offer a stage where social capital arrangement is conceivable yet social capital (particularly holding social capital) can likewise be thought to empower the development of a network.

## **Analysis of the data**

Data from a structured questionnaire as well as personal interview was aggregated and included through participatory observation of 56 nodes in the community. All the information was examined utilizing systems from grounded theory. Examination procedure was a steady and recurrent procedure wherein was first sorted various kinds of social capital. Practically speaking the outcome was arranged in various subjects found from source interviews, printed correspondence and network occasion under unmistakable components of social capital. Likewise, strategies from rambling investigation were sent to examine textual messages and different messages in network asset site.

The procedure was repetitive in a manner that after beginning classification further research was attempted until the classifications were soaked and it turned out to be evident that enough information upheld the announcement of presence of certain component of social capital. After the components of social capital were discovered, more examination of the information was attempted consolidated to all the more likely comprehend the intricate connection between social capital and network. This examination predominantly contrasted the information and existing hypothetical systems endeavouring to discover confirmation for depicting the relationship.

**Table 2.** Response regarding Community and Social Capital relationship

Structural Social Capital: Community is a Social Network	Yes	No
	39	17
Cognitive Social Capital: Sharing is Caring	Yes	No
	42	14
Relational Social Capital: We together make the tie and bond	38	18

**Table 3.** Participatory Social Information Capital formation by Communities

<b>Reporting Knowledge, Participation and Satisfaction in Participatory Community Development of Research Scholars in NBU</b>		
	Number of Respondents	Percentage
Knowledge/information generation through participation (Structural Social Capital)	45	80.35
Direct participation in one or more communities in the network development program (information, proposal development, implementation, monitoring, evaluation)- (Cognitive Social Capital)	6	10.71
Satisfaction with the information communicated or shared (Relational Social Capital)	5	8.94
Total		100%

**Measures for building community social capital in Research community in NBU**

<b>Parameters</b>	<b>Effects</b>
Identification of latent standards and practices of trust, bonds, ties, correspondence and collaboration in the research scholar community evidently ruled by individualism and "familism".	Community Orientation, Participative Information Sharing, Open Information Transfer Tacit-Transfer of Information
Analyze and exploit positive conditions for the resurgence of social capital made by the Community	Use of conceived information for generation of new information for sharing in cyclic way.
Bridging the past of social information capital advancement encounters that have been recorded.	Considering information generated information and information capital tends to social information capital, that breeds bridging of trust and ties in information consumption and information assimilation.
Develop a platform of information disseminators, who themselves are shy and hideous in traditional platform of Information sharing.	Information shared by the poor disseminators is increased in community involvement; especially in network environment as physical barrier is greatly reduced in this environment.
Advancing a feeling of improvement of self-sufficient social capital.	Community promotes participatory attitude and thus the self of a community node becomes more prone to develop new information of social importance. Collective development of such information by individualistic thrust proliferates more social information capital

**Conclusion**

The study reveals that social information capital and community formation is intermingled in both ways. Information generation is largely an induced process and this process develops information/knowledge for social information capital. The research community of the university of north bengal generates social information capital through their community and they are more focused to share their expertise to the peers for enriched social information capital.

## References

1. **Asur, S., Parthasarathy, S., Ucar, D.** An Event-based Framework for Characterizing the Evolutionary Behavior of Interaction Graphs, KDD 2007, ACM, 2007, pp. 913-921. **Bourdieu, P. (1983).** The field of cultural production, or: The economic world reversed. *Poetics*, 12(4), 311–356.
2. **Brehm, J., & Rahn, W. (1997).** Individual-level evidence for the causes and consequences of social capital. *American Journal of Political Science*, 41(3), 999-1023. <https://doi.org/10.2307/2111684>
3. **Bródka P., Saganowski S., Kazienko P.,** GED: The Method for Group Evolution Discovery in Social Networks, *Social Network Analysis and Mining*, 2012, DOI:10.1007/s13278-012-0058-8
4. **Coleman, J. S. (1988).** Social capital in the creation of human capital. *American Journal of Sociology*, 94, S95–S120. doi:10.2307/2780243
5. **Fernback, J. (1999).** There Is a There there – Notes Towards a Definition of Cybercommunity, **Jones, S. (Ed.)** *Doing Internet Research, Critical Issues and Methods for Examining the Net*, 10:203-220. London, UK: Sage Publications.
6. **Granovetter, M. S. (1973).** The strength of weak ties, *Journal of American Sociology*, 78 (6):1360-1380.
7. **Hine, C. (2000).** *Virtual Ethnography*. London: Sage Publications.
8. **Homero Gil de Zúñiga, Matthew Barnidge & Andrés Scherman (2017).** Social Media Social Capital, Offline Social Capital, and Citizenship: Exploring Asymmetrical Social Capital Effects, *Political Communication*, 34:1, 44-68, DOI: 10.1080/10584609.2016.1227000 **Leave, J. & Wenger, E. (1991).** *Situated Learning. Legitimate Peripheral Participation*, Cambridge University Press, Cambridge.
9. **Lin, N. & Erickson, B. H. (2008).** Theory, Measurement, and the Research Enterprise on Social Capital. In Lin, N. & Erickson, B. H. (Ed.) *Social Capital, An International Research Program 1*: 1-24. New York: Oxford University Press Inc.
10. **Meyerson, D. E. (2003).** *Tempered Radicals: How everyday leaders inspire change at work*. Cambridge, MA: Harvard Business School Press.
11. **Newton, K. (1997).** Social capital and democracy, *American Behavioral Scientist*, 40 (5): 575–586.
12. **P. Brodka, S. Saganowski and P. Kazienko,** "Group Evolution Discovery in Social Networks," 2011 International Conference on Advances in Social Networks Analysis and Mining, Kaohsiung, 2011, pp. 247-253. doi: 10.1109/ASONAM.2011.69
13. **Putnam, R. (2000).** *Bowling alone: The collapse and revival of American community* (p. 541). New York: Simon & Schuster.
14. **Sandefur, R. L. & Laumann, E. O. (2000)** A Paradigm for Social Capital. In Lesser, E. R. (Ed.) *Knowledge and Social Capital – Foundations and Applications*, 4: 69-88. Woburn: Butterworth Heinemann.
15. **Shah, D., & Gil de Zúñiga, H. (2008).** Social capital. In Paul J. Lavrakas (Ed.). *Encyclopedia of survey research methods* (pp. 824–825). Thousand Oaks, CA: Sage Publications
16. **Smith, M. S. (2008)** Social Capital in Online Communities, *Proceeding of the 2nd PhD workshop on Information and knowledge management*.



17. **Syrjänen, A-L. & Kuutti, K. (2004)** Trust, Acceptance, and Alignment: The Role of IT in Redirecting a Community. In Huysman, M. & Wulf, V. (Eds.) *Social capital and information technology 2*: 21-51. Cambridge, MA: MIT Press.
18. **Williams, D. (2006a)**. Groups and goblins: The social and civic impact of an online game. *Journal of Broadcasting and Electronic Media*. 50(December), 651–670.
19. **Williams, D. (2006c)**. On and off the 'net: Scales for social capital in an online era. *Journal of Computer-Mediated Communication*, 11(2), 593–628. doi:10.1111/j.1083-6101.2006.00029.x
20. **Zhang, Weiwu & C. Chia, Stella. (2006)**. The Effects of Mass Media Use and Social Capital on Civic and Political Participation. *Communication Studies*. 57. 277-297. 10.1080/10510970600666974.

# **Social Networking Sites for Learning: Use of Facebook by the Library and Information Science Students of National University**

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## **Abstract**

Social networking sites (SNSs) especially Facebook is now widely used by the students to connect and share information with friends across the world. Nowadays, these tools have been widely using for academic purposes. However, there are different perceptions regarding whether Facebook should be used for teaching and learning purposes. The primary aim of this study is to investigate the use of social networking tools, especially Facebook by the Library and Information Science (LIS) students of the National University. Based on random sampling method, a structured questionnaire was distributed among 240 LIS students of National University and 207 were received. The response rate was 86.25%. It was found that most of the respondents were aware of using Facebook and it is very significant that majority of them use Facebook for academic purposes. The finding is significant because Facebook is not only used for social networking but it is also used for academic learning. National university of Bangladesh must prepare policies and mechanism on how they can foster SNSs to promote education and learning.

## **Keywords**

Social Networking Sites, Facebook, Learning, National university, Bangladesh.

## **Introduction and background**

Social networking sites (SNSs) have altered human lives by providing a whole range of new possibilities. SNSs are the websites that permits easy access to a vast quantity of information resources, enables fast synchronous as well as asynchronous communication and offers a wide array of entertainment prospects (Jahan& Ahmed, 2012). SNSs allow users to maintain social relationship by viewing, visiting; sharing and it provide user-created content platform applications allowing the users to contribute their knowledge in different formats like text, data, video, and audio. Facebook, MySpace, Twitter, Second Life, Delicious, Blogs, Wikis are just a

few of the social networking options available on the internet today (Dickson & Holley, 2010) that are used by various groups to stay in touch with friends and colleagues. Special SNSs have emerged targeting specific user groups, especially professionals (Vascellaro, 2007). Facebook is currently the most popular SNS and the focus of the current research. Now a day's Facebook is not only social applications, but also academic uses. It is a popular social networking site and online communication tool that allows users to construct a public or private profile in order to connect and interact with people who are part of their extended social network. It is so successful that the students use this site on a daily basis for both academic and social goals (Kirschner&Karpinski, 2010).

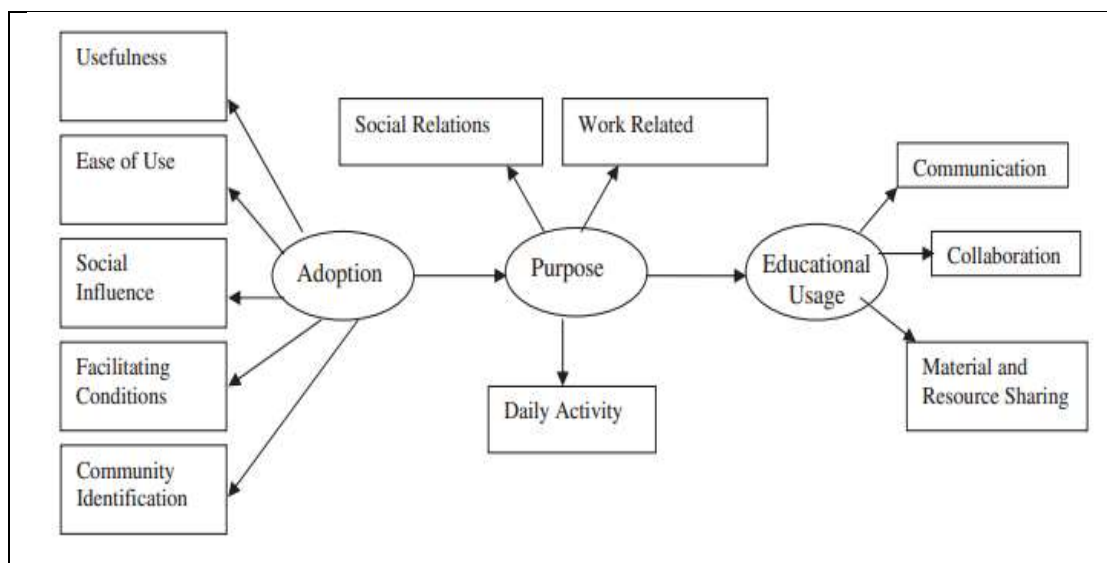
National University is mainly an autonomous affiliating University in Bangladesh. This university is established in 1992. The University has 2300 affiliated colleges & institutions and offers various academic programs for graduate and post-graduate degrees. In terms of the enrolment of students it is one of the largest universities in the world. It has a total enrolment of 2 million students (NU Website, 2019). The National University conducts graduate and post-graduate academic programs such as, MAS, M.Phil, Ph.D. and PGD program on its central campus at Gazipur, Bangladesh. The University has 30 departments under the five academic committees such as Arts, Social Sciences, Natural Science, Life and Earth Sciences and Business Studies (NU Prospectus, 2019). Since 2016-2017 sessions the University offers Ph.D, M.Phil, MAS and PGD program in the Library and Information Science department. In this regards this work focuses on the using social networking sites for learning: Facebook use by the LIS students of National University.

## Literature review

Social Networking Sites (SNSs) are the popular media to the formation of a community on the internet, which facilitates the users to interact or share views for a common purpose. SNSs can play a vital role for business purposes, social purposes and educational purposes with the internet through sites such as Facebook, Twitter, LinkedIn, MySpace, Whatsapp, Google+ etc. During the early period when SNSs emerge, that time users' just sharing and chatting personal information and ideas around the topic via personal homepage (Mahajan, 2009). According to Social Networking Service (2019) there are over 200 SNSs catering to different languages and countries in the world. Shaheen (2008) investigated the use of social networks and political activism on the Internet and the findings concluded that Internet use by the students promoted democracy, freedom of expression and greater awareness about their rights during the political crises in Pakistan. Researcher focused that, the use of social networking websites may be an alternate medium to promote the freedom of speech and greater awareness about their political rights among the students of these universities.

SNSs play an important role in every student's life. It is easier and convenient to access information, provide information and communicate via social media. Teachers and students are connected to each other and can make good use of these platforms for the working of their education (Social Network Service, 2019). SNS site enables us to stay connected despite the hindrances of distance and time (Mori, Sugiyama & Matsuo, 2005). University of Minnesota (2008) stated students are now so used to use social networking sites that one university in the

US has actually been running sessions to encourage students to build up face-to-face networks. SNSs are being used by different disciplines for its growing popularity in the world. Information professionals are also using SNSs as a tool for marketing of library services, creating awareness, building customer relationship, provide useful links to information, share photos and information about various events, share the opinions or expertise of staff members, to support just-in-time reference (Phillips, 2011). In particular there is a lack of research looking at the educational use of SNSs such as Facebook (Vrocharidou&Efthymiou 2012). The popularity of SNSs varies from country to country. Facebook is currently the most popular SNS and the focus of the current research. Social media including SNS are now part of many people's everyday lives with active users, irrespective of age, using SNSs (Madhusudhan, 2012). However, it was also stressed that Facebook is only one aspect of student's social networking practices and clearly face-to-face relationships and interactions remain significant. Mazman and Usluel (2010) focused their article that, there was a statistically positive correlation between perceived ease of use of Facebook as learning site and intention to use by the users. They also design a model about "Purposes of using Facebook and Facebook adoption" that mentioned below:



**Figure 1.** Purposes of using Facebook and Facebook adoption (Mazman and Usluel, 2010)

Espinosa (2015) focused of his article that, specific ways in which EFL teachers can use Facebook as an educational tool, describing the benefits of this technological instrument and analyzing the potential pitfalls and challenges that it could create. Facebook is popular in education too. Facebook has been found to increase collaboration between students (Mazman&Usluel 2010) and also increase the communication between student and lecturer (Bosch 2009). Roblyer *et al.* (2010), Facebook is a valuable tool in educational communications and collaborations. Facebook also provides immediate responses from the students. Many advocate the use of Facebook as a tool for learning due to the interaction, collaboration, information and resource sharing it can facilitate (Mazman&Usluel 2010). Using Facebook as part of teaching has been found to enable quick and easy communication between teachers and students (Bosch 2009). In order to successfully integrate the technologies into their teaching and

learning strategies, educators need to understand and use social media such as Facebook (Vie, 2008). Islam, Afroze and Darwin (2019) conducted a study on usage of SNS in Bangladesh and offer a model for business student. Authors built a usage model of SNSs among business students of Bangladesh through creating eight different factors consisting of 33 variables. The higher academic institutions must plan fitting policies and techniques on how they can foster SNSs to prop up education and learning outside the classroom. These above studies, however conducted on different settings and different countries. The use of Facebook in academic setting is widely accepted and used developed countries. Compare to the developed countries, Facebook in academic settings in developing countries are less. As a developing country in Bangladesh, few studies conducted on Facebook using for academic purposes. There are research gap in this area. The present study has been focused and shed light of using Facebook as an academic tool and how it can be used for LIS students of National University.

## Objectives of the research

The primary objectives of this study is to investigate the use of social networking tools especially Facebook by the Library and Information Science (LIS) students in National University. The specific objectives are to:

- Identify the reason of using facebook for different purposes.
- Examine the interest of using Facebook for academic purpose.

## Methodology

To meet the objective of this study, a questionnaire was designed for data collection. Data was collected from the LIS students of National University. The questionnaire contains 17 questions. Out of the seventeen questions, eight were open ended questions and the rest of all are close ended. Initial part of the questionnaire contains the bibliographic information and later parts composed of SNT's related questions. Some of the questions used Likert scale. SPSS (Statistical Package for the Social Sciences) version 20.0 was used to analyze data. Descriptive statistics was used to analyze the data. The results and discussions are also discussed below.

## Analysis and results

### ***Response rate***

Students of the Department of Library and Information Science were taken as sample of this study. Based on random sampling method, 240 questionnaires were distributed among LIS students in National University. After that 207 questionnaires were received and the overall response rate is 86.25%. The results of the study are discussed below.

### ***Demographic information of the respondents***

Table 1 indicates the demographic distribution (gender, age and batch) of the survey respondents. A total number of 207 respondents used for data analysis. Based on the demographics and other personal background information obtained, a majority of the respondents were male 71.50% (N=148) and 48.1% (N=59) were female. 11.61% (N=24)

students were age group between 15-20 years. The biggest part of students 55.57% (N=115) included in the age group 21-25 years. 19.81% (N=41) students were age group between 26-30 years and the age group of students 13.01% (N=27) were between 30+ years. In total, 25.60% (N=53) of the respondents were from PGD 1<sup>st</sup> batch students, followed by 29.47% (N=61) PGD 2<sup>nd</sup> batch students, 36.23% (N=75) PGD 3<sup>rd</sup> batch students, 4.83% (N=10) MAS students and only 3.87% (N=08) from M.Phil students.

**Table 1.** Demographic information of the respondents (N= 207)

Variables	Types	N	%
Gender	Male	148	71.50
	Female	59	28.50
Age	15-20 years	24	11.61
	21-25 years	115	55.57
	26-30 years	41	19.81
	30+ years	27	13.01
	PGD 1 <sup>st</sup> Batch	53	25.60
Disciplines	PGD 2 <sup>nd</sup> Batch	61	29.47
	PGD 3 <sup>rd</sup> Batch	75	36.23
	MAS	10	4.83
	M.Phil	08	3.87

### ***Information about internet access place by the students***

The first question to the students was about internet access point and that was multiple choice questions. Table 2 show that most of the students 56.52% (N=196) used internet at their home. A significant proportion of the students used internet in the library 32.85% (N=68). 14.98% (N=31) students used internet in department lab, 14.00% (N=29) students used internet in Cyber café and 2.90% (N=6) students answered that they do not yet use Internet.

**Table 2.** Internet access place by the students (multiple responses) (N= 207)

Internet access place	N	%
Library	68	32.85
Department lab	31	14.98
Cyber café	29	14.00
Home	117	56.52
I do not use Internet	6	2.90

### ***Information about internet connection methods by the students***

In this section the question asked to the respondents that was multiple choice questions. Table 3 show that most of the students 52.24% (N=105) used broadband connection. Students also used different mobile phone operators data 41.29% (N=83). 30.35% (N=61) students used Wi-Fi connection and 14.44% (N=25) students used wireless modem to access Internet.

**Table 3.** Internet connection methods by the students (multiple responses) ( $N= 201$ )

Internet connection methods	$N$	%
Broadband	105	52.24
Mobile data	83	41.29
Wi-Fi	61	30.35
Wireless modem	25	14.44

***Use of SNSs by the respondents***

Figure 2 shows that among 207 respondents, most of the respondents 94.69% ( $N=196$ ) use SNS while only 5.31% ( $N=11$ ) students do not use SNSs yet.

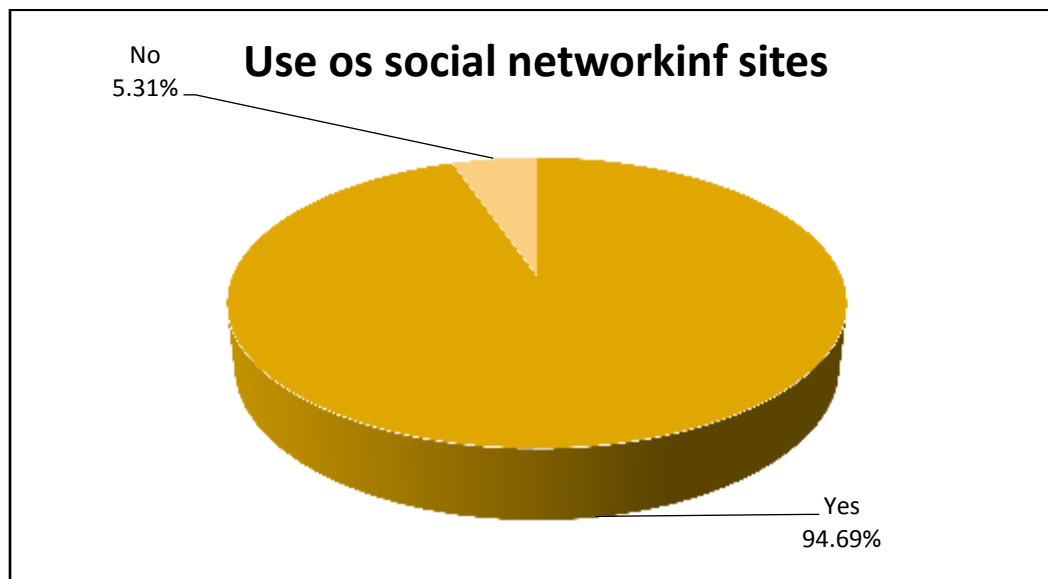
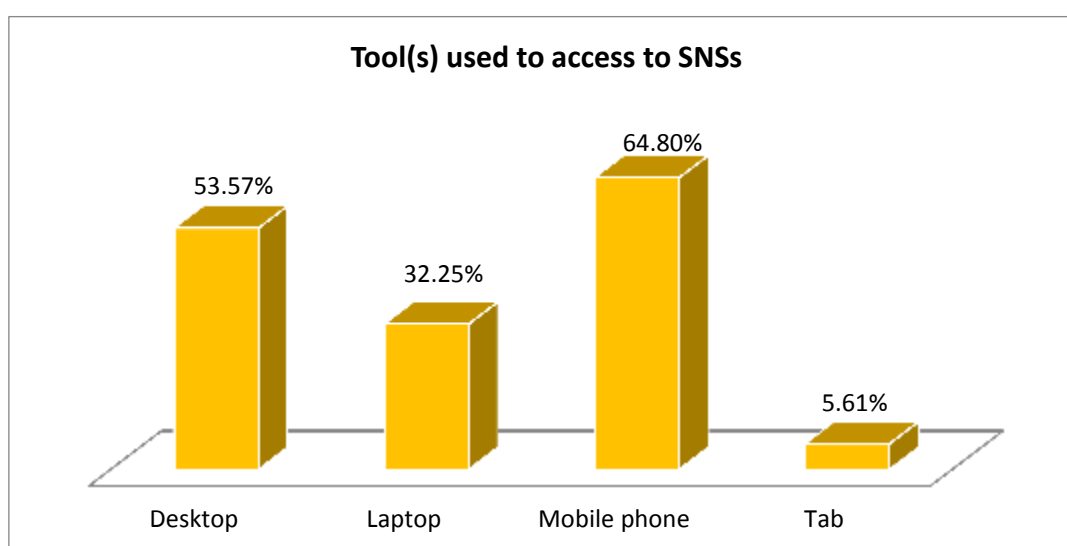
**Figure 2.** Use of SNSs by the students ( $N=207$ )***SNSs access tools by the respondents***

Table 4 as well as in figure 3 show that among students, 105 (53.57%) students used desktop, 73 (32.25%) used laptop, a big part of the students 127 (64.80%) used mobile phones and 11 (5.61%) used Tab for accessing social networking sites.

**Table 4.** Tool(s) used to access to SNSs by the students (multiple responses)

Tool(s) used to access to SNSs	N	%
Desktop	105	53.57
Laptop	73	32.25
Mobile phone	127	64.80
Tab	11	5.61

**Figure 3.** Percentage-wise distribution tools used to access to SNSs by the Students***SNSs Usages Information by the respondents***

The below Table 5 shows that all of the respondents 100% (N=196) use Facebook who use SNSs, 7.14% (N=14) use Academia, 13.27% (N=26) use Twitter, 16.33% (N=32) use Google+, 17.80% (N=29) use LinkedIn, 8.63% (N=17) use Hi5 and 20.92% (N=41) use others SNSs. The below table also shows that, most of the respondents 48.98% (N=96) use SNSs more than 5 years, 29.08% (N=57) use SNSs from 4-5 years, 16.33% (N=32) use SNSs from 2-3 years and only 5.61% (N=11) use SNSs from 1 month to 1 year. Table 2 also shows that, a big part of the respondents 52.55% (N=103) always use SNSs, 26.02% (N=51) usually use SNSs, 14.80% (N=29) sometimes use SNSs and few students 6.63% (N=13) use SNSs rarely.



**Table 5.** SNSs usages information by the respondents ( $N= 196$ )

Question	Variable	Frequency	%
Do you have any account of the following SNSs? (multiple responses)	Facebook	196	100
	Academia	14	7.14
	Twitter	26	13.27
	Google+	32	16.33
	LinkedIn	29	17.80
	Hi5	17	8.63
	Others	41	20.92
How long have you been using SNSs?	1 month-1 year	11	5.61
	1-2 years	32	16.33
	2-4 years	57	29.08
	4 years +	96	48.98
How often do you usually use SNSs?	Rarely	13	6.63
	Sometimes	29	14.80
	Usually	51	26.02
	Always	103	52.55

**Purpose of using Facebook**

The question to the respondents was “Which purpose(s) do you use Facebook?” On the question, identify about the purpose of using Facebook by the respondents. The below table 6 provides the details of the mean value, Standard Deviation and Variance as well as consequence level for the seven attributes measured by a five-point *Likert Scale*.

**Table 6.** Purpose of using Facebook $(N=196)$ 

SL No.	Indicators	Minimum	Maximum	Mean	Std. Deviation	Variance
1	For sharing information with friends	4	5	4.79	1.78	.157
2	For entertainment/hobby	4	5	4.56	1.85	.235
3	For passing time	1	5	3.99	1.59	.269
4	For making new friend	3	5	3.69	2.09	.290
5	For looking job opportunities	2	5	3.35	1.90	.433
6	For academic purpose	1	5	3.10	1.85	.367
7	For business purpose/shopping	1	5	3.05	1.90	.450

[Weight: *Strongly agree*=5, *Agree*=4, *Neutra* =3, *Disagree*=2, *Strongly disagree*=1]  
(Here 4.79 highest & 3.05 lowest score)

The above table shows the purpose of using Facebook by the department of LIS students of National University. The table shows that, “For sharing information with friends” is the 1<sup>st</sup> rank with a mean score of 4.79 and std. deviation 1.78 which is the highest value. Similarly, “For academic purpose” and “For business purpose/shopping” are the 6<sup>th</sup> and 7<sup>th</sup> ranks with a mean score of 3.10 and 3.05 and std. deviation 1.85 and 1.90 respectively which are the lowest values.

“For entertainment/hobby”; “For passing time”; “For making new friend” and “For looking job opportunities” ranked 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> indicated with a mean score of 4.56, 3.99, 3.69 and 3.35, and std. deviation 1.85, 1.59, 2.09 and 1.90 respectively.

### **Use of Facebook for academic purposes**

At the last portion of the questionnaire, students were asked to find out their opinion about the use of Facebook for academic purposes. This question was also a five-point *Likert Scale* questions with six attributes.

**Table 7.** Use of Facebook for academic purposes

(N=196)

SL No.	Indicators	Minimum	Maximum	Mean	Std. Deviation	Variance
1	Viewing course and class schedule	4	5	4.90	1.85	.178
2	Communicate with other students in the courses	4	5	4.86	1.80	.235
3	Communicate with course teachers	3	5	4.54	2.07	.269
4	Access course notes and other materials	3	5	4.48	2.04	.290
5	Live/Online group discussion	4	5	4.07	1.92	.433
6	Students collaborate in higher education courses	2	5	3.39	1.79	.367

[Weight: *Strongly agree*=5, *Agree*=4, *Neutral*=3, *Disagree*=2, *Strongly disagree*=1](Here 4.79 highest & 3.05 lowest score)

The above table 7 is arranged to identify the opinion about use of Facebook for academic purposes by the LIS students. The table demonstrates that “Viewing course and class schedule” is the highest mean value that is 1<sup>st</sup> in rank with a mean score of 4.90 and std. deviation 1.85. Similarly, “Communicate with other students in the courses” is the 2<sup>nd</sup> indicator with a mean score of 4.86 and std. deviation 1.80. “Communicate with course teachers” is the 3<sup>rd</sup> rank with a mean score 4.54 and std. deviation 2.07. “Access course notes and other materials” is the 4<sup>th</sup> rank with a mean score 4.48 and std. deviation 2.04.

The last two ranks “Live/Online group discussion” and “Students collaborate in higher education courses” with mean values of 4.07 and 3.39 and their std. deviation 1.92 and 1.79 belong to ranks 5<sup>th</sup> and 6<sup>th</sup> respectively.

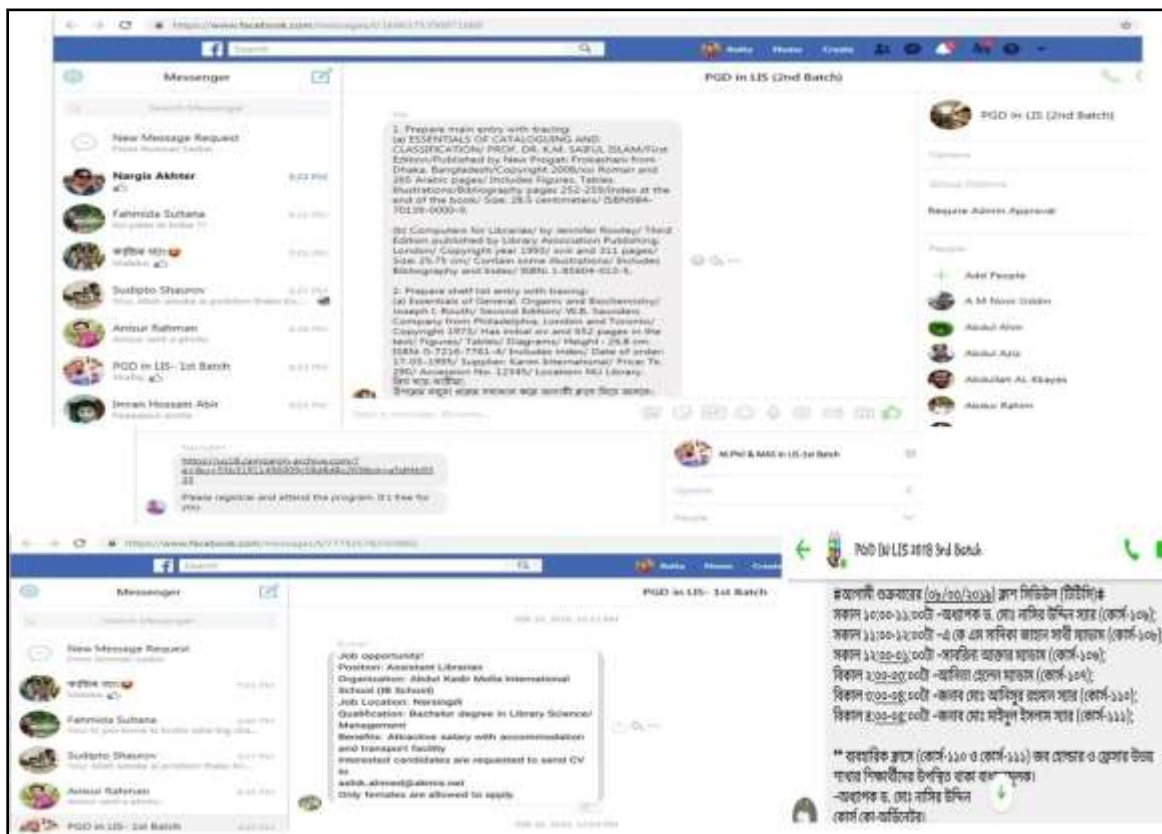


Figure 4. Existing use of Facebook by the LIS students of National University

## Findings, discussion and recommendations

Use of Facebook as a medium of learning and communication tool for academic purposes has been widely accepted by the NU students in Bangladesh. It was found from the findings that students extensively use Facebook for academic purposes. Considering it easy to use and convenient sharing facilities, probably the students use it for communication purposes in the academic environment. This finding is in line with the Magogwe&Ntereke's (2013) study where they found that Facebook has become one of the vital medium for communication. It significantly to improve communication skills. In this research most of students 196 (94.69%) out of 207 use SNSs. This study found that respondents who use SNSs all of the respondents (N=196) use Facebook. It is apparent from the responses that most of the respondents, 48.98% (N=96) use SNSs more than 5 years and a big part of the respondents 52.55% (N=103) always use SNSs (Table-5). The study exposed that, students of the LIS department are using Facebook for many purposes. “For sharing information with friends” is the 1<sup>st</sup> rank with a mean score of

4.79 and std. deviation 1.78 which is the highest value, on the contrary “For academic purpose” is the 6<sup>th</sup> rank with a mean score of 3.10 and std. deviation 1.85 which is the lowest value.

Facebook nowadays, along with much of the Internet is a great innovation that allows users to express their opportunity to create new communities. Especially, Facebook may break the silence of the communication and academic literacy students and create a more interactive relationship between the students and the institution. The study also identifies the opinion about the use of Facebook for academic purposes by the LIS students of National University. The result found that, “Viewing course and class schedule” is the highest mean value that is 1<sup>st</sup> in rank with a mean score of 4.90 and std. deviation 1.85, on the other “Students collaborate in higher education courses” with a mean value of 3.39 and the std. deviation 1.92 and 1.79 belong to rank 6<sup>th</sup> respectively.

Although there is no central policy regarding Facebook use, some departments and academic committees of National University now have their own Facebook pages (Figure-4). Students should follow them to get updated information about the institutions, check out useful links and resources pertaining to their courses. Teachers should encourage students using Facebook for academic purposes. They should allow students to interact with them via these sites. Though many students are not interested in creating separate Facebook accounts for course-related activities, teachers may create separate accounts specifically to communicate with students and to share messages, class schedules, class lectures, exam result and important links of books or journal. Also, National University authority should create an official Facebook page so that students, teachers, staffs and related person get information easily.

## Conclusion

This study sought to examine the use of SNSs e.g., Facebook use by the LIS students of National University. For this study, researcher set out two objectives and most of the objectives are met surrounded by the results. The popularity of Facebook among the on campus students of National University are increase day by day. It is clear from the study that most of the respondents are aware and use SNSs especially Facebook. This work revealed how students use Facebook to serve their academic purpose. Overall, LIS students of National University showed a positive attitude in using Facebook in higher education. Most of the students feel that social networking tools can be useful for their courses as well as these tools can improve communication between and among students and teachers. This study showed that SNSs especially Facebook hold great opportunities and challenges for transforming education and learning in National University and it is very essential for networking and communication in the 21st century.

## Acknowledgement

The author is grateful to all of on campus LIS students of National University who have been associated for this research and extended their helping hands in different ways. Author is entirely grateful to Dr. Md. Nasiruddin, Professor, Department of LIS and Dean, School Undergraduate Studies, National University for his invaluable suggestions which lead to significant improvement of this paper.

## References

1. Bosch, T. E. (2009) **Using online social networks for teaching and learning: Facebook use at the University of Cape Town**, *South African Journal of Communication Theory and Research*, 35: 185-200.
2. Espinosa, L. F. (2015) **The use of Facebook for educational purposes in EFL classrooms**, *Theory and Practice in Language Studies*, 5 (11): 2206-2211.
3. Islam, A. and Tsuji, K. (2016) **Information professionals' knowledge sharing practices in social media: A study of professionals in developing countries**, *International Journal of Knowledge Content Development & Technology*, 6 (2): 43-66.
4. Islam, M. M., Afroze, S and Darwin, C. (2019) **Usage of social networking sites in Bangladesh: A model for Business students of a developing country**, *KELPRO BULLETIN*, 23 (1): 1-17
5. Jahan, I. and Ahmed, S. M. Z. (2012) **Students' perceptions of academic use of social networking sites: A survey of university students in Bangladesh**, *Information Development*, 28 (3): 235-247.
6. Kirschner, P. and Karpinski, A. (2010) **Facebook and academic performance**, *Computers in Human Behavior*, 26 (6): 1237-1245.
7. Madhusudhan, M. (2012) **Use of social networking sites by research scholars of the University of Delhi: A study**, *The International Information and Library Review*, 44 (2): 100-113.
8. Magogwe, J. and Ntereke, B. (2013) **Using facebook to teach communication and academic literacy skills: Perceptions of university students in Botswana**, *Conference Proceedings - 8th international conference on e-learning*, 248-254.
9. Mahajan, P. (2009) **Use of social networking in a linguistically and culturally rich in India**, *The International Information & Library Review*, 41 (3): 129-136.
10. Mazman, S. G. and Usluel, Y. K. (2010) **Modeling educational usage of Facebook**, *Computers & Education*, 55 (2): 444-453.
11. Mori, J., Sugiyama, T., and Matsuo, Y. (2005) **Real-world oriented information sharing using social networks**, *Proceedings of the 2005 international ACM SIGGROUP conference on Supporting group work GROUP 05*, available at: <http://portal.acm.org/citation.cfm?doid=1099203.1099215>.
12. National University Prospectus (2019) **College Ranking Award and Certificate giving Prospectus**, National University, Dhaka, Bangladesh, 115.
13. National University Website (2018) Available at: <http://www.nu.ac.bd/nu-brief-history.php> (accessed on 25 December 2018).

14. Phillips, N. K. (2011) **Academic library use of Facebook: Building relationships with students**, *The Journal of Academic Librarianship*, 37 (6): 512-522.
15. Roblyer, M. D. et al. (2010) **Findings on Facebook in higher education: A comparison of college faculty and student uses and perceptions of social networking sites**, *Internet and Higher Education*, 13: 134-140.
16. Shaheen, M. A. (2008) **Use of social networks and information seeking behavior of students during political crises in Pakistan: a case study**, *The International Information & Library Review*, 40: 142-147.
17. Social Network Service (2019) Available at:[http://en.wikipedia.org/wiki/Social\\_networking\\_service](http://en.wikipedia.org/wiki/Social_networking_service) (accessed on 3 January 2019).
18. University of Minnesota (2008) **Educational Benefits of Social Networking Sites Uncovered**, *Science Daily*, available at: <http://www.sciencedaily.com/releases/2008/06/080620133907.htm> (accessed on 11 January 2019).
19. Vie, S. (2008) **Digital divide 2.0: generation M and online social networking sites in the composition classroom**, *Computers and Composition*, 25 (2): 9-23.
20. Vrocharidou, A. and Efthymiou, I. (2012) **Computer mediated communication for social and academic purposes: profiles of use and university students' gratifications**, *Computers and Education*, 58 (1): 609-616.

## APENDIX

### The Questionnaire on Social Networking Sites for Learning: Use of Facebook by the Library and Information Science Students of National University

The main aim of this questionnaire is to assess the use of social networking sites in particular Facebook by the Library and Information Science (LIS) Students of National University. It will be highly appreciated if you could take a few minutes to complete the survey.

#### 1. Demographic and academic information:

- 1.1 Name : .....
- 1.2 Gender : ☐ Male ☐ Female
- 1.3 Age group : ☐ 15-20 years ☐ 21-25 years  
☐ 26-30 years ☐ 30+ years
- 1.4 Program : ☐ PGD ☐ MAS ☐ M.Phil
- 1.5 Academic Session/Year : .....

#### 2. Information on Social Networking Sites (SNSs) use:

- 2.1 You have access to Internet at: (you can choose more than one)  
☐ Library ☐ Department lab ☐ Cyber café  
☐ Home ☐ I do not use Internet
- 2.2 What is your main Internet connection method? (you can choose more than one)  
☐ Broadband ☐ Mobile data ☐ Wi-Fi  
☐ Wireless modem ☐ Other (please specify).....
- 2.3 Do you use social networking sites?  
☐ Yes ☐ No (**Please go to Question no. 4**)
- 2.4 Which tools(s) do you use to access to SNSs? (you can choose more than one)  
☐ Desktop ☐ Laptop ☐ Mobile phone  
☐ Tab ☐ Others (please specify).....
- 2.5 Do you have any account of the following SNSs? (you can choose more than one)  
☐ Facebook ☐ Academia ☐ Twitter  
☐ Google+ ☐ LinkedIn ☐ Hi5  
☐ Other (please specify).....
- 2.6 How long have you been using SNSs?  
☐ 1 month to 1 year ☐ 1-2 years ☐ 2-4 years  
☐ More than 4 years
- 2.7 How often do you usually use SNSs?  
☐ Rarely ☐ Sometimes ☐ Usually ☐ Always
- 2.8 How many connections (Friends) do you have for your SNS account (on average)?  
☐ Less than 100 ☐ 101-300 ☐ 301-500 ☐ 501 +

#### 3. Information about usages of Facebook:

- 3.1 Which purpose(s) do you use Facebook?

(Weight: *Strongly agree* =5, *Agree* =4, *Neutral* =3, *Disagree* =2, *Strongly disagree* =1)

Purposes	5	4	3	2	1
For entertainment/hobby	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
For looking job opportunities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
For academic purpose	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
For business purpose/shopping	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
For making new friend	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
For sharing information with friends	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
For passing time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3.2 Frequency of responses to likelihood of participation in academic purposes:

(Weight: *Strongly agree* =5, *Agree* =4, *Neutral* =3, *Disagree* =2, *Strongly disagree* =1)

Course related activities	5	4	3	2	1
Communicate with other students in the courses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Access course notes and other materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Live/Online group discussion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Communicate with course teachers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Viewing course and class schedule	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Students collaborate in higher education courses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. If you do not use the Social Networking Sites (SNSs), what is the reason?

- ☐ I am not interested
 ☐ I joined once but I do not enjoy doing it  
☐ I do not have time
 ☐ I do not know how to join  
☐ Other (please specify).....

**Thank you very much for your participation**



# **Assessment of the utilization of social media towards information literacy by faculty of engineering students Kebbi State University of Science Technology, Aliero**

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## **Abstract**

This paper assessed the utilization of social media towards information literacy by Faculty of engineering students in Kebbi State University of Science and Technology Aliero. The survey design method was adopted for the study in which question was used as instrument for data collection. The likert scale was used to generate and analyze data. Tables, percentages, mean and remarks as either less than 2.5 as rejected or greater than 2.4 as accepted. The findings indicates that students are aware of Facebook, Twitter and WhatsApp. Majority have Facebook, YouTube and WhatsApp with more than 50%. YouTube recorded the highest usage with (3.2 mean). Chatting was the major reason for using social media platforms with (3.4 mean). The poor internet connection was the forefront challenge users of social media faced. Sequel to the findings of the study, some recommendations were suggested for Kebbi State University of Science and Technology, Aliero

## **Introduction**

Social media undoubtedly changes our conception of information, the social web, further complicated matters. The social web has transported information literacy from pull of information to push. The relationship between social media and information literacy is increasingly manifesting, so the possibility of social media tools replacing conventional ways of information literacy instruction.uy56 In the same vein, the line between information consumers and information producers has blurred. While the generation of information led to information overload, information retrieval has ushered in a new era of push consumption. More importantly, social media increasingly mediates users' personal, professional, and democratic lives. Utilization of social media has proliferated over the years, most prominently making its mark on younger generations. Pew Research Center posit that , 83% of 18 to 29 -year -olds use social networking sites (SNS)and, as of August 2011, 61% of this group use SNS on a daily basis. This group of users are usually found in the institution of higher learning.Drury (2008) defines social media as “online resources that people use to share content: video, photos, images, text, ideas, insight, humor, opinion, gossip, news”. As social media has rapidly growth, the manner in which it is used has shifted. Once primarily used as a social outlet, social media has emerged as a

notable channel of information for younger generations. Studies have shown that undergraduate students prefer to access information via human and electronic resources, which “suggest[s] that students are likely to turn to social media as information sources, for social media are just as accessible as other online resources and are as convenient and user-friendly as humans, students need to know how to use social media not just in the actual work environment, but also to shape their online presence and conveying the skills they have for future employment. Information literacy is coined by Armstrong et-al as “knowing when and why you need information, where to find it and how to evaluate use and communicate it in an ethical manner. People who recognize their own need for good information and who have the skills to identify access evaluate, synthesize and apply the needed information are thus information literate. A range of social media should be demonstrated and used. It is important that learners appreciate that social media is more than social networks and blogs. The selection of social media should reflect the interests and demographics of the learners. While all learners should be exposed to the most common types of social media (which include social networks and blogs), other types of social media may be better suited to specific types of learners. For example, mature learners may benefit from, and enjoy using, the more immersive forms of media such as virtual worlds; young learners may benefit from, and enjoy using, the more exciting forms of media such as games. The critical aspect is that all of these platforms (social networks, blogs, wikis, virtual worlds and games) are seen as social media.

## Statement of the Problem

Information literacy is important elements to be considered in social media use by students of faculty of engineering in Kebbi State University of Science and Technology, Aliero. **Oluwaseye&Oyetola (2018)** insinuated that social media use involves information literacy skills; In exploring social media, users engage in different activities like sharing, uploading, retrieving, and evaluating information at one point or the other; all these show relationships between social media use and information literacy skills. Nevertheless, it seems there has not been much study on the influence of information literacy on social media use by faculty of engineering students in KSUST, Aliero. For proper and effective recommendations to be made for universities to adopt the use for social media there is need to reveal students’ awareness level of different types of social media, availability of social media tools, frequency of use and challenges face by users through empirical investigation. It has not been unarguably established that students in universities use social media solely for academic purposes. There is need to reveal, through statistical analysis, whether information literacy skills can predict use of social media by students in faculty of engineering, KSUSTA, Aliero.

## Objectives

- To determines the level of awareness of existence of social media to be utilize for information literacy by faculty of engineering students
- To ascertain the availability of social media platforms by faculty of engineering students
- To find out the level of utilization of social media toward information literacy by faculty of engineering students

- To expose the challenges faculty of engineering student faced using social media for information literacy

## Literature Review

According to Ursachi&Scutelnicu (2014) “Information literate people are those who have learned how to learn. They know how to learn because they know how knowledge is organized, how to find information, and how to use information in such a way that others can learn from them. They are people prepared for lifelong learning, because they can always find the information needed for any task or decision at hand. Safko and Brake (2008) further defined social media as “activities, practices, and behaviors among communities of people who gather online to share information, knowledge, and opinions using conversational media. According to Junco al-et (2010), social media are a collection of internet websites, services, and practices that support collaboration, community building, participation, and sharing”. Social media, in another description is observed to mean an increasingly common and integral part of people’s lives, including children, nevertheless a minimum access age of 13 years for some platforms. Boyd and Ellison (2007) highlighted social networking to include Facebook, Twitter and Myspace used by people to create and sustain relationships with one another. There are other social networking sites which have greatly attracted millions of users such as; blog, del.icio.us, flickr, Skype, LinkedIn and so on (**Oluwaseye&Oyetola 2018. Bruce (2004)** has in mind that information literacy is believably the foundation for learning in this modern-day environment that is filled with constant technological change. He explained further that as the information environment becomes increasingly complex, educators are recognizing the needs for students’ engagement with the changing information environment as part of their formal learning processes. **Oluwaseye&Oyetola (2018)** in their study Information Literacy Skills and Social Media use by Students in Selected Private Secondary Schools in Ibadan revealed that most of the respondents were aware of Google+, Twitter, Facebook, YouTube, and Flickr. Overall, since the weighted average of 2.44 is less than the criterion mean of 2.50, it can be concluded that the respondents had low level of awareness on types of social media. Therefore, most the respondents regularly used Google+, Facebook, Twitter and Flickr. Acheaw& Larson (2015) the study was conducted to examine the impact of students’ use of social media sites on their academic performance. The study revealed that majority of the respondents had mobile phones with internet facility and had knowledge of the existence of social media sites. As a result they visit their social media sites and spend between thirty minutes to three hours every day. In addition, the study revealed that the use of social media had affected academic performance of the respondents negatively and further confirmed that there was a strong positive relationship between the use of social media and academic performance. Musa (2016) postulated in the study of assessment of academic library services: performance, challenges and prospects that “users can be alerted using social media such as Facebook, Twitter, social Bookmark, Blogs and Rich Site Summary”. Google, Facebook, Twitter, and YouTube provide platforms for people to create a personal profile, share information, link to others, befriend strangers, connect with others, subscribe to channels, and follow people. This involves the sharing of personal information for verification that is later used to profile individuals for advertisements and other purposes (Buchman, 2013; Meikle, 2016). Buzzetto-More (2012) submitted that students see Facebook as a

valued instrument that can support relationships among people, rebrand learning environment, and engage foster students' engagement. Furthermore, not only information and facts, but also misinformation or rumors, can spread "virally" through SNS (Nahon&Hemsley, 2013). Averill and Lewis (2013) maintained that information literacy skills are set of competencies that are attained when people can recognise that information is needed and could locate as well as evaluate the information successfully. Information literacy relates with ability to locate, evaluate, manage and use information from different sources for problem solving and decision making (ALA's 1990) Therefore, technology literacy has become a major element to be considered while information literacy is to be defined; it is the tool that helps information seeker to function effectively in an information-loaded society.

## **Social Media as Tool for Information Literacy**

Over the many studies have been conducted and social media has depicted both positive as well as negative effect on the academic performance of the students. There are certain factors that influence the relationship between social media and academic performance such as how long students use social networking sites? What time of the day do they use these sites the most? A handful of studies have discussed the relationship between these variables internationally as well as in Pakistan. A research was done by Madge, Meek, Wellens and Hooley (2009)

Impact of Social Media:

Social media has redefined the way election campaigning is done in various countries. On November 4, 2008, Barack Obama, 47, became the first African American to win presidential election against Republican candidate John McCain. His success was attributed to the way he used social media and technology to raise funds and win supporters. By November 2008, he had around 2.5 million Facebook (FB) followers, 1,15,000 twitter followers and 5 million supporters on social networks. It is estimated that 50 million people spent 14 million hours watching campaign-related videos on YouTube, which was four times more than McCain's viewers. His social network, [www.mybarackobama.com](http://www.mybarackobama.com) (MyBo) witnessed registered users and volunteers writing 4,00,000 blog posts and creating 35,000 volunteer groups.

SM has taken up many women-related issues. For instance, within a week of the Delhi gang-rape incident, 'Delhi for Women's Safety' a Facebook group was created on December 18, 2012. It received 1,74,430 'Likes.' Many such Facebook groups were created — Delhi Gang Rape — Protest; another girl gang-raped in Delhi — Can we stop it?' to fight crimes against women. These groups provided a platform to everyone not only in India but across the world, to raise their voices.

By June 2014, SM reach was estimated to be overwhelmingly high —approximately 700 million people on Facebook, 343 million on Google+, 288 million on Twitter, 200 million on LinkedIn and 48.7 million were on Pinterest.

## **Social Media platforms**

Some of the popular SM platforms which have the highest number of members registered under them are: Facebook, the online social networking application; Twitter, the micro-blogging social network; and video sharing platform YouTube where 35 hours of video material are being uploaded every minute (Royal Pingdom, January 12th, 2010)

### **YouTube**

It is an audio-visual platform that allows people to upload and share videos. As of February 2017, more than 400 hours of video material were uploaded to YouTube every minute and one billion hours of content has been watched on this site daily. Google bought YouTube in November 2006 for US\$1.65 billion and the site now operates as one of Google's subsidiaries (Source: Wikipedia). According to Alexa Internet, a web traffic analysis company, YouTube is the second most popular site in the world (the latest figures as of April 2017).

### **Facebook**

Facebook (FB) is an online social networking service where users can add other users as friends, exchange messages, post status updates, and digital photos, share digital videos and links. Facebook had more than 1.86 billion monthly active users as of December 31, 2016. It was the most popular social networking site in the world, based on the number of active user accounts as per April 2016 estimation (Wikipedia). By May 2017 which is the latest figure, Facebook had two billion populations (according to a posting by its co-founder and Chairman Mark Zuckerberg who is now the fifth richest man in the world, thanks to Facebook

### **Twitter**

Launched in March 2006 by four friends Jack Dorsey, Noah Glass, Biz Stone, and Evan Williams, Twitter is being used to break news and interact within a word limit of 140 characters in each tweet. It is a social networking site that also offers microblogging facility (short contents known as tweets are distributed online among followers) to registered users. On the day of the 2016 US presidential election in November, Twitter was the largest source of breaking news, with 40 million election-related tweets that were sent.

## **Social networking**

The social networking tools can be used to set up 'learning communities' in which students can meet and communicate with one another. According to Wikipedia (2018) 2.3 billion people active users use Facebook every day to keep up with friends, upload photos and learn more about the people they meet online. On an academic level, various studies have indicated that increased interaction and participation in course discussions are seen as anticipated benefits of using Facebook (Tess 2013) and could thus be the ideal host site for a blended learning environment (McCarthy, 2010). Facebook is also increasingly being used to promote information literacy at various institutions (Click & Petit, 2010; Fernandez-Villavicencio 2010). Microblogging enables real-time interaction where students can ask questions and get immediate, timely replies, and it can keep students up to date with academic activities news. Twitter, for example, can be used for activities such as a low stress means of asking questions, and posting class reminders. The use of microblogging also stimulates concise writing and writing for an audience (Tess 2013). *In the IL*

*course opportunities for interaction and collaboration between individuals and groups are introduced by the creation of open groups for the students on Facebook and Twitter as it is impractical for more than 8 000 students to individually 'befriend' one another! The lecturers serve as moderators on these sites. Announcements and tips for assignments are posted, to which students are expected to reply, or comment on, and students are encouraged to engage freely in general discussions pertaining to the course. This also serves as a valuable informal feedback and evaluation opportunity which lecturers can act on where necessary.*

## Methodologies

The research study used descriptive survey, involving of a sample of 120 drawn from a population 300. Simple random sampling was adopted in the course of selecting the population of the study. The population of the study consist of faculty of engineering student, Kebbi State University of Science and technology, Aliero. Questionnaire was distributed to the student concerned. Out of 120 questionnaire distributed, 112 copies was filled and returned which constituted 93% rate of return. The result was analyzed using mean scores according to modified likert scale on four points of strongly Agree (SA), Agree (A), Disagree (A), and Strongly Disagree (SD) were modified. An item is accepted if it is 2.50 average and above, while it would be rejected if it falls below 2.50.

Analysis of data

**Table 1.** Awareness of social media by faculty of Engineering students

S/N	Social media tools	Not Aware		Rarely Aware		Aware		Fully aware		Mean	Remarks
		Freq.	%	Freq.	%	Freq.	%	Freq	%		
1	Facebook	37	15.4 %	58	24.2%	82	34.2%	63	26.3%	2.7	Accepted
2	Coursemates.com	112	46.7%	73	30.4%	34	14.2%	21	8.8%	1.9	Rejected
3	Twitter	42	17.5%	66	27.5%	92	38.3	40	16.7%	2.5	Accepted
4	YouTube	59	24.6%	106	44.2%	25	10.4%	50	20.8%	2.3	Rejected
5	whatsapp	25	10.4%	40	16.7%	76	31.7%	99	41.3%	3.0	Accepted

Table 1 presents the results on awareness level of social media types by respondents in the faculty of Engineering Kebbi State University of Science and Technology Aliero. It shows that most of the respondents were aware of Facebook, (145 or 60.4%); Whatsapp, (175or 72.9%) and Twitter, (132 or 55%). However, most of the respondents were not aware of Coursemates.com, (131 or 65.2%) and Youtube, (75 or 31.3%) response rate. Overall, since the weighted average of 2.44 is less than the criterion mean of 2.50, it can be concluded that the respondents had low level of awareness on types of social media.

**Table 2.** Availability of social media by students

S/N	Types of social media	Available		Not Available		Mean	Remarks
		Freq.	%	Freq.	%		
1	Facebook	197	82.1%	43	17.9%	1.2	Rejected
2	Coursemates.com	24	10%	216	90%	1.9	Rejected
3	Youtube	185	77.1%	55	22.9%	1.2	Rejected
4	Twitter	102	42.5%	138	57.5%	1.6	Rejected
5	Whatsapp	201	83.8%	39	16.3%	1.2	Rejected

Table 2 presents the results on availability level of social media types by respondents in the faculty of Engineering Kebbi State University of Science and Technology Aliero. It shows that most of the respondents were have of Facebook, (197 or 82.1%); Whatsapp, (201 or 83.8%) and youtube, (185 or 77.1%). However, most of the respondents were not aware of Coursemates.com, (24 or 10%) and twitter, (102 or 42.5%) response rate. It can be concluded that majority of respondents have facebook, youtube, whatsapp accounts, but they don't have or subscribes to twitter and coursemates.com

**Table 3.** Level of usage of social media

S/N	Types of social Media	Never		Occasionally		Daily		weekly		monthly		Mean	Remark
		Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
1	Facebook	18	7.5%	42	17.5%	88	36.7%	62	25.8%	40	16.7%	2.8	Accepted
2	Coursemates.com	106	44.2%	62	25.8%	15	6.3%	20	8.3%	37	15.4%	2.3	Rejected
3	Twitter	77	32.1%	50	20.8%	29	12.1%	48	20%	36	15%	2.7	Accepted
4	YouTube	28	11.6%	68	28.3%	17	7.1%	75	31.3%	52	21.7%	3.2	Accepted
5	Whatsapp	39	16.3%	55	22.9%	98	40.8%	18	7.5%	30	12.5	2.8	Accepted

Table 3.Shows the response rate on social media types that are mostly used by students in the Faculty of Engineering Kebbi State University of Science and Technology Aliero. It was revealed that most of the respondents 92(38.3%) used whatsapp on a daily basis. Similarly, 88(36.7%) used Facebook daily, and 75(31.3%) used Youtube weekly. However, 106(44.2%) and 77(32.1%) respondents indicated that they never used Coursemates.com and twitter respectively. Therefore it could be concluded that the respondents regularly used Whatsapp, Facebook, and Youtube

**Table 4.** Reasons for using social media

S/N	Reasons for social media use	Never		Occasionally		Regularly		Always		Mean	Remark
		Freq.	%	Freq.	%	Freq.	%	Freq.	%		
1	Learning	35	14.6%	78	32.5%	69	28.8%	58	24.2%	2.6	Accepted
2	Research	42	17.5%	50	20.8%	80	33.3%	68	28.3%	2.7	Accepted
3	Assignment	77	32.1%	57	23.8%	82	34.2%	25	10.4%	2.2	Rejected
4	Chatting	0	0%	25	10.4%	92	38.3%	123	51.3%	3.4	Accepted
5	Compiling reading note	106	44.2%	56	23.3%	47	19.6%	31	12.9%	2.0	Rejected
6	Upload and view pictures and photographs	12	5%	44	18.3%	81	33.8%	103	42.9%	3.2	Accepted
7	For updates on happening	88	36.7%	57	23.8%	29	12.1%	66	27.5%	2.3	Rejected

Table 4 presents information on the reasons for which students in the Faculty of Engineering Kebbi State University of Science and Technology Aliero use social media. It shows that most of the respondents used social media to: chatting (mean = 3.4), for Upload and view pictures and photographs (mean = 3.2), Research (mean = 2.7) and learning (mean = 2.6) respectively. However, the table also revealed other reasons for which students use social media to include Assignment (mean = 2.2) and Class note (mean = 2.0).

**Table 5.** Literary skills of students

S/N	Information literacy of users	Strongly Disagree		Disagree		Agree		Strongly Agree		Mean	Remarks
		Freq.	%	Freq.	%	Freq.	%	Freq.	%		
1	I know how to use social media	24	10%	58	24.2%	97	40.4%	61	25.4%	3.2	Accepted
2	I have learning skills of information on social media	100	41.7%	45	18.8%	48	20%	47	19.7%	2.2	Rejected
3	I know how to search for relevant information on social media	12	5%	44	18.3%	81	33.8%	103	42.9%	3.2	Accepted
4	I can differentiate between authentic and fake information on social media	22	9.2%	63	26.3%	55	22.9%	100	41.7%	3.0	Accepted
5	I am fully prepared for lifelong learning	88	36.7%	57	23.8%	29	12.1%	66	27.5%	2.3	Rejected

Table 5 presents information on the information literacy skills levels of students in the Faculty of Engineering Kebbi State University of Science and Technology Aliero. Most of the respondents indicated that they know how to use social media and equally knew how to search for relevant information on social media with corresponding (mean = 3.2), moreover, large number of the respondents indicated that they can differentiate between authentic and fake information on social



media (media = 3.0). The result shows that a number of the respondents indicated that they have learning skills of information on social media (mean = 2.2), and prepared for lifelong learning (mean=2.3). But, since the weighted average of is less than the criterion mean of 2.50, it can be concluded that the respondents had a very low level of information literacy skills.

S/N	Difficulties in using social media	Strongly Disagree		Disagree		Agree		Strongly Agree		Mean	Remarks
		Freq.	%	Freq.	%	Freq.	%	Freq.	%		
1	Poor Internet connection	61	25.4%	39	16.3%	54	22.5%	86	35.8%	2.7	Accepted
2	Cost of Data Packages	77	32.1%	57	23.8%	82	34.2%	25	10.4%	2.2	Rejected
3	Authentication of information	62	25.8%	50	20.8%	56	23.3%	72	30%	2.6	Accepted
4	Cyber-crimes	42	17.5%	66	27.5%	92	38.3	40	16.7%	2.5	Accepted
5	Majority of information on social media is not relevant	59	24.6%	54	22.5%	57	23.3%	70	29.2%	2.6	Accepted

#### Q6 Challenges faced by the faculty of engineering students on use of social media

Table 6 shows the peculiar challenges faced by the Faculty of Engineering Kebbi State University of Science and Technology Aliero on use of social media. 140(58.3%) of the respondents indicated that their Poor Internet connection make it difficult for them to use the social media because the school wireless is not stable. Similarly, 128 (53.3%) specified that Authentication of information poses threat in the use of information on social media for academic activities because it has fails many students. While 124(51.7%) respondents declared that Majority of information on social media is not relevant is often rubbish as everybody can publish on social media and such has constituted a challenge to using social media, 132(55%) indicated that Cyber-crimes is the major issue why they are afraid of subscribing social media platforms. However, only 107(44.6%) of the respondents shows that Cost of Data Packages were not parts of the challenges the students face while using social media

## Discussion of Findings

From table 1 above, the result of the analysis, it could be noted that three out of five items are accepted which satisfied the criterion mean of 2.50 and above as weighted average, the other two items was rejected because they are less than 2.50. The level of availability incurs shows highest percentages of the students have facebook, YouTube and whatsapp accounts, while few of them subscribe to Twitter and Coursemates.com. For the level of usage the analysis shows that all the four items were accepted only Coursemates.com, was rejected on the ground that it is less than 2.50. All the respondent express their reasons for using social media, analysis of out of seven items results in the acceptance of four and rejection of three items. The analysis of five items under information literacy skills saw three items accepted and the rest two rejected. Out of the five items responded by the student only Cost of data packages was rejected the rest of the four items scaled true.

## Conclusion

Information literacy skills on social media is so paramount that every student should try to acquire, the best and fastest means of information creation, sharing and updates is through social media platforms. The ability to process and manage information effectively and efficiently could be regarded as information literacy. The social media aids students' interaction and consortium for academic activities. Students from faculty of Engineering, Kebbi State University of Science and Technology Aliero, utilizes social media tools for their academics activities, but they are not conversant with coursemate.com and twitter.

Although, majority of the respondent posses the skills for using social media platforms, there are some that lacks the basic skill needed to utilize social media tools for lifelong learning. The challenges faced by student is becoming so prevalence and frustrating.

## Recommendation

Based on the finding of the study, the following recommendations are offered:

- Information literacy course should be created and included in Tertiary institutions higher learning curriculum, with particular consideration to social media skills and competences of student.
- Libraries and information centers attached to our Tertiary institution should create information literacy and enlightenment forum, to help student acquire basic knowledge.
- Lecturers should encourage students create online forums of sharing information, like whatsapp groups, blogs etc
- School Authority, Government and relevant institutions should supply needed equipment, resources and materials that will help to overcome the prevalence challenges causing our development

## References

1. AcheawM. O. & Larson A. G. (2015) Use of Social Media and its Impact on Academic Performance of Tertiary Institution Students: A Study of Students of Koforidua Polytechnic, Ghana; Journal of Education and Practice Vol.6, No.6.retrieved fromwww.iiste.org
2. ALA. (1990). a progress report on information literacy: An update on the American Library Association presidential Committee on information literacy: Final report. Retrieved from <http://www.ala.org>
3. Averill, D., & Lewis, N. (2013). Students and Information Literacy: High School and Postsecondary Perspectives. *Maine Policy Review*, 22(1), 114-117.
4. Boyd, D.M., &Elison (2007). Social network sites: Definition, History and Scholarship. Retrieved from [www.danah.org/papers/JCMCintro.pdf](http://www.danah.org/papers/JCMCintro.pdf)

5. CECILIA PENZHORN (2013): the use of social media in teaching a campus-wide information literacy course
6. Junco, R., Heiberger, G. & Loken, E. (2010). The Effect of Twitter on college students Engagement and Grades, *Journal of Computer Assisted Learning*, pp 1-14
7. Musa A. (2016). Assessment of Nigerian academic Library Services: Performance, Challenges and Prospects: Paper Presented At the 100<sup>th</sup> Meeting of the Association of University Librarians of Nigerian Universities (AU-NU) Held on the 6-7 Nov.2016 at the north West University, Kano
8. Alexander, B. 2008. Social networking in higher education, in Katz, RN (ed). *The tower and the cloud: higher education in the age of cloud computing*. Boulder, CO: Educause, 197–201.
9. Click, A. & Petit, J. 2010. Social networking and Web 2.0 in information literacy. *International Information and Library Review*, 42:137–142.
10. McCarthy, J. 2010. Blended learning environments: using social networking sites to enhance the first year experience. *Australasian Journal of Educational Technology*, 26(6):729–740.
11. Pew Research Center, "In Changing News Landscape, Even Television Is Vulnerable: Trends in News Consumption: 1991-2012," Pew Research Center, <http://www.people-press.org/2012/09/27/in-changing-news-landscape-even-television-is-vulnerable/>.
12. Buzzetto-More, N. (2012). Understanding Social Media. In C. Cheal, J. Coughlin, and S. Moore (Eds.), *Transformation in teaching: Social media strategies in higher education* (pp. 1–18). Santa Rosa, CA: Informing Science Press.
13. Bruce, C. (2004). *Information Literacy as a Catalyst for Educational Change. A background paper*. In Danaher, Patrick Alan, Eds. Proceedings "Lifelong Learning: Whose responsibility and what is your contribution?" the 3<sup>rd</sup> International Lifelong Learning Conference, pages pp. 8-19, Yeppoon, Queensland. Retrieved June 10, 2018 from <http://eprints.qut.edu.au>
14. Oluwaseye A. J. (2018) Information Literacy Skills and Social Media use by Students in Selected Private Secondary Schools in Ibadan, Nigeria; *Covenant Journal of Library & Information Science (CJLIS) Vol. 1 No 2*. An Open Access Journal available online. Retrieved on 11/may/2019 at <https://www.researchgate.net/publication/330713156>.
15. Drury, G. (2008). Opinion piece: Social media: Should marketers engage and how can it be done effectively. *Journal of Direct, Data and Digital Marketing Practice*, 9, 274-277.
16. Tess, PA. 2013. The role of social media in higher education classes (real and virtual): a literature review. *Computers in Human Behaviour*. <http://dx.doi.org/10.1016/j.chb.2012.12.032> (Accessed 13 March 2013).
17. Safko, L. and Brake, D. K. (2009). The social media bible: Tactics, tools, and strategies for business success. *John Wiley & Sons*.
18. American Library Association Presidential Committee on Information Literacy (January 10, 1989, Washington, D.C.) L. Ursachi, E. Scutelnicu. A synergetic approach to the information literacy and social media. SMART2014, Timisoara, 18-21 September 2014.
19. G., S. S. (2017). Usage of blogging for effective Communication an evaluation.
20. [http://www.icrossing.com/uk/sites/default/files\\_uk/insight\\_pdf/files/What%20is%20Social%20Media\\_iCrossing\\_ebook.pdf](http://www.icrossing.com/uk/sites/default/files_uk/insight_pdf/files/What%20is%20Social%20Media_iCrossing_ebook.pdf)

# Academic Social Networking Sites: An Assessment

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## Abstract

**Purpose:** Rapid extension of information technology and educational research has led to emergence of scholarly social networking sites in about every discipline or subject. Each site offers its own combination of tools and capabilities to support research activities, communication, collaboration, and networking. There are scholarly social networks for academicians to create their own profiles, list their publications, and interact with one another. It provides a new way for scholars to disseminate their research work, obtain citations and name among the scientific community in the field of expertise. The purpose of the study is to study the features and services provided by some of the well-known academic social networking sites.

**Design/methodology:** Online survey was conducted to gauge the usage, features and services provided by select academic social networking sites namely ResearchGate, Academia.edu, Zotero. The study conducts the comparative study of the services and tools of select scholarly social networks.

**Findings:** ResearchGate is found to be the leading professional network with over millions of members and the community is continuing to grow at an incredible rate globally. It is also found that Academia has become essential to scholarly work as papers uploaded to Academia received 69% boost in citations over 5 years. Furthermore, findings divulge that Zotero being a reference management software help scholars and researchers to manage bibliographic data and related research materials (such as PDF files). Notable features of Zotero include web browser integration, online syncing, generation of in-text citations, footnotes and bibliographies, as well as integration with the word processors Microsoft Word, LibreOffice, OpenOffice.org Writer and NeoOffice. Hence, the article deals with the study of select academic social networking tools used by researchers.

## Keywords

Social Networking Sites, Databases, Researchgate, Google Scholar, Academia.com, Research tools.

## Introduction

A multitude of social networking sites have appeared on the Internet in recent years. Traditionally researchers make efforts through conferences and journals to make their research visible. However, due to emergence of social networks the ways of dissemination of one's research work is changing. A social network is a community established to connect people with common interests. Social networking sites take the network online providing users with the ability to set up profiles and connect with other users to form groups for sharing information and other content (Murray, 2014). As *Facebook* and *LinkedIn* that attracts broad audience have proven a great success as a place for sharing and collaboration, there are other sites that focus on specific communities of interest. One such area is that of scholarly social networking sites for academicians and researchers. Academics are increasingly using social media, and are expected to have a professional online presence (Gruzd, Staves & Wilk, 2012; Markgren, 2011). In the last decade, there has been an emergence of Academic Social Networking Sites (ASNS) (Bullinger, Hallerstede, Renken, Soeldner & Möselein, 2010; Boyd & Ellison, 2007). These sites provide several means to connect researchers, allowing them to share valuable data and publications which are otherwise difficult to access (Veletsianos, 2013). ASNSs facilitate users to organize, create profiles, display research work and connect with peers having similar research interests (Mangan, 2012). These sites have proliferated with many, such as *ResearchGate.net*, *Academia.edu* and *Zotero*. *ResearchGate*, founded in 2008, is aimed at creating a working and discovering network among scientists i.e. "Discover", "Communicate" and "Collaborate" are its main purposes. A similar project is *Academia.edu* which aims to help academics to follow the latest research in their field (Giglia, 2011). Both *ResearchGate* and *Academia.edu* allow users to post public questions to the community, much like *Quora*, another online question-and-answer site. Both networks categorize its users by institution, allowing users to see colleagues. *Academia.edu* takes affiliation a step further than *ResearchGate*, using a subdomain to indicate the institution (Ovadia, 2014). While *Zotero*'s primary purpose is to be an "easy to use tool" to help a user to collect, organize, cite, and share various research sources (Szkolar, 2012). Thus, these are some important Scholarly or Academic Social Networking Sites that can be used by academicians and researchers to disseminate their research work. Given their variety, it might be challenging for academics to evaluate and use them. This study is an attempt to assess or evaluate the features of various scholarly social networks like *ResearchGate*, *Academia.edu*, and *Zotero*. Furthermore, the study conducts the comparative study of the services and tools of select scholarly social networks.

## Review of Literature

Academic social network sites (ASNS) like *ResearchGate*, *Zotero* and *Academia.edu* are gaining great impetus among scholars of multiple disciplines as these act as electronic systems for open dissemination of scholarly practices as well as timely information sharing. Despite of the fact that these network sites provide numerous benefit, very few studies have highlighted the specific benefits of *ResearchGate*, *Zotero* and *Academia.edu* for academic and professional development among the scholarly community (**Manca, 2017**). *ResearchGate* is the professional network for researchers and scientists. This network is used by more than 15 million members to discover, share, and discuss research globally. It is come up with the mission to make research open to all (**ResearchGate, 2019**). Among the academic social network site, *ResearchGate* (RG) has its own indicator, RG Score, for its members. This score can be used for promotion, evaluation, impact, recruitment, and other similar tasks for which researchers and authors are assessed (**Orduna-Malea, Martín-Martín, Thelwall&López-Cózar, 2017**). *ResearchGate* provides a rich amount of scholarly data; employs usage data in an entirely efficient manner; struggles with the deployment of alternative, engagement metrics, such as Q&A and follower data, which can lead to reputational anomalies and; leads the field in the way it engages with the scholar (**Nicholas, Clark & Herman, 2016**). *Zotero* extracts bibliographical details of books, research articles and other scholarly information sources through browsers and helps to save references. It helps in the automatic extraction of metadata and full-text search. It facilitates users to join various intellectual groups that enable scholarly discussions, author collaborations and sharing of online research. *Zotero* website is frequently updated and users need to register their accounts before downloading the software so as to know whether each download is a unique or duplicate user (**Chen, Hayes, Larivière& Sugimoto, 2018**). *Zotero* easily transforms information to and from other web applications and services, and it runs both as offline on one's personal devices as well as a web service (**Zotero, 2018**).

*Academia.edu* is an academic platform to share scholarly content. *Academia.edu* enables its members to share their research and measure its impact. *Academia.edu* has more than 70 million members who have added 21 million papers. More than 45 million academicians visit *Academia.edu* website every month (**Academia, 2019a**).

Academic social network site *Academia.edu* facilitate scholars with the ability to highlight their scholarly content and connect and communicate with each other. In addition to the scholarly communication, *Academia.edu* enables academic information seeking eco-structure (**Thelwall&Kousha, 2014**).

## Evaluation

**Research Gate:** *ResearchGate* is the largest professional social networking site for scientists and researchers where they create their profile, share their publications, hold discussions with other scholars and can even find collaborators. Researchers here can find the first hand scholarly information and share their own. Founded in the year 2008 by physicians *Dr. Ijad Madish*,

*Dr. Soren Hofmayer* and computer scientist *Horst Fickenscher*, *ResearchGate* today has more than 5 million members and is still growing at an incredible rate (**Dembosky, 2013**).

*New York Times* defined the site as a mashup of *Facebook*, *Twitter* and *LinkedIn*. Registered members of the site can "follow" other individual members of the site and also their research interest (**Neal, 2012**). The company was started in Boston, and then moved to Berlin, Germany, shortly later. In the year 2009, the company started partnership seeding labs and its first funding was announced in September 2010 (**Hamm, 2009**).

Features:

- *Scientific Profile*: Academics design their personal profile on *ResearchGate* that encapsulates their study interests, education, projects, experiences, contact details and much more. *ResearchGate* provides other facilities like bookmark, direct messaging, notifications and blog feature. Researchers can export their curriculum vitae to their RG profile to make their profile more informative.
- *RG Score*: Publications in reputed journals determine the score of academics on *ResearchGate*. Every journal has its impact value and on the basis of impact value of the journals where we publish the research articles, RG score will increase or decrease. *ResearchGate* gives more score to the publications in the reputed journals than conference proceedings, seminars etc. RG score also gets amplified by simply asking questions or answer various questions. *ResearchGate* even provides h-index of the academics on this scientific social networking site.
- *Stats*: Another feature of *ResearchGate* is the statistics they provide for publications uploaded. Weekly stats of reads received are shown graphically to showcase the pace at which people are reading your work. Furthermore, *ResearchGate* offers the citation count feature enabling the academics to be updated about the citation they receive for their publications. People here can also recommend your work and *ResearchGate* showcases the stats for that as well.
- *Contribution*: Individual profiles enlist their publications in journals, books or any other source. Full text papers can be uploaded and kept open for audience on *ResearchGate* or only abstracts can be uploaded to restrict audience from downloading full texts.

**Academia.edu**: *Academia.edu* is a scientific social networking site for researchers to share their research papers, chart their impact, and track the research done in a particular field of study. The platform was launched in September 2008 by *Richard Price*, who raised \$600,000 from Spark Ventures, Brent Hoberman, and others. As of January 2016, *Academia.edu* has 31 million registered users and over 8 million uploaded texts (**Academia.2019b**). *Academia.edu* is the easiest approach to share papers with millions of individuals across the globe for free. The company's mission is to hasten the world's research. A study published in *PlosONE* found that papers uploaded to *Academia.edu* receive 69% boost in citations over 5 years (**Niyazov et al., 2016**). *Academia.edu* is not a university or institution for higher learning and so under current standards it would not qualify for the ".edu" top-level domain. However, the domain name "*Academia.edu*" was registered in 1999, prior to the regulations requiring .edu domain names to be held solely by accredited post-secondary institutions.

Features:

- *Personal profile*: *Academia.edu* allows researchers to create their personal profile to provide their biography, research interests and affiliation. Curriculum vitae (CV) can also be uploaded directly to personal profile of a user. In *Academia.edu*, one can contact other academics directly to interact by sending direct messages. Personal website can be generated using *Academia.edu* to increase academic visibility.
- *Analytics*: This feature of *Academia.edu* showcases the details about the visitors to the personal profile and academic publications uploaded/tagged over the last 30 days. Research impact of a researcher can also be tracked for the past 30 days or 12 months using the download count, number of unique visitors, views by country, cities and universities etc. This analytics feature also tracks the analytics for the CV of a researcher.
- *Sessions*: This feature allows researchers on *Academia.edu* to get feedback from audience to their draft paper by inviting colleagues to leave feedback as well as receive comments from readers interested. *Academia.edu* provides other facilities like bookmark, sessions, reading history and even can find friends.
- *Mentions*: Using this feature of *Academia.edu*, citation count to the uploaded publications can be tracked. Academics get notified whenever any other academicians are saying about the user and even growing reputation can be tracked using this feature of academia.

**ZOTERO**: It is free and open-source reference management software to manage bibliographic data and related research materials (such as PDF files). Notable features include web browser integration, online syncing, generation of in-text citations, footnotes and bibliographies, as well as integration with the word processors Microsoft Word, LibreOffice, OpenOffice.org Writer and NeoOffice. It is produced by the Center for History and New Media of George Mason University (GMU) (Zotero, 2019).

It is a citation management tool built into the web browser -- Firefox, Safari, or Chrome which helps to collect, organize, and share citations. *Zotero* also helps to create and format bibliographies and footnotes in a wide variety of citation styles (Chicago, MLA, APA, etc.) for research papers and research projects (The University of Chicago Library, 2018). *Zotero* can automatically download and link the reference record to associated PDFs and other files related to the reference available on the Web site. The information is then indexed within the program so that its contents are available while using *Zotero*'s search function. Additionally, *Zotero* is able to store call number information for items grabbed from an online library catalog, and any keywords on the Website linked with the particular citation (Muldrow & Yoder, 2009). Fernandez (2011) states that the open-source Reference management program *Zotero* has many powerful tools which add functionality for users who want to maintain bibliographic control.

Features:

- *Availability*: It is free software and provides different subscription models like 2GB \$20/year, 6GB \$60/year and unlimited access \$120/year.
- *Personal profile*: Users can set up individual and group profiles and share records and has free storage limit to 300MB. *Zotero* can be used by researchers, staff and students.



- *Compatibility*: It is compatible with different operating systems like Windows, Mac, Linux, Unix, BSD etc. *Zotero* uses the native language according to browser setting. It can share data with other reference management software viz *EndNote*. It has database compatibility with most of the web. It imports/exports file formats to *BibTex*, *Endnote*, *Refer*, *BibIX*, *MODS XML&RIS*.
- *Search feature*: It has advanced, field and full text pdf search facility. One can create or edit styles via citation style editor.
- *Citation Styles*: It can store Pdf's in personal citation database. It supports various citation styles like APA, Chicago/Turabian, MLA and over 6751 styles and can install upto 1,555 more from the *Zotero* style repository. In *Zotero*, one can insert references manually and then automatically generate formatted bibliographies, in-text citations and footnotes (**Zotero, 2018**).

## Conclusion

The extensive use of Social Networking has been on the rise among the new generation youth. In today's world, life cannot be imagined without *Facebook*, *YouTube*, *Instagram*, *WhatsApp*, *LinkedIn* or *Twitter* accounts. The new age of social networking culture has been well accepted and has met an enthusiastic response and acceptance. Social Networking Sites (SNS) are widely used around the world especially by the younger generation. Scholars use a number of academic and social networking applications while carrying out research. Academic social network sites (ASNS) like *ResearchGate*, *Zotero* and *Academia.edu* are gaining great impetus among the scholarly world as these act as electronic systems for open dissemination of scholarly practices as well as timely information sharing. Despite of the fact that the networking sites provide numerous benefits, very few studies have highlighted the specific benefits of *ResearchGate*, *Zotero* and *Academia.edu* for academic and professional development among the scholarly community. Thus, this study is a small attempt to fill that gap whereby it helps in identifying and understanding various features and functionalities of these ASNSs. Every social network provides its users with a profile page that can include a photo, name, basic information, interests and many other things including user's connections and social networks. ASNSs like *Academia.edu* and *ResearchGate* give scholars the ability to publicize their research outputs and connect to each other. Millions of researchers and academics (as observed in the study) have associated themselves with these scholarly social networks making it easier for them to connect with their peers, colleagues with similar interests, and many other intellectuals around the globe. These ASNSs provide a platform for the researchers where they can discuss the problems they face in their scholarly works with their peers from any part of the globe, share their works with anyone and everyone, access the works of other intellects from any part of the world, making the research community a global one. Thus, in order to remain well acquainted with the present era of ITC and knowledge explosion, development of such new platforms and upgradation of the available ones is the need of the hour and is highly recommended.

## References

1. Academia. (2019). *About Academia.edu*. Retrieved on May 26, 2019 from: <http://www.academia.edu/about>
2. Boyd, D. M., & Ellison, N. B. (2007). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication*, 13(1), 210-230. DOI: 10.1111/j.1083-6101.2007.00393.
3. Bullinger, A. C., Hallerstede, S. H., Renken, U., Soeldner, J., & Moeslein, K. M. (2010). Towards research collaboration - A taxonomy of social research network sites. *AMCIS 2010 Proceedings*, 92. Retrieved from: <https://aisel.aisnet.org/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1091&context=amcis2010>
4. Chen, P., Hayes, E., Larivière, V., & Sugimoto, C. R. (2018). Social reference managers and their users: A survey of demographics and ideologies. *PloS one*, 13(7), e0202315. DOI: 10.1371/journal.pone.0198033
5. Dembosky, A. (2013). Bill Gates leads \$35m investment in social network for scientists. *Financial Times*. Retrieved from <https://www.ft.com/content/6379b274-cd09-11e2-90e8-00144feab7de>
6. Fernandez, P. (2011). Zotero: Information management software 2.0. *Library Hi Tech News*, 28(4), 5-7. DOI: 10.1108/07419051111154758
7. Giglia, E. (2011). Academic social networks: It's time to change the way we do research. *European Journal of Physical and Rehabilitation Medicine*, 47(2), 345-349. Retrieved from: <http://hdl.handle.net/10760/16299>
8. Gruz, A., Staves, K., & Wilk, A. (2012). Tenure and promotion in the age of online social media. *Proceedings of the American Society for Information Science and Technology*, 48(1), 1-9. DOI: 10.1002/meet.2011.14504801154
9. Hamm, S. (2009, December 7). ResearchGate and its Savvy use of the Web. *Bloomberg*. Retrieved from: <https://www.bloomberg.com/news/articles/2009-12-07/researchgate-and-its-savvy-use-of-the-web>
10. Hicks, A. (2011). "Mendeley": A review. *Collaborative Librarianship*, 3(2), 127-128. Retrieved from: <https://digitalcommons.du.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1218&context=collaborativelibrarianship>
11. Manca, S. (2017). An analysis of ResearchGate and Academia.edu as socio-technical systems for scholars' networked learning: A multilevel framework proposal. *Italian Journal of Educational Technology*, 25(3), 20-34. DOI: 10.17471/2499-4324/985
12. Mangan, K. (2012, April 29). Social networks for academics proliferate, despite some doubts. *The Chronicle of Higher Education*, 58(35), 20-21. Retrieved from: <https://www.chronicle.com/article/Social-Networks-for-Academics/131726>
13. Markgren, S. (2011). Ten simple steps to create and manage your professional online identity: How to use portfolios and profiles. *College & Research Libraries News*, 72(1), pp. 31-35. Retrieved from: <http://crln.acrl.org/index.php/crlnews/article/view/8494/8776>
14. Muldrow, J., & Yoder, S. (2009). Out of Cite! How Reference Managers Are Taking Research to the Next Level. *PS: Political Science & Politics*, 42(1), 167-172. DOI: 10.1017/S1049096509090337
15. Murray, M. (2014). Analysis of a scholarly social networking site: The case of the dormant user. *Proceedings of the Southern Association for Information Systems Conference, Macon, GA, USA*. Retrieved from: <https://aisel.aisnet.org/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1023&context=aisel>

xt=sais2014

16. Neal, D. R. (Ed.). (2012). *Social Media for Academics: A Practical Guide* (1st ed., p. 28). Oxford, U.K.: Chandos Publishing.
17. Nicholas, D., Clark, D., & Herman, E. (2016). ResearchGate: Reputation uncovered. *Learned Publishing*, 29(3), 173-182. DOI: 10.1002/leap.1035
18. Niyazov, Y., Vogel, C., Price, R., Lund, B., Judd, D., Akil, A., ...Shron, M. (2016). Open Access Meets Discoverability: Citations to Articles Posted to Academia.edu. *PLoS ONE*, 11(2), e0148257. DOI: 10.1371/journal.pone.0148257
19. Orduna-Malea, E., Martín-Martín, A., Thelwall, M., & López-Cózar, E. D. (2017). Do ResearchGate Scores create ghost academic reputations? *Scientometrics*, 112(1), 443-460. DOI: 10.1007/s11192-017-2396-9
20. Ovadia, S. (2014). ResearchGate and Academia.edu: Academic Social Networks. *Behavioral & Social Sciences Librarian*, 33(3), 165–169. DOI: 10.1080/01639269.2014.934093
21. ResearchGate. (2019). *ResearchGate*. Retrieved from: <https://www.researchgate.net/about>
22. Szkolar, D. (2012, June 21). Social Networking for Academics and Scholars [Blog Post]. *INFOSPACE: The Official Blog of the Syracuse University iSchool*. Retrieved from: <https://ischool.syr.edu/infospace/2012/06/21/social-networking-for-academics-and-scholars/>
23. The University of Chicago Library. (2018). *Zotero: An overview of Zotero, a free citation manager*. Retrieved from: <https://guides.lib.uchicago.edu/zotero>
24. Thelwall, M., & Kousha, K. (2014). Academia.edu: Social network or Academic Network? *Journal of the Association for Information Science and Technology*, 65(4), 721-731. DOI: 10.1002/asi.23038
25. Veletsianos, G. (2013). Open practices and identity: Evidence from researchers and educators' social media participation. *British Journal of Educational Technology*, 44(4), 639-651. DOI: 10.1111/bjet.12052
26. Zotero. (2018). *About*. Retrieved from: <https://www.zotero.org/about/>
27. Zotero. (2019). Retrieved July 18, 2019, from Wikipedia: <https://en.wikipedia.org/wiki/Zotero>



# ICDL 2019

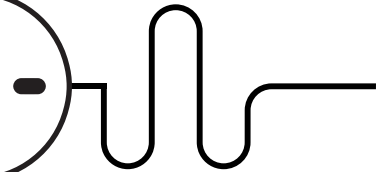
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7

Open Access



Organizer



The Energy and Resources Institute



# Open Access Tracking Project How it work ?

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Open Access is getting popular day by day in all over the world. Many discussions are happening on this topic. Many articles are publishing in various journals and newspapers. But after some period of time if we want to trace all news on open access it's really difficult. Open Access Tracking Project can solve this problem and tag all open access related news under one platform. The OATP project now in an all volunteer phase and looking taggers, especially from Asia. This paper gives detailed information about OATP , how it works and how it benefits people following the progress of open access . Through this paper we want to make awareness of OATP project.

## Keywords

OATP, Open Access, Tags

## Introduction

From long time Peter Suber (1) working as open access advocate and worked for open access through writing, speaking, research education, collaboration, research, writing, tool-building, direct assistance, and *pro bono* consulting. The Open Access Tracking Project developed by him in April 2009. All detail description about OATP project written by Peter Suber in SPARC Open Access News letter, In 2011 OATP has become part of Harvard University Open Access Project. This project got funding from Arcadia(2011-2016) and the Laura and John Arnold Foundation (2016-2018).

## What is OATP

OATP is a crowd sourced social tagging project running on open source software. It aims to capture news and comments related to open access, open data and open education around the globe.

It has two main mission-

- Create real time alerts for new developments.
- Organize knowledge of the field by tags for easy searching and sharing.

## How OATP Publish Data

OATP publish data through primary and secondary feeds. The primary feed contain recent developments (in the last six months), on every aspect of open access. Secondary feeds cover developments on selected subtopics of open access, such as OA in a certain field, OA in a certain country, or OA of certain kinds, such as policies, journals, and repositories (2).

The primary feed is available in eight file formats to serve users with different needs. Twitter is the most popular version of the primary feed.

There is a secondary feed for every project tag. But users can also create customized secondary feeds based on any Boolean combination of tags and keywords. Every feed has a simple and self explanatory URL.

## Importance of OATP

OATP help to build collection of Open Access related data at one place though this database users can export, update and search data. This project help to open access community to get information about latest development in Open Access Area. Its support for research on Open Access. This data can be shared among OA community. Its support growth of open access around the globe (3)

## What tags you can add in tag for OATP

Anything about open access: Policies, Journal articles, Articles, preprints, studies, surveys, reports, announcements, books, dissertations, datasets, calls for papers, funding opportunities, job ads, conferences, workshops, organizations, projects, tools, services, blog posts, slide presentations, videos, podcasts, wikis.

## Can I make my own Tags for OATP ?

The project supports user-defined "subtopic tags" for classifying OA-related web pages, Users also can tag in OATP to create tags they have to follow the OATP tag syntax. few example of this tag are oa.india, oa.china, oa.asia. oa.south, oa.policies, oa.data, oa.mandates, oa.paywalls (4)OATP supports feeds of any boolean combination of project tags, such as oa.india AND oa.policies, oa.india AND oa.repositories, oa.india AND oa.journals, and even more complex constructions like (oa.india OR oa.south) AND oa.plan\_s.(5)



## How to become OATP Tagger

Open account on <https://tagteam.harvard.edu/>

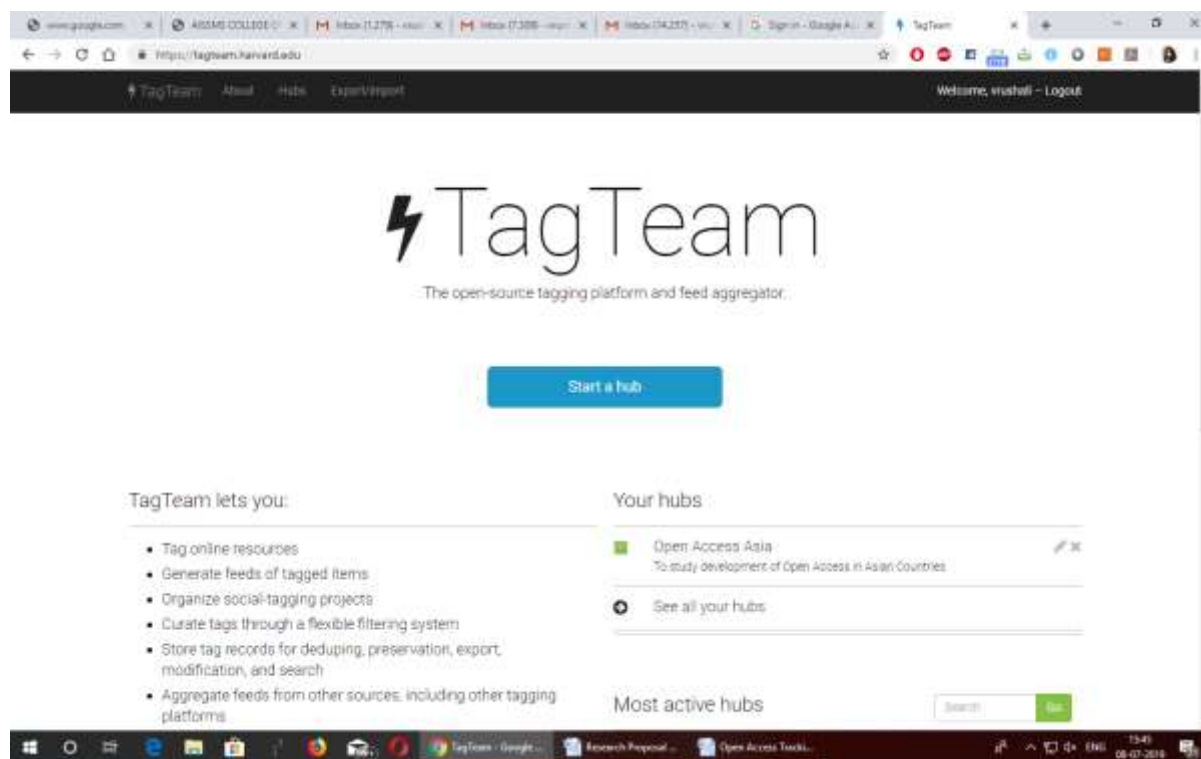
Give description about your project its required. If you want to tag for OATP, just say that. if you are not giving description your project may be denied

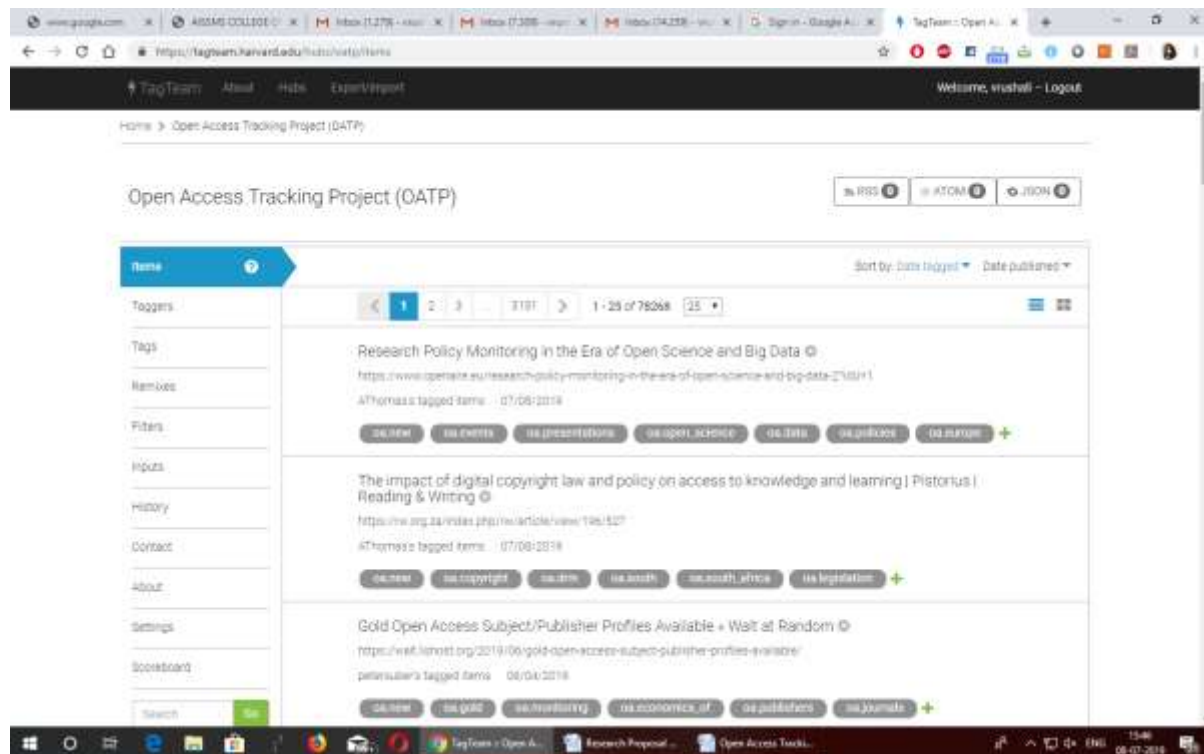
Once your account is approved in TagT team, you can create new hub or project even you can tag to existing hubs request permission to tag for OATP, which is one “hub” or project within TagTeam. Once you’re approved to tag for OATP, learn the basics about tagging for OATP. These are collected in the OATP “getting started” handout. (6) and follow basic four steps given on getting started handout link.

## How to become OATP Tagger

Open account on <https://tagteam.harvard.edu/>

Give description about your project its required if you are not giving description your project may bdenied. Once your account is approved in Tag team you can create new hub or project even you can tag to existing hubs (4) more information is available on <http://bit.ly/oatp-start-tagging>.

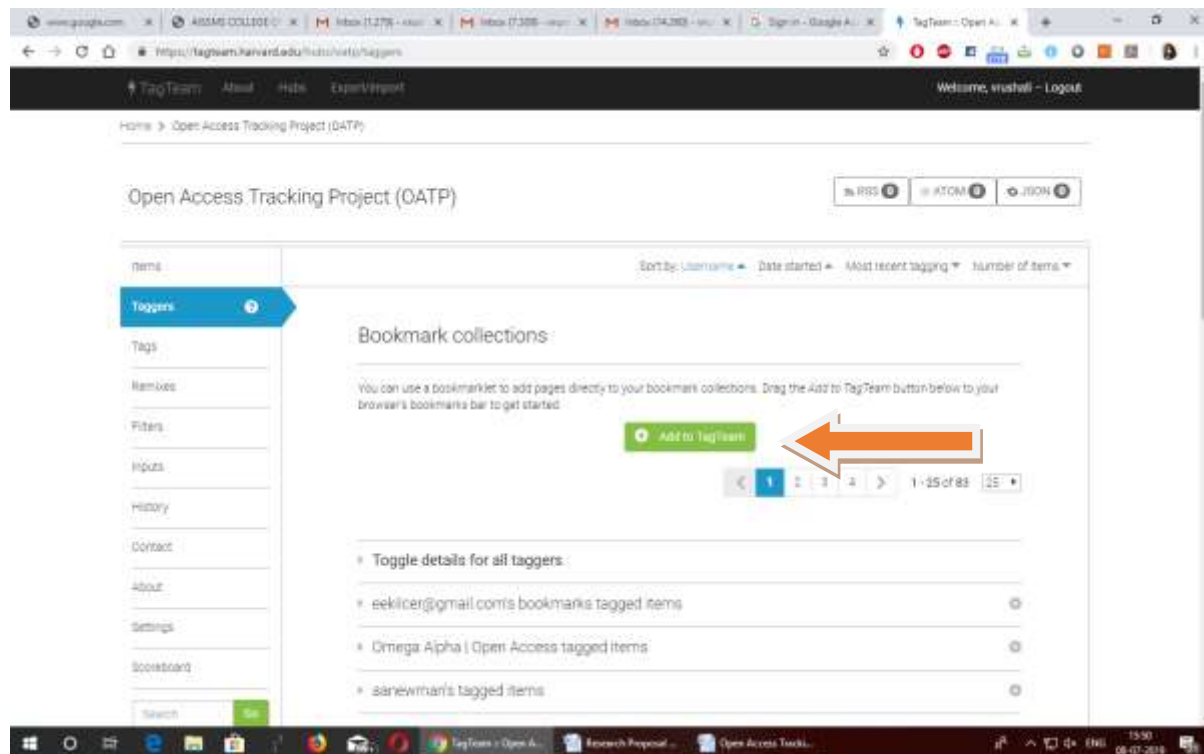




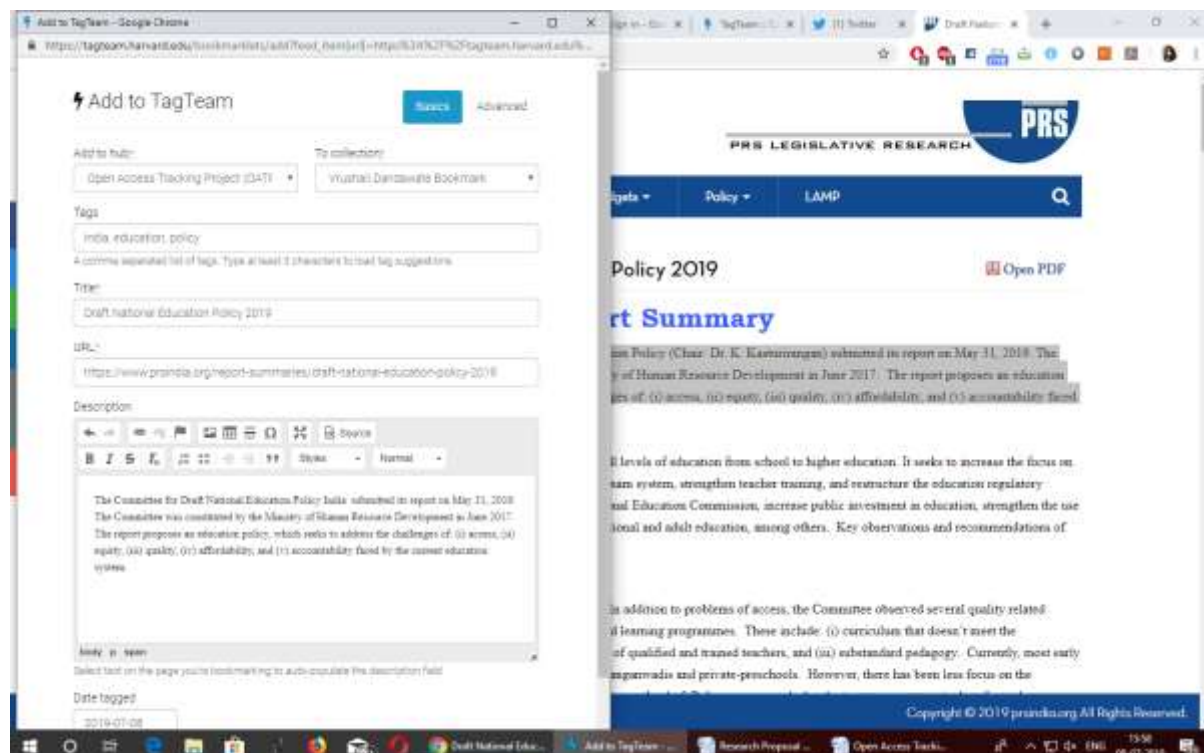
## How to install the tagging book marklet on your browser

- Login in to TagTeam and enter the OATP hub.
- Click on Taggers.
- Drag the “Add to TagTeam” icon to your browser toolbar.

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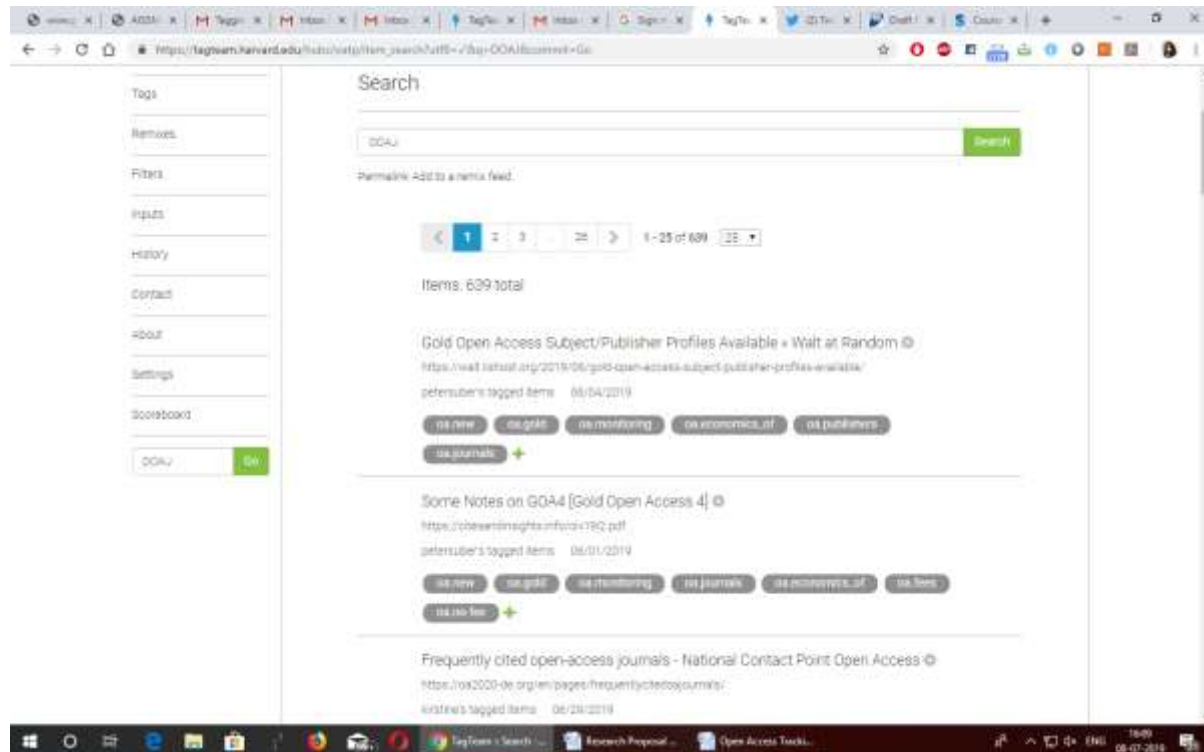


When you visit a page you want to tag, click on the tagging icon on your browser toolbar. The tagging form will pop up. Just fill it in.



## How to search OATP

Put a keyword in search system it show number of records with details



To search for a tag, precede it with the “#” character, such as “#oa.india”.

## Conclusion

OATP is really helpful project which is useful for academic field. OATP has very less response from India. Many development are happening in India related to Open Access. Somewhere this work to be archived or stored in searchable format and OATP is best solution for this. OATP is inviting volunteers who can tag to tag team regularly please come and join the team.

## Reference

1. [https://cyber.harvard.edu/~psuber/wiki/Peter\\_Suber](https://cyber.harvard.edu/~psuber/wiki/Peter_Suber)
2. [https://cyber.harvard.edu/hoap/OATP\\_introduction](https://cyber.harvard.edu/hoap/OATP_introduction)
3. [https://cyber.harvard.edu/hoap/Why\\_tag\\_for\\_OATP](https://cyber.harvard.edu/hoap/Why_tag_for_OATP)
4. [https://cyber.harvard.edu/hoap/OATP\\_tags](https://cyber.harvard.edu/hoap/OATP_tags)

5. Hulagabali, Santosh C. (2019 June, 29). Peter Suber: The largest obstacles to open access are unfamiliarity and misunderstanding of open access itself. Interview Retrieved from: <https://openinterview.org/2019/06/29/peter-suber:-the-largest-obstacles-to-open-access-are-unfamiliarity-and-misunderstanding-of-open-access-itself/>

6. [https://cyber.harvard.edu/hoap/Get\\_started\\_as\\_a\\_tagger](https://cyber.harvard.edu/hoap/Get_started_as_a_tagger)

## Acknowledgement

I would like to express my sincere *thanks to Peter Suber, Director, Office for Scholarly Communication, Director, Harvard Open Access Project Harvard University for reviewing manuscript and giving his valuable suggestions.*

# Faculty perception, adoption and usage of open access scholarly publishing: Bibliometric analysis from last 10 years in academia

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## Abstract

The study aims to analyze the research output regarding Faculty Perception, Adoption and Usage of Open Access Scholarly Publishing from 2009 to 2018 in academia. Data were collected from Microsoft Academic Search database and were resulted by using descriptive statistics. Total of 234 research article were analyzed in this study. The findings revealed that during the period of study the publication output data are maximum of Library and Information Science (65%) sub-domains, followed by Computer Science (21%), Health Science (6%), Engineering (5 %) and Management (3%). Based on the citation, the results showed that 10 authors were considered as most productive authors, “Open Access Issues and Engineering Faculty Attitudes and Practices” was highly cited paper, “Journal of Librarianship and Scholarly Communication” was ranked 1<sup>st</sup> position in terms of 51 total citation scores and “University of Illinois at Urbana–Champaign” was highly cited institution.

## Keywords

Open Access, Scholarly Publishing, Bibliometrics, Faculty Engagement, Open Data

## Introduction

Scholarly communication has changed dramatically since the development of the Internet. The ability to publish, access and store scholarly works digitally has transformed not only how libraries store information, but how academic research is published. Libraries, traditionally storehouses of print publications, are expanding services by collecting digital content and are becoming content providers by digitizing archival and special collections. By providing access to electronic documents, libraries are adding to the choice and diversity of scholarly publishing. Different models are being developed to provide access, manage costs and manage the scholarly

output of institutions – especially at colleges and universities providing faculty members with multiple avenues for publishing the research that they do.

Electronic publishing and electronic access have brought tremendous changes in scholarly communication. In the traditional model, researchers submitted scholarly articles to publishers and frequently signed away any copyright control in order to publish. Scholarly publishers then sell the content back to the academic community, primarily libraries, through print and now electronic journal subscriptions. The development of the Internet and the use of electronic documents that can be stored online have changed the way researchers share and publish material. Researchers can easily email articles and papers directly to a colleague or post copies in online repositories to share within a scholarly community. Organizations and groups have developed to assist researchers and promote free access to scholarly materials.

The term "open access" denotes free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself [1]. Today, open access journal has also gained its momentum by having their own impact factor and also indexed in various databases such as Web of Science and Scopus. Driven by this development, the growth rate for the open access journal has increased rapidly over the year and regarded as phenomena in today's scholarly publishing landscape.

Academicians and scholars have shown great interest, signaling their acceptance on this mode of publishing. One of the most highlighted advantages of open access journal is the free access to the journal content. Unlike the traditional publishing model where users have to pay, open access journal allows free access to almost everyone. Restrictions or barriers that are normally created through subscriptions have been totally eliminated, hence accelerating the pace of dissemination and creation of knowledge. The cost of journal subscriptions can now be used by the libraries for other development activities.

Faculty members may choose to share scholarly works through an open access repository or through an individual website or blog. Essentially, a repository is a digital library of scholarly content that is freely available. Materials may be placed in a subject repository hosted by a scholarly association or in an institutional repository (IR), hosted by a college, university, or research organization. In addition to formal repositories, many researchers host or post their own works on a personal website that may be associated with the university or belong to the individual faculty member.

There have been several studies on faculty perception towards open access publishing. Nicholas and Rowland [2] found that the more faculties published literature on open access publishing, the more research momentum has been achieved worldwide through faculty perception, adoption and usage of open access scholarly publishing over the past years. Due to the growth of the subjects and the trend towards inter disciplinary nature of research, the literature concerning the open access publishing is not only widely scattered in large number of periodicals, but also widely scattered by country, language and is recorded on a variety of media. Therefore, present study is an attempt to examine the growth pattern of literature in academia on faculty perception, adoption and usage of open access scholarly publishing from 2009-2018 through bibliometric lens.

The term ‘Bibliometrics’ was first coined by Alan Pritchard in 1969. According to him, bibliometric is- "the application of mathematics and statistical methods to books and other media of communication"[3]. It is the quantitative analysis of academic literature to traces the relationships between documents, journals or other channels of scholarly communications [4,5]. Bibliometric analysis is helpful in identifying research trends, growth pattern and performance of scholarly journal. It is often used to identify the pattern of publications, authorship, citations and journal coverage with the hope to give an insight in to the dynamics of the field under consideration [6]. Železnik, Vošner and Kokol [7] in their recently published article described bibliometrics as- “a method used to present research literature production visually by using a variety of bibliometric maps and to, in this way, provide an overview of the publications.”

## Objectives

The main objective of this study is to analyze the research output concerning faculty perception, adoption and usage of open access scholarly publishing during 2009-2018 in academia.

The specific objectives of this study are:

- to examine the distribution of output in different subject domain
- to study the research communication in highly productive journals
- to study the contribution and citation impact of its most productive institutions
- to identify the most popular paper concerning the topic

## Materials and Methods

Data were collected from Microsoft Academic Search database for the period 2009-2018. Microsoft Academic Search is a database providing access to research paper, article, review, conference paper etc. ranging from different academic disciplines.

The search string used was:

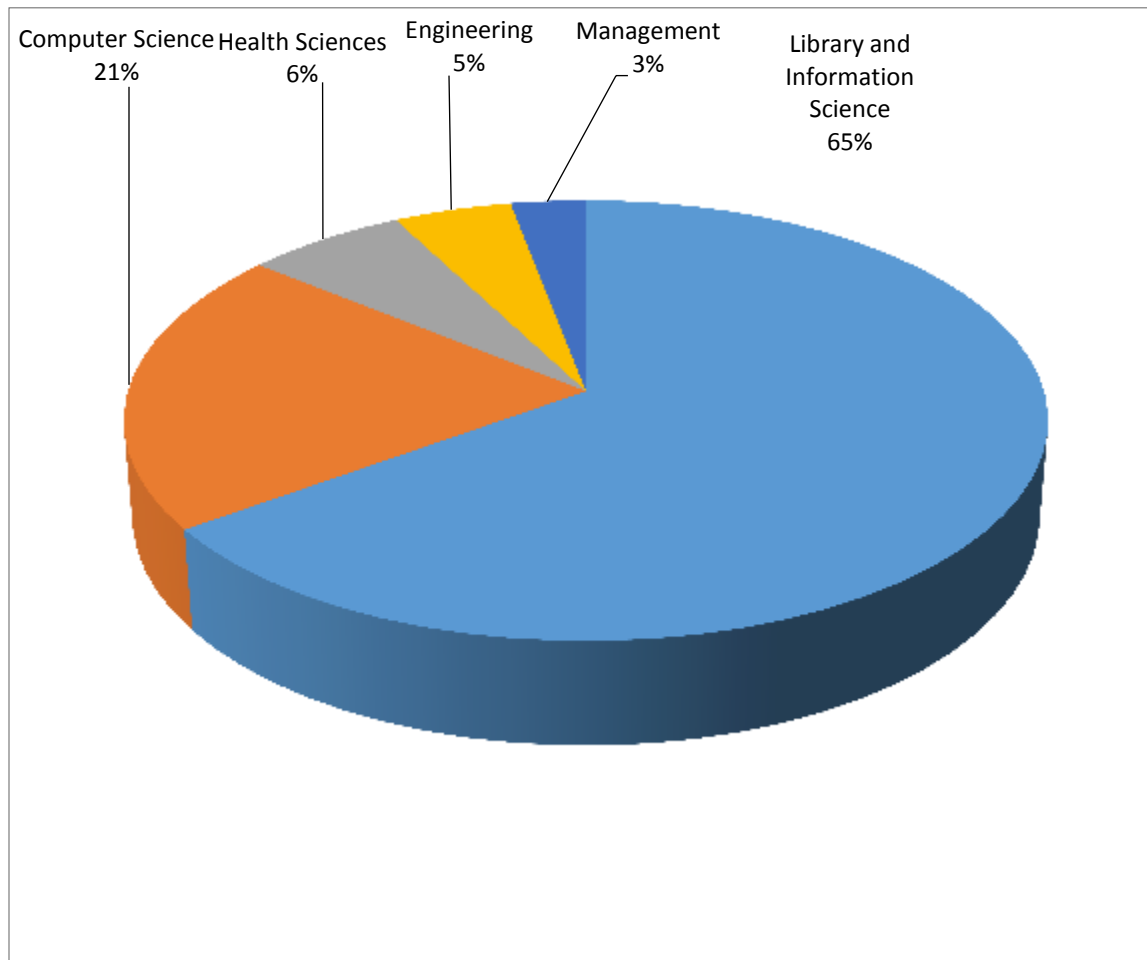
(Faculty AND Open Access OR Publishing OR Adoption OR Agriculture, Multidisciplinary OR Usage). A total of 234 research article were found. A bibliometric analysis was performed to reveal the trends faculty perception, adoption and usage of open access scholarly publishing from the following perspectives: publication outputs, subject categories and major journals, author productivity, geographic and institutional distribution of publications. To meet the aforementioned objectives, the data were organized, calculated, tabulated, analyzed and presented by using descriptive statistics for the result.



## Result

### ***Subject Domain Distribution***

Based on the classification of subject categories in Microsoft Academic, the publication output data of was classified into five sub domains (Figure 1) during 2009-2018. Result shows that during the period of study sub-domains has been distributed as: Library and Information Science (65%), Computer Science (21%), Health Science (6%), Engineering (5 %) and Management (3%).



**Figure 1.** Subject-wise Distribution of Papers

### ***Author productivity***

Highly cited authors typically, are authored by a large number of researchers, often involving international collaboration. The focus here is on citations of publications rather than citations of specific authors. A primary reason for this emphasis is that the publication citation count reflects on the publication itself, while the author citation count reflects ancillary features, such as the total number of author publications, the quality of each of these publications, and co-author

attributes [8]. Thus this study attempted to get insight on the citation distribution of individual authors was argued to have a stretched exponential tail.

A total of 10 authors were considered as most productive author based on the citation. Authors citation more than 7 were considered as prolific authors in this study. Among the 10 most prolific authors, Wilhelm Peekhaus from University of Wisconsin-Madison, Mary C. Schlembach and William H. Mischo, University of Illinois at Urbana–Champaign were the most productive author with citation of 24 each followed by Frederik Questier from Vrije Universiteit Brussel Sarah Beaubien and Max Eckard from Grand Valley State University, with citation of 20 each; Yu Li and Zheng Ye (Lan) Yang from Texas A&M University with citation of 17 both; Edda Tandilwoga from Muhimbili University of Health and Allied Sciences with citation of 9; Richard C. Doty from Georgia Institute of Technology with citation of 7.

**Table 1.** Most productive Author

Author	Times Cited	Affiliation	Country
Wilhelm Peekhaus	24	University of Wisconsin-Madison	USA
Mary C. Schlembach	24	University of Illinois at Urbana–Champaign	USA
William H. Mischo	24	University of Illinois at Urbana–Champaign	USA
Frederik Questier	20	Vrije Universiteit Brussel	Belgium
Max Eckard	20	Grand Valley State University	USA
Sarah Beaubien	20	Grand Valley State University	USA
Yu Li	17	Texas A&M University	USA
Zheng Ye (Lan) Yang	17	Texas A&M University	USA
Edda Tandilwoga	9	Muhimbili University of Health and Allied Sciences	Tanzania
Richard C. Doty	7	Georgia Institute of Technology	USA

### **Highly Cited Paper**

Studies revealing highly cited papers have become now widespread in many disciplines therefore countries, funding agencies, institution and universities are trying to measure research performance and recognize top researchers and research impact [9] could provide interesting information about the contributors, articles and topics which are influential in the research community during a certain period [10]. To understand these characteristics, the common approach used is the bibliometric method. In this study table 2 indicates the highly cited paper concerning faculty perception, adoption and usage of open access scholarly publishing.

**Table 2.** Highly Cited Paper

<b>Paper</b>	<b>Author</b>	<b>Year</b>	<b>Times Cited</b>
Open Access Issues and Engineering Faculty Attitudes and Practices	Mischo, W. H., &Schlembach, M. C.	2011	24
Addressing Faculty Publishing Concerns with Open Access Journal Quality Indicators	Beaubien, S., &Eckard, M.	2014	20
University Faculty Awareness and Attitudes towards Open Access Publishing and the Institutional Repository: A Case Study	Yang, Z. Y., & Li, Y.	2015	17
A “librarian-LIS faculty” divide in open access practice	Xia, J., Wilhoite, S. K., & Myers, R. L.	2011	17
How library and information science faculty perceive and engage with open access	Peekhaus, W., &Proferes, N.	2015	17
Business Faculty’s Attitudes: Open Access, Disciplinary Repositories, and Institutional Repositories	Hahn, S. E., & Wyatt, A.	2014	12
Faculty adoption and usage behaviour of open access scholarly in health sciences Universities	Lwoga, E. T., &Questier, F.	2014	11
Open access behaviours and perceptions of health sciences faculty and roles of information professionals	Lwoga, E. T., &Questier, F.	2015	9
Tenure-Track Science Faculty and the ‘Open Access Citation Effect	Doty, R. C.	2013	7
An examination of North American Library and Information Studies faculty perceptions of and experience with open-access scholarly publishing	Peekhaus, W., &Proferes, N.	2016	7

### ***Highly Cited Journal***

The Journal Impact Factor (JIF), introduced by Eugene Garfield [11] and then published in the Journal Citation Reports (JCR) by the Institute for Scientific Information (ISI), is the most common indicator for journal significance and impact. The JIF is defined to be the number of citations in the current year to journal articles published over the previous two years divided by the number of articles published in these two years. The most productive journals published at least 5 papers on the given topic listed in Table 2. These top 10 journals with citation  $\geq 5$  together received 165 citation contributed 70.52% of the total output. Out of top 10 productive journals, Journal of Librarianship and Scholarly Communication has been ranked 1<sup>st</sup> place in terms of number 51 total citation scores. Based on the citations Journal of Library Administration holds the 2<sup>nd</sup> position (24), followed by Journal of Documentation (17), Journal of Information Science (17), New Library World (14), Journal of Business & Finance Librarianship (12), Health Information and Libraries Journal (9), IFLA Journal (9), Library & Information Science Research (7) and College and research libraries (5).

**Table 3.** Highly Cited Journal

<b>Name of Journal</b>	<b>Times Cited</b>
Journal of Librarianship and Scholarly Communication	51
Journal of Library Administration	24
Journal of Documentation	17
Journal of Information Science	17
New Library World	14
Journal of Business & Finance Librarianship	12
Health Information and Libraries Journal	9
IFLA Journal	9
Library & Information Science Research	7
College and research libraries	5
Other	69
Total	234

### ***Highly Cited Institutions***

Bibliometric methods are widely implemented for institutional research evaluations and citation counts are popularly used as a proxy for research impact. The citation can be used for evaluating institutional impact [12]. Table 3 shows that the leading 10 institutions were involved towards publications. These 10 prolific institutions considering the number of papers with citation  $\geq 7$  are: University of Illinois at Urbana–Champaign, University of Wisconsin–Milwaukee (TC= 24 each), followed by Grand Valley State University (20), Indiana University – Purdue University Indianapolis (18), Ivy Tech Community College of Indiana (17), Texas A&M University (17), University of Oklahoma (12) and Muhimbili University of Health and Allied Sciences (9).

**Table 4.** Highly Cited Institution

<b>Institution</b>	<b>Times Cited</b>
University of Illinois at Urbana–Champaign	24
University of Wisconsin–Milwaukee	24
Grand Valley State University	20
Indiana University – Purdue University Indianapolis	18
Ivy Tech Community College of Indiana	17
Texas A&M University	17
Ivy Tech Community College of Indiana	17
University of Oklahoma	12
Muhimbili University of Health and Allied Sciences	9
Vrije Universiteit Brussel	9
Georgia Institute of Technology	7

## Conclusion

The purpose of this study was to analyze the research output regarding Faculty Perception, Adoption and Usage of Open Access Scholarly Publishing from 2009 to 2018 in academia. Over the period studied, it is evident that the researchers engaged in studied theme has grown owing to an increase in the number of papers published by the academia. The study findings indicated that faculties are positive about adopting and using open access.

Open Access contents are used for different purposes such as to establish and confirm facts, reaffirm the results of previous work, solve new or existing problems and to develop new theories, amongst others. As a consequence, faculties prefer Open Access to search for appropriate and meaningful data for academic work and disseminate study results. This has severe consequences for academic work and disseminate study results. This has severe impact for academic acceptance. As an exploratory study, this study also has some limitations. First of all, the more in-depth study of keywords and citation behavior might be done for better understanding. Notwithstanding its limitation, this study may have potential usefulness in uncovering the research fields of open access scholarly publishing.

## References

1. Budapestopenaccessinitiative.org. (2019). **Budapest Open Access Initiative**[online] Available at: <https://budapestopenaccessinitiative.org/> [Accessed 6 Sep. 2019].
2. Nicholas D, Rowlands I. **Open Access Publishing: The Evidence from the Authors**. The Journal of Academic Librarianship. 2005;31(3):179-181.
3. Pritchard A. **Statistical Bibliography or Bibliometrics?** Journal of Documentation. 1969;25(4): 348-349.
4. De Bellis N. **Bibliometrics and citation analysis**. Lanham, Md.: Scarecrow Press; 2009.
5. Tsay M Y. **A bibliometric analysis on the Journal of Information Science**.Journal of Library and Information Science Research. 2011;5(2): 1-28.
6. Warraich N F, Ahmad S. **Pakistan Journal of Library and Information Science: A bibliometric analysis**. Pakistan Journal of Library and Information Science. 2011;12(1): 1-7.
7. Železnik D, BlažunVošner H, Kokol P. **A bibliometric analysis of the Journal of Advanced Nursing, 1976-2015**.Journal of Advanced Nursing. 2017;73(10):2407-2419.
8. Redner S. How popular is your paper? **An empirical study of the citation distribution**. The European Physical Journal B. 1998;4(2):131-134.
9. Noorhidawati A, M.K. Y, Zahila M, Abrizah A. **Characteristics of Malaysian highly cited papers**. Malaysian Journal of Library & Information Science. 2017;22(2):85-99.
10. Smith D. **Citation indexing and highly cited articles in theAustralian Veterinary Journal**. Australian Veterinary Journal. 2008;86(9):337-339.
11. Garfield E. **The History and Meaning of the Journal Impact Factor**.JAMA. 2006;295(1):90.
12. van Raan A. **Comparison of the Hirsch-index with standard bibliometric indicators and with peer judgment for 147 chemistry research groups**. Scientometrics. 2006;67(3):491-502.

# Does availability of open access scholarly literature affect citation impact?

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## Abstract

This paper reviewed the studies published on citation impact of Open Access (OA) publishing and examined any positive or negative relation between OAthe availability of publications and their citation counts. 57 articles on the theme were identified and collected from different sources, of which 11 were excluded as they were not either relevant to the theme or met the selection criteria. Remaining 46 article were finally selected for review. Each article was thoroughly reviewed on the following parameters: study objective, sample/methods/approach, findings, attribution of advantage to a particular OA component. The findings of the studies included in this paper indicate that there is obvious citation advantage of OA articles. OA articles received more citations than subscription-based articles. However, the difference between number of citations of OA and non-OA publications is dependent on the age of OA availability of publications, and there is variation in the citation counts across disciplines, institutions and journals.

## Keywords

Open Access; Citation Advantage; Citation Impact; Citation rate.

## Introduction

The growth of scholarly publications primarily in the form of articles in peer-reviewed journals and research articles is often evaluated through the number of scientific work in journals and their citations. With the advent of the Internet many researchers are making their research openly accessible by publishing their research output in open access journals and self-archiving to increase its visibility, usage and citation impact. OA literature is digital, online, free of charge, and free of most copyright and permitting limitations. Open access resources are electronic resources which are freely accessible without any restrictions. User can read, download, copy,

disseminate, print, search, or link to full texts of these articles, no need to pay either by the institution or individual. There are three roads to OA: Green, Gold, and Hybrid OA. Green road to OA, also known as self-archiving, refers to the practice of providing OA to a version of a work published in a closed – access (subscription) journal by depositing it in a repository. Gold road to OA refers to the primary publication of the articles in OA journals, monographs, or as contributions to openly accessible edited volumes or conference proceedings. Hybrid road to OA is new OA publishing model where some articles in a subscription journal are made OA on payment of an Article Processing Charge (APC) (Suber, 2007).

Since the early 1990s Open Access journal publishing has been growing at a far faster rate than traditional subscription journal publishing. OA brought radical change in the information use behavior of the researchers and academics. It gives them greater freedom to share their ideas as well as their research work. It provides free of charge and unrestricted access to researchers and their publications without copyright restrictions, which increased citations of their research work. The publishing policies of OA improve the impact of scholarly literature because scholars publish their scientific articles without the expectation of payment. This paper aims to review the studies on OA availability of publications and its impact on citations counts.

Citation impact quantifies the citation usage of scholarly works. Citation impact can be used as a measure of the impact of an article within particular field. An article is being widely read and cited is an indication that it has influence on other researchers within the field. The research on citation impact of OA journals started in the late 1990s, but the researches have started conducting extensive research in this area since 2000. However, increasing citation impact of articles or journal is not the only benefit of self-archiving or making research openly accessible, it also increases the accessibility of research work that is freely available for anyone to read. Many studies have been conducted on the impact of open access publishing in terms of citation advantage. In 2001, Lawrence firstly claimed that OA papers have an advantage in citation count and found that OA articles tend to have more citations than subscription-based articles. (Lawrence, 2001). The researchers has analyzed OA citation advantage across disciplines, institutions, journals, etc.

## Study Objectives

Specific objectives of the study are as:

1. To examine the current trends of research in OA publishing and its citation impact
2. To examine whether there is any positive or negative relation between OA availability of publications and numbers of citations.

## Methodology

To accomplish the study objectives, research articles on OA publishing and its impact on citation



counts were identified through different sources such as Emerald Insight, JSTOR, Science Direct, Google Scholar, etc. Total 57 articles on the theme were identified and collected. 11 articles were excluded as they were not either relevant to the theme or met the selection criteria. Remaining 46 articles were selected for the review. Each article was thoroughly reviewed on the following parameters: study objective, sample/methods/approach, findings, attribution of advantage to a particular OA component. All the selected articles were published during 2005-2018. These articles were read and summarized, and the following categories of information were noted: (i) Author(s), year and title of the study; (ii) Discipline area; (iii) Sample of the study; (iv) Basic analytical approach; (v) Citation advantages of Open Access; (vi) Attribution of advantage to a particular OA component. In the next step statements that explicitly described issues relevant to the citation advantages of OA were identified within each article. After that all the data from the articles had been coded analyzed and presented in table 1. Summary of the findings highlighting positive or negative impact of OA publishing on citation counts is given in table 2.

**Table 1.** Description of the studies on citation impact of Open Access publications

Study	Disciplinary Area	Sample	Basic Analytical Approach	Citation Advantages?	Attribution of advantage to a particular OA component?
Hajjem, C., Harnad, S., & Gingras, Y. (2005). Ten-Year Cross-Disciplinary Comparison of the Growth of Open Access and How it Increases Research Citation Impact.	Biology, Psychology, Sociology, Health, Political Science, Economics, Education, Law, Business, Management	1,307,038 articles	Analyzed 1,307,038 articles published across 12 years (1992-2003) in 10 disciplines. A robot was designed that searches the Web for full-texts using reference metadata and citation data from the Institute for Scientific Information (ISI) database.	The percentage of OA articles in the 10 disciplines was between 5% and 16% and that OA is associated with citation impact that is 36% to 172% higher. The other variables, such as, download counts, journal citation averages, article quality, co-citation measures, hub/authority ranks, growth rate, longevity, and other new impact measures generated by the growing OA database.	Not Examined
Metcalfe, T.S. (2005). The Rise and Citation Impact of astrophysics in Major Journals.	Astronomy	Around 7000 articles from 13 major astronomy journals	Compared citations to articles in 13 astrophysics journals with citations to articles in those journals that had also been made OA by posting in the arXiv. Time elapsed for citations to accrue: tracked citations from publication over 12 years.	The study found a two-fold difference. And article from higher-impact journals get a proportionately higher boost from being made Open Access by being posted to the arXiv. Higher-impact journal articles not posted to arXiv are cited less often than those from lower-impact journals posted to arXiv.	Not Examined
Sahu, D.K., Gogtay, N.J., & Bavdekar, S.B. (2005). Effect of open access on citation rates for a small biomedical journal.	Medicine	One journal the of Postgraduate Medicine	Measured citations per volume per year and per 100 articles per year, before and after the journal went Open Access. Time elapsed for citations to accrue: from publication for 15 years.	The study found that OA articles have been cited 3 times to 4.5 times more than non-OA articles.	Not Examined
Davis, P.M. & Fromerth, M.J. (2006). Does the arXiv lead to higher citations and reduced	Mathematics	2765 articles in 4 journals	Compared citations to articles in the journals with citations to articles published in those journals but also posted to arXiv. Time elapsed for citations to accrue: 6 months to 8 years	Mean increase is 35% (number of citations to each article increased from between 0.8 to 2.1, giving a mean increase of 1.1, corresponding to a 35% increase overall)	Explored Early Advantage and Quality Advantage. The results suggest that

publisher downloads for mathematics articles?					the “OA effect may be severely limited to highly-cited articles” i.e. the best articles get the greatest citation benefit. This confirms the Quality Advantage but there is no empirical evidence that this Quality Advantage effect is also a Selective Bias effect.
Eysenbach, G. (2006). Citation advantage of open access articles.	Science	1,492 articles	Longitudinal bibliometric analysis of OA and non- OA articles published between June 8, 2004, and December 20, 2004. Citation data were compared between the two groups at three different points in time: at (December 2004, 0–6 month after publication), in April 2005 (4– 10 month after publication), and in October 2005 (10–16 mo after publication).	Immediate OA articles have higher impact than self-archived or other openly accessible articles. OA articles are more immediately recognized and cited by peers than non-OA articles published in the same journal.	Indirectly supports policies of granting agencies which made OA publishing mandatory.
Henneken, E.A., Kurtz, M.J., Eichhorn, G., Accomazzi, A., Grant, C., Thompson, D., & Murray, S.S. (2006). Effect of E-printing on Citation Rates in Astronomy and Physics.	Astronomy and physics	All articles published in 2 astronomy and 2 physics journals	Tracked citations to these articles over 20 years, covering the periods before and after the arXiv was established. Time elapsed for citations to accrue: from publication over 20 years	On average, articles posted on arXiv were ‘cited more than twice as often as those published only in the journals. The study also found that articles in arXiv are read more and cited more	The authors suggest that the results support their suggestion from previous studies that in physics the best articles are made OA earliest, giving them a significant citation advantage
Metcalfe, T.S. (2006). The Citation Impact of Digital Preprint Archives for Solar Physics Papers.	Solar physics	171 articles in the test set and 170 articles in the control set	Compared OA to non-OA articles. OA articles were made OA either in the arXiv or in Montana State University’s solar physics Open Access archive. Time elapsed for citations to accrue: 2+ years	Articles posted to MSU’s archive gained 1.7 times as many citations as non-OA articles and those posted to arXiv received 2.6 times as many citations	Not Examined
Zhang, Y. (2006). The Effect of Open Access on Citation Impact: A Comparison Study Based on Web Citation	Communication	1 OA journal, and 1 Non-OA journal	To examined the impact advantage of Open Access Compared Web citations to articles in an OA journal, the Journal of Computer-Mediated Communication (JCMC), and a traditional access journal, New Media & Society (NMS), in the	JCMC are significantly higher than those for NMS. It receives significantly higher Web citations than NMS does.	It proves that the OA journals have impact advantage in developing countries. Compared

Analysis.			communication discipline.in 2005		with NMS, JCMC has more Web citations from developing countries
Kurtz, M.J., &Henneken, E.A. (2007). Open Access does not increase citations for research articles from The Astrophysical Journal.	Astronomy	4271 articles	Compared citations to articles published in the Astrophysical Journals prior to and after 1 January 1998, when the journal switched from Open Access to toll-access. These articles were matched with counterparts that had also been made Open Access by posting in arXiv. Time elapsed for citations to accrue: 9 to 10 years.	Found that posting in arXiv raised citations two-fold but citations to articles in the journal before and after it switched to subscription access did not change. These authors have previously pointed out that all astronomy researchers have access to all astronomy journals anyway, meaning that the kind of access they have (Open or subscription) makes no difference.	Posting in arXiv brings a twofold increase in citations, and this is likely to be the Early Access effect.
Lin, S.K. (2007). Editorial: Non-Open Access and Its Adverse Impact.	Molecular science	Two journals	Looked at papers published in 2005 and 2006 under the 'hybrid OA' scheme that these journals had at the time. Time elapsed for citations to accrue: 12 to 24 months	In that period, the number of OA articles in the journals declined and the journals' Impact Factor reduced concomitantly. As a result, the publisher has made all articles in these journals Open Access and expects the Journal Impact factors for rise accordingly	Not Examined
Moed, H.F. (2007). The Effect of "Open Access" on Citation Impact: An Analysis of ArXiv's Condensed Matter Section.	Physics	74,521 papers	Analyzed the effect of two factors, "early view" and "quality bias," on differences in citation impact between these two sets of papers, and to discriminate between an "open access" effect and an early view effect, longitudinal citation data were analyzed covering a time period as long as 7 years.	It provided evidence of a strong quality bias and early view effect. Correcting for these effects, there is in a sample of six condensed matter physics journals studied in detail no sign of a general "open access advantage" of papers deposited in ArXiv. ArXivaccelerates citation due to the fact that ArXiv makes papers available earlier rather than makes them freely available.	Not Examined
Piwowar, H.A., Day, R.S., &Fridsma, D.B. (2007). Sharing Detailed Research Data Is Associated with Increased Citation Rate.	Clinical trials	Journal articles describing 85 microarray trials	Looked at the availability of Open Data supporting the articles to see if this correlated with citation impact. Time elapsed for citations to accrue: 4 to 7 years.	Publicly-available datasets (open data) are significantly associated with a 69% increase in citations to articles that the data accompany. This correlation is independent of Journal Impact Factor, country of authors and time since publication.	Not Examined
Tonta, Y., Ünal, Y., & A. U. (2007). The Research Impact of Open Access Journal Articles.	Biology, economics, physics, mathematics, chemical engineering, environmental science, sociology, psychology, anthropology	270 articles (30 from each discipline)	Looked at citations to articles randomly picked from journals listed in the Directory of Open Access Journals. Time elapsed for citations to accrue: 4 to 8 years.	Not measured directly. The study examined whether there is a relationship between OA citation impact and the characteristics of the subject field: that is, is there an OA citation difference between 'hard, urban' subjects and 'soft, rural' ones.	Not Examined
Cheng, W.H., &Ren, S.L. (2008). Evolution of open access publishing in Chinese scientific journals.	Medicine, biology, agricultural sciences, chemistry and a set of university-produced journals	240 Chinese Open Access journals It contained 91 fully OA journals and 139 hybrid OA journals	Examined citations, immediacy index and Journal Impact Factor for OA journals and non-OA journals in the 4 fields and in the set of university-produced journals. Time elapsed for citations to accrue: 2 years (basing approach on the Journal Citation Index methodology for calculating Journal Impact factor).	There was an approximately two-fold increase in citations for OA journals.	Not Examined
Davis, P.M., Lewenstein, B.V., Simon,	All	247 articles and reviews	Random assignment on online publication of articles published in 11 scientific journals to open	Open access publishing may reach more readers than subscription access publishing. No evidence was found of a citation	Open access articles on the American

D.H., Booth, J.G., Connolly, M.J.L. & Godlee. (2008). Open access publishing, article downloads, and citations: randomized controlled trial		published in 11 journals of the American Physiological Society	access or subscription access to measure the effect of free access to the scientific literature on article downloads and citations.	advantage for open access articles in the first year after publication. The citation advantage from open access reported widely in the literature may be an artifact of other causes.	Physiological Society's journals website are indicated by an open green lock on the table of contents page. These may signal something about the quality of the article to potential readers and therefore created a positive bias on download counts.
Frandsen, T.F. (2008). The integration of open access journals in the scholarly communication system: Three science fields.	Biology, mathematics, pharmacy & pharmacology	74 biology journals, 25 mathematics journals, 20 pharmacy & pharmacology journals	Compared citations from subscription journals to journals that are OA and those that are non-OA. Controlled for self-citation, Journal Impact Factor and sampling dependency. Time elapsed for citations to accrue: 2 years (basing approach on the Journal Citation Index methodology for calculating Journal Impact factor)	The effect of OA on citations was neutral in biology and mathematics and negative in pharmacy & pharmacology	Not examined
Gaule, P., & Maystre, N. (2008). Getting cited: does open access help?	Biology	4388 articles published in PNAS over 2 years	Compared citations accumulating over time for articles in the journal that had been made OA as a result of authors paying an article-processing fee with those that were not OA. Also looked to see if there was a correlation with article quality by looking at articles that were in the Faculty of 1000 (F1000) dataset. Time elapsed for citations to accrue: from publication over 2 years	The difference was not found to be statistically significant.	Selection Bias explains at least a part of the observed OA citation impact
Norris, M., Oppenheim, C., & Rowland, F. (2008). Open Access Citation Rates and Developing Countries.	Mathematics	1158 articles from 16 high-impact journals	Used mathematics because it is not covered by any special access schemes for developing countries (e.g. HINARI). Tested the hypothesis that authors in developing countries are the main (or a significant) cause of the Open Access Advantage. Found OA articles via Google and matched them with non-OA counterparts in the same journals. Time elapsed for citations to accrue: 2 to 4 years	The study found a "modest difference" in citations to the two groups of articles that came from authors in the developed world (average 3.84 citations to OA articles versus 2.92 to non-OA articles), but a much greater difference for authors from developing countries. The authors of this article state that the sample of authors from developing countries was small and the study needs to be repeated with a larger sample.	Not Examined
Norris, M., Oppenheim, C. & Rowland, F., (2008). The citation advantage of open-access	Ecology, Applied Mathematics, Sociology, Economics,	4633 articles	Four subjects were selected to assess whether there is a citation advantage between journal articles that have an open access (OA) and toll access (TA). Citations were counted using the Web of Science and the OA	Significant difference in the mean number of citations that OA articles received than compared to TA articles.	Not Examined

articles.			status of articles was determined by searching OAster, OpenDOAR, Google and Google Scholar.		
Turk, N. (2008). Citation impact of Open Access journals.	Library and information Science	36 articles	To provide a synthesis of available key information about the citation impact of Open Access journals in LIS and science in general. Citation impact is defined as a surrogate measure of citation counts.	There were similar way about methodology of citation counts and substantial research about motivation for URL citations to LIS articles.	Not Examined
Davis, P.M. (2009). Author-choice open access publishing in the biological and medical literature: a citation analysis.	Biology, Medical Science	11 biological and medical journals	Articles published in 11 biological and medical journals from 2003 to 2007 that employ author-choice open access models. Out of 11 scientific journals, 9 cover the biomedical sciences, 2 cover the plant sciences, and 1 is a multi-disciplinary sciences journal	Significant increase in article citations of 17% but open access advantage is declining by about 7% per year, from 32% in 2004 to 11% in 2007.	Not Examined
Frandsen, T.F. (2009). The effects of open access on unpublished documents: A case study of economics working papers.	Economics	Working papers in EconLit, RePEc and 10 institutional working paper collections	Time elapsed for citations to accrue: Citations to working papers were measured over a period of ten years. Time elapsed for citations to accrue: up to 10 years	Found no clear tendency towards an increase in impact during 10 years of open availability for the working papers. Conversely, economics articles in high-impact journals do show a clear tendency for citation impact to increase in a ten-year period. The author therefore deduced that there is no OA citation advantage	Not Examined
Evans, J.A., & Reimer, J. (2009). Open Access and Global Participation in Science.	All	26 million articles in 8000 journals	Compared citations to OA or non-OA journals (not articles)	The increase in citations with OA is 8% for newly-published articles, and twice as large for citations coming from developing countries. The study also found a jump in citations when articles first become openly available from commercial publishers at the end of an embargo period	Not Examined
Gargouri, Y., & Harnad, S. (2009). Logistic regression of potential explanatory variables on citation counts.	Engineering, Biology, biomedicine, chemistry, psychology, mathematics, clinical medicine, health, physics, social sciences, earth sciences	27,197 articles	Compared these OA articles to articles published in the same issue of the same journals that had not been made OA. Analyzed by logistic regression. Time elapsed for citations to accrue: 2 to 6 years	The size of OA advantage varies with discipline. There was no correlation found with mandated or non-mandated status. The advantage found was independent of Journal Impact Factor, time since publication, number of references in the article and number of co-authors. Found that the increase in citations for OA articles is strong for highly-cited articles. Articles from mandated institutions have increased citations in the medium-to-highly cited range. Review articles have increased citations and the effect is greatest in the highly-cited range.	Confirms other findings that suggest that the best quality articles have most to gain, relatively, from OA. Also found no evidence to support the Selection Bias, since there was no difference in the citation advantage for mandated articles and non-mandated articles.
Gentil-Beccot, A., Mele, S., & Brooks, T. (2009). Citing and Reading Behaviours in High-Energy Physics.	High energy physics	286,180 OA articles in three mutually-exclusive sets, all compared with	Compared citations to three sets of articles made OA with citations to articles published in the same journals but not made OA. The sets were: preprints posted in arXiv and subsequently published in journals; post-prints posted in	Found an "immense" citation advantage from Open Access. Also found that 15% of articles have accumulated citations by the time of publication if they are posted to arXiv as preprints. Finally, found that articles made OA in hybrid high energy physics journals had no citation advantage	It found evidence for the Early Advantage

		subscription articles	arXiv and subsequently published in journals; articles posted in arXiv and never published in journals. Time elapsed for citations to accrue: from publication over 2 years		
Kousha, K., & Abdoli, M. (2009). The citation impact of Open Access Agricultural Research: a comparison between OA and Non-OA publications	Agricultural	400 research articles	To estimate whether there is a citation advantage to open access (OA) agriculture research compared the citation counts of self-archived with non-OA articles based upon a sample of 400 research articles from ISI-indexed agriculture journals in 2005. Also compared Impact Factors (IFs) of OA against non-OA agriculture journals during 2005-2007.	There was citation advantage for self-archived agriculture articles as compared to non-OA articles. The average IF for OA agriculture journals during 2005-2007 was 0.29, considerably lower than the average IF for 0.73 non-OA journals. It seems that OA is an advantage for individual articles but not for whole journals.	Not Examined
Lansingh, V.C., & Carter, M.J. (2009). Does Open Access in Ophthalmology Affect How Articles are Subsequently Cited in Research?	Ophthalmology	480 OA articles and 415 non-OA control articles	Compared citations to articles that were made OA by their authors with those to articles that were not OA in the same set of journals.	Found an increase in mean citations from 11.5 to 15.2 but the advantage correlated with author number, country of publication, language, subject area and funding though not with access	Not Examined
Lin, S-K. (2009). Full Open Access Journals Have Increased Impact Factors (editorial).	Molecular science	Two journals, Molecules and International Journal of Molecular Science,	Looked at the Journal Impact factors after the journals had gone fully OA. Also looked at two other journals from the same publisher, one that experimented briefly with paid-for OA (via article-processing charges) and one that made all its content OA a short time before the experiment. Time elapsed for citations to accrue: 2 years	Reported an increase in Journal Impact Factors after the journals were made fully-OA. All MDPI journals are now fully Open Access	Not Examined
Norris, M. (2009). The citation advantage of open access articles.	Ecology, mathematics, sociology and economics	4633 articles: 82 economy journals, 21 sociology journals	Compared citations to articles in these journals with those also made OA. Identified OA articles by using Google and OAIster. Time elapsed for citations to accrue: 2 to 4 years	The mean citation count for OA articles was 9.04 and for non-OA articles 5.76 (see Norris <i>et al</i> 2008). The size of the advantage varied with discipline; sociology showed the greatest OA advantage and ecology the lowest. Correlation with author number and Journal Impact Factor is weak or non-existent	Not Examined
Gargouri, Y., Hajjem, C., Lariviere, V., Gingras, Y., Brody, T., Carr, L., & Harnad, S. (2010). Self-Selected or Mandated, Open Access Increases Citation Impact for Higher Quality Research.	Engineering, Biology, biomedicine, chemistry, psychology, mathematics, clinical medicine, health, physics, social sciences, earth sciences	27,197 articles in 1984 journals. See Gargouri & Harnad, 2009. This is the updated version of that preprint	See Gargouri & Harnad, 2009. This is the updated version of that preprint. Time elapsed for citations to accrue: 2 to 6 years	The size of OA advantage varies with discipline. There was no significant reduction in the OA advantage found with mandated or non-mandated status. The advantage found was independent of Journal Impact Factor, time since publication, number of references in the article and number of co-authors. Found that the increase in citations for OA articles is stronger for highly-cited articles. Articles from mandated institutions have increased citations in the medium-to-highly cited range. Review articles have increased citations and the effect is greatest in the highly-cited range.	Confirms other findings that suggest that the best quality (i.e. the most highly-cited) articles have most to gain, relatively, from OA. Also found no evidence to support the Selection Bias, since there was no difference in the citation advantage for

					mandated articles and non-mandated articles (i.e. those that might be preferentially made OA out of choice because their authors thought they were better examples of their work)
Giglia, E. (2010). The impact factor of open access journals: data and trends.	Science, Social Sciences	Open Access journals in Journal Citation Reports from 2003-2005	“Gold” Open Access, is to test the performance of Open Access journals with the most traditional bibliometric indicator – Impact Factor, to verify the hypothesis that unrestricted access might turn into more citations and 5- year Impact Factor, will be tested too.	Open Access journals were gaining reputation and visibility was complex. Some of them show impressive Impact Factor trends. The performance of Open Access journals, also tested with the most traditional bibliometric indicator, is quite good in terms of citations.	Not Examined
Davis, P. M. (2011). Open access, readership, citations: A randomized controlled trial of scientific journal publishing.	Science, Social Science, and humanities	3245 articles	The effect of open access on article downloads at 12 mo and article citations within 36 mo. Out of 20 participating science journals 19 journals provide free access to articles at the end of their first year.	The real benefit of free access to provide knowledge about how scientific papers are transmitted through informal networks.	Not Examined
Xia, J., & Nakanishi, K. (2012). Self-selection and the citation advantage of open access articles.	Anthropology	Articles published in high-ranked and low-ranked journals	Statistical logistic regression model applied to explore the relationship, and compares two groups of articles, those published in high-ranked journals and those in low-ranked journals.	Open access articles receive more citations. Articles in high-ranked journals do not have a higher open access rate, and articles in lower-ranked journals have a greater increase rate of citations if they are freely accessible.	Not Examined
Doty, R.C. (2013). Tenure-Track Science Faculty and the 'Open Access Citation Effect.	Science	15 faculty members in the Department s of Biology and Chemistry	To determine what influence the OACE has on the decision-making process of tenure-track science faculty when they consider where to submit a manuscript for publication. in semi-structured interviews employing a variation of the critical incident technique.	7 faculty members said they would consider making a future article freely-available based on the OACE. Due to different expectations with OACE, only one of them is likely to seriously consider the OACE when deciding where to submit their next manuscript for publication	Not Examined
Koler-Povh, T., Juz'nic, P., & Turk, G., (2013). Impact of open access on citation of scholarly publications in the field of civil engineering.	Civil Engineering	2026 Articles	The value of impact factor and ranking in quartiles, also viewed the influence of the rank of journals on citations of both OA and Non OA articles, in Web of Science (WOS), Scopus and Google Scholar.	In civil engineering OA articles reach more citation than Non OA articles. Open access is increases the number of citations for articles published in journals with high impact.	Not Examined
Solomon, D., Laakso, M., & Björk, B. (2013). A longitudinal comparison of	All	18,854 journal indexed in SciMago	The growth of journals and articles along with the development in citation rates of open access (OA) journals listed in the Scopus between 1999 and 2010.	OA journals/articles have grown much faster than subscription journals. Two-year citation averages of OA journals well forward from journals funded by article processing charges (APCs) and by other means.	Citation averages born OA journals showing a rapid rise in citation

citation rates and growth among open access journals.					averages as compared to converted OA journals.
Kullman, L. (2014). The Effect of Open Access on Citation Rates of Self-Archived Articles at Chalmers.	Science and Technology	3424 articles	Self-archived paper was used as a synonym to 'OA article', defined as a full text version of a paper freely available in CPL. A total of 3424 original articles published 2010-2012 were included, 899 of which were published in full text in CPL, and 2571 that were only registered with bibliographical data.	The OA articles have a 22% higher citation rate than the non-OA articles, and the difference is statistically significant.	Not Examined
Sotudeh, H., & Ghasempour, Z. (2015). The citation advantage of author-pays model: the case of Springer and Elsevier OA journals.	Natural Sciences Social Sciences and Humanities Health Sciences Life Sciences	18,654 OA papers published in Springer and Elsevier	Analyze the citation advantage of author-pays model; the present communication compares open access (OA) and Toll Access (TA) papers recognition in author-pays OA journals in 2007–2011.	APC OA model has gained momentum in recent years as regards the number of OA papers. The increasing contribution to and recognition of OA papers published in the model highlights its importance to the scientific communities. The growing body of literature documenting the OACA and provide further evidence about the impact of APC OA model, specially its hybrid mode, on authors' visibility and influence in their scientific communities.	Not Examined
Ferreras-Fernández, T., García-Peñalvo, F., Merlo-Vega, J.A., Martín-Rodero, H. (2016). Providing open access to PhD theses: visibility and citation benefits.	All	125 Ph.D. E- Thesis	Determined the benefits of accessibility, dissemination, visibility and impact of PhD e-theses deposited in repositories and analyse the differences between the indicators in different knowledge areas, the Kurskall-Wallis test has been used.	OA IRs become an advantageous channel of scientific communication to grey literature like dissertations and PhD theses, because it increases visibility and use and also produces a significant citation rate. OA repositories can obtain information of visibility, and citation impact of doctoral theses, that type of information cannot be obtained in the case of theses that are not OA.	Not Examined
Dorta-González, P. González-Betancor, S.M. & Dorta-González, M.I. (2017). Reconsidering the gold open access citation advantage postulate in a multidisciplinary context: an analysis of the subject categories in the Web of Science database 2009-2014.	All	1,137,634 articles	Longitudinal and multidisciplinary analysis of the gold OA citation advantage was developed. All research articles in all journals for all subject categories in the multidisciplinary database, Web of Science, were considered. 2009 to 2014, and data were aggregated for the 249 disciplines.	There is no generalizable gold OA citation advantage, neither at article nor at journal level.	Not Examined
Hua, F.; Sun, H.; Walsh, T.; Glenn, A.-M.; & Worthington, H. (2017). Open access to journal articles in oncology: Current situation and citation	Oncology	1000 articles	PubMed was searched for oncology-related, peer-reviewed journal articles published in December 2014. Citation data were extracted from Web of Science, Scopus and Google Scholar.	Green road of providing OA is more common than the Gold road. OA is associated with higher citation counts.	Not Examined



impact.					
Hubbard, D.E. (2017). Open Access Citation Advantage? A Local Study at a Large Research University.	Agriculture, Biological Sciences, Chemistry, Engineering, Medicine, Physics, Science and Technology	Articles of TAMU in 2014-2016	The average citations per article for 2014-2016 journal articles were determined using Web of Science for the research areas corresponding to the major LC classes. Average citation counts were compared using the Mann-Whitney U test.	Identified several research areas where gold OA articles published at TAMU were cited at least the same average number of times, compared to subscription journals.	These perceptions can assist in adapting messaging to promote OA publishing to researchers on a university campus.
Turk, N. (2017). The impact of open access on the medical literature: A review of current Literature.	Medical	107 studies	The impact of OA on the medical articles based on 3-part categorization and were identified by a search strategy with eight combinations of keywords and searched in three different databases	OA articles were downloaded more frequently, but found no evidence of a citation advantage for open access articles. The citation advantage from open access might be caused by other factors	Not Examined
Dorta-González, P., & Santana-Jiménez, Y. (2018). Prevalence and citation advantage of gold open access in the subject areas of the Scopus database.	All	22,256 journals	Analyse exclusively gold OA, and test the OA citation advantage includes comparing OA vs. non-OA journal impact factors and citations of OA versus non-OA articles published in the same non-OA journals.	There was no generalizable gold OA citation advantage at journal level.	Not Examined
Sotudeh, H., Estakhr, Z. (2018). Sustainability of open access citation advantage: the case of Elsevier's author-pays hybrid open access journals.	All	160,168 articles in 47 Elsevier APC-funded hybrid open access journals	Comparative citation analysis method applied for analysis. Two citation windows were selected: one ranging from the journals' publication years until 2013.	The citation advantage of the APC-funded OA articles was sustainable significant in almost all fields. Many APC-funded OA articles increased in comparison with that of the toll-access articles. In addition, the APC funded OA articles exhibited citation advantages.	Not Examined
Wani, Z.A., & Wani, S.A. (2018). Mapping the use of open access resources by doctoral students in the USA by employing citation analysis.	Physics	Ph.D. Thesis of Physics in top three universities of USA	To identify usage percentage of OA journals and evaluate the core fully OA journals to check their quality, which is cited by researchers in the field of physics in their selected ETDs submitted during the year 2014.	Fully OA resources were sufficiently used by the researchers of top three universities of USA. These fully OA journals are highly impressive as showed by performance indicators applied.	Not Examined

**Table 2.** Summary of the findings: positive versus negative citation impact of OA

Positive versus negative citation impact	Results
Number of studies that reported positive citation advantage of OA articles/ journals	37
Number of studies that reported negative citation advantage of OA articles/ journals	9
<b>Total/ Or No Advantage</b>	<b>46</b>

## Analysis of Findings

An analysis of the findings of the studies included in this paper indicate that different scientific disciplines have significant effect of open access on citation counts. OA articles in the field of Physics, Astronomy, Biology, and Oncology were highly increased their citation rate, while Economics, Mathematics, Engineering significantly had reached more citation with Open Access than subscribed journals. It has also been found that other disciplines were also influenced with the impact of OA disciplines (Koler-Povh, *et al.*, 2013; Frandsen, 2008; Hajjem, *et al.*, 2005; Frandsen, 2008).

Findings of more than 80 percent studies indicated positive impact of OA on number of citations. It has been signified that OA journals received more citations than subscribed journals. The citation rate was lower in those fields where journals were not widely accessible and available through subscription. Gold OA article have higher citation rate than Green OA (self-archiving). OA articles were cited more frequently than non-OA articles published in the same journal (Lewenstein, *et al.*, 2008; Eysenbach, 2006; Oppenheim, & Rowland, 2008).

Significantly, Green OA is extensively used than Gold OA, and open repositories have become main channels of OA during the past few years. ResearchGate and Pub-Med Central were the main venues for self-archiving and it is an important route for OA to improve the visibility and access of research work (Hua, *et al.*, 2017; Dorta-González, & Santana-Jiménez, 2018). It is also found from the analysis of the findings of studies that self-archived articles attract more citations than non-OA articles. Self-archived articles have 22 percent more citations rate than non-self-archived articles (Kullman, 2014; Eysenbach, 2006; Kousha, & Abdoli, 2009).

In comparison to the subscribed journal articles, citations of APC-funded OA articles were found more sustainable in all fields. The impact of APC-funded OA model not only increases authors' visibility but also influence their research impact. Two-year citation average of OA journals have reached the same level as subscription journals, with the help of APC funded OA. APC funded OA model has gained momentum in recent years (Solomon, *et al.*, 2013; Sotudeh, & Ghasempour, 2015; Sotudeh, & Estakhr, 2018). A significant growth is observed in the number of institutional repositories into which authors can self-archive their research output and make it freely available. OA repositories encourage authors to archive their research output, which not only maximizes its accessibility but also increase their citation rate (Doty, 2013; Henneken, *et al.*, 2006; Ferreras-Fernández, *et al.*, 2016; Ferreras-Fernández, *et al.*, 2016).

In comparison to the subscription-based journals, the distribution of OA journals citations were widespread both in developing and developed countries. However, citation advantage is more common to OA articles contributed by the authors of developing countries..The influence of OA was increased by 8 percent for newly-published articles, and this increment is more than double in the developing countries(Zhang, 2006; Evans, & Reimer 2009).

## Conclusion

On the basis of review of studies on citation advantage to open access publications, we have observed an overall growth of citations in open access literature over the years. Analysis of the findings of studies confirmed that OA articles received more citations than Non OA articles. Most of the studies found positive citation impact of OA publications, as they are visible and accessible to a wider research community. Furthermore, it is also revealed that open access and self-archiving has significantly increased citation rate in different subject areas, but the level of citation advantage is varied across disciplines. Self- archived articles receive more citations than non-OA articles and Green OA route is more popular than Gold OA route. APC funded OA model is now accepted to the scientific communities. Faculty members consider OA citation effect (OACE) in order to decide where to submit their next publication.

On the basis of the review of the findings of studies on open access citation advantage, it is found that OA has a progressive influence the citation rate and the distribution of OA journals citations are widespread both in developing and developed countries. These insights show that researchers, libraries, information centers and research scholars should make their research work available in OA outlets to increase its accessibility and citation rate.

## References

1. Cheng, W.H., &Ren, S.L. (2008). Evolution of open access publishing in Chinese scientific journals. *Learned Publishing*, 21 (2). 140-152. doi: 10.1087/095315108X288884
2. Davis, P.M., &Fromerth, M.J. (2006). Does the arXiv lead to higher citations and reduced publisher downloads for mathematics articles? *Scientometrics*, 71 (2). Retrieved from <https://arxiv.org/ftp/cs/papers/0603/0603056.pdf>
3. Davis, P.M., Lewenstein, B.V., Simon, D.H., Booth, J.G., Connolly, M.J.L. &Godlee. (2008). Open access publishing, article downloads, and citations: randomized controlled trial. *British Medical Journal*, 337 (7665).343-345. Retrieved from <http://www.jstor.org/stable/20510537>
4. Davis, P.M. (2009). Author-choice open access publishing in the biological and medical literature: a citation analysis.*Journal of the American Society for Information Science and Technology*, 60(1).3-8. Retrieved from <https://onlinelibrary.wiley.com/doi/pdf/10.1002/asi.20965>

5. Davis, P. M. (2011). Open access, readership, citations: A randomized controlled trial of scientific journal publishing. *The FASEB Journal*, 25 (7).2129-2134. doi: 10.1096/fj.11-183988.
6. Dorta-González, P. González-Betancor, S.M. &Dorta-González, M.I. (2017). Reconsidering the gold open access citation advantage postulate in a multidisciplinary context: an analysis of the subject categories in the Web of Science database 2009-2014.*Scientometrics*, 112 (2). 877- 901. Retrieved from<https://arxiv.org/pdf/1703.03220>
7. Dorta-González, P. & Santana-Jiménez, Y. (2018). Prevalence and citation advantage of gold open access in the subject areas of the Scopus database. *Research Evaluation*, 27 (1). 1–15.doi.org/10.1093/reseval/rvx035
8. Doty, R.C. (2013). Tenure-Track Science Faculty and the 'Open Access Citation Effect'.*Journal of Librarianship and Scholarly Communication*, 1 (3). e P1052. doi.org/10.7710/2162-3309.1052
9. Evans, J.A., & Reimer, J. (2009). Open Access and Global Participation in Science. *Science*, 323 (5917). 1025. doi: 10.1126/science.1154562
10. Eysenbach, G. (2006).Citation Advantage of Open Access Articles.*PLoS Biology*, 4 (5). 0692- 0698. doi: 10.1371/journal.pbio.0040157
11. Frandsen, T.F. (2008). The integration of open access journals in the scholarly communication system: Three science fields. *Information Processing & Management*, 45 (1).131-141. Retrieved from <https://hal-hprints.archives-ouvertes.fr/hprints-00326285/document>
12. Frandsen, T.F. (2009). The effects of open access on un-published documents: A case study of economics working papers. *Journal of Informetrics*, 3 (2). 124-133. doi.org/10.1016/j.joi.2008.12.002
13. Ferreras-Fernández, T., García-Peñalvo, F., Merlo-Vega, J.A., Martín-Rodero, H. (2016). Providing open access to PhD theses: visibility and citation benefits. *Program*, 50 (4). 399 -416. doi.org/10.1108/PROG-04-2016-0039
14. Gargouri, Y., &Harnad, S. (2009). Logistic regression of potential explanatory variables on citation counts. Retrieved from. <http://www.crsc.uqam.ca/yassine/SelfArchiving/LogisticRegression.htm>
15. Gargouri, Y., Hajjem, C., Lariviere, V., Gingras, Y., Brody, T., Carr, L., &Harnad, S. (2010). Self-Selected or Mandated, Open Access Increases Citation Impact for Higher Quality Research. *PLoS ONE*. doi.org/10.1371/journal.pone.0013636
16. Gaule, P., &Maystre, N. (2008). Getting cited: does open access help? *EcolePolytechniqueFédérale de Lausanne,CEMI-WORKINGPAPER-2008-007*. Retrieved from <https://www.aeaweb.org/conference/2010/retrieve.php?pdfid=147>
17. Gentil-Beccot, A., Mele, S., Brooks, T. (2009). Citing and Reading Behaviours in High-Energy Physics. *How a Community Stopped Worrying about Journals and Learned to Love Repositories*. Retrieved from <https://arxiv.org/abs/0906.5418>
18. Giglia, E. (2010).The impact factor of open access journals: data and trends. *ELPUB2010. Publishing in the networked world: Transforming the Nature of Communication, 14th International Conference on Electronic Publishing*. 17-39. Retrieved from <http://hdl.handle.net/2318/1502923>
19. Hajjem, C., Harnad, S., &Gingras, Y. (2005). Ten-Year Cross-Disciplinary Comparison of the Growth of Open Access and How it Increases Research Citation Impact. *IEEE Data Engineering Bulletin* 28(4).39-47. Retrieved from <https://eprints.soton.ac.uk/262906/1/rev1IEEE.pdf>

20. Henneken, E.A., Kurtz, M.J., Eichhorn, G., Accomazzi, A., Grant, C., Thompson, D., & Murray, S.S. (2006). Effect of E-printing on Citation Rates in Astronomy and Physics. *Journal of Electronic Publishing*, 9 (2).doi.org/10.3998/3336451.0009.202
21. Hua, F.; Sun, H.; Walsh, T.; Glenney, A.-M.; & Worthington, H. (2017). Open access to journal articles in oncology: Current situation and citation impact. *Annals of Oncology*, 28 (7). 1-14.doi: 10.1093/annonc/mdx398
22. Hubbard, D.E. (2017). Open Access Citation Advantage? A Local Study at a Large Research University. *80th Annual Meeting of the Association for Information Science & Technology, Washington, DC*. 712-713. doi.org/10.1002/pr2.2017.14505401126
23. Koler-Povh, T., Juz˘nic˘, P., & Turk, G. (2013). Impact of open access on citation of scholarly publications in the field of civil engineering. *Scientometrics*, 98 (2).1033-1045. doi: 10.1007/s11192-013-1101-x
24. Kousha, K., &Abdoli, M. (2009). The citation impact of Open Access Agricultural Research: a comparison between OA and Non-OA publications. *Online Information Review*, 34 (5).772-785. doi.org/10.1108/14684521011084618
25. Kullman, L. (2014). The Effect of Open Access on Citation Rates of Self-Archived Articles at Chalmers. *Proceedings of the IATUL Conferences. Paper 2*.Retrieved from <http://docs.lib.purdue.edu/iatul/2014/bibliometrics/2>
26. Kurtz, M.J., &Henneken, E.A. (2007). Open Access does not increase citations for research articles from The Astrophysical Journal. Retrieved from <https://arxiv.org/ftp/arxiv/papers/0709/0709.0896.pdf>
27. Lansingh, V.C., & Carter, M.J. (2009). Does Open Access in Ophthalmology Affect How Articles are Subsequently Cited in Research? *Ophthalmology*, 116(8). 1425-1431. doi: 10.1016/j.ophtha.2008.12.052.
28. Lin, S.K. (2007). Editorial: Non-Open Access and Its Adverse Impact on Molecules. *International Journal of Molecular Sciences*, 8. 686-687. Retrieved from [www.mdpi.org/molecules/papers/12071436.pdf](http://www.mdpi.org/molecules/papers/12071436.pdf)
29. Lin, S-K. (2009). Full Open Access Journals Have Increased Impact Factors (editorial). *International Journal of Molecular Sciences*, 14 (6). 2254-2255. Retrieved from <https://www.mdpi.com/1420-3049/14/6/2254/pdf>
30. Lawrence, S, (2001) Online or Invisible? *Nature*,411(6837). 521-523. Retrieved from <http://www.neci.nec.com/lawrence/papers/online-nature01/>
31. Metcalfe, T.S. (2005). The Rise and Citation Impact of astro-ph in Major Journals. *Bulletin of the American Astronomical Society*, 37 (2). 555-557.Retrieved from<https://arxiv.org/abs/astro-ph/0503519>
32. Metcalfe, T.S. (2006). The Citation Impact of Digital Preprint Archives for Solar Physics Papers. *Solar Physics*, 239 (1-2). 549-553: <http://arxiv.org/abs/astro-ph/0607079>
33. Moed, H.F. (2007). The Effect of “Open Access” on Citation Impact: An Analysis of ArXiv’s Condensed Matter Section. *Journal of the American Society for Information Science and Technology*, 58 (13).2047–2054. doi: 10.1002/asi.20663
34. Norris, M., Oppenheim, C., & Rowland, F. (2008). Open Access Citation Rates and Developing Countries. *12th International Conference on Electronic Publishing*. 335-342. Retrieved from [https://www.researchgate.net/profile/Charles\\_Oppenheim2/publication/37676874\\_Open\\_access\\_citation\\_rates\\_and\\_developing\\_countries/links/5534f9570cf2ea51c1337163.pdf](https://www.researchgate.net/profile/Charles_Oppenheim2/publication/37676874_Open_access_citation_rates_and_developing_countries/links/5534f9570cf2ea51c1337163.pdf)
35. Norris, M., Oppenheim, C. & Rowland, F., (2008). The citation advantage of open-access articles. *Journal of the American Society for Information Science and Technology*, 59 (12). 1963-1972. Retrieved from

<https://pdfs.semanticscholar.org/45c7/176239209846e6031d2e75df7e2ec9515d76.pdf>

36. Norris, M. (2009). The citation advantage of open access articles. PhD thesis, Loughborough University. Retrieved from <https://dspace.lboro.ac.uk/dspace-jspui/bitstream/2134/4089/1/Thesis%20MN.pdf>
37. Piwowar, H.A., Day, R.S., & Fridsma, D.B. (2007). Sharing Detailed Research Data Is Associated with Increased Citation Rate. *PLoS ONE*, 2 (3). Retrieved from [doi.org/10.1371/journal.pone.0000308](https://doi.org/10.1371/journal.pone.0000308)
38. Sahu, D.K., Gogtay, N.J., & Bavdekar, S.B. (2005). Effect of open access on citation rates for a small biomedical journal. *Fifth International Congress on Peer Review and Biomedical Publication*. Retrieved from [https://www.researchgate.net/publication/36446808\\_Effect\\_of\\_open\\_access\\_on\\_citation\\_rates\\_for\\_a\\_small\\_biomedical\\_journal](https://www.researchgate.net/publication/36446808_Effect_of_open_access_on_citation_rates_for_a_small_biomedical_journal)
39. Solomon, D.J., Laakso, M., Björk, B-C. (2013). A longitudinal comparison of citation rates and growth among open access journals. *Journal of Informetrics*, 7 (3). 642-650. [doi.org/10.1016/j.joi.2013.03.008](https://doi.org/10.1016/j.joi.2013.03.008)
40. Sotudeh, H., Estakhr, Z. (2018). Sustainability of open access citation advantage: The cases of Elsevier's author-pays hybrid open access journals. *Scientometrics*, 115(1).563–576. [doi.org/10.1007/s11192-018-2663-4](https://doi.org/10.1007/s11192-018-2663-4)
41. Sotudeh, H., & Ghasempour, Z. & Yaghtin, M. (2015). The citation advantage of author-pays model: the case of Springer and Elsevier OA journals. *Scientometrics*, 104 (2). 581–608. [doi: 10.1007/s11192-015-1607-5](https://doi.org/10.1007/s11192-015-1607-5)
42. Suber, Peter. (2007). SPARC OA Newsletter. Retrieved from <http://www.legacy.earlham.edu/~peters/fos/newsletter/05-02-07.htm>
43. Swan, A. (2010). The open access citation advantage: studies and results to date. Retrieved from <https://eprints.soton.ac.uk/id/eprint/268516>
44. Tonta, Y., Unal, Y., & A, U. (2007). The Research Impact of Open Access Journal Articles. *Proceedings ELPUB 2007, the 11th International Conference on Electronic Publishing*. Retrieved from <http://eprints.rclis.org/9424/1/tonta-unal-al-elpub2007.pdf>
45. Turk, N. (2008). Citation impact of Open Access journals. *New Library World*, 109 (1/2). 65-74. [doi.org/10.1108/03074800810846010](https://doi.org/10.1108/03074800810846010)
46. Turk, N. (2017). The impact of open access on the medical literature: A review of current Literature. 640-663. Retrieved from [vestnik.szczecin.pl/index.php/ZdravVest/article/download/2463/1980](http://vestnik.szczecin.pl/index.php/ZdravVest/article/download/2463/1980)
47. Wani, Z.A., & Wani, S.A. (2018). Mapping the use of open access resources by doctoral students in the USA by employing citation analysis. *Collection and Curation*. [doi.org/10.1108/CC-05-2018-0014](https://doi.org/10.1108/CC-05-2018-0014)
48. Xia, J., & Nakanishi, K. (2012). Self- selection and the citation advantage of open access articles. *Online Information Review*, 36 (1). 40-51. [doi.org/10.1108/14684521211206953](https://doi.org/10.1108/14684521211206953)
49. Zhang, Y. (2006). The Effect of Open Access on Citation Impact: A Comparison Study Based on Web Citation Analysis. *Libri*, 56 (3). 145–156. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.103.9094&rep=rep1&type=pdf>

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# Understanding the “Digital Divide” in India: A Data Mining Approach

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## Abstract

Digital technologies and the Internet are rapidly changing how people live and work. However, not everyone has the same access or ability to utilise these technologies to the same extent. Some of the key barriers to access include a lack of infrastructure, unaffordability, digital illiteracy, and the lack of relevant, local content. While technology and market forces have largely prevailed over the challenges of infrastructure and affordability and people’s aspirations are helping them become digitally literate, the lack of local and relevant content remains a challenge. This is more so in India with its diversity of languages and scripts and lack of standardised input methods.

This article is a preliminary analysis of an ongoing two-pronged research that seeks to examine the tools and techniques used to create original Indian language content by mining Twitter data. Every tweet contains a “source” field and provides the ability to separate re-tweeted content from the original, thus allowing one to better understand the tools and technologies being used for content creation. In the first phase of the research, we are collecting a set of tweets, from largely Indian users and analysing them for their language content to identify the top tweeters and their networks. The next phase of the research plans to interview a few identified users to better understand the tools, technologies and processes they use in the creation of original content.

This research will help contribute to a much deeper and richer understanding of how Indians access the Internet and create content in their own languages. This understanding can then be used by researchers to develop content creation platforms and by policymakers to develop policies that foster the creation of accessible local content.

## Introduction

Digital technologies, combined with the rise of the Internet are rapidly changing the way we live and work (World Bank Group 2016; World Bank Group 2019), with increased broadband access also leading to an increase in GDP (Ericsson 2019). However, despite recent strides in providing broadband internet access to large

portions of the population worldwide, more than half the world population continues to be offline (Bahia 2018; World Economic Forum 2019). Data shows large inequities across geographies in both population accessing the Internet and the modes and speed of access (Akamai 2017; Bahia 2018). This inequity in access is multidimensional and the GSM Association attempts to capture it as a “Mobile Connectivity Index” by looking at four key enablers: *Infrastructure*, *Affordability*, *Consumer readiness*, and *Relevant content and services*<sup>1</sup>. While market forces coupled with appropriate policy responses can help in providing the the first two (that is infrastructure and affordability)<sup>2</sup>, the other two require a combination of social, cultural and technical approaches. Hence, the debate around the “Digital Divide” in the use of Information and Communication Technologies for Development (ICT4D) has moved on from access and affordability to that of relevance and accessibility of content.

**Table 1.** Wikipedia Data for May 2019.

	English	Hindi	Bangla	Telugu	Tamil
Total Page Views	7.78 bn	54.18 mn	14.51 mn	2.68 mn	7.14 mn
Page Views from India	675.92 mn	49.51 mn	2.37 mn <sup>3</sup>	2.12 mn	5.11 mn
Number of Edits	4.49 mn	22.5 k	37.76 k	19.52 k	36.49 k
Number of Pages Edits	1.41 mn	11.88 k	17.33 k	8.82 k	26.3 k

Source: WikiStats [https:// stats.wikimedia.org/v2/](https://stats.wikimedia.org/v2/)

Graham (2014) has related the lack of local content on the Internet to geography and concludes that despite the global south being relatively well connected to the Internet, it is not generating enough local content. This lack of local content has been attributed to a *language barrier* by Orriss (2014) and as an indicator of Internet users *not creating enough* value (Surman, Gardner, and Ascher 2014). An indication of this can be seen in Table 1, which shows data about some language wikipeidias for May 2019. From the table, we note that almost a *tenth* of the views of the English Wikipedia come from India, starkly contrasted with the Indian language wikipeidias

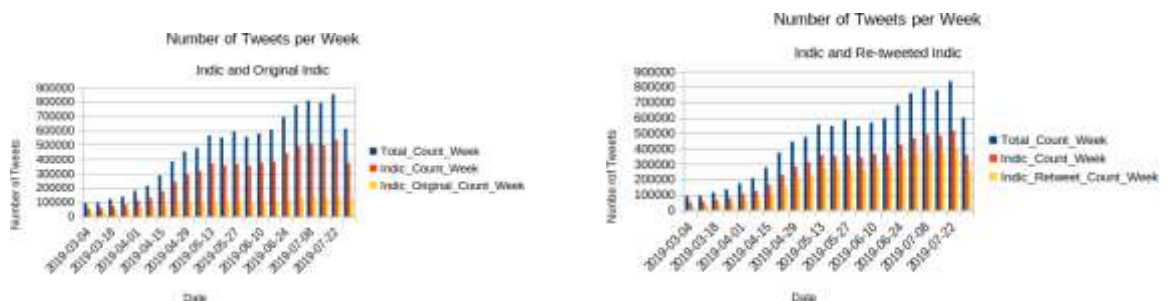
<sup>1</sup> The World Economic Forum (2019) also identifies these as the four “key barriers” to providing inclusive access to the Internet.

<sup>2</sup> A report by McKinsey Global Institute (Kaka et al. 2019) points out data costs have dropped sharply by 95% since 2013 (as a fraction of monthly per capita GDP), while per user monthly mobile data consumption is growing at 152% annually—more than double the rate in the USA and China. Another data point from Akamai’s *Q1 2017 State of the Internet / Connectivity Report* (2017) shows Reliance Jio to be third worldwide in carrying their traffic (79%) using the IPv6 protocol, which underlines the rapid transformation occurring in the telecom infrastructure space.

<sup>3</sup> 6.27 mn from Bangladesh

that have significantly smaller page views as well as edits. This number of edits can be taken as a proxy for content creation<sup>4</sup>.

This ongoing research attempts to identify the creation of content in local Indic languages using Twitter as the data source. Indian language twitter has seen a phenomenal increase (refer to Figure 1) and I hypothesise that this is largely due to the availability of built-in Indian language keyboards on mobile operating systems like Android and iOS. Every tweet has a `source` field identifying the platform on which the tweet was originally composed. This makes Twitter an ideal source to understand the tools being used to create local language content.



(a) Original Indian Language Tweets (b) Indian Language Tweets & Re-tweets  
(Weekly). March 1, 2019–July 31, 2019 (Weekly). March 1, 2019–July 31, 2019

Figure 1: Indian Language Original Tweets and Re-tweets  
(Weekly). March 1, 2019–July 31, 2019

Understanding what tools are being used to create local language content, and how these are being used will allow policies to be targeted towards such platforms. According to researchers<sup>5</sup>, people access the Internet differently on a mobile phone than on a desktop system. Mobile phones tend to be more heavily used for entertainment and leisure<sup>6</sup> as opposed to content creation, especially textual content. This research will attempt to identify if this has continued to be the case given the significant changes in mobile phone form factors and the availability of software that was earlier tied to the PC (MS-Word, Powerpoint etc.) since that research five years ago. This research is an attempt to study users in the Indian twitter-sphere who create local language content using tweets data collected over a period of time.

<sup>4</sup> Graham (2014) provides a geographical overview of Wikipedia edits based on 2011–12 data which also bears this out

<sup>5</sup> Schoemaker (2014) cites research of Napoli and Obar (among others).

<sup>6</sup> The main driver of the growth of the Internet in India seems to be video, with the average Indian mobile data usage being around 11 GB in February 2018. (<https://tech.economictimes.indiatimes.com/news/mobile/average-mobile-data-usage-at-11gb-a-month-nokia/63035051>)

This research will contribute to a much deeper and richer understanding of how Indians access the Internet and create content in their own languages. By deeply examining the sources of local content creation, the current research can inform and help policymakers in developing policies that foster the creation of accessible local content.

## Research Methodology

As discussed earlier in §1, researchers have been using Twitter data to answer multiple questions in the social sciences, like communications during natural disasters (Starbird et al. 2010), the spread of revolutions (Bruns, Highfield, and Burgess 2013) or how citizens engage on socio-political issues, for example welfare provision (Brooker et al. 2018). Most such research has used a sample set of tweets collected from Twitter, by searching for specific “hashtags” that are user generated “metatags” that group content into themes and allow other users to access relevant content<sup>7</sup>. This sample set of tweets is often collected via a set of Application Programming Interfaces (APIs) provided by Twitter. The access to Twitter’s database is multi-tiered—a limited set of tweets is available for free, while broader and deeper access requires subscription and fees. Further, as Twitter itself notes with regard to its “search service”:

“Please note that Twitter’s search service and, by extension, the Search API is not meant to be an exhaustive source of Tweets. Not all Tweets will be indexed or made available via the search interface”.<sup>8</sup>

Due to these data collection limitations, most research using Twitter has focused on a narrow cross-section of twitter data collected using hashtag based search. Not much research has been done on longitudinal Twitter data, that can possibly identify the changes in the Twitter eco-system over time. While (Brooker et al. 2018) have looked at tweets from “ordinary citizens” to get a feel of the chatter around social welfare (in the context of a BBC television show), even their research only collected tweets from a sample of users who used specific hashtags. This research seeks to understand how the ecosystem of Indian language tweeting has developed over time and thus uses a slightly different approach.

The very nature of the research question prevents us from collecting tweets related to any specific hashtag, and thus we are collecting tweets from a much broader universe. Specifically, we are collecting twitter data (“*user timelines*”) of a small subset of tweeters who are known to be either in India or linked somehow to the

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<sup>7</sup> See: <https://en.wikipedia.org/wiki/Hashtag> for more on Twitter hasht-ags. Retrieved 30 July, 2019

<sup>8</sup> <https://developer.twitter.com/en/docs/tweets/search/api-reference/get-search-tweets.html>. Retrieved 30 July, 2019

Indian twitter-sphere. As of 31<sup>st</sup> July, 2019, we have identified around 2400 users whose timelines are being continuously collected and have collected more than thirteen million tweets. The data collection and analytical design is discussed next.

## Data Collection

Data is currently being actively collected using the *free* version of the “Get Tweet timelines” API. We have developed a set of software tools using the design pattern of collecting tweets using the TwitterAPI and storing them in a NoSQL database (Bruns and Liang 2012). Specifically, we are using the Tweepy<sup>9</sup> library to collect as JSON (JavaScript Object Notation) documents which are then stored directly in a MongoDB<sup>10</sup> database. This design pattern allows the creation of continuous big data that can be later analysed across multiple axes as required (see Berman 2013, for more on these big data principles).

However, usage of the free TwitterAPI is challenging owing to it being *rate-limited*<sup>11</sup> and providing *extremely limited* support for historical tweets<sup>12</sup>. To get around these challenges, we are planning to extend the tweet collection by leveraging the newly released “Premium” Search APIs. To gain further insights into the hows of Indic language content creation, we are planning to further augment the initial analysis be augmented by a short structured survey questionnaire.

## Data Analysis

**Original Tweets** are segregated from re-tweets by looking at the “retweet\_status” field in the tweet metadata. If this field is present, it indicates that the tweet is a re-tweet. This field also contains important information about creation date, user etc.

**Indic Tweets** are defined as those that have atleast half of their content (stripped of hashtags, URLs and mentions) in an Indic script. We define an Indic character as one in the Unicode range of U+9000 – U+0D80<sup>13</sup>.

**Time Series** analysis of the tweets is being done by aggregating the tweets on a weekly basis, based on their “creation\_date”.

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<sup>9</sup> <http://www.tweepy.org/>

<sup>10</sup> <https://www.mongodb.com/>

<sup>11</sup> The rate limits are enforced on both a per-user and per-user basis and prevent collecting tweets from a much larger universe.

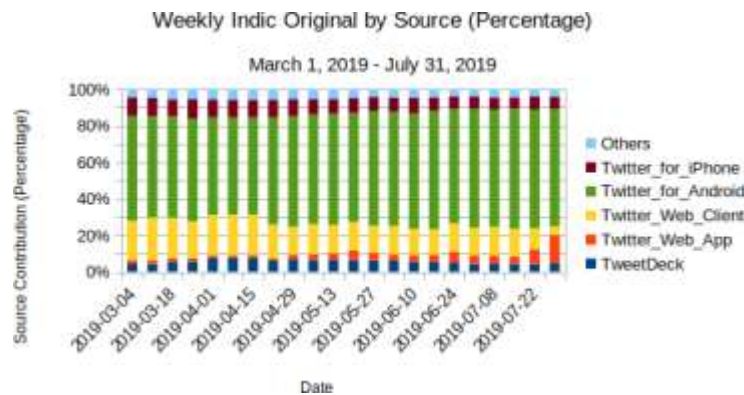
<sup>12</sup> Only the last 3200 tweets of a user can be retrieved, or those in the past few (7) days. For more details: <https://gwu-libraries.github.io/sfm-ui/posts/2017-09-14-twitter-data>.

<sup>13</sup> Unicode Consortium <https://home.unicode.org/>

**Source** of the tweet is identified by looking at the source field of the tweet. We note that there is a large diversity of sources, ranging from phone based apps to third-part applications that post directly to Twitter using user credentials.

## Preliminary Data Analysis

As discussed above, this is a work in progress and a preliminary analysis has been performed on the data from March 1, 2019 till July 31, 2019, and on a subset of users with *at least* three thousand tweets<sup>14</sup>. From Figure 1, we note that there has been a continuing increase in the number of Indian language tweets, both original and re-tweets in our sample.



**Figure 2:** Original Indian Language Tweets (Weekly by Source).  
March 1, 2019–July 31, 2019

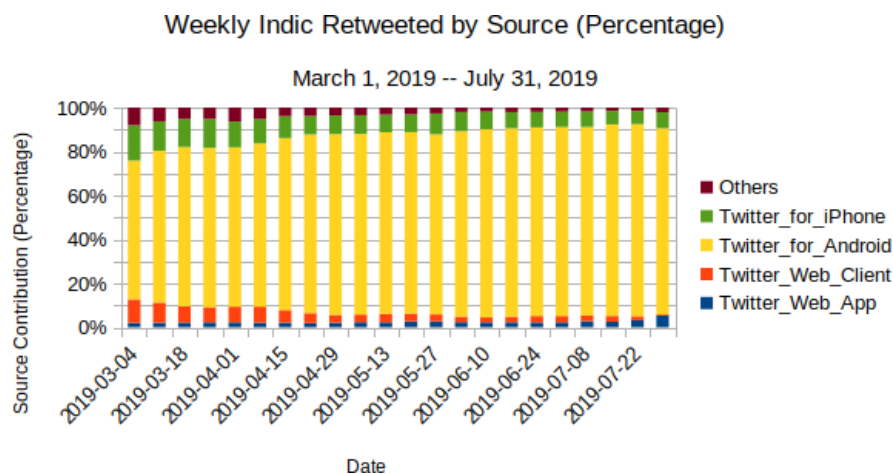
Figure 2 depicts the source of original tweets created by the users in our sample. All sources that contribute to more than one percent of the total tweets have been listed separately, while the rest have been clubbed under “Others”. From this figure we note that the platform of choice for our sample of users who tweet *originally* in an Indian language is the official Twitter app on the Android platform and it accounts for around *two-thirds* of the original Indic content created on Twitter by our sample of users in this period, followed by the “Twitter Web Client”. The analysis of tweets that have been re-tweeted by our sample users is shown in Figure 3. In this figure we note that the ‘Twitter for Android’ application has a much larger share, almost eighty percent of the tweets have been originally composed using the Android application. On the user front, Figure 4 shows the number of people in our sample who have

<sup>14</sup> The median number of tweets in the database is slightly more than three thousand, and thus we are using this number to weed out outliers at the lower end.

created *at least* one Indian language tweet in the week. These graphs are discussed in detail in section 4.

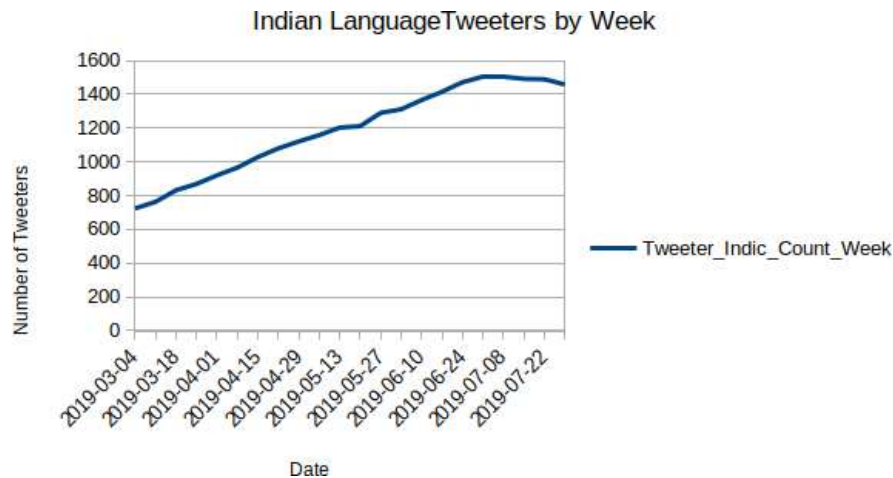
## Results and Discussion

The preliminary data analysis shows that Android based mobile phones are the primary tool used to post tweets in Indian languages. Coming a close second is the “Twitter Web Client”, that can be used on multiple platforms—both mobiles and desktops. It also shows that there is a trend of users posting more and more original content in Indian languages. However, further research is needed to get a much broader historical perspective, one that goes back much further in time. The current database has tweets dating back to January 2009, but these are very few and far between, largely from users who are not prolific tweeters, and thus have been weeded out because they are an outlier (see footnote 14).



**Figure 3.** Indian Language Re-Tweets (Weekly by Source).  
March 1, 2019–July 31, 2019





**Figure 4.** Indian Language Tweeters (Weekly in sample).  
March 1, 2019–July 31, 2019

Currently, we are collecting tweets using the *free* API provided by Twitter. As discussed earlier in section 2.1, the free API allows for a very limited historical context, only going back to 3200 tweets from the archive. Thus, we can only access the full twitter archive of users who have tweeted less than this number, and unable to access the twitter archive of users who have been prolific tweeters.

Users have been selected using a “snowball” methodology by first selecting a few known personalities who tweet in Indian languages. Then, one looked at people who interacted with this group through retweets, replies, mentions and follows. Thus, we have a set of users that that has grown over time and thus we are unable to get a precise estimate of the growth trend of the Indian language twitter-sphere.

The above mentioned challenges—lack of a deep historical archive, and a rolling user set means that more historical tweets data is needed. How to go about this and the plan for the next few months is discussed next.

## Future Work

The Indian language twitter sphere has been growing as discussed above. The spread of cheap data plans and the availability of in-built Indian language keyboards has possibly been a reason for the same. To be able to better understand the factors behind the rise of the Indian twitter-sphere, we need a deeper historical archive.

Over the next couple of months, we plan to expand the tweets collection by creating a deeper historical archive. To start with, it is planned to use the “premium” search



API as a starting point to fetch the full archive of a few users. This deeper archive will then be analysed to get deeper insights which will then be enriched with survey questionnaires.

## References

1. Akamai (Apr. 1, 2017). *Q1 2017 State of the Internet / Connectivity Report*. Ed. by David Belson. URL: <https://www.akamai.com/us/en/resources/our-thinking/state-of-the-internet-report/global-state-of-the-internet-connectivity-reports.jsp> (visited on June 1, 2019).
2. Bahia, Calvin (2018). *State of Mobile Internet Connectivity 2018*. GSM Association. URL: <https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2018/09/State-of-Mobile-Internet-Connectivity-2018.pdf> (visited on June 1, 2019).
3. Berman, Jules J. (2013). *Principles of Big Data: Preparing, Sharing, and Analyzing Complex Information*. Boston: Morgan Kaufmann, pp. i–ii. ISBN: 978-0-12-404576-7. DOI: <https://doi.org/10.1016/B978-0-12-404576-7.09977-9>. URL: <http://www.sciencedirect.com/science/article/pii/B9780124045767099779>.
4. Brooker, Phillip et al. (2018). “Researching with Twitter timeline data: A demonstration via “everyday” socio-political talk around welfare provision”. In: *Big Data & Society* 5.1, p. 2053951718766624. DOI: [10.1177/2053951718766624](https://doi.org/10.1177/2053951718766624). eprint: <https://doi.org/10.1177/2053951718766624>. URL: <https://doi.org/10.1177/2053951718766624>.
5. Bruns, Axel, Tim Highfield, and Jean Burgess (2013). “The Arab Spring and Social Media Audiences: English and Arabic Twitter Users and Their Networks”. In: *American Behavioral Scientist* 57.7, pp. 871–898. DOI: [10.1177/0002764213479374](https://doi.org/10.1177/0002764213479374). eprint: <https://doi.org/10.1177/0002764213479374>. URL: <https://doi.org/10.1177/0002764213479374>.
6. Bruns, Axel and Yuxian Liang (2012). “Tools and methods for capturing Twitter data during natural disasters”. In: *First Monday* 17.4. ISSN: 13960466. DOI: [10.5210/fm.v17i4.3937](https://doi.org/10.5210/fm.v17i4.3937). URL: <https://firstmonday.org/ojs/index.php/fm/article/view/3937>.
7. Ericsson (2019). *Enabling internet for all. Extract from the Ericsson Mobility Report, January 2019*. URL: <https://www.ericsson.com/en/mobility-report/enabling-internet-for-all-wef-edition> (visited on June 1, 2019).
8. Graham, Mark (2014). “Inequitable Distributions in Internet Geographies: The Global South Is Gaining Access, but Lags in Local Content”. In: *Innovations: Technology, Governance, Globalization* 9.3–4, pp. 3–19. DOI: [10.1162/inov\\_a\\_00212](https://doi.org/10.1162/inov_a_00212). eprint: [https://doi.org/10.1162/inov\\_a\\_00212](https://doi.org/10.1162/inov_a_00212). URL: [https://doi.org/10.1162/inov\\_a\\_00212](https://doi.org/10.1162/inov_a_00212) (visited on June 1, 2019).
9. Kaka, Noshir et al. (Mar. 1, 2019). *Digital India: Technology to transform a connected nation*. McKinsey Global Institute. URL: <https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/digital-india-technology-to-transform-a-connected-nation> (visited on June 1, 2019).
10. Orriss, Iris (2014). “The Internet’s Language Barrier”. In: *Innovations: Technology, Governance, Globalization* 9.3–4, pp. 123–126. DOI: [10.1162/inov\\_a\\_00223](https://doi.org/10.1162/inov_a_00223). eprint: [https://doi.org/10.1162/inov\\_a\\_00223](https://doi.org/10.1162/inov_a_00223). URL: [https://doi.org/10.1162/inov\\_a\\_00223](https://doi.org/10.1162/inov_a_00223) (visited on June 1, 2019).
11. Schoemaker, Emrys (2014). “The Mobile Web: Amplifying, but Not Creating, Changemakers”. In: *Innovations: Technology, Governance, Globalization* 9.3–4, pp. 75–85. DOI: [10.1162/inov\\_a\\_00218](https://doi.org/10.1162/inov_a_00218). eprint: [https://doi.org/10.1162/inov\\_a\\_00218](https://doi.org/10.1162/inov_a_00218). URL: [https://doi.org/10.1162/inov\\_a\\_00218](https://doi.org/10.1162/inov_a_00218) (visited on June 1, 2019).

12. Starbird, Kate et al. (Feb. 6, 2010). “Chatter on the red: what hazards threat reveals about the social life of microblogged information”. eng. In: *Proceedings of the 2010 ACM conference on computer supported cooperative work*. CSCW '10. ACM, pp. 241, 250. ISBN: 9781605587950.
13. Surman, Mark, Corina Gardner, and David Ascher (2014). “Local Content, Smartphones, and Digital Inclusion”. In: *Innovations: Technology, Governance, Globalization* 9.3–4, pp. 63–74. DOI: [10.1162/inov\\_a\\_00217](https://doi.org/10.1162/inov_a_00217). eprint: [https://doi.org/10.1162/inov\\_a\\_00217](https://doi.org/10.1162/inov_a_00217). URL: [https://doi.org/10.1162/inov\\_a\\_00217](https://doi.org/10.1162/inov_a_00217)(visited on June 1, 2019).
14. World Bank Group (2016). *World Development Report 2016. Digital Dividends*. World Bank Publications. ISBN: 978-1-4648-0671-1. DOI: [10.1596/978-1-4648-0671-1](https://doi.org/10.1596/978-1-4648-0671-1). URL: <http://www.worldbank.org/en/publication/wdr2016>(visited on June 1, 2019).
15. World Bank Group (2019). *World Development Report 2019. The Changing Nature of Work*. World Bank Publications. ISBN: 978-1-4648-1328-3. DOI: [10.1596/978-1-4648-1328-3](https://doi.org/10.1596/978-1-4648-1328-3). URL: <http://www.worldbank.org/en/publication/wdr2019>(visited on June 1, 2019).
16. World Economic Forum (2019). *Internet for All*. URL: <https://www.weforum.org/projects/internet-for-all> (visited on June 1, 2019).

# Knowledge Economy and role of Libraries in Data Management

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## Abstract

LIS contributes information management to strengthen the explicit knowledge providing access to targeted subject information which adds value to economic development activities like education, business and SMEs, agriculture, etc. with the help of libraries focussing on indigenous/cultural knowledge. Writers, publishing houses, libraries keep on battling Google's exertion to digitise the world's books and make world's biggest library on the web. In the last two decades of 21<sup>st</sup> century, rapidly growth of mobile technologies changed the human life and paradigms shifted from digital library services to mobile library services in the changing world. The libraries have to explore the best practices of digital transformation of library services in Indian libraries.

## Keywords

Knowledge Economy, Knowledge Management, Digital Universe, Global Megatrends, Mobile OPAC, Artificial Intelligence

## Knowledge Economy

The term 'Knowledge Economy' was first propagated in the 1960s to describe a shift from traditional economics to ones where production and use of knowledge are two main components. The term was popularised by Peter Drucker at the Chapter of 12 in his book *The age of Discontinuity* (1969). The data economy is that the use of data to get bigger tangible and intangible values. Technology and in particular "knowledge technology", helps to incorporate part of human knowledge into machines.<sup>1</sup>

As described in the Business Dictionary, knowledge economy is that in which knowledge is the primary material and source of value. It is categorised by

- convergence and integration of communication and data processing technologies into information technology (IT),

- pervasive influence of information technology on economic activity such as the most workers are information workers and most products are information products and;
- application IT networks through the economic institutions, organisations and processes resulting in very high degree flexibility, weakening of regulatory control, and acceleration of globalisation.<sup>2</sup> In the knowledge economy the specialised labour force is characterised as computer literate and well trained in handling data, developing algorithms and simulated models, and innovating on processes and systems.

Social advancement has an immediate connection to the control of development: its utilization, access and association. Information records human learning in various structures. Internet on things (IoT) adds a totally different dimension to human life as it engages with more information progressively and leads us to a continuous dealing with redundancies. The Indian Data Centres are opening up for multiple opportunities – right from core computer elements to rack et al. The growth in the data and digital intelligent devices has paved a new way for the IT infrastructure arena. (Source: Dataquest, May 2019) These data centres are Knowledge Management hubs which incorporates complex method for curating and disseminating information, as well as sharing ideas and thoughts that enable groups to create opportunities from new perspectives.

The digital transformation of knowledge or information is data. It is everywhere. It is a digital world out there and whether you are an individual or an organisation or academic institution, in any given day huge amount of data is generated and no wonder we call it a ‘Digital Universe’. World Economic Forum (WEF) observed that “this personal data – digital data created by and about people – is generating a new wave of opportunity for economic and societal value creation. (Source: Dataquest, Sept. 2018)

## **The Role of Libraries in data Management and data Economy**

Books are being pushed aside for digital learning centres and gaming zones. By certain records, the library framework is experiencing a seismic change. Writers, publishing houses, librarians, keep on battling Google's exertion to digitize the world books and make world's biggest library on the web. In this present reality where data is progressively social and increasingly on the web, librarians are getting to be arbitrators, providers of specialized help and network outreach organizers. They are additionally never again bound to the physical library, said Greenwalt of the Skokie, Illinois. Librarians must endeavour into the digital space, where their potential exist, to demonstrate to them why the physical library is as yet vital.<sup>3</sup>

According to Urs (2004) - “The metamorphosis of the library skilled to data profession for the most part reflects the shifting within the stress and activities aimed at realizing the basic goal of profession- to participate and facilitate the creation transmission and use of knowledge”.<sup>4</sup>

Jestin & Parameswari (2002)<sup>5</sup> explored the challenges for library professionals in the present digital environment. They found that LIS professionals in India would confront various challenges. The introduction of ICT and new digital technology were a major challenge to librarians. It was acquainted that librarians should almost certainly take an interest inside the

strategy for creating and circulating information and information for personal satisfaction and education for all. Librarians ought to join to face up to the transformations which will happen inside the information and communication fields. Today the librarians are to manage data and train themselves to suit into the information age acting as knowledge manager. In this context, the following challenges are faced by them:

- Sharing of Existing Knowledge
- Transferring the Information
- Library as a knowledge management centre
- Library as access providers
- Filtering of the information

(See: Ref. 6)

LIS contributes information management to strengthen the explicit knowledge providing access to targeted subject information which adds value to economic development activities like education, business and SMEs, agriculture etc. with the help of libraries focussing on indigenous/cultural knowledge. British Library supports small business owners, entrepreneurs and investors to help to take the right steps to start up. It protects and assists to grow by developing ideas with its market research and corporate databases. Imparts training to learn new skills at a workshop through its pilot programmes, fosters the development of start-ups in London libraries in a hub with 10 London boroughs and 13 national network centres throughout the UK providing collaborative support to aspiring entrepreneurs and early stage SMEs.

This is not the whole scenario. In the 90's libraries began digitization. These simply automated the 19th century libraries. But this digitisation is limited to some programmed software of TLMS (Total Library Management Systems) which has very limited capacity to disseminate information from the big data it failed to mine. Libraries often refer users to other information and knowledge providers. There are some technical/special libraries which made themselves fit and competitive by taking an active role in the emerging "knowledge economy".

The bibliographic access is very traditional and rigid physical descriptions based on the book and classification schemes are reluctant to accommodate contemporary society. The cataloguing access has a predictable arrangement lacking specialised collection access points can be limited, resulting increase in search time.<sup>7</sup>

## **Mega Trend shaping the future**

### **What is Mega Trend?**

As Manoj Menon of Twimbit (Ex MD of Frost and Sullivan) says 'mega trends are transformative global forces that define the future world with their far reaching sustainable impact on business, societies, economies, culture and personal lives'.

Top 5 mega trends of last decade are:-

- Globalisation
- INTERNET
- Convergence
- Emerging Markets
- Business modules

Now we have seen that the mobile users have increased manifold. The following statistics would show the trend:-

500 Million<sup>+</sup> Face book Users

2 Billion<sup>+</sup> photos on Face book per month

1 Billion<sup>+</sup> tweets on Twitter

100 Million<sup>+</sup> videos on Yutubes

200 Million<sup>+</sup> blogs

13 Million<sup>+</sup> Wikipedia articles

India is third world largest country for education system in the world. In last two decade of 21<sup>st</sup> century, rapidly growth of mobile technologies, especially Smartphone technology changed the human life and paradigms shifted from digital library services to mobile library services in the changing world. Currently, digital transformation landscape is evolving very fast in information management and dissemination over the networks at the global level. Actually, ICT infrastructures as well as mobile software's/apps are commonly used by information professional in information management, preservation and dissemination in educational institutions but it is very helps to users to instant access of information resources on their mobile devices through mobile apps and web 3.0 (in future obviously web 4.0 as Forbes Magazine predicts) tools through Mobile apps, MOPAC, Mobile library websites, mobile databases etc. Implementing of several tools, some academic libraries provide the mobile bases services like Library Kiosk (self services tools), Mobile accessible websites, Mobile OPAC, Web-scale discovery, e-resources platform, Ask a Librarian, Audio Video Tutorials, Library user guides, Library orientations, Library floor plan, Library blogs, e-Mail/SMS alert and Library exhibits etc. Libraries have evolved to provide new ways of 24/7 access to their collections with open data and library services on mobile devices. The Librarians have to explore the best practices of digital transformation of library services in Indian libraries. Currently, almost Indian academic libraries are engages to provide e-resources to 24x7 accessible and discover by the user's on their mobile devices at the global level.

### **8 (eight) steps in changing the Library and Information (LIS) model in borderless environment**

The global information need is changing rapidly than we can react. Change is outpacing us quicker than we can pronounce “library users”. Our ability to stay agile and versatile is tested. There are eight steps of leading changes in managing models of information creation and dissemination:

- Create a sense of localised urgency – Examine what motivates your local team to see the need for change and the importance of speed based on their cultural management and communication preferences.
- Build a diverse global coalition – Ensure you have support from top level with the right skills and credibility.
- Develop vision and “global” strategy – Leverage the evidence of change to create a shared roadmap based on two metrics – global and local.
- Communicate the vision with the stakeholders in mind – Confirm acceptance and understanding for change by using the knowledge on local difference in risk aversion, tolerance of ambiguity and communication style.
- Empower the others to act on the vision – Remove local barriers to make the team successful, be flexible in the approach used to gain traction.
- Get quick wins from different regions – Identify and publicity the wins to gain momentum, pilot in high impact region.
- Consolidate improvements by leveraging wins that drive change – Use momentum from wins to continue driving change.
- Institutionalise new approach – Make it a new culture.

## Artificial Intelligence (AI)

Client administrations are the most significant part of the LIS, and AI can alter the client administration widely. With the appearance of chatbots, library can make certain that no client and his/her data need goes unattended or unanswered and that their quires are settled in least conceivable time. Artificial intelligence enables library clients to share their issues and get a continuous goal.

Today innovation is an undeniably essential factor in the effective disposal of information and AI is subjectively comes into the usage of innovation in the circle of Library and Information scattering administrations.

Artificial intelligence has transformed into an essential to live insightful for transforming into another pattern in present day society. Elite Group Computer Systems (ECS) acquires the most recent arrangement of items over different stages, for example, Amazon’s Alexa, Google Assistance or windows Cortana to help individuals achieve day by day errands, amusement, home gadgets control by basic voice control. Robotic Process Automation (RPA) bots can send messages and visit based choices to clients.

The entire array of online Catalogue has changed. It has started to abstracting and ordering information bases, full content, and 'pass through' access of list of material housed in physical assorted areas<sup>7</sup>.

## Conclusion

Libraries are an essential part of the general public that encompasses it. Librarians ought to recognize the progressions that are contemporaneous according to the demand of the passing state, and to tolerate as a top priority of the ways that within which more extensive social adjustment are influencing libraries. A few library activities are moving to new situations (and because of libraries are exonerated with the general public around them). They need to fathom the benefits of the mass conveyance of library data benefits within the digital age. It infers the established truth that librarians will exclusively create such a digital environment only when having been obtained an ideal training. Furthermore, it's the consequences of IT that the job of librarian was totally changed. As of now they're alluded to as "data professionals".

## References

1. Arthur, W.B., 2009. The nature of technology: what it is and how it evolves. Simon & Schuster  
[terminologieetmondialisationblog.wordpress.com](http://terminologieetmondialisationblog.wordpress.com)
2. The future of libraries with or without books. September 4, 2009 updated 1214-  
<http://edition.cnn.com/2009/TECH/09/04/future.library.technology/index.html>
3. Urs, Shalini., 2004, Shifting paradigms or paradise lost? Redefining and re-engineering the LIS profession for the digital age( Keynote address in national conference on library and information services, 44<sup>th</sup> Annual General Meeting of Srilanka Library Association, June 24-25, 2004.
4. Jestin, J., & Parameswari, B., 2002, Challenges for library professionals in India in the new millennium. Library Philosophy & Practice. 4(2). Available on <http://unlib.uni.edu/LPP/jestin1.html> .
5. Verma, Monaj Kumar. Changing Role of Library Professional in Digital Environment study. Vol.13, Issue No.2, Year 2015.
6. John A. Mess, "Artificial Intelligence in Information Services: revolution or survival? Proceedings of the AITUL Conferences. Paper 8. <http://docs.lib.purdue.edu/iatul/1991/papers/8> .



# **Census of India Database: An Exposition for Users and Library and Information Science(LIS) Professionals**

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## **Abstract**

Census of India is one of the most prominent example of information generation and dissemination by a government agency. It is known as the most important source of information on characteristics of human population. The census is conducted every ten years. During the past seven decades several changes have been made. Data collection, processing and tabulation programmes have been expanded substantially to meet the changing needs of the development planners and other groups of users. The purpose of this paper is to discuss various stages of census operations carried out in 2011 with special emphasis on dissemination of data; and also to acquaint the librarians and users of data with its structure and contents.

## **Keywords**

Population Data: India, Census Data Collection, Census Schedules and Questionnaires, Census Volumes, Census Data Centres, Census Data Dissemination.

## **Introduction**

An eminent Indian demographer has described Census of India as a 'goldmine of data'[1]. No doubt decennial population census, first conducted in India in the year 1871 is one of the most prominent example of information generation and dissemination by a government agency. By measuring the overall scale of its operation as well as variety and magnitude of data collected through this operation one can infer that it is one of the largest administrative exercise in the world and certainly so in the country itself. It is the source of maximum data on characteristics of human population.

The United Nations has defined census as the total process of collecting, compiling, evaluating and analysing, publishing or disseminating demographic and other data pertaining at a specified time to all persons in a country or delimited territory. The definition affirms that census operation is not merely collection of data rather it includes compilation of data on different

demographic, social, cultural as well as economic indicators of the population as well as publication of results in varied forms;-e. g classification of persons by sex and age, marital status, rural/urban residence, educational standard, economic activity, etc.[2] In India such data are primarily used by the government agencies for the purpose of development planning in combination with other data sources like national income statistics, multi subject sample surveys (conducted under the aegis of NSSO i e National Sample Survey Office),foreign trade data etc. The first concern of a development plan programme is how many people reside in the area earmarked for development and what sort of demographic changes are occurring and are likely to occur in the coming years. It makes a difference if the people are evenly distributed throughout the area or if they are clustered in one region or in villages and small cities.[3]

Population census results are increasingly being used by planners as well as social science researchers as there is a close interrelationship between population trends and socioeconomic development. Also there is a growing trend to use statistical sources by the researchers from social science disciplines. It has been said "in older days people derived their understanding of society from history, literature, and personal experience. Now they base their conclusions on numerical evidence provided by the agencies like CSO(UK),OECD etc. As a result economists have become more econometric, political scientists more numerate and sociologists more systematic".[4]

The purpose of this paper is to explore and discuss various genre of socio economic data emanating from the Census of India with special reference to the changes made in data collection and dissemination during the 2001 census and the 2011 census. The preparatory measures taken so far for the forthcoming 2021 census have also been discussed briefly.

The paper has been written with the premise that LIS professionals working in academic and research libraries are required to know the content and structure of census data in order to serve their clientele in a better way.

## Background

The first Census of India was conducted in the year 1871 in a non synchronised manner. Thenext was taken in 1881 in a synchronised manner all over the Indian sub- continent. Since 1881 a census has been conducted in the country every ten years. For administrative purpose the British government was eager to collect socio- cultural data about their subjects. Peter Gottschalk in his book *Religion, Science and Empire: Classifying Hinduism and Islam in British India* has written that Census of India was a powerful source of information to represent India's religion based on systematic quantification of their followers.[5] Also census has been one of the institutions of power along with other two i e map and museum which proved to be instruments of domination during the colonial rule.[6]

After the independence a permanent legislation Census of India Act (Act no. 38 of 1947) empowered the government to conduct census on a regular basis every ten years by appointing a Census Commissioner at centre and Directors of Census Operations in States. The law also made it obligatory on the part of the citizen to answer the questions asked in the census schedule.

Needless to say that the scope and coverage of Indian census expanded enormously during the past seven decades as the government set up an elaborate network of agencies and institutions to gather and collate a wide range of information. New questions have been added in the census schedule on the basis of requests received from the users. Tabulation plan has been expanded correspondingly to meet the requirements of researchers. The first three censuses conducted after the independence i.e. 1951, 1961 and 1971 introduced several innovations to reflect the changing socio economic needs of the country. A comparison of the questions asked in different censuses would reveal that the items like a) name of the person for identification purpose) b) relationship to head of the family c) age c) sex d) marital status e) birth place f) mother tongue g) literacy and h) occupation always featured in the schedule. After the introduction of development plans the scope and coverage of these variables have been expanded by breaking down details and also by extending tabulation programmes. Later in the subsequent censuses held in the years 1981, 1991, 2001 and in 2011 major changes have been introduced in the data processing and dissemination programmes with the help of information and communication technology(ICT).

The British government introduced census as a tool for collecting data on India's population mainly for the purpose of administration. Following this tradition the Republic of India made the census a part of Ministry of Home Affairs (MHA) in the Allocation of Business Rules(1961). The Office of the Registrar General of India(RGI)under the MHA is the agency responsible for holding decennial census.

Apart from development planning the census data also help in the administrative decision making process.

Following are the examples:

- The partition of India was done in the year 1947 on the basis of religion data provided by the population census.
- The census data on mother tongue was primarily used for the reorganisation of states in the year 1956.
- Since 1952 the general elections are conducted on the basis of delimitation of constituencies based on census data.
- The reservation of seats in the parliament and state assemblies are done on the basis of census data on scheduled castes(SC) and scheduled tribes(ST).
- The reservation of jobs for SC's and ST's and for Muslims in Andhra Pradesh according to the decision taken by the state government is done with the help of the census data.
- The calculation of house rent allowance of government employees is calculated on the basis of size and category of cities defined by the census.

There could be many other examples of administrative use of census data. Indicators like female to male ratio has become important. Similarly migration and urbanisation has received consideration from the planners. The details of a household and the data pertaining to the individuals residing in it collected through the censuses held during 2001 and 2011 would reveal that 'need based extended tabulation' of micro level data permitted by the ORG (with certain confidentiality related conditions) can result in exploration of a real 'goldmine of information' for research.

## Census of India: Data Collection

Census schedule or questionnaire is the main instrument for data collection. In the censuses conducted in the years 1951, 1961, 1971 and 1981 three basic questionnaires were canvassed;-- the House List, the Household Schedule and the Individual Slip. Later for the sake of convenience the Household Schedule and the Individual Slip were merged and a detailed Household Schedule was designed to collect information on head of the household as well as each and every member of the household in considerable detail. And over the years several changes were made in these instruments to reflect the changing conditions and to incorporate many new data series in the dissemination programme as shown below.

**Table 1.** Significant Changes Made in Census of India during the Post-Independence Era.

### **Census of India 1951**

- More emphasis was given to economic characteristics of population to meet the requirement of development planners. Cross tabulation of data by livelihood and rural urban breakdown for all tables was incorporated.
- *District Census Handbook* were compiled and released for the first time in the history of Indian census.
- There was a three-fold rise in the number of census volumes disseminating data (total number being 495).[7]

### **Census of India 1961**

- Became the most comprehensive census in terms of questions asked, tabulation programme, maps, ancillary studies and publications released. Two new schedules, i.e., House List and Household Schedule, were canvassed.
- District level data for the whole of India were made available on a large number of socio-economic variables. These data were published in *All India Census Report, Series A*.
- Social Studies Division was set up in the RGI. Scholars from universities and institutions were invited to compile monographs on important demographic subjects.
- There was nearly four- fold increase in census volumes. The total number was more than 1700 publications though the initial plan was to publish 1476 volumes.[8]

### **Census of India 1971**

- A large number of basic tables were prepared quickly on 1 Per cent sample data. The use of computers was introduced for processing and tabulating data.
- Data on industrial establishments of all sizes were collected. A direct question on migration was included(with reference to last move only). Two new questions on childbirth and age at marriage were also added.
- In order to collect estimates of birth and death, a sample registration system was introduced in 1969 by the RGI. This came as a supplement to census data.
- This census conducted socio economic surveys of more than 200 towns and villages. More attention was given to compile District Census Handbook and Census Atlas.

### **Census of India 1981**

- Computerisation of sample data was taken up on a large number of variables so that publications at appropriate geographic or administrative level could be produced periodically for the users.[9]
- Individual Slip of 1981 census was in two parts. Universal items and a set of sample items which were related to migration and fertility related information. The second part was canvassed in 20% Of the sample blocks.
- In the first part question related to school attendance was added.
- A new item 'seeking/available for work' was added to estimate the extent of unemployment.
- In the sample part a new question on reason for migration was added. In addition questions on number of children ever born and the number of children surviving(by sex) for every married women was added.
- All these new items resulted in extended tabulation programme. And these provided more information to the data users though the comparability of data between the 1971 and 1981 census was lost to a certain extent.

### **Census of India 1991**

- Data were published on various household amenities like source of drinking water, source of lighting, toilet facilities and source of fuel used in the household.
- These data were made available for both urban and rural areas at district and city levels.
- The data could not be collected in Jammu and Kashmir because of disturbed conditions in the state.
- Based on 1991 census data, a website was created by the ORG in 1998 to provide easy access to the data users and to generate about the forthcoming 2001 census operation.

### **Census of India 2001**

- Data dissemination in a user friendly manner was given priority. Census data were put on the website of the RGI. Geographical Information System(GIS) related website was more impressive as it contained thematic maps of every state and district in India going down to sub-district or *tehsil* level.[10]
- Important tables generated from the data collected through this operation were put on moderately priced(Rs 350) CDs which one could buy from the RGI's Office located at Man Singh Road New Delhi.
- In earlier census operations key tables were generated quickly on the basis of 5% sample data. This practice was discontinued. The entire data on 100% basis was transferred to computer for the purpose of tabulation. This caused considerable in publication of results.[11]
- The nine-fold classification of industrial workers(1961) was replaced by a more detailed seventeen-fold classification based on National Industrial Classification(1998). As a result the comparability of data with the previous 1991 census became a difficult task.[12]

The Census of India 2011 was conducted in two phases. a) House Listing and Housing Census and b) Population Enumeration with the help of a Household Schedule. The first phase was

completed during April-September, 2010 covering almost all states. One month's time was given to each state to complete this phase. The second phase i.e population enumeration was done in between 9th February and 28th February 2011. Immediately after a revision round was conducted from 1st March to 5th March 2011. The count was updated to arrive at a final figure on the reference date of the census i.e 1st March 2011. On the basis of suggestions received some new items were added in the House Listing and Household Schedule. Details are given below.[13]

- Type of Wall 'stone packed with mortar' or 'stone not packed with mortar'.
- Type of Roof 'Use of hand-made tiles or machine made tiles'.
- Source of Drinking Water 'whether tap water from treated source or untreated source'
- Source of Lighting and Bathing Facility within Premises (to identify whether the enclosure is with roof or without roof).
- Latrine Facilities- The questions were expanded to include indicators using WHO/UNICEF categories. The purpose was to assess the impact of 'toilets for all' project.
- Computer/ Laptop Availability with or without Internet and Telephone Facility Including Mobile
- Personal Data: Gender Specification (other than male or female).
- Date of Birth: Completed Years as well as Actual Date of Birth.
- Marital Status: Separate Codes for 'Divorced' and 'separated'
- Disability: Instead of 'Five Codes' provision for 'Eight Codes' was made to make the disability status more specific.
- Education of Persons: New Indicators for persons who never attended any institution and who have attended earlier were added. Additional code for persons who are attending special institutions for disabled people was added.
- Detailed Data on Marginal Workers: a) three months but less than six months and b) less than three months.
- Specific Details of 'non economic activities (like sex worker or illegal work)', 'migration( birth place and place of last residence) added for recording district names.' number of children born alive during last one year' was also included.

A few questions related to households owning land and engaged in agriculture were dropped as there were technical problems like variation in measurement, comparability of data with other sources like Agricultural Census or land holding surveys of the National Sample Survey Office (NSSO). According to the prevailing practice, Provisional Population Totals on the quick tabulation of the totals on some basic indicators like total population, child population (age group 0-6), literates and illiterates (by sex), based on manual compilation were released for the country on 30 March 2011.

On manual processing which was time consuming and difficult to manage as there was always a chance of getting the records damaged. This led to the partial adoption of computerised data processing in the 1971 census followed by 1981 census in which results were obtained on a number of variables by The figures were released for India, states and union territories at district level for the states and union territories. Data collection was done on the basis of coded questionnaires or schedules to facilitate transfer of data to computers. In total 35 questions were

included in the House Listing and Housing Census schedule and 29 questions featured in the Household Schedule which was meant for population enumeration.

Due to the largeness of the country and high density of population, the requirement of instruction manuals and census schedules was huge:- 5.4 million instruction manuals and 340 million census schedules were printed in different languages. The schedules had to be printed on special quality papers as suggested by the experts in scanning technology. Bar codes in each schedule, unique form numbers, pre printing of some location numbers were special features of the schedules canvassed for the purpose of data collection.

Census of India 2011 data collection is important from another perspective. It has provided benchmark data for the creation of a National Population Register. This new project when completed will pave the way for successful conduct of future censuses perhaps with lesser cost and effort.

## **Census of India: Data Processing and Tabulation**

It has been rightly said that data collected through census are processed and tabulated by the RGI selectively. Data are not processed or published for the users on 100% basis. Only a part of the data collected are processed and tabulated.

The Indian census during its initial years after the independence mainly relied computerised processing of sample data. And 2001 onwards manual processing has been continued only for getting the preliminary results in the form of *Provisional Population Totals*. Modern data processing was introduced in 2001 which facilitated 100% transfer of data millions of Household Schedules and Population Enumeration records to the computer. This did not result in timely processing and tabulation of results partly due to limited Information and Communication Technology (ICT) infrastructure available with the census organisation. In fact time lag in the publication of results still continues. There has been complaint that some of the 2011 data (D Series) are yet to be released or published by the RGI.[14]

In the 2011 Census of India, use of coded schedules and adoption of ICR technology for processing has greatly helped in generating large number of tables on full count basis and cross classified results on a number of important variables. The results derived from House Listing and Housing Census have been presented in 48 tables. They contain data on housing conditions, household amenities and assets owned by the households have been made available in the public domain. Similarly the data on a large number of socio economic indicators derived from the population enumeration have been released in the public domain. The final tables on migration were to be published after the general elections.

The present state of release of population enumeration data may be seen in the following Table 2.

**Table 2.** Tables Released on the Basis of Population Enumeration Data 2011 (as on April 2019)

Type of Data	Broad Indicators	Number of Tables Released
General Population Table, Series A	Population (including Primary Census Abstract for total SCs, STs, Houseless, Others individual SC St etc) area and density.	30
Economic Activity Table, Series B	Workers, Industrial Classifications, Occupation etc.	35
Socio Cultural Tables, Series C	Age structure, Education, Language and Mother Tongue, Marital Status, Religion, Disability.	64
Migration Table (Provisional), Series D	Migration by place of last residence, age, sex, reason for migration and duration of stay	1
Fertility Tables, Series F	Children ever born, Children surviving, Birth during last 12 months.	14
Household Tables, Series HH	Household size, Composition etc.	12
Special Tables on Scheduled Castes & Scheduled Tribes	Selected Indicators from all the above Series.	30

India is a country known for its diversity. There are many social, religious, linguistic and cultural groups in the country. There are many communities in the country who have faced oppression due to their caste based identity. A few others are isolated and cut off from the mainstream as a result of their geographic isolation. These groups were identified as SCs and STs and special provision was made in the constitution for safeguarding their interests. Similarly there is a National Commission for Minorities Act (1992) and National Commission on Backward Classes Act (1993). These developments along with 27% reservation for other backward classes has created demand for religious group or backward class specific data.

Though data pertaining to SCs and STs are collected through the census, no data related to OBCs are available. There was a proposal to include caste data in the 2001 census. The proposal was later dropped. However in the 2011 census it was decided to collect data on caste and their socio economic status as a supplementary exercise after the conclusion of the census operation.



It is difficult to say when and at what level the caste or religion specific data will be made available to the government agencies and researchers working in universities. Table 2 reveals that even after eight years of census taking RGI is yet to release tables on certain important variables. Therefore the issue of timeliness is a major factor in dissemination of census data.

## Census of India: Data Dissemination

The policy regarding dissemination of census data has many facets:- in what form data are to be made available, how to organise the printed volumes or CDs, what ancillary support is to be given to the users so that they can identify their required data series and use them for research and investigation. In the earlier period the census results were primarily disseminated through printed reports. The reports were organised at the centre i.e. Office of the ORG and in states i.e. Director of Census Operations depending on geographic area covered and demographic characteristics reflected in the data. Keeping in view these two aspects census volumes are organised and released in different 'Series' and 'Parts' as shown in Table 3. The information presented in the table would be helpful in gaining an understanding of the structure and content of census reports. One should note that the census organisation has now stopped publishing ad hoc reports like census monographs and occasional papers.

Like other statistical agencies of India, the census organisation has discontinued publishing bulky volumes containing detailed results. From 2001 Census of India detailed results are released in CDs at a nominal price of Rs 350 and most of the mainstream data at all India and state level are put on the official portal of the RGI (i.e. <http://www.censusindia.gov.in>) in Excel format as a part of 'open data' initiative of the government. Access policy will be governed by the National Data Sharing and Accessibility Policy of the government. A limited number of printed reports containing certain important indicators are printed for priority users.[15]

In order to provide an insight into the structure and content of different statistical publications including census volumes, a number of auxiliary tools or guidebooks which are useful for librarians as well as data users were published by the Central Statistical Office (CSO). Two important guides published four decades ago were *Guide to Official Statistics* (1985) and *Directory of Statistics* (1976). These two compilations were meant for official users and one could not get them through normal book trade channel. Therefore it is difficult to say whether any newer edition of these guides are available. However for the census volumes a small booklet titled *Data Users' Conference for Census of India 2021: Agenda, 9th-10th April 2019, Vigyan Bhavan, New Delhi* is immensely helpful.

**Table 3.** Classification of Census Volumes\* [16]

Criteria of Classification of Census Publications or Reports or CDs	Bibliographical Descriptor
Ad hoc publications, basic tables and special purpose tables (Relevant mostly in case of reports published as results of earlier censuses held in 1951,1961,1971,and 1981	<p>Paper no./ Occasional Paper no. released during a calendar year e g <i>Paper no1, 1981 Provisional Population Total.</i></p> <p>Census monographs published during a particular census as special studies on a subject of topical interest.</p>
Geographic and administrative divisions covered. i e states, union territory etc	Series in Indo Arabic numerals used as a descriptor or identifier, e g Series 1 India, Series 2 Andhra Pradesh etc.
Demographic Variables in broader as well as narrower terms	<p>Part in Roman numbers used as a descriptor, e g Part I Administrative Report, Part II General Population Tables etc. These parts are further subdivided.</p> <p>Series in Roman alphabets has also been used to denote a specific subdivided demographic variable covered in a volume, e g A Series General Population Tables, B Series GeneralEconomic Tables.[17]</p>

\* Bibliographic details of a census volume are confusing and difficult to understand. For example It reads like; *Census of India 1991, Series A India. Part IIIB B Series Economic Tables. Volume 3 (Part 2), Tables B-7(F) and B8(F). India, States and Union Territory.*

One way to make census data volumes known to the users is the compilation of bibliographies, documentation lists and cataloguing of concepts, definitions, methodology, error rates etc. So far the census organisation has made only sporadic attempts to compile bibliography of census volumes.[18] In fact there is no complete record to verify how many volumes were published as results of a particular census operation. Only tentative figures are available regarding number of census volumes. As regards concepts, definitions, methodology of data collection as well as data comparability, statements are normally included in the introductory part of a data source placed in the public domain or in the CDs. As mentioned in the previous paragraph booklet published on the eve of data users' conference practically works as a guide to census data. Another pamphlet *National Summary Data: Census 2011* contains explanatory notes on various terms and socio economic indicators associated with the census results.

One redeeming feature of data dissemination programme is the opening of census data workstations for the researchers. The first workstation has been set up in May 2012 as a joint collaboration between the RGI and Jawaharlal Nehru University, New Delhi. Other workstations set up for users in different parts of India are a) Punjabi University, Patiala; b) Gokhale Institute of Politics and Economics, Pune; c) University of Kerala, Thiruvanthapuram; d) Goa University, Goa; e) Naba Krishna Choudhary Institute of Development Studies, Bhubaneswar; f) Ranchi University; g) Rajasthan University Jaipur; h) University of Kashmir, Srinagar; i) Gujarat University, Ahmedabad; j) Indian Institute of Management, Bangalore; and k) Indian Statistical Institute, Calcutta. The purpose is to provide access to census tables from 1991, 2001 and 2011 census operations. Special customized tables generated from census databases on request from the researchers. According to the data dissemination policy of the RGI, these centres will allow access to micro data without revealing the identity of the population surveyed.[19] The Census Act 1948 stipulates that information collected or given by any respondent be treated as confidential. Such information is also prohibited from being presented or used as evidence in any court of law.

A Steering Committee has been set up in each of these centres to oversee that only qualified researcher gets access to micro data. The research proposal should have approval of the said committee.

The next census will be conducted in the year 2021 and preparation has already started for this gigantic task. The procedure to be adopted for data collection will undergo change. Methods like computer assisted personal interview, telephone interview, web based interview will be given priority. The traditional 'paper assisted personal interview' in which the enumerator visits every household and record the responses on a paper schedule will be gradually withdrawn. It is expected that the new ICT based method will minimise delay in finalisation of results. Online data cleaning will also improve the quality of data.[20]

## Concluding Remarks

Census of India is a major statistical operation conducted under the aegis of RGI, Ministry of Home Affairs. During the past seven decades its scope has increased manifold. Data are now collected on a large number of social, economic, ethnic and other characteristics of human population. Keeping in view the increasing demand of census data the RGI should adopt more user oriented data dissemination procedure particularly for non official users.

The published literature suggest that there is a huge demand for disaggregated and cross tabulated data on different castes and religious groups.[21] The possibility of constructing time series data on certain important socio economic indicators may be explored in consultation with experts. In order to reduce the time lag in release of data, modern ICT based method should be adopted in collaboration with other statistical agencies. It has been said that with a bit of innovation and coordination the 'Electoral Roll' database can be used for the purpose of obtaining demographic characteristics of the population.[22]

The responsibility of conducting Census of India should be shifted from the MHA to the Ministry of Statistics and Programme Implementation which is considered to be the apex body for India's Official Statistical System. This will ensure better coordination will state statistical authorities and adoption of new technology and method for census data collection.[23]

## Notes and References

1. Ashish Bose, "Census Goldmine: Dissemination of 2001 Data." *Economic and Political Weekly* 39 (August 7, 2004): 3595
2. P.R. Goswami, "The Census of India: A Discussion of Issues of Data Collection and Dissemination" *Government Publication Review* 16 (September-October 1989): 429
3. U.S. National Research Council, *Data Collection: A Statement for Administrators* (Washington D C: National Academy Press, 1981), 2
4. Nigel Forman, "What Role for the Social Sciences." *Policy Studies* 8 (July 1987): 44
5. Peter Gottschalk, *Religion, Science and Empire: Classifying Hindus and Muslims in British India* (Oxford: Oxford University Press, 2012).
6. Benedict Anderson, *Imagined Communities: Reflections on the Origin and Spread of Nationalism* (London: Verso, 1991) quoted in R.B. Bhagat, "Social Identity and Statistical Inclusion: An Appraisal of Demographic Sources of Data". *Demography India* 42, 1&2 (2013): 57
7. B.K. Roy Burman, ed. *Bibliography of Census Publications in India*. Census Centenary Publication 5 (New Delhi: Office of the Registrar General, 1972), 473
8. S.C. Srivastava, *Indian Census in Perspective*, 3rd ed. (New Delhi: Office of the Registrar General, 1983), 85
9. P. Padmanabha, "Computerisation of Census Data." *Economic and Political Weekly* 16 (April 18, 1981): 717-20
10. Ashish Bose, "Census Goldmine." 3596.
11. Ashish Bose, "Census Goldmine." 3595
12. Ashish Bose, "Census Goldmine." 3596.
13. India. Office of the Registrar General and *Census Commissioner, Data Users' Conference for Census of India 2021: Agenda*. 9th-10th April 2019, Vigyan Bhavan, New Delhi.
14. E mail correspondence with Dr D Mestri, Chief Librarian, International Institute of Population Sciences (IIPS), Deonar, Mumbai.
15. India. Office of the Registrar General and *Census Commissioner, Data Users' Conference*, 8
16. P.R. Goswami, "The Census of India", 434
17. Series as a bibliographical descriptor has been used for a dual purpose in census publications. One can find that numerical series has been used to specify geographical or administrative area covered in a volume. And alphabetical

series signifies the demographic characteristics covered in the volumes. This anomaly had surfaced during the 1971 census when it was decided instead of assigning a volume number to each State and Union Territory, as was the previous practice, it would be better to assign a distinctive series number.

18. P.R.Goswami, "The Census of India", 436. Also see B.K Roy Burman, *Bibliography of Census Publications in India*, 1-2

19. Website of the Office of the Registrar General and Census commissioner. [www.censusindia.gov.in](http://www.censusindia.gov.in)

20. India. Office of the Registrar General and *Census Commissioner, Data Users' Conference*, 1-8

21. R.B. Bhagat, "Social Identity and Statistical Inclusion", 63-64

22. Kaushik Bhattacharya, Abhiman Das and Anujit Mitra, "Demographic Statistics in India: Why Shall We Take the Electoral Roll Seriously?" *Demography India* 36, 1(2007):155-167.

23. It should be noted that the census is not the only source of demographic statistics in India. Other sources are sample surveys, civil registration and sample registration systems. Population data collected through these methods are largely meant for supplement census data, particularly during the period between the two censuses.

# Research Data Management (RDM): Demystifying the notion about Data Librarians

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## Abstract

The study aims to focus on the emergence of the concept of data librarian in the field of research and innovation. The authors concerned a vast number of literature to determine the evolution of data librarians in the 21<sup>st</sup> century. A semi-structured interview was conducted with LIS professionals to determine the likely impact of data librarianship. The findings suggest that LIS professionals in some cases are well equipped to sustain amidst the transition from contemporary librarianship to data librarianship. The paper also highlighted some of the existing roles and new roles that the librarians are needed to play. The authors provided a conceptual framework to educate and aware the data librarians. Few challenges and recommendations were lastly discussed in the paper.

## Keywords

Data science; data librarianship; data librarian; data curator; research data management;

## Introduction

The changing roles of librarians in research data management have triggered the evolution of the 21<sup>st</sup> century data librarians. Extensive generation of research data has led to the progression of data librarians that involved modification, diversification, convergence, divergence, hybridization, differentiation, and naturally selection. Research data management is incredibly important for high quality research and scholarly communication. Wider access to scholarly and scientific data can help to foster more innovation, improve collaboration between researchers, increase accountability, and responsiveness for research outcomes. Schmidt (2016) states that, research data management involve services and infrastructures to support the handling of research data across the data life cycle. The emerging need for research data management is persuading the library professionals to plan for additional research data services offered by the libraries and also increase the librarians' research data management skills (Tenopir et al. 2014). The shift in the roles of librarians is thus a critical and demanding issue in need for proper study and awareness among the professionals.

## Objectives

The study aims to discuss elaborately the different perspectives of librarians in changing roles for the 21<sup>st</sup> century. The authors of the paper discoursed different aspects of libraries in providing the research data management support for their patrons. The broad objectives of the paper are:

- to highlight the immediate need for data librarians in RDM.
- to identify the roles that academic libraries can play in RDM.
- to enunciate the shift in roles and responsibilities from librarians to data librarians/data curators of the 21<sup>st</sup> century.
- to provide a feasible framework to implement the concept of data librarians in the field of research and innovation.

## Research Questions

The paper aims to answer:

- What is the importance of data librarians in the field of research and development?
- What knowledge and skills are required of people working in data librarianship and management roles?
- What roles does an academic library play in the achievement of sustainable research data management practices?
- What are the challenges faced by the data librarians in implementing research data management practices?

## Literature Review

### *Research data lifecycle*

Research data develop over the entire research lifecycle, including the collection, analysis and evaluation of data (Wilms et al. 2018). Although data sharing is regarded as a good practice by the researchers, it appears that researchers invest little time in metadata and documentation making a great deal of data undiscoverable (Ünal et al. 2019). The data generated during the research activities are valuable resources which if properly stored may be accessed, browsed, consulted, used and built upon in future for academic work, research and scientific purposes (Tripathi, Shukla, and Sonker 2017).



**Figure 1.** Principle stages of the research life cycle (Richardson and Wolski 2018)

### *Research Data Management*

Researchers often struggle with the quantity, diversity and complexity of the generated data, making future research data management inevitable (Wilms et al. 2018). One common definition describes RDM as “the organization of data, from its entry to the research cycle through to the dissemination and archiving of valuable results” (Wilms et al. 2016). RDM is strongly related to the notion of scientific data curation “which means to collect, organize, validate and preserve data so that scientists can find new ways to address the grand research challenges that face society“. Transparency in research helps researchers to become more resistant against the accusation of delinquency. Providing access to research data has proved to be useful for scientists as sharing research data with the community may result in higher citation rates. (Wilms et al. 2016). Data management is the process by which observations and measurements are defined, made, and documented, and the methods by which the data from those observations are subsequently processed and maintained. (Williams, Bagwell, and Nahm Zozus 2017). Proper management of data throughout the research process is crucial for making it openly accessible, intelligible, assessable and usable (Ünal et al. 2019).



### ***Academic libraries and research data management services***

Universities all over the world have a central role in the generation of knowledge and innovation, they are major stakeholders in nation development (Richardson and Wolski 2018). Many academic libraries are undertaking themselves: to identify patron needs related to research data, and then learn the skills required to help meet their needs, then design and offer services, and lastly assist patrons in using the services and related resources (Witt and Horstmann 2016). Funds for open researches are also taken into consideration by academic libraries to support data sharing, open access and researchers in general (Witt and Horstmann 2016). The ways in which libraries are currently involved in research data management and the extent to which the development of research data management services is a strategic priority for them (Searle et al. 2015). Universities worldwide are focusing on enormous research activities which have tremendously boosted the production of research data (Tripathi, Shukla, and Sonker 2017). Academic libraries are ideally suited to add value throughout the entire research lifecycle within their institution (Searle et al. 2015). Academic libraries have progressed from focusing on the management of physical resources and related services to “transforming resources and services into digital formats to support teaching, learning and research” (Raju 2014).

### ***Data Librarians***

As institutional information experts, librarians are considered to be part of data sharing efforts, since enormous administrative and operational capabilities are urgently needed (Witt and Horstmann 2016). Data Librarians have a valuable contribution to make in ensuring that appropriate information related standards are set and met. ‘When a lot of non-librarians are talking about metadata, it is wise for the experts to make their voices heard’ (Wusteman 2008). Data Librarians are well placed to serve the roles of collaboration facilitators and managers; if librarians do not offer these services then researchers would merely ignore the interference of libraries and data librarians which would result in the loss of important research output. Librarians are helping researchers address needs throughout the research data lifecycle, for example, by conducting assessments and outreach, consulting on data management plans and metadata, incorporating data into information literacy instruction and collection management, providing reference services to help patrons find and cite data, and providing data publication and preservation solutions. They are creating web guides and tutorials, training colleagues within and outside of the library, contributing to discussions related to research data including policy development and planning, and in some cases, participating directly with researchers on data-intensive projects. (Witt and Horstmann 2016)

### ***Skills and competencies for data librarianship***

Librarians need to be proactive in identifying and advocating for their potential roles in research, development and use (Wusteman 2008). One of the reasons for librarians’ lack of identification with the future of RDM is likely to be lack of familiarity with the topic, although it is worth noting that librarians are far more aware of RDMs than researchers at present (Wusteman 2008). RDM facilitation would require some new skills training for the librarians involved, which, in

turn, would have implications for the professional LIS curriculum. But the role of service facilitator for a RDM would not necessarily be more ‘technical’, it would rely on the same underlying data management and communication skills in which many librarians already excel (Wusteman 2008). Data curation is the management of data right from the stage of its origin to the point of time when it slips into obsolescence, is no longer valid and is fit to be deleted. (Tripathi, Shukla, and Sonker 2017). Data curation competencies and understanding of the research environment were now required, and that point-of-need service models were planned for delivery (Woeber 2017). As the main competences for the librarians sees the knowledge in archiving data for a long-term period and as well the competence of standardizing metadata. There is need to develop digital curation skills in library professionals as well as researchers. (Tripathi, Shukla, and Sonker 2017). The experts have recommended that data literacy modules should be incorporated into the curricula to equip the students and the researchers with the competencies to organize and curate their data sets correctly. (Tripathi, Shukla, and Sonker 2017). The competences of the data curator are to be described as: knowledge and understanding, intellectual skills (ability to apply knowledge in different contexts) and practical skills (ability to manage projects and organizations) (Tammara and Casarosa 2014). Research data services should include activities that support researchers in building the skills and knowledge required to manage data well (“data literacy”) (Searle et al. 2015). “Although the role and competencies required align with existing liaison librarians’ roles, there are some major gaps in current knowledge and areas where the direction of development is unclear” (Searle et al. 2015)

## Methodology

A mixed method has been followed to articulate this paper considering a vast range of literature that was systematically reviewed as well as a semi-structured interview was conducted along with 20 Library and Information Science (LIS) professionals. The interviewees were concentrated among the academic libraries only. In some cases, group interviews of 2-3 respondents were held together and in others one to one response were collected. The Interviews were noted down by the authors themselves that was later used for discussing in the findings of the paper. The interviewees mainly provided their answers to the research questions posed to them. The authors’ delineated their perspectives and awareness in a holistic manner and also elaborated the interviews in a structured way. Lastly, the authors came up with a proposed framework to implement the concept of data librarians in the field of research and innovation.

## Findings and Discussion

The emerging need for research data management is prompting library directors to plan for additional RDS to be offered by their libraries, and at the same time many librarians are looking for opportunities to develop their RDS related skills (Tenopir et al. 2014). Academic librarians assist researchers at the beginning of the data cycle, and in some cases at the end of the cycle with data deposit (Matusiak and Sposito 2017). As per the perspectives of the interviewees concerned for the purpose of this study emphasized on the existing roles that librarians already

play in terms of research data management. When asked what roles an academic library plays in terms sustainable research data management practices, a good number of interviewees mentioned:

*“...Libraries are already taking active part in research data management by ensuring the accessibility, availability, and ensuring authenticity of the research data... It is worth mentioning here, librarians or data curators are the experts in the field of metadata generation and tagging...”*

Other interviewees ensured supporting the research activities of the fellow researchers by providing a platform of institutional repositories where their research works are displayed and put for sharing and dissemination. The findings suggest that, many academic libraries have been closely supporting the university research wings by way of research advocacy.

*“...Academic libraries are the heart of research and innovation... Librarians or subject experts have been giving clear instructions for the newbie researches in all aspects from data generation to data storage and sharing...”*

It was evident from discussing with the library professionals that, the libraries or research centers are well aware of the needs of their patrons and are well suited to provide their timely services. Many professionals stated that, they organize different training and workshops for the researchers where concepts of online data sharing tools are introduced.

*“...the library always arranges authors’ workshop on how to manage, store and share data on online platforms like Mendeley...”*

From the vast number of literature consulted and from the collected data, it was highly evident that the importance of data librarians is well noticed these days. Many interviews seemed to be aware about the transition that is taking place.

*“...we, the librarians are aware about the fact that it is a transition period where the librarians are coming out of their contemporary roles and serving the community as per their demands...”*

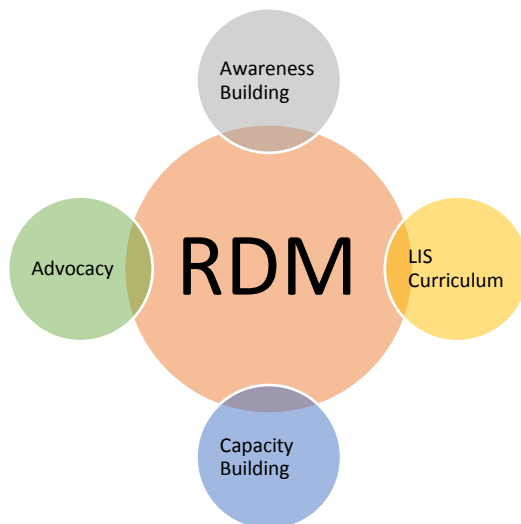
Nevertheless, a well number of literature suggested the need for incorporating research data management in the LIS curricula and the same was determined from the responses of the interviews,

*“...to serve the millennial it is inevitable to have it included from the very first stage of training and education... RDM is no more a concept in pen and paper it must be put into evidential practice...”*

The consulted literature and interviewees discussed about certain constraints that are faced on a day to day basis by a data librarian. It is worth mentioning here that, some of the LIS professionals are yet not competent enough to prove their existence in the field of research and innovation. The tremendous generation of data from different types of research conducted in a larger arena needs urgent notice of the data managers. In these aspects, many of the LIS professionals were found to be lagging behind. Proper awareness, capacity building, and advocacy might help to overcome these likely challenges. Some other noticeable issues that were raised during the discussion with the respondents were that, the researchers are resistant to accept the interference or the role that the data librarians can play in research and innovation.

*“...lack of collaboration between researchers and library specialists are one of the reasons for improper management and loss of research data...”*

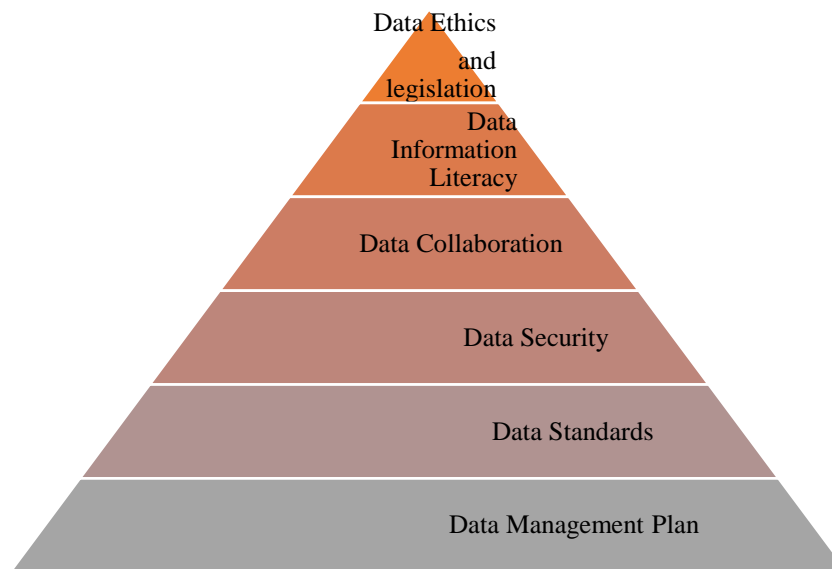
A proper RDM policy and practices are a priority if libraries are to become fully engaged with data management (Lewis 2018). A conceptual framework has been proposed after considering the related issues addressed in the study. The authors of the study depicted a process to implement the research data management practice in LIS. It certainly begins with awareness building among the LIS professionals where the concept of RDM must be made clear. The roles and responsibilities shared by the library professionals in terms of research must be well published and promoted. Awareness must be ensured about the transition that is taking place in the field of library science to data science. Only a well informed and aware librarian can stand up to the expectations from a 21<sup>st</sup> century data librarian. The LIS curriculum today is in need of bridging the gap to meet professional demands of big data skills in academic libraries. (Khan and Du 2018) Therefore, awareness alone would not aid the librarians to establish in the field of data science or data curation, it is inevitable to include the concept of RDM in LIS curricula so that, the upcoming professionals can prepare themselves well ahead of time by proper education and knowledge. Although, learning is always open if one wants to keep up to date about the latest trends and technologies. Thirdly, the authors suggested the need for capacity building of the Librarians or subject experts. Proper training, workshops, discussions can lead a path to innovation and development. Lastly, continuous advocacy must be held with the librarians and researchers for better collaboration among them.



**Figure 2.** A conceptual framework to implement the concept of data librarians in the field of RDM

Research Data as a knowledge resource ensures traceability of existing scientific results and provides potential for more insights, if disseminated with and/or across research communities (Latif, Limani, and Tochtermann 2019). It is therefore pertinent that the data librarians possess the qualities for timely and efficient services. Research data services in libraries are a growing and evolving field (Horstmann and Witt 2017). The authors of the study integrated the conceptual

framework with the roles and responsibilities that a data librarian plays in the totality of a research life cycle.



**Figure 3.** Data Librarian roles in RDM

The arguments which carried most weight were that both funders and academic publishers required research data to be properly managed and that there would be a significant financial imperative and advantage to support this centrally. In addition the research data management services were seen as one of the cornerstones to supporting the University's emerging data science strategy (Hiom et al. 2015). Data librarians play the crucial role of generating data management plans for the researchers. Data librarians provide a broad range of services to their users and, therefore, need a variety of skills and expertise (Federer 2018). Now that researchers have begun to share their data more freely, and repositories are increasingly available to facilitate access to those data, it's easier for researchers to take advantage of existing data that they can reuse to address their own research questions (Federer 2016). The data librarians here help in engaging the researchers for data collaboration with the outside world. Library professionals have already established themselves as experts in metadata; data curation and preservation techniques and hence can now extend their role to research data management also (Dora 2016).

## Challenges to implement Research Data Management

(Faniel and Connaway 2018) identified the factors that influence the data management programs as: technical resources; human resources; researchers' perceptions about the library; leadership support; and communication, coordination, and collaboration. Findings show different aspects of

these factors facilitate or constrain RDM activity. The major challenges of implementing research data management practices in academic libraries addressed in this paper are:

- Technical and ethical barriers of the researchers lead to unadapting of RDM practices.
- Uncertainties about how data copyrights are protected in public cloud storages make the researchers unwilling to share their research data on open data platforms.
- Lack of knowledge about metadata and tagging by the researchers often lead to unavailability of research data.
- Development of specialized RDS is often constrained by knowledge and skills gaps among library staff and a lack of confidence in their expected roles in RDS.
- This survey found that funding, librarian training, marketing, and uncertain demand from researchers and students were barriers to successfully providing RDS.

## Recommendations

- Research data management policy at academic institutes must be an integral part of Universities dealing with research and innovation.
- Awareness and promotion of the Governmental Open Data Portals.
- Capacity building and training of data librarians to develop their skills and competencies regarding data science.
- Fund allocation to research and development projects where the stakeholders can collaborate on a fundamental level.
- Initiation of research data management services at academic and research institutes as early as possible.
- Collaboration between the researchers and data librarians could lead to proper data management policy, data curation and data stewardship.
- Introducing the concept of data curators and data managers in the LIS education from the very basic level.
- Advocacy to the researchers for understanding the role of data librarians in terms of research and development can engage and build mutual trust between the two.
- Libraries should develop computing infrastructure in order to collect, organize and store the datasets. Some of the universities are already having institutional repositories. Implementing RDS will be extending the services of IRs which they have been long providing to their researchers. (Tripathi, Shukla, and Sonker 2017)
- Library science departments should revise their curricula in order to impart Education and Training in the application of new tools and technologies. (Tripathi, Shukla, and Sonker 2017)
- Library staffs need to continuously update themselves with new technologies, tools of data analysis and visualization.

## Conclusion

Research data management (RDM) is about “the organization of data, from its entry to the research cycle through to the dissemination and archiving of valuable results” (Cox and Pinfield 2013). Research data management practices these days are integral part of the scholarly community. Proper management of research data, data curation, data availability, data visualization will help improve the research sector in developing countries. Data modification, data reuse will ensure generation of new datasets that could contribute to the socioeconomic development of a nation. A revolution is taking place in research. It is fuelled by the ever-increasing sophistication of the e-information universe and by rapidly advancing ICT capabilities (Wusteman 2008). It is inevitable to mention here that, with the advancement of technology and other research tools for management, storage, and dissemination of research data has become easier but technical than ever before. Librarians have a key role in changing research behaviour by providing opportunities for researchers to build the skills needed to take advantage of the infrastructure on offer (Searle et al. 2015). While formal skills training is important as librarians move into new research support roles, there is also a critical need for informal training, mentoring and support networks (Brown, Wolski, and Richardson 2015). An informed and well trained data librarian can make it possible to ensure all the facilities and research data management services for the scholarly community.

## References

1. Brown, Rebecca A., Malcolm Wolski, and Joanna Richardson 2015. Developing New Skills for Research Support Librarians. *Australian Library Journal* 64(3): 224–234.
2. Cox, Andrew M, and Stephen Pinfield 2013. Universities of Leeds , Sheffield and York Research Data Management and Libraries : Current Activities and Future Priorities.
3. Dora, Mallikarjun 2016. Research Data Management in Academic Institution Role of Libraries Managing Research Data in Academic Institutions : Role of Libraries(July).
4. Faniel, Ixchel M., and Lynn Silipigni Connaway 2018. Librarians’ Perspectives on the Factors Influencing Research Data Management Programs. *College and Research Libraries* 79(1): 100–119.
5. Federer, Lisa 2016. Research Data Management in the Age of Big Data: Roles and Opportunities for Librarians. *Information Services and Use* 36(1–2): 35–43.
6. 2018Defining Data Librarianship: A Survey of Competencies, Skills, and Training. *Journal of the Medical Library Association* 106(3): 294–303.
7. Hiom, Debra, Dom Fripp, Stephen Gray, Kellie Snow, and Damian Steer 2015. Research Data Management at the University of Bristol: Charting a Course from Project to Service. *Program* 49(4): 475–493.
8. Horstmann, Wolfram, and Michael Witt 2017. Libraries Tackle the Challenge of Research Data Management. *IFLA Journal* 43(1): 3–4.

9. Khan, Hammad Rauf, and Yunfei Du 2018. What Is a Data Librarian?: A Content Analysis of Job Advertisements for Data Librarians in the United States Academic Libraries. *IFLA World Library and Information Congress 2018*: 1–9. <http://cort.as/-JDj8>.
10. Latif, Atif, Fidan Limani, and Klaus Tochtermann 2019. A Generic Research Data Infrastructure for Long Tail Research Data Management. *Data Science Journal* 18(1).
11. Lewis, Martin 2018. Libraries and the Management of Research Data. *Envisioning Future Academic Library Services*: 145–168.
12. Matusiak, Krystyna K., and Frank A. Sposito 2017. Types of Research Data Management Services: An International Perspective. *Proceedings of the Association for Information Science and Technology* 54(1): 754–756.
13. Raju, J. 2014 Knowledge and Skills for the Digital Era Academic Library. *Journal of Academic Librarianship* 40(2). Elsevier B.V.: 163–170. <http://dx.doi.org/10.1016/j.acalib.2014.02.007>.
14. Richardson, Joanna, and Malcolm Wolski 2018. A Framework for University Research Data Management A Framework for University Research Data Management Author Conference Title CCA-EDUCAUSE Australasia 2011 : The Game Has Changed Copyright Statement Copyright Remains with the Authors 2011 Griffith Unive(February).
15. Searle, Samantha, Malcolm Wolski, Natasha Simons, and Joanna Richardson 2015. Librarians as Partners in Research Data Service Development at Griffith University. *Program* 49(4): 440–460.
16. Tammaro, Anna Maria, and Vittore Casarosa 2014. Research Data Management in the Curriculum: An Interdisciplinary Approach. *Procedia Computer Science* 38(C). Elsevier Masson SAS: 138–142. <http://dx.doi.org/10.1016/j.procs.2014.10.023>.
17. Tenopir, Carol, Robert J. Sandusky, Suzie Allard, and Ben Birch 2014. Research Data Management Services in Academic Research Libraries and Perceptions of Librarians. *Library and Information Science Research* 36(2). The Authors: 84–90. <http://dx.doi.org/10.1016/j.lisr.2013.11.003>.
18. Tripathi, Manorama, Archana Shukla, and Sharad Kumar Sonker 2017. Research Data Management Practices in University Libraries: A Study. *DESIDOC Journal of Library and Information Technology* 37(6): 417–424.
19. Ünal, Yurdagül, Gobinda Chowdhury, Serap Kurbanoglu, Joumana Boustany, and Geoff Walton 2019. Research Data Management and Data Sharing Behaviour of University Researchers. *Information Research* 24(1). <http://www.informationr.net/ir/24-1/isic2018/isic1818.html> M4 - Citavi.
20. Williams, Mary, Jacqueline Bagwell, and Meredith Nahm Zozus 2017. Data Management Plans, the Missing Perspective. *Journal of Biomedical Informatics* 71: 130–142. <http://dx.doi.org/10.1016/j.jbi.2017.05.004>.
21. Wilms, Konstantin, Christian Meske, Stefan Stieglitz, and Dominik Rudolph 2016. Human Interface and the Management of Information : Applications. *Lecture Notes in Computer Science* 9735(July).
22. Wilms, Konstantin, Stefan Stieglitz, Alina Buchholz, Raimund Vogl, and Dominik Rudolph 2018. Do Researchers Dream of Research Data Management? *Proceedings of the 51st Hawaii International Conference on System Sciences*(January).
23. Witt, Michael, and Wolfram Horstmann 2016. International Approaches to Research Data Services in Libraries. *IFLA Journal* 42(4): 251–252.



24. Woeber, Catherine Anne 2017. Towards Best Practice in Research Data Management in the Humanities(June).
25. Wusteman, Judith 2008.Virtual Research Environments: What Is the Librarian's Role? Journal of Librarianship and Information Science 40(2): 67–70.



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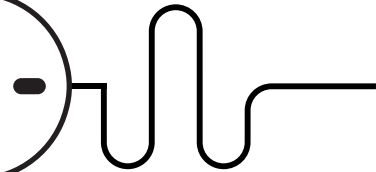
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# Archiving Endangered Mundā Languages in a Digital Library

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## **Abstract**

In the age of globalization and cultural assimilation, the number of speakers in many indigenous languages is fast dwindling. According to the UNESCO Atlas of the World's Languages in Danger, several languages of the Mundā family spoken by indigenous people predominantly in the eastern part of India are under the threat of extinction. In this paper, we present a study of the linguistic features of the endangered Mundā languages. We then propose the idea of a digital archive to collect and preserve textual, audio, and video documentation of these languages. We also explore the role of advanced technologies like artificial intelligence in the design of the archive. We believe our efforts will lead to the preservation and revitalization of the endangered Mundā languages.

## **Keywords**

Endangered Language, Language Documentation, Digital Library, Digital Archive, Mundā Language Family, Linguistic Diversity

## Introduction

A lost language echoes a lost culture, and it reflects an invaluable knowledge lost. Once a language is likely to become extinct in the near future, is obviously in danger. Of the estimated 7,111 known living languages in the world today (Simons 2017), nearly half are in danger of extinction and are likely to disappear in this century (Wilford 2007). Significant numbers of endangered languages disappear instantaneously at the moment of death of the sole extant speakers. Indeed, dozens of distinctive languages currently have only one native speaker still living, and that person's death will mean the extinction of the particular language: It will no longer be spoken, or known, by anyone. Others are lost slowly in the bilingual cultures since native languages are overwhelmed by the leading languages (Woodbury 1993). According to the Atlas of the World's Languages in Danger, at least 43% of the total languages spoken in the world are endangered (Moseley, 2010). When no one speaks the language, it is said to have died or become extinct.

In the document 'Language Vitality and Endangerment', United Nations Educational, Scientific and Cultural Organization (UNESCO) has specified six degrees of endangerment that 'may be distinguished with regard to intergenerational transmission'. Followed by UNESCO's Atlas of the World's Languages in Danger

([http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CLT/pdf/about\\_Endangered\\_Languages-WV-EN-1.pdf](http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CLT/pdf/about_Endangered_Languages-WV-EN-1.pdf)), languages have been classified under seven heads based on intergenerational language transmission: (1) safe, i.e., the language is spoken by all generations; (2) vulnerable, i.e., most children can speak the language, but they speak it only in some places, (3) definitely endangered, i.e., children no longer learn it as a mother tongue at home), (4) severely endangered, i.e., parents do not converse among themselves or with their children in this language, but grandparents and older generations speak it), (5) critically endangered, i.e., grandparents and older people speak it partially and infrequently; younger generations do not speak it at all, and (6) extinct, i.e., no one speaks it.

A language dies when its speakers disappear or switch to other languages. Globalization and cultural assimilation have accelerated language deaths in recent times. In 2003, Daniel Abrams and Steven Strogatz introduced an insightful mathematical model to capture the dynamics of dying languages (Abrams & Strogatz 2003). They mathematically modeled the competition between languages and explained why languages die. Daniel Abrams and Steven Strogatz considered two languages and assumed that a language's attractiveness depends on its current numbers of speakers and its perceived status. The perceived status encodes the social or economic opportunities of its speakers. The model predicts that two languages cannot exist together in a stable way; one will push the other to extinction. The perceived status is found to be an important indicator of the fate of a language; if the status degrades, the chances of its extinction quickly increase. Abrams and Steven Strogatz observed wherever bilingual or multilingual societies coexist; there has been little mixing among the linguistic populations. Therefore, one way to protect a language from extinction is to raise its perceived status.

A large number of indigenous languages spoken in tribal-dominated regions of India belongs to Astro- Asiatic Mundā language family. UNESCO has identified a total of 12 Mundā languages as endangered (UNESCO 2011) including Mundari, Birhor, Kharia, Turi, Korwa, Koda, Korku, Juang, Gadaba, Sora, and Bonda. Despite a few of the Mundā languages, bilingualism is widespread. At the present break-neck speed of assimilation, most Mundā languages are going to be extinct to the end of this century (Driem 2007). A significant number of Mundā language communities are now under a massive demographic and socioeconomic encumbrance to assimilate linguistically to the local Indo-Aryan majority languages, e.g., Bangla, Hindi, and Oriya. Till date, many Mundā communities throughout India and Bangladesh are virtually forced to cope with a different language and culture losing their own origin and identities in order to survive.

In general, a three-step response strategy has been recommended to save an endangered language (Austin & Sallabank 2014): (1) language documentation, i.e., producing textual and audio-visual documents of the syntax, semantics, and oral traditions of the language; (2) language revitalization, i.e., increasing the number of active speakers in the language, and (3) language maintenance, i.e., providing support to the language so that it is protected from those who might reduce its speakercount.

## Motivation

This paper explores how endangered Mundā languages can be archived in a digital library. It supports the tasks of *language documentation*, *language description* and *language revitalization* of an endangered language. The core objectives of this paper are the following:

- Creating a digital repository for preserving multimedia collections of endangered Mundā languages and the culture of the communities.
- Making a safe and long-term repository for the language documentation collections.
- Making the collections available to researchers, communities, and the public through the digital library setup.
- Supporting users in discovering and accessing the documents and recordings by means of a single point of accesses.
- Enabling the users to browse and access the collections through the online catalog of a digital library

## Contribution

This paper presents a detailed review of the characteristics of the Mundā languages. It sketches the design of an archive for endangered Mundā languages. It also proposes to augment the archive with cyber applications based on advanced technologies like artificial intelligence. It is hoped that with these initiatives, it is possible to protect the languages with the following contributions:

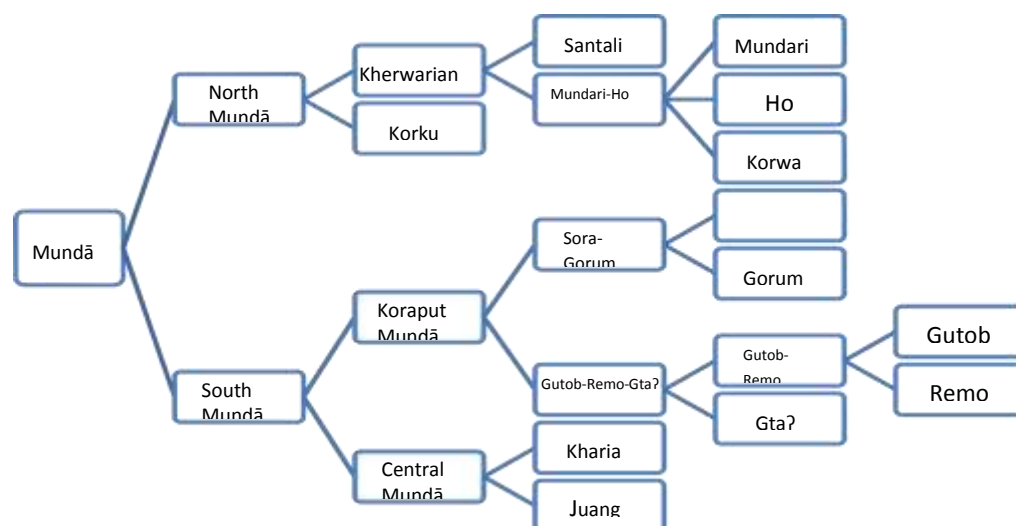
- Revitalization and Maintenance
- Preserving information on cultural resources and language diversity for upcoming generations and researchers
- Introducing accountability of archiving an endangered language in a digital library

*Roadmap:* The next section gives a brief report of the degree of endangerment and linguistic descriptions of the languages. The related works of the present study are described in the third section. It is followed by a section describing the methodology to build the archive. The fifth section gives a broad picture of the elements and architecture of the archive. The sixth section explores how artificial intelligence-based techniques can contribute to the initiative of language documentation and revitalization. The seventh section concludes the paper.

## Endangered Mundā Languages

### Demographic Classification and Degree of Endangerment

Mundā languages belong to the Austroasiatic family, and these are largely distributed into southern and northern branches. It has been classified into various subdivisions as shown in Figure 1.



**Figure 1.** Classification Mundā Languages (Source: Diffloth, Gérard. 1974)



This paper is an attempt to find a systematic exposition of indigenous and endangered Mundā languages in India by crafting digital documentation of their linguistic description and cultural orientation. As per the UNESCO Atlas of the World's Languages in Danger (The Guardian 2011), eleven Mundā languages viz. ; Mundari[unr], Birhor [biy], Kharia [khr], Turi [trd], Korwa [kfp], Koda/Kora [cdz], Korku [kfq], Juang [jun], Gadaba/ BodoGadaba [gbj], Sora [srb], and Bonda/Remo [bfw] were considered as endangered languages subsequently with parametric degrees of endangerment. An estimated 5,000 speakers of the definitely endangered Turi language live in West Bengal, Madhya Pradesh and Odisha whereas an estimated 25,000 speakers of vulnerable Kodā language live in West Bengal, Madhya Pradesh and Bihar. Khāriā and Mundāri are both 'vulnerable' in their class of endangerment. An estimated 7,50,000 Mundari speakers live in Bihar, Odisha and West Bengal and 1,77,000 speakers of Khāriā live in Bihar, Odisha, West Bengal, and Madhya Pradesh.

The South Mundā language Juang covers almost 1,7,000 speakers in the Kjonjhar and Dhekānāl districts of Orissa, whereas Khāriā dialects have over 1,90,000 speakers largely in ChoṭāNāgpur, Rāncī, and Orissa.

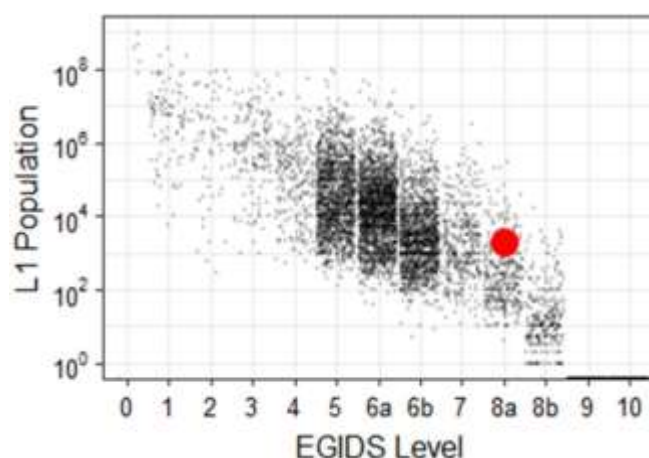
The language Sora has approximately 2,50,000 speakers in Orissa and Andhra Pradesh. Remo language has only 2,500 speakers in the Jayapur hills of Korāpuṭ. The language known as Geta has approximately 3,000 speakers in Koraput, Malkangiri, Kudumulgumma, Chitrakonda, Khairput and on either side of the Sileru River in the East Godāvarī district. The Mundā language Korku has almost 200,000 speakers in southwestern Madhya Pradesh and adjoining parts of Maharashtra, particularly in the Satpuḍā range and Mahādev hills. Muṇḍari has approximately 7,50,000 speakers in Siṃhabhum, Manbhum, Hazaribag and Palamu districts. Estimated 1,50,000 Bhumij speakers of Mundari language still survive in Bihar, Orissa and Madhya Pradesh. The seminomadic Birhoṛ language is waning with below two thousand speakers in Siṃhabhum, Southern Palāmu, Southern Hazārībāg, and Northern and Northeastern Ranchi. Koḍalanguage is spoken by approximately 2,5,000 people in Choṭa Nagpur. Turi is spoken by an estimated 2000 people in West Bengal, Palāmu, Ranchi, Siṃhabhum, Raygaḍh, and Chattisgaḍh. Endangered Mundā languages and their demographic variations have been mentioned in Table 1 to depict an estimated scenario of the languages and their status of endangerment.

Table 1: A list of endangered Mundā languages and demographic variations

Languages with Language Codes	Number of Speakers	Degree of Endangerment	Location	Available Writing System	Glottolog
Mundari [unr]	750000	Vulnerable	Bihar, Odisha, West Bengal, Bangladesh, Nepal	Mundari Bani, Devanagari, Bengali– Assamese script, Oriya script	mund1320
Birhor [biy]	2000	Critically Endangered	Chhattisgarh, Odisha, West Bengal, and Maharashtra	It does not have a script and is performed orally	birh1242
Kharia [khr]	200000	Vulnerable	India (Jharkhand, Chhattisgarh, Odisha, West Bengal, Assam, Tripura, Andaman and Nicobar Islands), Nepal	Devanagari, Bengali script, Oriya scrip	khar1287
Turi [trd]	2000	Critically Endangered	Jharkhand, Madhya Pradesh, Odisha	It does not have a script and is performed orally	turi1246
Korwa [kfp]	35000	Vulnerable	Madhya Pradesh, Bihar, Chhattisgarh (Surguja, Jashpur, parts of Raigarh district)	It does not have a script, and is performed orally	koda1256
Koda/Kora [cdz]	25000	Vulnerable	West Bengal (Bankura and Bardhaman districts), Odisha, Bihar, Bangladesh (Rajshahi Division)	Bengali (Bangla) script	koda1236
Korku [kfq]	200000	Vulnerable	Betul district, Hoshangabad and East Nimar in Madhya Pradesh, and Akola, Amravati, Buldana districts in Maharashtra.	Devanagari script	kork1243
Juang [jun]	17000	Vulnerable	North Angul, east Dhenkanal, south Keonjhar districts in Odisha	Oriya (Odia) script	juan1238
Gadaba/ Bodo Gadaba [gbj]	26262	Vulnerable	Telangana (Andhra Pradesh): Visakhapatnam district; Odisha: Koraput district, Lamtaput sub-district, 40 villages;	Oriya (Odia) script	bodo1267

			Malkangiri district, Khoirput sub-district		
Sora [srb]	250000	Vulnerable	Andhra Pradesh, Odisha, Bihar, Madhya Pradesh, Tamil Nadu, and West Bengal	Oriya (Odia) scrip, SoraSompeng script [Sora]. Telugu script [Telu]	sora1254
Bonda/Remo [bfw]	2500	Critically Endangered	Malkangiri, Khoirput, and Bondo Hills in Odisha	Oriya (Odia) script	bond1245
Geta [gaq]	3000	Severely endangered	East Godavari district in Andhra Pradesh; Koraput and Malkangiri districts in Odisha	It does not have a script and is performedorally	gata1239

In terms of the present degree of endangerment of such Mundā languages, it is necessary to undertake an organized work for proper documentation of these languages. Among the above mentioned existing endangered Mundā languages Birhor, Turi and Remo/Bonda have been identified as Critically Endangered. As per the Expanded Graded Intergenerational Disruption Scale (EGIDS) measured by the 'Ethnologue: Languages of the world' [Eberhard, David M., Gary F. Simons, and Charles D. Fennig (eds.). 2019.], Turi language has been shown in the language cloud in Figure 2 (Source: <https://www.ethnologue.com/cloud/trd>, Ethnologue 2019) as a critically endangered dying language and marked red.



**Figure 2.** Turi in Language Cloud (Ethnologue 2019)

## Shared Linguistic Features of Mundā languages

### Phonology

#### *Vowels*

Mundā vowel systems are generally simpler than other Austroasiatic languages. It is typically a triangular system of five vowels, like the Indo-Aryan and Dravidian languages. In Table 2, we find a striking exception in Sora, whose three central vowels look very Southeast Asian.

**Table 2.** A set of shared Mundā cardinal vowels

<b>High</b>	i	ɨ	u
<b>Mid-tense</b>	e		o
<b>Mid-lax</b>	ɛ	ə	ɔ
<b>Low</b>		ɑ	

It is essential to reconstruct three central vowels for each Mundā subgroup: Sora-Gorum, Gutob-Remo, Kharia-Juang, Khewarian, and Korku-Kherwarian. In 1989 Diffloth gave evidence of creaky-voiced vowels in Proto-Mon-Khmer. Vowel registers are in South Asia; if the correspondence can be resolved, this would be another Mon-Khmer-like feature of Mundā (Donegan & Stampe 2002).

#### *Consonants*

Followed by the place and manner of phonetic articulation, total 28 consonants, and 23 phonemes are commonly available in Mundā language family. As an example, we are listing the Mundari consonants in Table 3.

**Table 3.** A list of Mundari consonants

		<u><b>Labial</b></u>	<u><b>Dental</b></u>	<u><b>Retroflex</b></u>	<u><b>Palatal</b></u>	<u><b>Alar</b></u>	<u><b>Glottal</b></u>
<b>Stop</b>	<b>voiceless</b>	p	t̪	ʈ	t͡ɕ	k	ʔ
	<b>aspirated</b>	(p <sup>h</sup> )	(t̪ <sup>h</sup> )	(ʈ <sup>h</sup> )	(t͡ɕ <sup>h</sup> )	(k <sup>h</sup> )	
	<b>voiced</b>	b	d̪	ɖ	d͡z	g	
Fricative			s̪				h
Nasal		m	n̪	ɳ	ɲ	ŋ	
Approximant		w	l	ɭ	j		
Trill			r				

Dravidian languages have influenced Mundā phonology in case of the acquisition of some retroflex consonants. In contrast to Indo-Aryan and Dravidian languages, Mundā languages typically have unreleased final consonants. Initial and final consonant clusters are not permitted in Mundā languages, and the occurrence of preglottalized consonants is quite distinctive. Final stops before vocalic suffixes in Mundā languages alternate with their voiced equivalents (Stampe Patrica2002).

### *Tonality*

Mundā languages are generally non-tonal, even though we find Korku syllables with a difference of tonality between high and low tone.

## **Morphology**

- Mundā morphology is much more complex and multifaceted than that of an average Austroasiatic language. It is fundamentally agglutinating. Furthermore, it employs reduplication and a variety of affixes (prefixes, infixes, and suffixes) to formulate nominal and verbal derivatives
- The most important characteristic feature of the agglutinating Mundā languages is the case marker, which is added after the object.
- There are two gender classes, animate and inanimate in Mundā language; the first is divided into human and non-human. The grammatical numbers of Mundā have been distributed into singular, dual, and plural. It is striking the existence of inclusive/exclusive forms of the first person-plural-pronoun, i.e., there are two kinds of 'we', one includes the speaker, the other excludeshim.
- Verbs decide person, gender, and number with the subject by incorporating affixes or by adding them to the word that immediately precedes the verb.
- A variety of suffixes indicates tense, aspects, and modality. As well for suffixes, structures with auxiliary verbs may be active to express tense. As like many other languages, the tense and aspect features are closely related, but their relative importance is different in the northern and southern languages: in the first one's aspect is prevalent, in the second onetense.
- There are different voices in Mundā: middle, passive, reflexive, reciprocal, and causative.

## Syntax

In terms of syntactic patterns, Mundā syntax is quite distinctive from other Austroasiatic languages. Instead of Subject-Verb-Object (SVO), Mundā languages have a Subject-Object-Verb (SOV) rudimentary word-order. In this context, they are closer to Dravidian languages of India, though in contrast with them their order is quite strict.

## Lexicon and Vocabulary

Mundā lexicon has been inclined by adjacent Indo-Aryan languages which have had, however, little impact at the structural level. The opposite can be said of Dravidian languages. The unique linguistic unity of Mundā and Mon-Khmer has been refreshed, and it still breaks, mainly on lexical cognates (Bhattacharya 2000). The degree of similarity between Mundā languages is exposed in their shared lexicon.

## Endangered Mundā Scripts and Writing System

There are only three scripts available which have been created specifically for writing Mundā languages; SoraSompeng for the Sora language, Ol' Chiki for the Santali language, and VarangKshiti for the Ho language. As per the degree of endangerment, the language Sora is now vulnerable with 2,50,000 speakers (The Guardian, 2011) covering the states Andhra Pradesh, Assam state, Odisha, Bihar, Madhya Pradesh, Tamil Nadu, and West Bengal. The SoraSompeng (SorangSompeng) script was created by MangeiGomango in 1936 and was used in religious contexts (Everson Michael 2009). The Sora Sompeng (SorangSompeng) script shown in Figure 3 is quite distinctive with the following distinguishing characters:

- The Sora language is written in an IPA-based script developed by Christian missionaries, and in the Telugu and Oriya scripts. There are twenty-four letters in the SoraSompeng syllabary, named for the twenty-four deities in the Sora pantheon (Stephanie Holloway 2010). The eighteen consonant letters convey an inherent [ə] vowel ([ɔ] may or may not be written post-consonantly). Therefore, the characteristic vowel could be said to merge [ə] and [ɔ]). Unlike many of the South Asian syllabaries, there are no vowel diacritics. Vowels except the [ə] are written both initially and postconsonantly using six self-governing vowel characters.
- Sora follows the Mundā pattern of using dental [t] and retroflex [d], but not retroflex [ɖ] or dental [d] (which fill out the Brahmic pattern). Retroflex loan sounds (including [ɖ], [ʂ] and [ɳ]) are indicated by writing the one SoraSompeng diacritic to the left of the closest equivalent letter. Dental [d] is not differentiated from retroflex [d] in writing. Retroflex sound [ɖ] is also native to the Sora language.

- Aspirate stops are also challenging for SoraSompeng writing. Aspiration is not distinctive in native Sora, so is omitted in writing Sora words, but needs to be represented in writing a number of loan words from adjacent languages in which it is distinctive. The letter h cannot be used to indicate aspiration; it is used for representing a glottal stop. Nouns in Sora must have two syllables, and a glottal stop is often inserted halfway through the vowel in a mono-syllabic noun to split it into two syllables. Therefore, where aspiration needs to be written, it is written with the closest non-aspirate letter followed by the letter j.
- It is thought that vowel length is generally not written. The exception to this is in cases where a long [a:] at the start of a word conveys some kind of grammatical information about the word, or in cases where it changes the stress pattern of the word. In these cases, the letter a is written twice.
- Vowel-nasalization is quite unique in spoken Sora, but it is not clear whether this is represented in a written form.
- Sora Sompeng has no script-specific punctuation. The Latin full stop, comma, semicolon, exclamation mark, mathematical symbols, and parentheses are used.



**Figure 3.**The SoraSompeng Script (Source: Mahapatra 1978)

## Related Works

### DELMAN

The Digital Endangered Languages and Music Archives Network (DELMAN) presently works for documenting and archiving endangered languages and cultures worldwide (DELMAN 2003). It is an international network of archiving data on the linguistic and cultural diversity of endangered languages. DELAMAN is projected as an open organization for connecting any other organizations in the archiving and preservation of endangered languages and music.

## **ELAR**

The Endangered Languages Archive (ELAR) of SOAS University of London is a digital repository preserving and publishing multimedia collections of endangered languages (<https://www.soas.ac.uk/elar/>). ELAR archive holds collections all through the entire world with regional grip in Africa, the Middle East, Asia, Australia, and Latin America. Till date, recordings encircling more than 450 distinctive languages can be found in ELAR. Collections in ELAR mainly contain audio and video recordings of language, verbal art, songs, narratives and performances of rituals.

## **Pangloss Collection**

The Pangloss Collection, developed by the LACITO centre of CNRS in Paris, is a widely spread archive for endangered languages. As a member of the OLAC network of archival repositories, Pangloss Collection aims to store and enable access to audio recordings of endangered languages all over the world. The Pangloss Collection provides free online access to documents of unprompted spontaneous speech (Pangloss 2016). The Pangloss collection provides access to original recordings simultaneously along with transcriptions and translations (CoCoON2017).

## **DOBES Portal**

The DOBES Archive covers language documentation data of the languages in danger becoming extinct around the world. This portal gives access to the materials of the archive and provides information about the DOBES Endangered Languages Documentation programme(<http://dobes.mpi.nl/dobesprogramme>).

## **Living Tongues Initiatives**

Living Tongues Institute began a multi-year project in 2005 to widely document the lexica and grammars of the modern Mundā language family (Jennifer 2008). The major output of the project was creating a set of talking dictionaries and online grammar for Ho, Remo, Gta? and, Sora (Kari 2009). The initiative was led by linguist Dr. Gregory D. S.Anderson.

The works for Mundā languages initiated by Living Tongues Institute focused specifically the tasks of language documentation in a large-scale. Till date, the Living Tongues research team has not taken any initiative for digital archiving of the endangered Mundā languages as a single point of access.

## **Data Collection Methods**

We propose to organize data collection under the focused areas of fundamental or basic research, field study, content analysis, and laboratory experiments. Here the fundamental or basic research will be concerned with a theoretical framework and underlying rules of linguistics and cultural study for a grammatical description of entire languages and anthropological survey of the communities.



A very large variety of data should be collected through field study. Based on the degree of endangerment, the informants of the survey may be divided into two categories: (1) grandparents and the older generation, the parent generation and the younger generation.

Interviews should be designed in three ways: informal, structured, and focused. There will be a goal-oriented set of questions for structured and focused interviews. As supporting tools, the project will use a voice recorder for audio data collection and video recorder to capture the ambiance, field data, and overall expression. The field data will be transcribed and translated during the survey. Content analysis denotes the document analysis based on the abovementioned field study. It aims to fulfill the aims of the proposed research by extracting and analyzing the relevant grammatical and anthropological data from the proposed field study.

In laboratory experiments, several experiments can be carried out for linguistic and cultural documentation. Recorded pronunciation and phonetic notations may be documented through graphical representations to examine the numbers of phonemes, place/s of articulation, manner/s of articulation, and tonal qualities, among others. On the other side, the root words of the selected Mundā languages can be grouped into different sets. All members of any such set will exhibit the same morpheme-alterations during suffixation. Generalization and classification of root words into classes or paradigm sets will help in identifying the morphophonemic rules for each class of words. It is hoped that this will help to generate a comprehensive lexical and grammatical database of these endangered Mundā languages.

The data collected in a field-survey will be described with a set of standardized metadata. Moreover, the archive aims to take care of the long-term perseverance of digital materials.

The language documentation depositories in the archive will contain the following types of components:

- Audio and video recordings with different depths of annotation
- Transcriptions and translations together with morphosyntactic glossing (Simons 1998).
- Photographs and drawings bundled into groups of photos documenting processes
- Videos and music recordings of cultural activities, rituals, and social performances
- Documents on the genealogical affiliation of an endangered language accompanied by its socio-linguistic contexts, grammatical and phonetic features

## Elements of the Archive

We envision a comprehensive archive of the selected Mundā languages. It might be designed as part of a more general digital educational library like the National Digital Library of India (<https://www.ndl.gov.in/>). It will have the following components.

### Repository of textual and non-textual documents:

It will include the following:

*Written documentation:* A documentation of written forms of oral Mundā languages and their culture will be archived. It includes different texts produced by the community as well as research documents that enlighten and inform others of their language, lifestyle, and culture. It is

important to develop fonts and virtual keywords for these languages so that users can type seamlessly and produce written documents easily.

*Audio Documentation:* It will be an aid in research for annotation, transcription, and translation of speech corpus. Moreover, it will help preserve the oral forms that encode folklores, songs, recitations, music, daily utterances, and rare verbal expressions of the Mundā community.

*Visual Documentation:* Photographic documentation and video documentation of diverse aspects of languages and culture of these communities will be prepared and preserved. It will provide a graphic window into ways in which the languages are used by the communities.

## Metadata elements

While preserving endangered languages in digital format Metadata takes a front-seat role to disseminate the records. The broad range of language documentation in both text and audio-visual forms needs to be properly annotated for the recall in digital space. There are various metadata standards and we have opted for Dublin Core metadata element set (Dublin Core Metadata Initiative, August 2007) to describe the digital resources, as presented in table4.

**Table 4.** Metadata elements on archiving endangered languages

Metadata Registry Name	Value
dc.contributor	Any person or institution or agency is responsible for creating the work.
dc.creator.researcher	The researcher is responsible for the creation of the work.
dc.language.iso	Language in which the resource is written for text and the language in which the interview or video is shoot.
dc.coverage.temporal	Temporal period, period label, date, or date range
dc.description	Description of the item/work.
dc.subject.ddc	Classification of the item.
dc.title	Title of the work.
dc.title.alternative	Transliteration of the wok in regional language.
dc.publisher	Institution/Agency/Person who makes the work available in the public domain/market.
dc.publisher.date	Date of the work published.
dc.format.mimetype	The digital format of the work. www.e.g-pdf/epub/rdf/odc/html

## Online talking dictionary/dictionaries of endangered languages

Bilingual and multilingual dictionaries of endangered and vulnerable languages help non-native speakers, and other people understand the meaning of words in these languages. Recently the Odisha Government has published bilingual dictionaries of several endangered languages spoken in the remote tribal areas of Odisha (Satyasundar, 2018). A talking dictionary of a language is an online interactive tool that allows users to listen to high-quality audio recordings of words and phrases in that language, and also to enrich the database with new uploads. Typically, a talking dictionary also contains meanings of the words in a mainstream language like English as well as descriptive images so that users can easily understand them. A talking dictionary of the Kera-Mundāri language is accessible at [http://talkingdictionary.swarthmore.edu/kera\\_mundari/](http://talkingdictionary.swarthmore.edu/kera_mundari/); it is developed by the Living Tongues Institute of Endangered Languages. We also plan to develop talking dictionaries of the endangered Mundā languages.

## Opening of socialization of traditional Mundā culture and languages

A common website will be developed and launched for public access to all the above digital content and associated applications. The website can serve as a one-stop access point to the digital archive of the languages. For example, the textual and multimedia documents and the dictionaries can be made accessible through the website. Additionally, users may be allowed to upload new content on the languages and cultures of these communities through the website into the archive. The interface should be very user-friendly to promote greater use of language resources.

We believe, along with the above digital tools, there must be initiatives to hold periodical workshops, seminars and training camps where the attendees will communicate in these languages and discuss the problems faced by the native communities. There is indeed a strong need for capacity building of the languages and communities in terms of culture and major communicative existence. These steps can help revitalize and maintain indigenous languages.

## Artificial Intelligence in Language Archiving

Artificial intelligence (AI) has a very high potential in contributing to efforts in language preservation. We enumerate below some of the ways AI can help in archiving and revitalization of Mundā languages. The first of the three ways mentioned below is useful to the public directly while the remaining two ways are relevant to the engineers designing various tools for the archive.

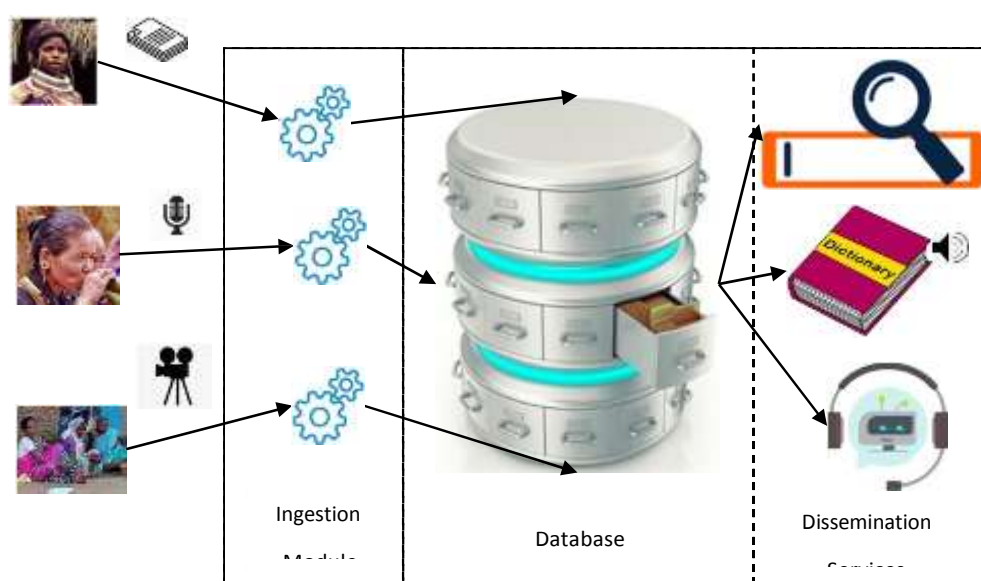
**Conversational chatbots:** Due to the low number of speakers in indigenous languages, the scope of conversation in these languages is reduced, which further decreases the influence of these languages. One way to counter this is to construct AI-based chatbots that can talk to people in these languages. The advances in natural language processing have enabled machines to engage in meaningful dialog with humans in many mainstream languages like English. It is technically possible to train these chatbots in endangered indigenous languages

and then have them talk with humans in these languages. But it needs a large corpus of conversation texts in the corresponding languages because training modern deep learning-based models require enormous data. These corpora can be collected in ways already discussed. The chatbots can use either a text-based conversation or voice-based conversation. In the latter case, voice recordings from indigenous speakers are necessary for machines to learn the accents and phonetic details. Following are two instances where successful AI-powered robots have been constructed to revitalize endangered languages (Constantin, 2019). Scientists at the ARC Centre of Excellence for the Dynamics of Language (CoEDL) based in Australia have built a social robot called Opie (<http://www.opierobots.com/>) that uses Google's AI platform to teach children heritage languages through games, stories, and lessons. The robot displays human-like responses (such as facial expressions) to children's reactions. It is trained with 40,000 hours worth of spoken material in six indigenous languages spoken in Australia and, five languages are spoken in Asia-Pacific. Reobot is an AI-enabled chatbot that understands te reo Māori, an indigenous language of New Zealand. It can reply to messages in both English and Māori.

***Automated annotation, transcription, and translation:*** Language documentation projects typically require ethnolinguists and language experts to annotate texts (i.e., associate labels with text spans) and transcribe voice recordings collected from speakers of endangered languages. It also entails translating them to more mainstream languages, so they are understandable to a larger audience across the world. These tasks require enormous human effort spanning days and months of laborious work. Thanks to advances in AI, this task can be speeded up with the latest machine learning tools. Automatic speech recognition systems have been built for indigenous languages (Besacier et al., 2014). These techniques do not always generate very accurate results, but they do provide significant assistance in the documentation of endangered languages. Technology companies like Microsoft and Google in collaboration with universities and research centers, have produced translators for endangered languages. For example, Microsoft Translator (<https://translator.microsoft.com/>) supports Yucatec Maya and Querétaro Otomi, which are spoken only by a few thousand people in parts of Mexico (Charney, 2015). Similar translators should be designed for Mundā languages. Google and CoEDL have designed a pipeline to simplify the development of automatic speech recognition systems for languages that have a very low speaker base; this, in turn, aids the task of language documentation (Foley, 2018). Note, however, that most of these systems need a corpus of text or speech where the annotation/transcription/translation (as the case may be) has been manually done. This corpus is needed to train the machine learning algorithms. The trained model then works on new data.

***Automatic data augmentation:*** Machine learning-based solutions to the revitalization of endangered languages often suffer from the lack of adequate labeled corpus, whether it is speech recognition or language translation or conversation or the like. These languages are sometimes called acutely low-resource languages as it is difficult to find high quality transcribed and labeled audio data and labeled text data for them. Deep learning-based approaches that have produced very high-quality speech recognizers and language translators for mainstream languages require extremely large training datasets. Therefore, it is unrealistic to expect these state-of-the-art techniques to be directly applicable to indigenous languages. Hence researchers have been motivated to devise various methods to augment the sparse

datasets available for indigenous languages. Methods like noise addition, pitch augmentation, and speed augmentation have been used to augment speech data and improve the accuracy of speech recognition systems for Seneca, an endangered indigenous language of North America (Jimerson, 2018a). Dictionaries and grammar rules have also been leveraged to generate new texts for enhancing the corpus (Jimerson, & Prud'hommeaux, 2018b). Another approach to increase available data is to use a generative adversarial network (GAN) which is a powerful class of machine learning systems (Kontzer, 2019). Given a training set, a GAN learns to generate new data with the same statistics as the training set. For example, a GAN that is trained on a given set of images can produce new images that are similar to the ones in the training set and might look authentic to human eyes. Similarly, given a collection of recorded speech, a GAN can generate new but similar data containing characteristics in the recorded version. These synthetic datasets can help develop more accurate AI-based tools for the preservation of threatened languages.



**Figure 4.**Architecture of the Mundā language archive

Figure 4 shows the architecture of the proposed language archive. Textual, audio, and video documentation collected through fieldwork and other methods are ingested using a variety of software tools. These records are stored in appropriate databases. It may be recommended to anonymize the data by removing personally identifiable information to protect user privacy. Each language resource is curated with appropriate metadata. Different dissemination services may be implemented on top of the database so users can easily discover and use the resources. The most important among them is a search engine that allows faceted search and browses the database. The search engine should support different filters to limit the displayed results and thus, cater more precisely to the user's information needs. Another interesting service could be a

talking dictionary that, given a word in a Mundā language, can speak it out (thus, familiarizing the user with its pronunciation) and show the meaning and example uses of the word. Users may be interested to learn the indigenous languages by engaging in conversation with speakers of these languages. However, due to the low number of Mundā speakers, it may not be possible. A possible alternative is to design chat bots that can understand and reply in a Mundā language. The chatbots may also support language translation, i.e., translate a text input in a mainstream language like English to a Mundā language, and vice-versa.

## Conclusion

We have looked at the alarming state of some of the indigenous languages of the Eastern part of India. In order to protect them from extinction, a concerted effort is needed from social scientists, engineers as well as policymakers. We have proposed the idea of an archive where the nuances of these endangered languages will be captured, preserved, and available for others to study or better still, practice. Artificial intelligence tools will play a pivotal role in keeping them alive. We expect linguistic documentation, engaging virtual reality, and artificial intelligence-based tools, and a continuous capacity building exercise will revitalize the endangered Mundā languages and the centuries-old cultures that speak through them.

## References

1. Abney, S., & Bird, S. (2010). The human language project: building a Universal Corpus of the world's languages. In Proceedings of the 48th annual meeting of the association for computational linguistics (pp.88-97).
2. Daniel M. Abrams, Steven H. Strogatz. (2003). Modeling the dynamics of languagedeath.  
h [https://www.math.uh.edu/~zpkilpat/teaching/math4309/project/nature03\\_abrams.pdf](https://www.math.uh.edu/~zpkilpat/teaching/math4309/project/nature03_abrams.pdf)
3. Austin, P. K., & Sallabank, J. (Eds.). (2011). The Cambridge handbook of endangered languages. Cambridge University Press.
4. Barik, Satyasundar. (2017). Tribal communities in Odisha are speaking up to save their dialects.  
<https://www.thehindu.com/news/national/other-states/tribal-communities-in-odisha-are-speaking-up-to-save-their-dialects/article18713925.ece>
5. Besacier, L., Barnard, E., Karpov, A., & Schultz, T. (2014). Automatic speech recognition for under-resourced languages: A survey. Speech Communication (PP.85-100).
6. Bhattacharya, Sudhibhushan. (2000). Kinship Terms in the Munda Languages.  
<https://www.jstor.org/stable/40457389>
7. Matthias, Brenzinger. Language Diversity Endangered. <https://www.degruyter.com/viewbooktoc/product/36447>
8. Charney, S. (2015, February 23). For language, technology is both the medium and the message. (Retrieved August 18, 2019). <https://blogs.microsoft.com/blog/2015/02/23/language-technology-medium-message/>.

9. Constantin, S. (2019, January 16). Can AI help save endangered languages? (Retrieved August 18, 2019).<http://www.alignedthoughts.com/can-ai-help-save-endangered-languages>
10. Diffloth, Gérard. (1974). Austro-Asiatic Languages. *Encyclopædia Britannica* (pp.480–484).
11. Diffloth, Gérard. (1989). Proto-Austroasiatic creaky voice. *Mon-Khmer Studies* (PP.139-154).
12. Digital Endangered Languages and Musics Archives Network.<http://www.delaman.org>
13. DOBES Archive.<http://dobes.mpi.nl/dobesprogramme>
14. Drude, S. (2003). Language vitality and endangerment. International Expert Meeting on UNESCO Programme Safeguarding of Endangered Languages. (Retrieved August 18,2019).
15. [http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CLT/pdf/Language\\_vitality\\_and\\_endangerment\\_EN.pdf](http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CLT/pdf/Language_vitality_and_endangerment_EN.pdf)
16. Evans, Nicholas & Toshki Osada. (2005). Mundari and argumentation in word-class analysis (pp. 442–457).
17. Evans, Nicholas & Toshki Osada. (2005). Mundari: the myth of a language without word classes (pp.351–390).
18. Everson, Michael. (2009). Proposal for encoding the SoraSompeng script in the UCS (pdf). <http://std.dkuug.dk/jtc1/sc2/wg2/docs/n3647.pdf>
19. Foley, B., Arnold, J. T., Coto-Solano, R., Durantin, G., Ellison, T. M., van Esch, D. & Olsson, O. (2018). Building Speech Recognition Systems for Language Documentation: The CoEDL Endangered Language Pipeline and Inference System (ELPIS). In *Proceedings of the 6<sup>th</sup> International Workshop on Spoken language Technologies for Under-Resourced Languages (SLTU 2018)*(pp.205-209).
20. <http://www.unesco.org/culture/en/endangeredlanguages/atlas>.
21. [https://www.researchgate.net/publication/265199702\\_Endangered\\_Languages\\_of\\_South\\_Asia](https://www.researchgate.net/publication/265199702_Endangered_Languages_of_South_Asia)
22. Hughes, Jennifer V. (2008). ‘Racing to Capture Vanishing Languages’. *The New York Times*. (Retrieved February 22, 2009).
23. Jane, Patrica & Stampe, David. South-East Asian Features in the Munda Languages: Evidence for the Analytic-to-Synthetic Drift of Munda. <http://www.ling.hawaii.edu/austroasiatic/AA/bls2002.pdf>
24. Jimerson, R., & Prud’hommeaux, E. (2018). ASR for documenting acutely under-resourced indigenous languages. In *Proceedings of the Eleventh International Conference on Language Resources and Evaluation (LREC-2018)*(pp.4161-4166).
25. Jimerson, R., Simha, K., Ptucha, R. W., & Prudhommeaux, E. (2018). Improving ASR Output for Endangered Language Documentation. *Proceedings of the 6<sup>th</sup> International Workshop on Spoken language Technologies for Under-Resourced Languages (SLTU 2018)*(pp.187-191).
26. Kontzer, T. (2019, January 2). The oral of this story? AI can help keep rare language alive. (Retrieved August 18,2019).<https://blogs.nvidia.com/blog/2019/01/02/deep-learning-preserves-seneca-language/>
27. Living Tongues Project.<https://livingtongues.org/>

28. Lyderson, Kari. (2009). Preserving Languages Is About More Than Words. Washington Post. (Retrieved March 16,2009).
29. Mahapatra, Kh. 1978-79. SoraNSompenN: A SoraScript. <http://sealang.net/sala/archives/pdf8/zide1999three.pdf>
30. Moseley, Christopher (ed.). (2010). Atlas of the World's Languages in Danger (3rd ed.). Paris: UNESCO Publishing. (Retrieved August 18,2019).
31. Mundari language. Wikipedia.[https://en.wikipedia.org/wiki/Mundari\\_language](https://en.wikipedia.org/wiki/Mundari_language)
32. Newberry, J. (2000). North Munda dialects: Mundari, Santali, Bhumia. Victoria, B.C.: J. Newberry.
33. Pangloss Collection.[https://lacito.vjf.cnrs.fr/pangloss/index\\_en.html](https://lacito.vjf.cnrs.fr/pangloss/index_en.html)
34. Patricia, Donegan&Stampe, David. (2002). Proceedings of the Twenty-Eighth Annual Meeting of the Berkeley Linguistics Society: Special Session on Tibeto-Burman and Southeast Asian Linguistics.(pp.111-120).
35. Peter K. Austin, Julia Sallabank. (2014). Endangered Languages: Beliefs and Ideologies in LanguageDocumentationandRevitalisation;1edition(November25,2014),BritishAcademy.
36. Peterson, John. (2015). Introduction – advances in the study of Munda languages. DOI: <https://doi.org/10.1515/jsall-2015-0008>
37. Satyasundar B. (2018, Nov. 24). Odisha now has a lexicon for rare tribal languages. The Hindu. (Retrieved August 18,2019).
38. <https://www.thehindu.com/news/national/odisha-now-has-a-lexicon-for-rare-tribal-languages/article25588109.ece>
39. Simons, Gary F. (1998). The nature of linguistic data and the requirements of a computing environment for linguistic research. In “Using Computers in Linguistics: a practical guide”, John M. Lawler and Helen Aristar Dry (eds.). London and New York: Routledge,(pp.10-25).
40. The Dublin Core Metadata Initiative.<https://www.dublincore.org/>
41. The Endangered Languages Archive (ELAR).<https://www.soas.ac.uk/elar/>
42. The Guardian, Guardian News and Media Limited. Endangered languages: the full list. 2011. <https://www.theguardian.com/news/datablog/2011/apr/15/language-extinct-endangered#data>
43. The Language Gulper: An insatiable appetite for ancient and modern tongues. <http://www.languagesgulper.com/eng/Munda.html>
44. Turi in the Language Cloud. Languages of the World. (2019). <https://www.ethnologue.com/cloud/trd>
45. UNESCO Atlas of the World's Languages in Danger, United Nations Educational, Scientific and Cultural Organization. (2011). <http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CLT/pdf/aboutEndangeredLanguages-WV-EN-1.pdf>
46. Van Driem, George. (May 2007). Chapter 14: Endangered Languages of South Asia. Handbook of EndangeredLanguages,MoutondeGruyter,Editors:MatthiasBrenzinger.(pp..303-341).



47. Wilford, J. (September 19, 2007). Languages die: But not their last words. New York Times.  
[www.nytimes.com/2007/09/19/science/19language.html?ex=1347854400&en=03c91ba69ddb61&ei=5090&partner=rssuserland&emc=rss](http://www.nytimes.com/2007/09/19/science/19language.html?ex=1347854400&en=03c91ba69ddb61&ei=5090&partner=rssuserland&emc=rss)
48. Woodbury, Anthony C. (1993). A defense of the proposition, “When a language dies, a culture dies”. Proceedings of the First Annual Symposium about language and society—Austin(SALSA).
49. Zide, Norman. (1996) (Eds.). Scripts for Munda languages. Oxford: Oxford University Press.



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# Information Commons - The Emerging Third Place: A Case Study on the Students' Perception of an Ideal Learning Environment at the Indian Institute of Management Lucknow-Noida Campus

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## Abstract

**Purpose** - The present study aims to capture the perception of an ideal learning environment in the library by the students of the Indian Institute of Management Lucknow-Noida Campus (IIMLNC).

**Design/methodology/approach** - A survey was conducted through a carefully targeted questionnaire, using Google Forms, sent to a total of 264 students, currently studying at IIMLNC in postgraduate executive courses.

**Findings** – The findings of the study show that the students are not fully satisfied with the current library space and schedule. They want enhanced quiet spaces as well as collaborative spaces where information experts more effectively help the students using the current technology to enhance their learning experience.

**Research limitations/implications** – As a pilot study, it was confined to the students of IIMLNC only.

**Originality/value** – This study is the first of its kind in India. Though much research has been done on Information Commons (IC) in American and European countries, in India no significant research has been conducted. This study highlights the students' expectations and perceptions regarding an optimal learning environment. It also shows their keen interest in library resources and services. Based on the results, a model of IC for redesigning the existing library was developed.

## Keywords

User research, academic libraries, Information Commons, Learning Commons, library spaces

## Introduction

The advancement of information technology and increased use of the internet have significantly changed the nature of libraries and the information behaviour of the students. The academic library has become an extension of the classroom, where students learn by collaborating. The students use the library not only for seeking information but also to socialise intellectually. The use of electronic resources has significantly increased in recent years, and faculty members use both printed material and electronic resources. In a nutshell, the library has become the centre of the intellectual community.

To make libraries more user-friendly, librarians in the USA started conducting surveys on the needs and expectations of students from libraries in their colleges and universities. After analyzing the data, a clear picture of users' preferences for library spaces and services indicated that the users wanted a place where they can study using desktop and laptop computers with wireless internet connection; a place for joint/group study; a lab for using multimedia and myriad software; a quiet area for serious research work; a seminar room with projector and screen for lectures and presentations; a cafe and a lounge for light refreshments and socializing; a place away from home and classroom – *The Third Place: An Information Commons*.

Many universities and colleges in the USA and UK have integrated their libraries into IC, and the students and faculty are using the IC for information sharing and knowledge creation. Some other countries, like France, Italy, Spain, Australia, China, Japan, New Zealand, have also integrated into or in the process of integrating the college/university libraries into an IC.

The present case study is an attempt to find out whether the models developed in international universities for their students are relevant in India or must a different model be developed for the Indian academic libraries. It also tries to find out whether the needs, expectations and perceptions of Indian students of higher education are different from or the same as their counterparts in other countries of the world.

## Information Commons

The traditional libraries are resource-oriented, whereas ICs are learning-oriented. The purpose of an IC is to enhance the learning, teaching and research experience of the students, faculty, and researchers alike. The prominent feature of an IC is the physical space of the library with new arrangements, technologies, and services to organise workspace and service delivery. It is 'a collaborative physical and virtual environment that invites and ignites participatory learning'. (Loertscher & Koachlin, 2014)

At the next level, after the physical space, an IC is the virtual space where students can search, access and retrieve all the relevant information instantly; use the virtual IC for their studies and project work and also connect with other students/researchers/faculty, who are working in the same area, in order to keep themselves updated. A Virtual Commons is ‘a pervasive online environment in which a wide variety of electronic resources and services can be accessed through a single graphical user interface (GUI) and potentially searched in parallel with a single search engine from any networked workstation.’ (Beagle, 2006, p4)

At the third level, IC becomes Cultural Commons. At this third level a social and cultural arena of free speech, shared knowledge and creative expression in the digital age, as contained within the surrounding envelope of laws, regulations, commercial practices, and popular traditions. (Beagle, 2006, p5)

## Literature Review

‘The concept of IC came into existence in the 1990s’. (Chaddha, 2017) Donald Robert Beagle (2006) has done significant work in the field of IC. He developed the concept of IC at three levels – physical, virtual, and cultural.

Donald Russell Bailey and Barbara Gunter Tierney (2008) have further developed the “Information Commons and Learning Commons” at four levels. According to them, the first two levels are of IC, and the next two levels are of Learning Commons (LC).

Laurie A. MacWhinnie (2003) has called the library a third place for students, the first being home and the second the classroom.

Susan McMullen (2008) has emphasised on analysis of students’ needs before planning an IC on a campus. The space utilisation of the library, the technology used, and the library staff required in the IC should be in sync with the students’ needs.

Bryan Sinclair (2009) has discussed the changing role of academic librarians due to the increasing use of IT in the libraries. This new role of librarians is not only focused on overall expertise, guidance, and instructions which they give to the students in using the offline/online information but also their focus is on overall goals of the institution as well.

Bruce E. Massis (2010) emphasises that the libraries in the new role have become a one-stop-shop for campus teaching and learning. The IC is full of students, working in groups, discussing topics and preparing projects.

Nicole Kay Peterson (2013) conducted a case study on the central library at a midwestern US university to find out the current usage behaviour of the students, their preferences, and expectations from the library. She found that the students know what they want from a modern library. They need quiet spaces as were provided in the traditional libraries, and they require group study spaces separately.

Nancy H. Dryden and Shelley Goldstein (2013) have discussed the assessment models, which may be useful for the evaluation of LC. They have used various assessment methods like technology surveys, space assessment surveys, and focus groups.

Esther M.W. Woo, Alexander Serenko and Samuel K.W. Chu (2019) have written about the impact of Learning Commons on the students' learning behaviour and skills development.

## Objectives of the study and methodology

- To understand the current library usage pattern of the students
- To find out how satisfied are students from the existing library
- To find out the factors which influence the satisfaction level of the students for library
- To find out students' expectations and perception of an ideal learning environment
- Based on the data received, suggest a model for converting the existing library into a favourite place for students – “The Information Commons.”

An online questionnaire survey was constructed with the help of Google forms and sent to currently cohorts (IPMX, WMP and PGPSM students) studying at IIMLNC, through e-mail, along with the rationale of the study, with a request for participation. Total of 262 students was contacted, of which 177 responded. The data were analysed using SPSS software.

## Data analysis and discussion

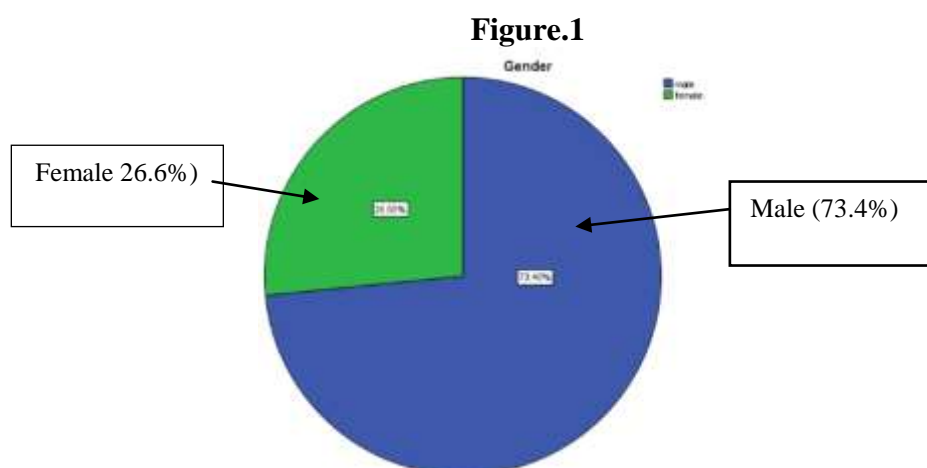
The captured data show that the needs and expectations of the students differ course wise. The IPMX course, being a one-year course, is very compact and the students after attending classes for the whole day, use the library during evening and night. The other course WMP (two years' programme), has working executives who reside on the campus for three days (Friday evening to Sunday evening), twice a month. They use the library only six days per month. All the students of IPMX and WMP own a laptop, so they use the library for individual and group study. Another course PGPSM is a two years' residential course, where students are fresher, comparatively younger, and they use the computers in the lab for e-resources. The atmosphere, feel, and the smell of the books attracts its patrons to the library.

The gender representation of the respondents shows that over the years, more female students are entering management courses. The study done in 2016 for the usage of mobile app for library services had only 10% female students, but the current study has 26.6% female students.

**Table.1. Gender**

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	130	73.4	73.4	73.4
Valid female	47	26.6	26.6	100.0
<b>Total</b>	<b>177</b>	<b>100.0</b>	<b>100.0</b>	

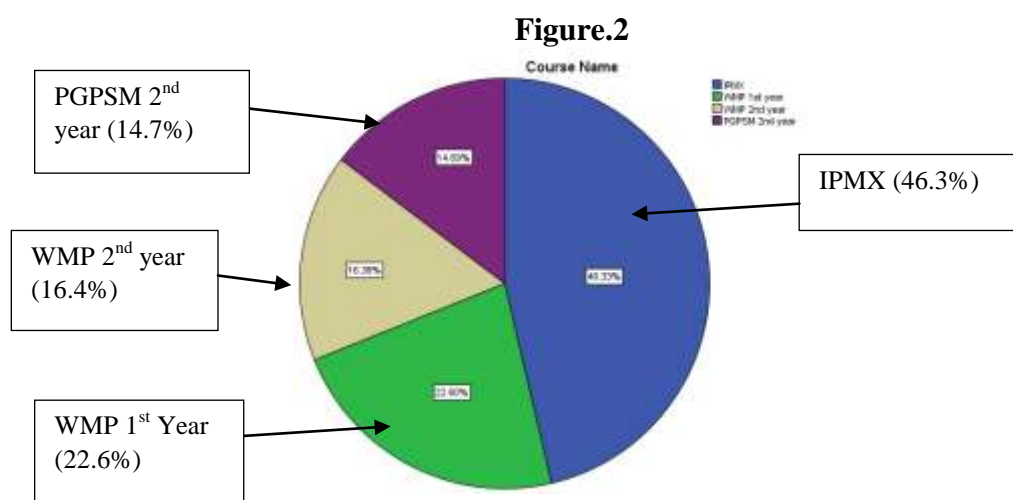




The course-wise representation of students shows that the largest batch is of IPMX students, which means their needs and perceptions of an ideal learning environment will have more weightage in the findings. Moreover, their participation in the survey is also higher than students of other courses. 81.88% of IPMX students responded to the questionnaire, followed by 78.78% PGPSM, 57.97% WMP 1<sup>st</sup> year and 47.54% WMP 2<sup>nd</sup> year students.

**Table 2.** Course Name

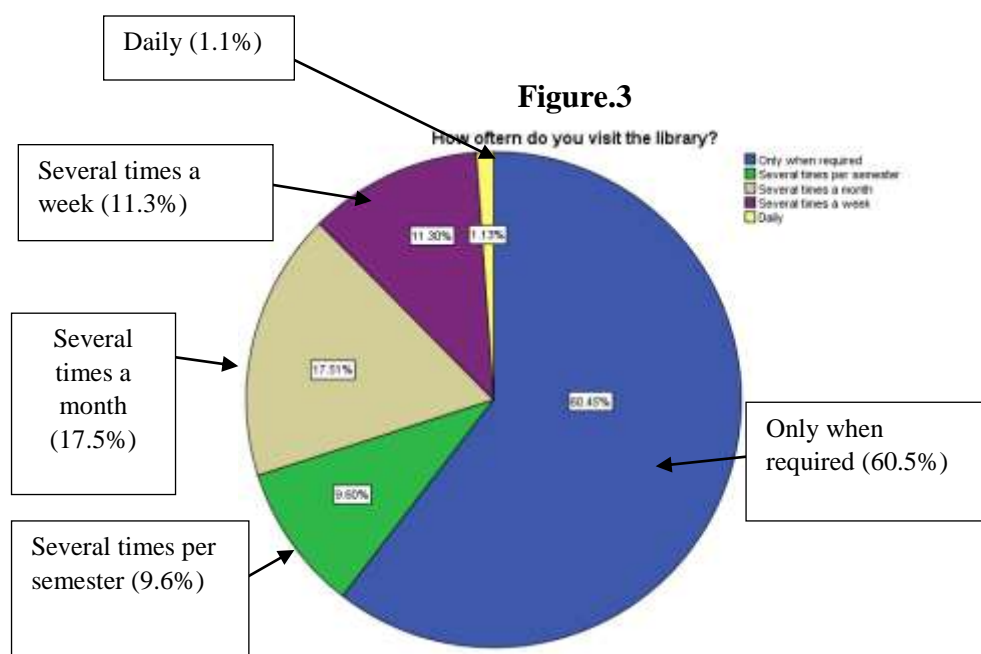
	Number of students (% of respondents)	Frequency	Percent	Valid Percent	Cumulative Percent
Valid IPMX	101 (81.88%)	82	46.3	46.3	46.3
WMP 1st year	69 (57.97%)	40	22.6	22.6	68.9
WMP 2nd year	61 (47.54%)	29	16.4	16.4	85.3
PGPSM 2nd year	33 (78.78%)	26	14.7	14.7	100.0
Total		177	100.0	100.0	



The frequency of students' library visits shows that the library is not one of their favourite places. 60.5% of students visit it only when required, followed by 17.5% who visit the library several times a month, 11.3% visit the library several times a week, 9.6% several times per semester, and only 1.1% visit the library daily.

**Table 3.** How often do you visit the library?

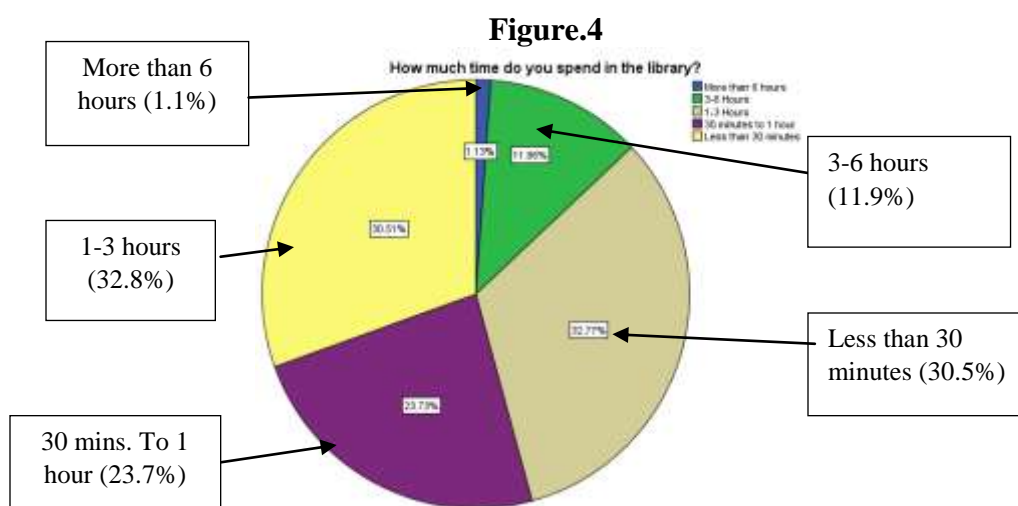
	Frequency	Per cent	Valid Percent	Cumulative Percent
Valid	Only when required	107	60.5	60.5
	Several times per semester	17	9.6	70.1
	Several times a month	31	17.5	87.6
	Several times a week	20	11.3	98.9
	Daily	2	1.1	100.0
	Total	177	100.0	100.0



In response to the question regarding time spent in the library by the students the data show that most of the students (32.8%) spend 1-3 hours in the library, followed by 30.5% who spend less than 30 minutes, 23.7% who spend 30 minutes to 1 hour, 11.9% who spend 3-6 hours and only 1.1% who spend more than 6 hours in the library.

**Table 4.** How much time do you spend in the library?

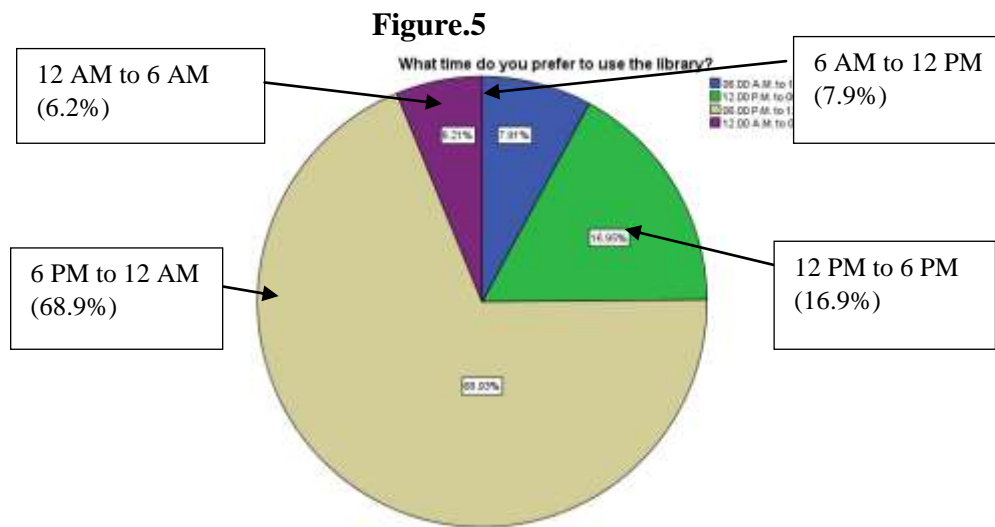
	Frequency	Percent	Valid Percent	Cumulative Percent
More than 6 hours	2	1.1	1.1	1.1
3-6 Hours	21	11.9	11.9	13.0
1-3 Hours	58	32.8	32.8	45.8
30 minutes to 1 hour	42	23.7	23.7	69.5
Less than 30 minutes	54	30.5	30.5	100.0
Total	177	100.0	100.0	



The data (for preferred time for using the library by the students) show that 68.9% students prefer to use the library from 6.00 P.M. to 12.00 A.M., followed by 16.9% from 12.00 P.M. to 6.00 P.M., 7.9% from 6.00 A.M. to 12.00 P.M. and 6.2% from 12.00 A.M. to 6.00 A.M. The main reason is that the students have most of the classes from 9.00 A.M. to 5.30 P.M. The best time is the evening time to study for them.

**Table 5.** What time do you prefer to use the library?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 06.00 A.M. to 12.00 P.M.	14	7.9	7.9	7.9
12.00 P.M. to 06.00 P.M.	30	16.9	16.9	24.9
06.00 P.M. to 12.00 A.M.	122	68.9	68.9	93.8
12.00 A.M. to 06.00 A.M.	11	6.2	6.2	100.0
Total	177	100.0	100.0	

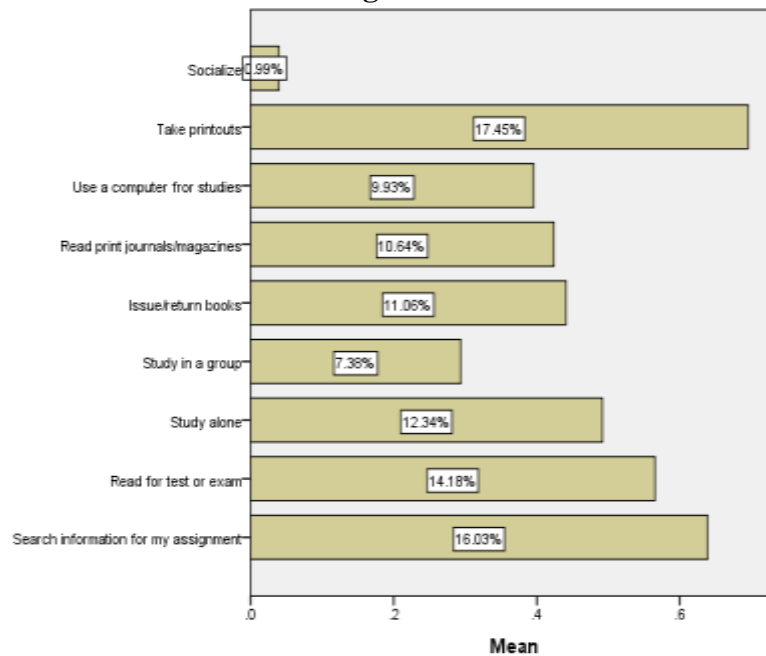


In order to find out the reasons for visiting the library by the students, the main reasons were identified by going through the case studies, previously conducted on this topic, and listed in the question – Why do you go to the library? The students could choose as many appropriate options as apply.

**Table 6.** Reasons for visiting the library

		Responses		Percent of Cases
		N	Percent	
Reasons	Search information for my assignment	113	16.0%	63.8%
	Read for test or exam	100	14.2%	56.5%
	Study alone	87	12.3%	49.2%
	Study in a group	52	7.4%	29.4%
	Issue/return books	78	11.1%	44.1%
	Read print journals/magazines	75	10.6%	42.4%
	Use a computer for studies	70	9.9%	39.5%
	Take printouts	123	17.4%	69.5%
	Socialize	7	1.0%	4.0%
Total		705	100.0%	398.3%

a. Dichotomy group tabulated at value 1

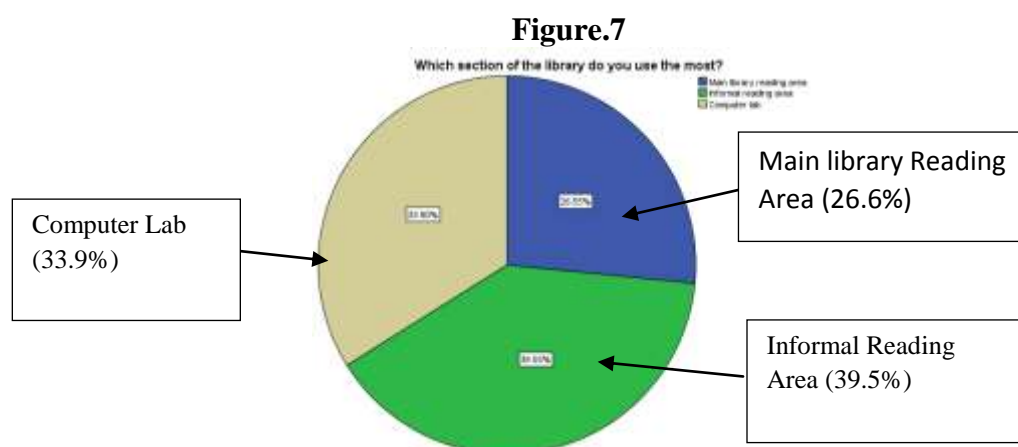
**Figure 6.**

The data show that most of the students (69.5%) go to the library to take print-outs, followed by 63.8% to searching for information for assignments, 56.5% to read for test or exam, 49.2% to study alone, 44.1% to issue/return book/s, 42.4% to read print journals and magazines, 39.5% to use computers for studies, 29.4% to study in a group, and only 4% go to socialize with other students.

For collecting data for the preferred section of the library, the students had to choose amongst the three sections of the library based on the functionality – Main library reading area, Informal reading area and the computer lab. The combined data shows that informal reading area is preferred by 39.5% of students, followed by computer lab 33.9% and main library reading area by 26.6% students.

**Table7.** Which section of the library do you use the most?

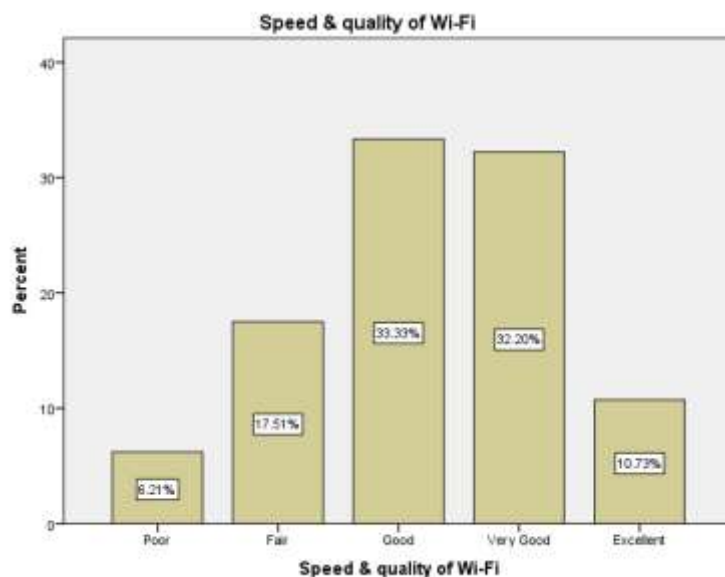
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Main library reading area	47	26.6	26.6	26.6
	Informal reading area	70	39.5	39.5	66.1
	Computer lab	60	33.9	33.9	100.0
	Total	177	100.0	100.0	



In order to know the speed and quality of Wi-Fi connectivity in the library, the students were asked to rate it, using the Likert's five-point scale. Most of the students - 33.3% rated it as "Good", 32.3% as "Very Good", 17.5% as "Fair", 10.7% as "Excellent" and 6.2% as "Poor".

**Table 8.** Speed & quality of Wi-Fi

	Frequency	Percent	Valid Percent	Cumulative Percent
Poor	11	6.2	6.2	6.2
Fair	31	17.5	17.5	23.7
Good	59	33.3	33.3	57.1
Very Good	57	32.2	32.2	89.3
Excellent	19	10.7	10.7	100.0
Total	177	100.0	100.0	

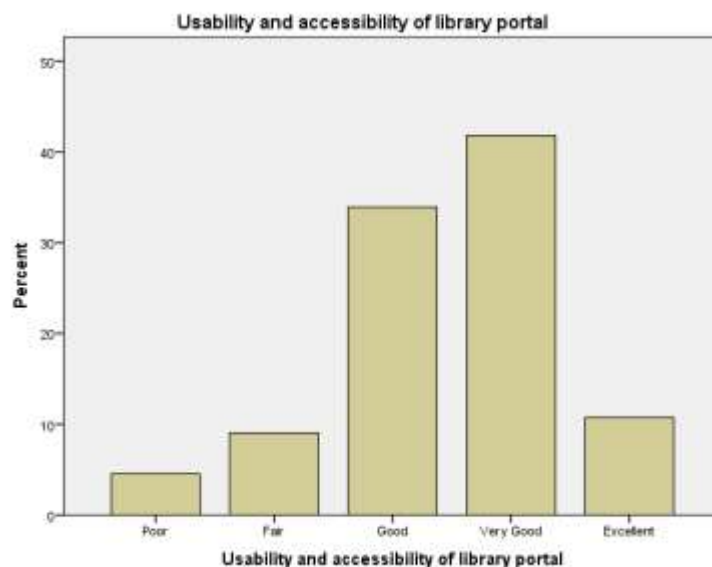
**Figure 8**

The data collected about the usability and accessibility of the library portal, show that most of the students (41.8%) have rated it as “Very good”, followed by 33.9% as “Good”, 10.7% as “Excellent”, 9% as “Fair” and 4.5% as “Poor”.

**Table 9.** Usability and accessibility of library portal

	Frequency	Percent	Valid Percent	Cumulative Percent
Poor	8	4.5	4.5	4.5
Fair	16	9.0	9.0	13.6
Good	60	33.9	33.9	47.5
Valid Very Good	74	41.8	41.8	89.3
Good				
Excellent	19	10.7	10.7	100.0
Total	177	100.0	100.0	

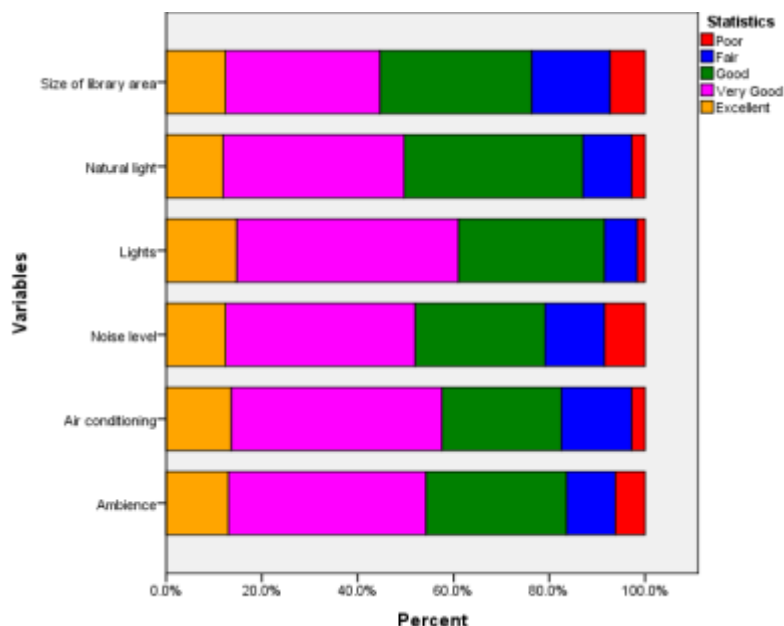


**Figure 9.**

The students were asked to rate the library based on various physical attributes on a scale of five. Most of the students have rated the library as “Very Good” in terms of ambience, air conditioning, noise level, lights, natural light and size of the library whereas the least number of students have rated it “Poor” for the same attributes.

**Table 10.** Rating the library on various physical attributes

	Ambience	Air conditioning	Noise level	Lights	Natural light	Size of the library area
Poor	6.2%	2.8%	8.5%	1.7%	2.8%	7.3%
Fair	10.2%	14.7%	12.4%	6.8%	10.2%	16.4%
Good	29.4%	24.9%	27.1%	30.5%	37.3%	31.6%
Very Good	41.2%	44.1%	39.5%	46.3%	37.9%	32.2%
Excellent	13.0%	13.6%	12.4%	14.7%	11.9%	12.4%

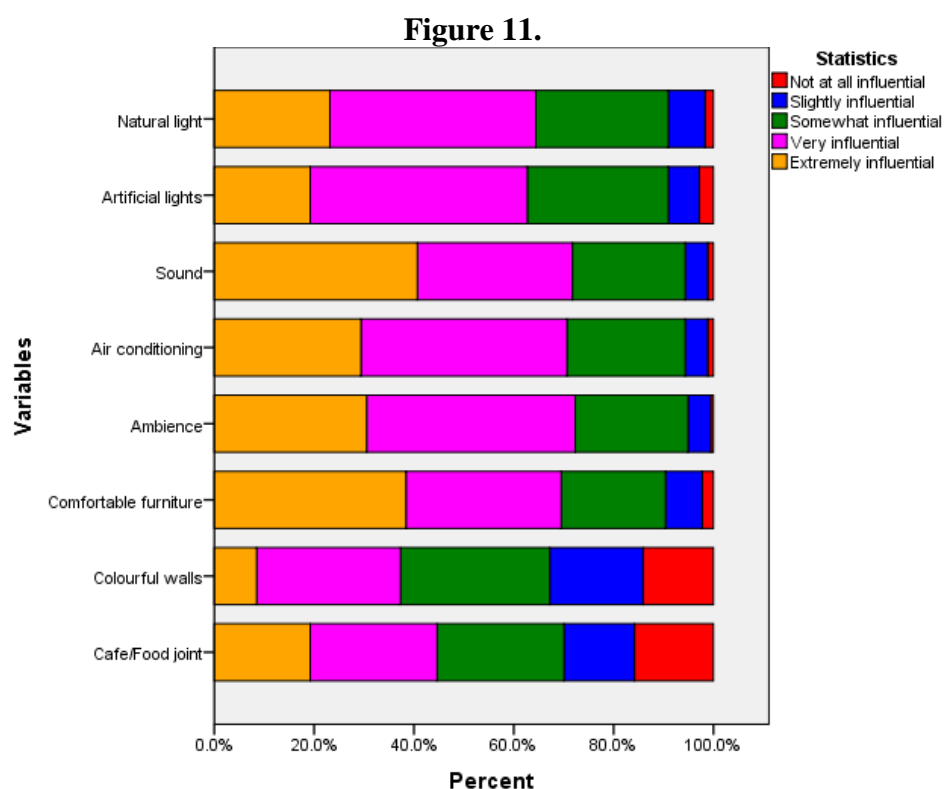
**Figure 10**

The students were asked to rate the attributes of the library, which (if included in the library), may influence their learning experience.

**Table 11.** Rating the attributes of the library

	Cafe/Food joint	Colourful walls	Comfortable furniture	Ambience	Air conditioning	Sound	Artificial lights	Natural light
Not at all influential	15.8%	14.1%	2.3%	0.6%	1.1%	1.1%	2.8%	1.7%
Slightly influential	14.1%	18.6%	7.3%	4.5%	4.5%	4.5%	6.2%	7.3%
Somewhat influential	25.4%	29.9%	20.9%	22.6%	23.7%	22.6%	28.2%	26.6%
Very influential	25.4%	28.8%	31.1%	41.8%	41.2%	31.1%	43.5%	41.2%
Extremely influential	19.2%	8.5%	38.4%	30.5%	29.4%	40.7%	19.2%	23.2%

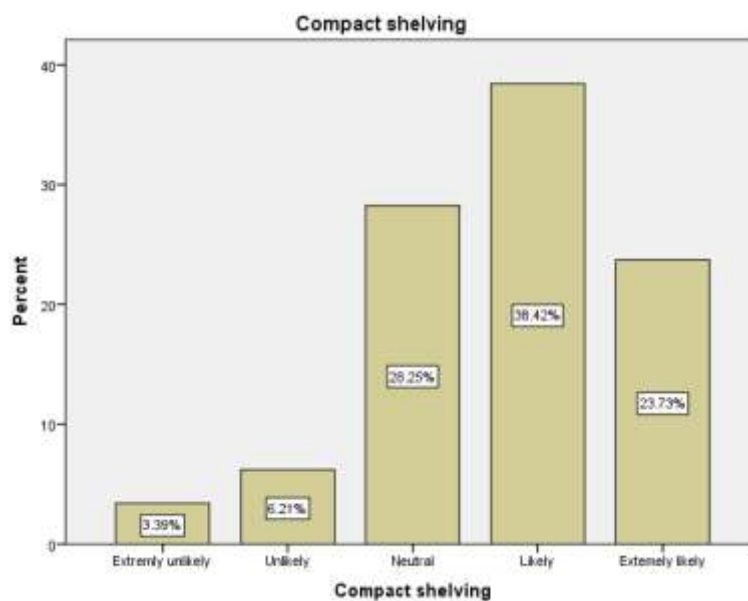
The data show that the most crucial feature which is “extremely influential” in students' learning experience is the level of sound (40.7%) in the library, followed by comfortable furniture (38.4%). The next feature which is “very influential” is the artificial lights (43.5%), followed by ambience (41.8%), air conditioning and natural light (41.2%), café/food joint (25.4%). The somewhat prominent feature is colourful walls (29.9%).



The students liked the idea of keeping the print material in the library to compact shelving. The percentage of students who think that it is “likely” that by doing this the space of the library would be better utilized is 38.4%, 28.2% are “neutral”, 23.7% find it “extremely likely”, 6.2% have rated it as “unlikely”, and 3.4% think that it is “extremely unlikely”.

**Table12.** Compact shelving

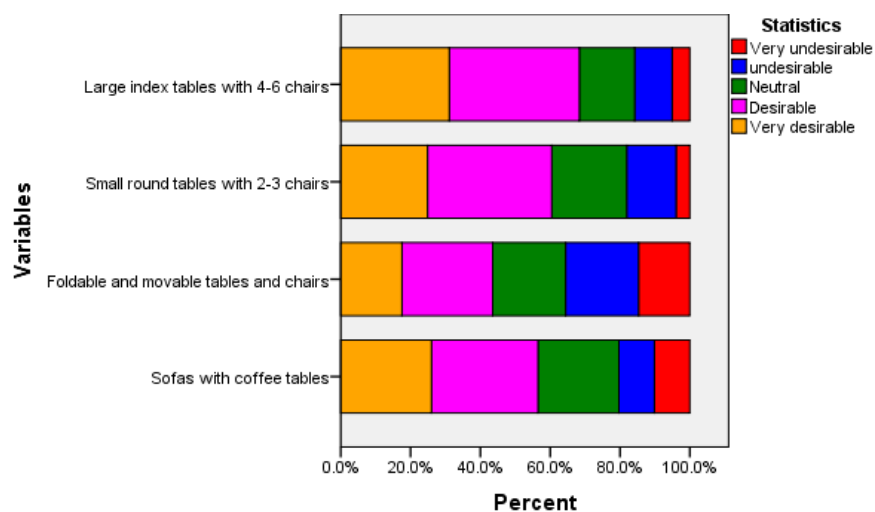
	Frequency	Per cent	Valid Percent	Cumulative Percent
Valid	Extremely unlikely	6	3.4	3.4
	Unlikely	11	6.2	9.6
	Neutral	50	28.2	37.9
	Likely	68	38.4	76.3
	Extremely likely	42	23.7	100.0
	Total	177	100.0	

**Figure 12.**

The next set of data is about the type of furniture preferred by the students. Most of the students have rated all the features as “desirable”, 37.3% have chosen large index tables with 4-6 chairs, followed by 35.6% small round tables with 2-3 chairs, 30.5% sofas with coffee tables and 26% foldable and movable tables and chairs.

**Table13.** Type of furniture preferred

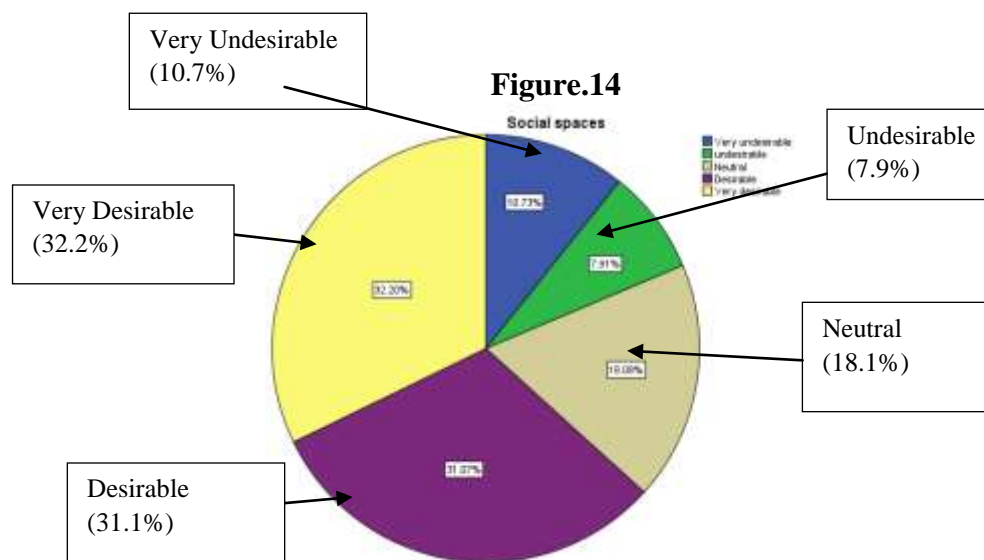
	Sofas with coffee tables	Foldable and movable tables and chairs	Small round tables with 2-3 chairs	Large index tables with 4-6 chairs
Very undesirable	10.2%	14.7%	4.0%	5.1%
Undesirable	10.2%	20.9%	14.1%	10.7%
Neutral	23.2%	20.9%	21.5%	15.8%
Desirable	30.5%	26.0%	35.6%	37.3%
Very desirable	26.0%	17.5%	24.9%	31.1%

**Figure.13**

While collecting data to find out students' desirability for including social spaces in the library the data shows that most of the students (32.2%) are "desirable" to have social spaces, whereas the least (7.9%) students have rated this feature as "undesirable".

**Table 14.** Social spaces

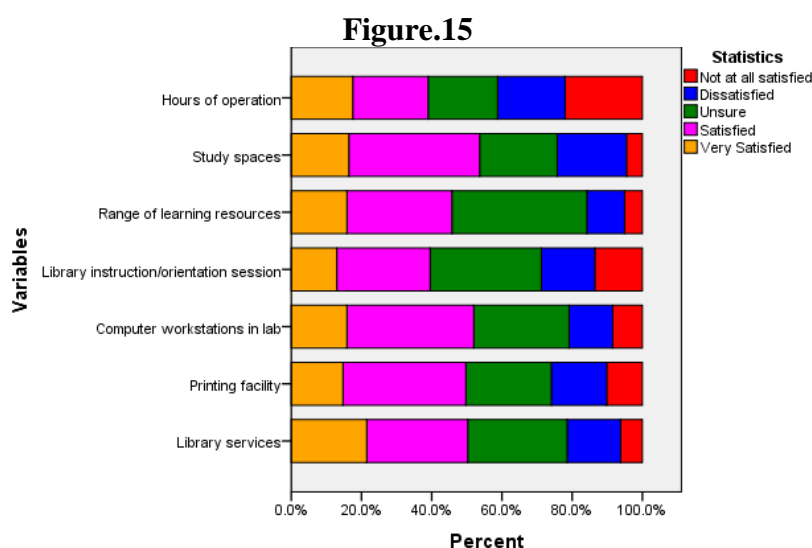
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very undesirable	19	10.7	10.7	10.7
	Undesirable	14	7.9	7.9	18.6
	Neutral	32	18.1	18.1	36.7
	Desirable	55	31.1	31.1	67.8
	Very desirable	57	32.2	32.2	100.0
	Total	177	100.0	100.0	



In order to measure the level of satisfaction of students from various library services and operations, the students were asked to rate those on a scale of five. Most of the students, except hours of operation, rated all the features as "satisfied" and the least per cent of students have rated "not at all satisfied".

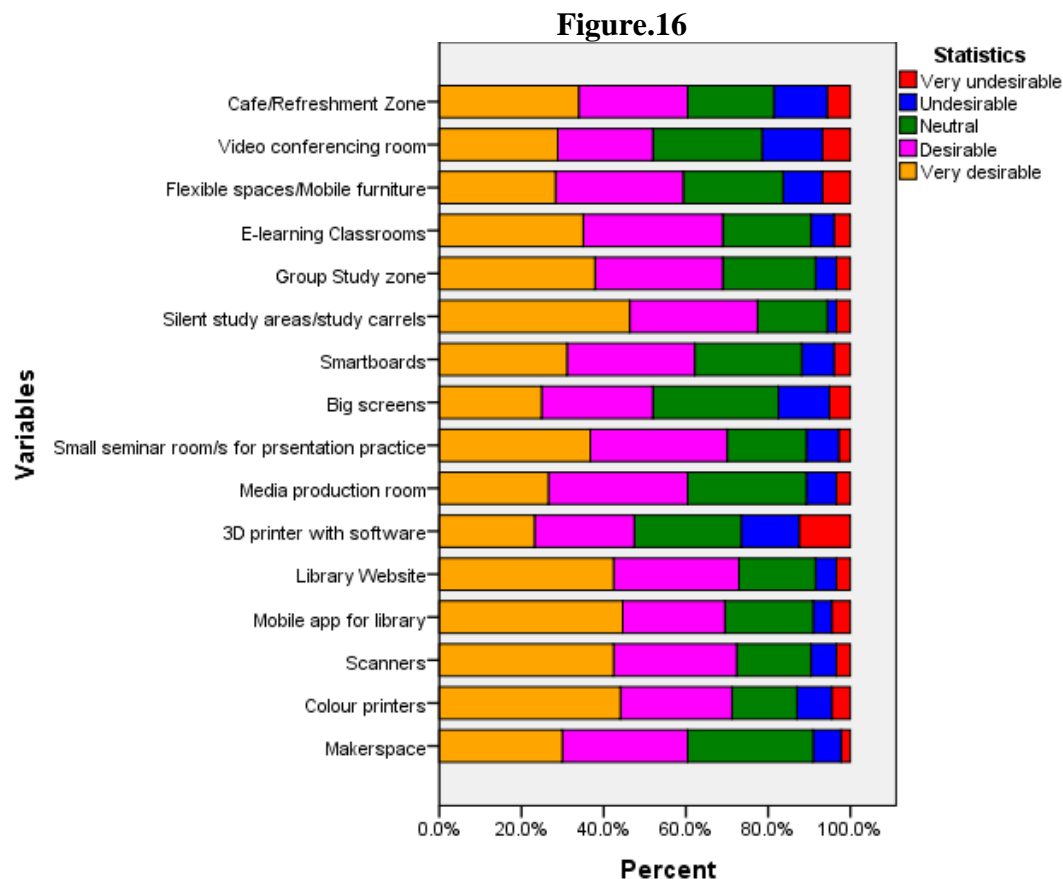
**Table 15.** Satisfaction level of students for library services

	Library services	Printing facility	Computer workstation in the lab	Library instruction/ orientation session	Range of learning resources	Study space	Hours of operation
Not at all satisfied	6.2%	10.2%	8.5%	13.6%	5.1%	4.5%	22.0%
Dissatisfied	15.3%	15.8%	12.4%	15.3%	10.7%	19.8%	19.2%
Unsure	28.2%	24.3%	27.1%	31.6%	38.4%	22.0%	19.8%
Satisfied	28.8%	35.0%	36.2%	26.6%	29.9%	37.3%	21.5%
Very Satisfied	21.5%	14.7%	15.8%	13.0%	15.8%	16.4%	17.5%

**Table16.** Desirable features in IC

Component	Very desirable	Desirable	Neutral	Undesirable	Very undesirable
Maker space	29.9%	30.5%	30.5%	6.8%	2.3%
Colour printers	44.1%	27.1%	15.8%	8.5%	4.5%
Scanners	42.4%	29.9%	18.1%	6.2%	3.4%
Mobile app	44.6%	24.9%	21.5%	4.5%	4.5%
Library Website	42.4%	30.5%	18.6%	5.1%	3.4%
3D printer	23.2%	24.3%	26.0%	14.1%	12.4%
Media production room	26.6%	33.9%	28.8%	7.3%	3.4%
Small seminar room/s	36.7%	33.3%	19.2%	7.9%	2.8%
Big monitors	24.9%	27.1%	30.5%	12.4%	5.1%
Smartboards	31.1%	31.1%	26.0%	7.9%	4.0%
Silent study areas	46.3%	31.1%	16.9%	2.3%	3.4%
Group Study zone	37.9%	31.1%	22.6%	5.1%	3.4%
E-learning Classrooms	35.0%	33.9%	21.5%	5.6%	4.0%
Flexible spaces/ Mobile furniture	28.2%	31.1%	24.3%	9.6%	6.8%
Video conferencing room	28.8%	23.2%	26.6%	14.7%	6.8%
Cafe/Refreshment Zone	33.9%	26.6%	20.9%	13.0%	5.6%

The most desirable component (46.3%) voted by the students is “Silent study area/research carrels”. The second most desirable component (44.6%) is “Mobile app for the library”, followed by (44.1%) “Colour printers”, (42.4%) “Library website” and “Scanners”, (37.9%) “Group study zone”, (36.7%) “Small seminar room for presentation practice”, (35%) “E-learning classroom”, (33.9%) “Café/refreshment zone”, (33.9%) “Media production room”, (31.1%) “Smartboards” and “Flexible spaces/Mobile furniture”, (30.5%) “Maker space” and “Big screens”, (28.8%) “Video viewing/Conferencing room”, (26%) “3D printer”.



In order to know the students' perception of an ideal learning environment, an open-ended question was framed. A few key points, selected from the responses, are listed below:

- 24/7 functional library, full of resources, both digital and physical, with the most suitable internet speed and comfortable furniture.
- Perfect ambience with natural light and other furniture/decor
- Quiet study space along with separate group discussion/presentation practice spaces.
- Self-checkout/check-in machine
- A cosy place with well air-conditioned rooms and lots of reading materials and journals.
- An informal cubicle type place for group study with sofa & table is a must
- Commonplace with bean bags and lively experience
- Cafe serving tea and coffee
- A room to watch videos
- A quiet place where all reading material is at hand. Audio and video books to be streamed on Wi-Fi so that students can use their headphone for better analysis of the topic



## Research Findings

- The students are not very frequent visitors to the library. Most of the students use it only when required. The average usage is for 1-3 hours. Most of them use it between 6.00 p.m. to 12.00 a.m.
- The two primary reasons for visiting the library are to take printouts and search for information for the assignment.
- The students are overall satisfied with the speed and quality of the Wi-Fi and usability and accessibility of the library portal.
- Most of the students have rated the library as “Very Good” based on various physical attributes like ambience, air conditioning, noise level, lights, natural light and size of the library.
- Most of the students are not at all satisfied with the hours of operation of the library. However, they are satisfied with the study space, library instruction/orientation session with a class to learn about library resources, library services, computer workstations in the lab and printing facilities. They are unsure about the range of learning resources in the library (books/journals/media).
- Natural light, artificial lights, sound, air conditioning, ambience, comfortable furniture, colourful walls, cafe/Food joint - all these factors are very influential in enhancing the students’ learning experience.
- Most of the students are in favour of keeping the print books and bound journals in compact shelving as the space in the library will be better utilised.
- The students preferred the large index tables with 4-6 chairs over the small round tables with 2-3 chairs, sofas with coffee tables and foldable and movable tables and chairs.
- Most of the students want to have social spaces in the library. Being a small campus, they need a place which is centrally located, 24/7 open, adequately lit, full of ambience, with comfortable furniture.
- The choice of the students in order of preference is as follows:
  - Quiet study area/research carrels(46.3%)
  - Mobile app for the library (44.6%)
  - Colour printers (44.1%)
  - Library website (42.4%)
  - Scanners (42.4%)
  - Group study zone (37.9%)
  - Small seminar room for presentation practise(36.7%)
  - E-learning classroom (35%)
  - Café/refreshment zone (33.9%)
  - Smartboards (31.1%)
  - Maker space (29.9%)
  - Video conferencing room (28.8%)
  - Flexible spaces/Mobile furniture (28.2%)
  - Media production room (26.6%)
  - Big monitors (24.9%)
  - 3D printer (23.2%)

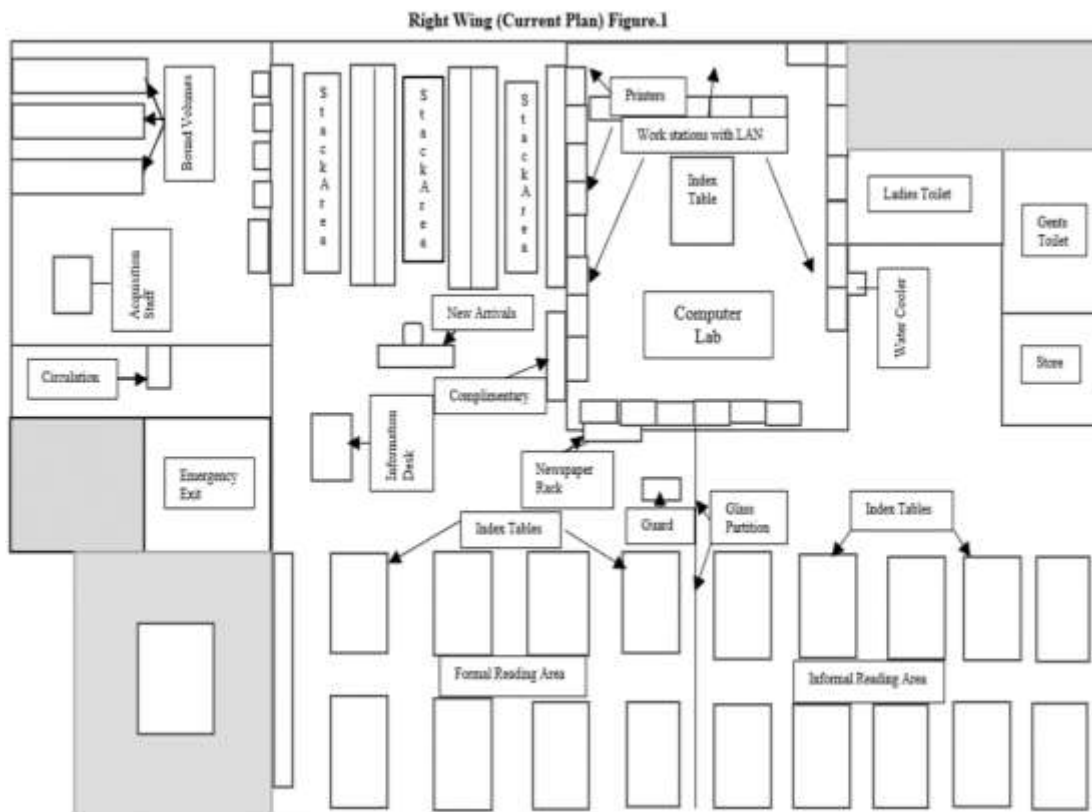
## Model of Information Commons

### Existing Library

#### *Right Wing*

The library is situated on the 2nd floor in the Administration block. The second floor has two wings. The library operates from the right-wing. The existing library has a stack area, print journals display, reading area, bound volumes room, in one portion. This portion is open from 9.00 a.m. to 6.30 p.m. The other portion has a computer lab and an informal reading area. This portion is open 24/7. A glass partition divides the library into two parts.

**Figure 1** . depicts the existing right-wing plan



## Model Plan

*Right Wing*

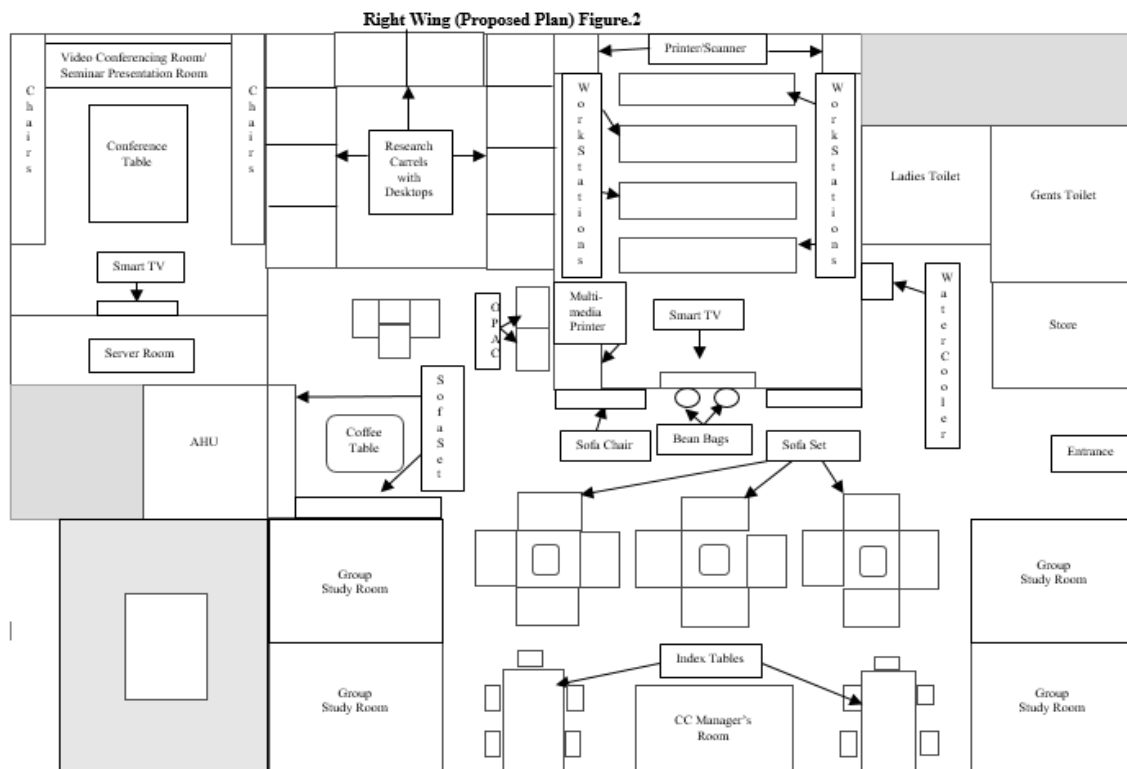
Based on the data analysed, the right-wing has been remodelled accordingly. The bound volumes and book stacks have been shifted to the left-wing and the area thus vacated has been used for video conferencing/small seminar room (36.7% students) and research carrels(46.6% students) respectively.

Four group study rooms (37.9% students) and one room for the Computer Center (CC) manager have been placed in the right-wing. These rooms will be made soundproof.

The reading tables have been shifted to the left-wing. Sofa sets, chairs and bean bags have been added in that area.

The workstations in the computer lab have been rearranged so that CC can be used for E-classroom (35% of students) also. A smart TV with a large monitor has been installed there.

**Figur .2.** depicts the model plan of the right-wing



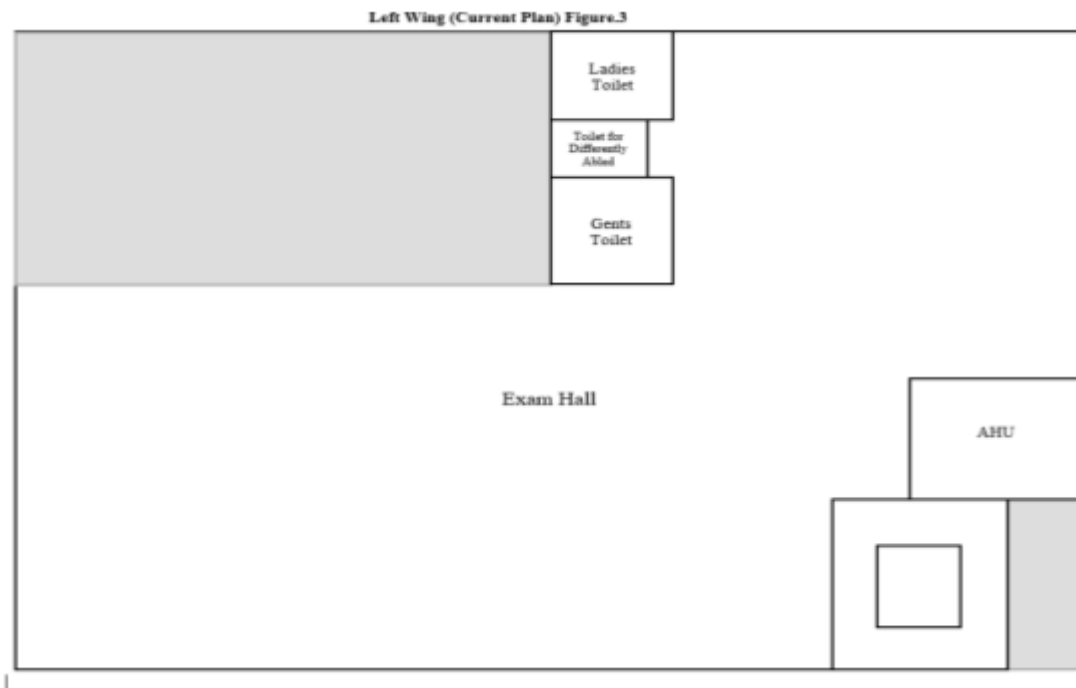
## Existing Library

### *Left-Wing*

The left-wing is currently not used for the library. Though the whole 2<sup>nd</sup> floor was constructed for the library, the left-wing is being used by the institute for student examination purposes.

While creating a model for IC, the author has used both the wings. With minimal changes in the existing infrastructure, maximal components have been incorporated to convert the library into an ideal place for students.

**Figure 3.** depicts the current plan of the left-wing.



## Model Plan

### *Left-Wing*

The left-wing has been planned as a quietzone. The books have been kept in compact shelving (38.6% students) to utilise the space for seating purposes. The bound volumes of journals are also kept in compact shelves.

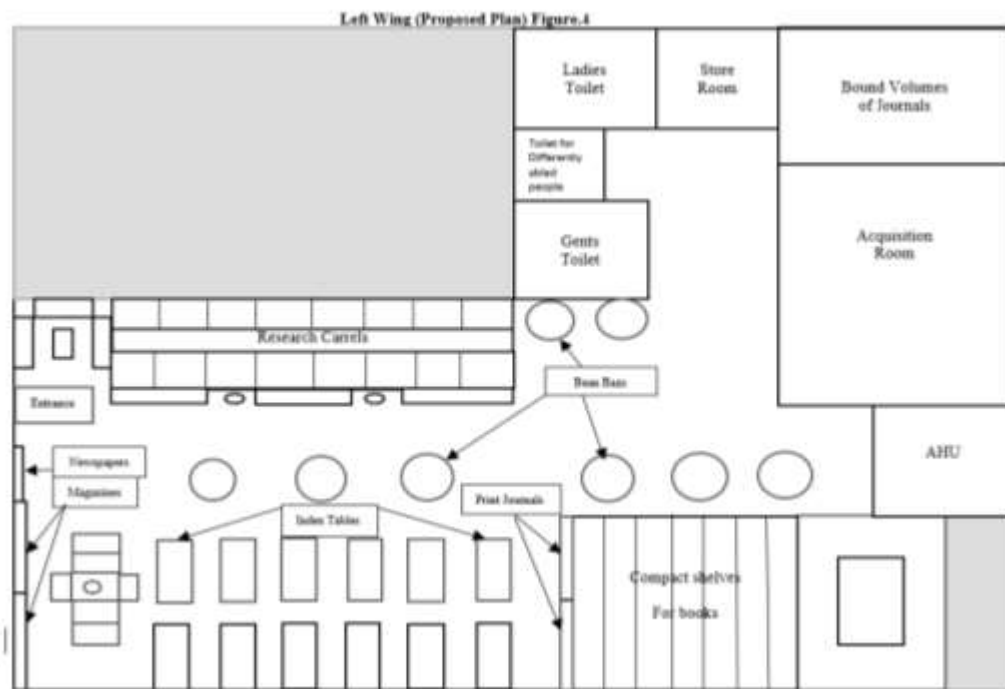
Acquisition roomhas been shifted to the left-wing. A storeroomis also in this wing.

Current periodicals, magazines and newspapers have been shifted from right to left-wing.

Research carrels (46.6% of students)have been planned for this wing also for quiet reading.

Sofa sets, comfortable chairs and bean bagshave been put in proper places.

**Figure 4.** depicts the model plan of the left-wing.



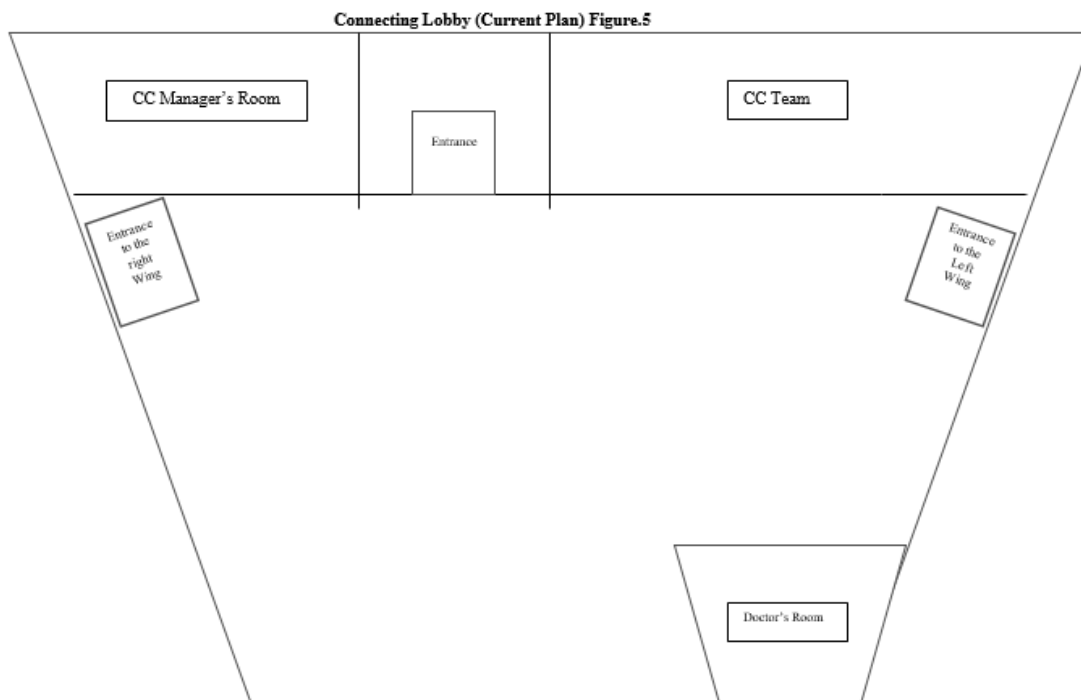
## Connecting Lobby

### *Current Plan*

The lobby area which connects the left wing to the right-wing is currently not being used for any purpose. There is a room, which is being used by the institution's visiting doctor.

At the entrance of the lobby, two makeshift rooms have been constructed recently for CC manager and CC staff.

**Figure5.** depicts the current plan of the lobby area.



## Model Plan

### Connecting Lobby

The lobby area was initially earmarked for the circulation service of the library.

The model plan has the same purpose for space. A circulation desk has been proposed to be built on the opposite side of the entrance. The option for self-check-in and check-out of library documents is also there.

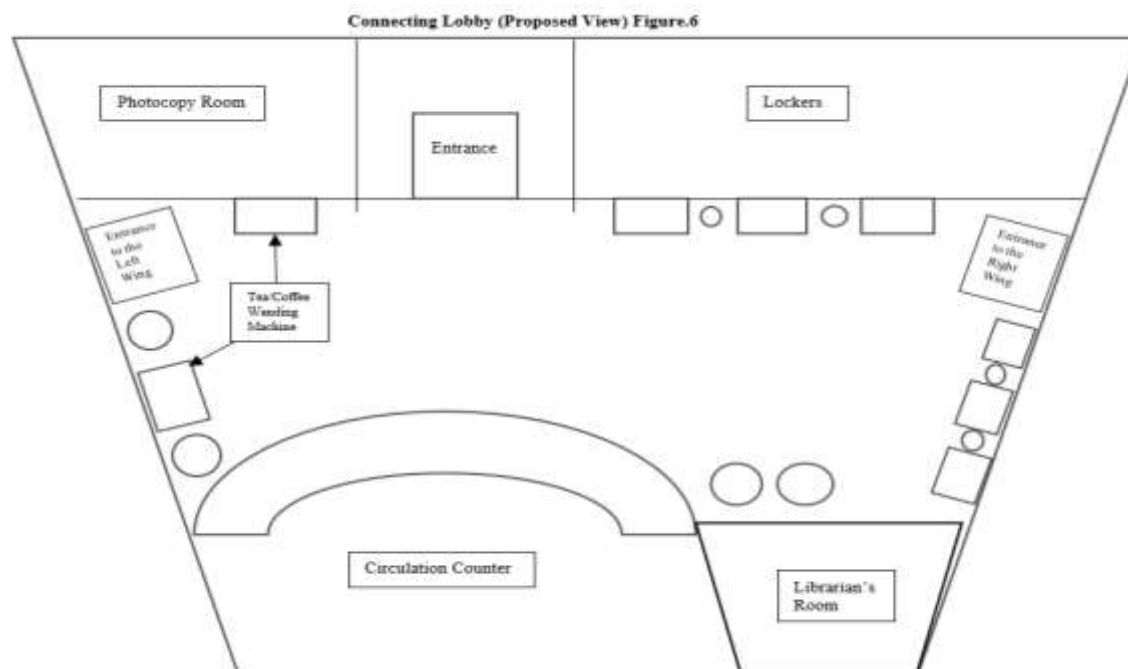
The room, which is currently used by the visiting doctor, has been proposed to be the librarian's room.

The CC manager and staff have been shifted to the right-wing. Their rooms have been purposed for photocopy/scanner/printer room and locker-room respectively.

Tea/coffee vending machines (33.9% students) and snacks dispenser machine have been placed in the lobby area.

Some bean bags and chairs have been put in this area.

**Figure 6.** depicts the model plan for the lobby area.



## Conclusion

With the increasing use of IT and Web-enabled educational resources, the use of traditional library spaces and services is decreasing in higher education institutions in India. The success of the ICs in American, European and other international universities has proved that modern libraries, which are learning-oriented, play an influential role in achieving the teaching, learning and research goals of its parent organisation. It is time for Indian academic libraries to start updating their spaces, services, technology, and staff accordingly. However, before planning to implement the models developed and based on the research of foreign universities, the librarians should utilise the research conducted in India. There is a difference in social, cultural, financial and educational systems between developed and developing countries. The needs and expectations of the Indian library users must be taken into consideration while renovating and redesigning the existing library. The present model is cost-effective, need-based and requires fewer changes in physical structure.

## References

1. Bailey, D. R., & Tierney, B. G. (2008). *Transforming library service through Information Commons: Case studies for the digital age*. Chicago: American Library Association.
2. Beagle, D. R. (2006). *The Information Commons handbook*. New York: Neal-Schuman.
3. Chaddha, K. (2017, July-December). The Information Commons: Redesigning and repurposing academic libraries. *Journal of Library Management*, 6(3-4), 7-20.
4. Dryden, N. H., & Goldstein, S. (2013). Regional Campus Learning Commons: Assessing to meet students needs. *Journal of Library Administration*, 53(5-6), 293-322. doi:10.1080/01930826.2013.876822
5. Loertscher, D. V., & Koechlin, C. (2014, March/April). Climbing to excellence: Defining Characteristics of Successful Learning Commons. *Knowledge Quest*, 42(4), pp. E1-E10.
6. MacWhinnie, L. A. (2003). The Information Commons: The Academic Library of the Future. *Libraries and the Academy*, 3(2), 241-257.
7. Massis, B. E. (2010). The academic library becomes the academic learning commons. *New Library World*, 111(3/4), 161-163.
8. McMullen, S. (2008). US Academic Libraries: Today's Learning Commons Model. *PEB Exchange*(4), 1-6.
9. Peterson, N. K. (2013). *The developing role of the university library as a student learning commons: Implications to the interior spaces within*. Iowa: Iowa State University Capstones, Graduate Theses and Dissertations. Retrieved from <https://lib.dr.iastate.edu/etd/13186>
10. Woo, E. M., Serenko, A., & Chu, S. K. (2019). An exploratory study of the relationship between the use of the Learning Commons and students' perceived learning outcomes. *The Journal of Academic Librarianship*, 45, 413-419.



## ANNEXURE 1

### Questionnaire

1. Name of the course
2. Gender
3. How often do you visit the library?
  - a. Only when required
  - b. Several times per semester
  - c. Several times a month
  - d. Several times a week
  - e. Daily
4. How much time do you spend in the library?
  - a. More than 6 hours
  - b. 3-6 hours
  - c. 1-3 hours
  - d. 30 minutes to 1 hour
  - e. Less than 30 minutes
5. What time do you prefer to use the library?
  - a. 6.00 AM to 12.00 PM
  - b. 12.00 PM to 6.00 PM
  - c. 6.00 PM to 12.00 AM
  - d. 12.00 AM to 6.00 AM
6. Why do you visit the library? You may opt as many as applicable.
  - a. Study alone
  - b. Study with a group
  - c. Use a computer for studies
  - d. Issue/return books
  - e. Read print journals/magazines
  - f. Take printouts
  - g. Socialise
7. Which section of the library do you use most and why?
  - a. Main library reading area
  - b. Informal reading area
  - c. Computer lab
8. Please rate the speed and quality of Wi-Fi connectivity inside the library on a scale of 5, where one stands for the least and five stands for the most.
9. Please rate the usability and accessibility of the library portal on a scale of 5, where 1 stand for the least and 5 stands for the most.
10. Please rate the quality of reading space in the library based on given features on a scale of 5, where 1 stands for least and 5 stands for most
  - a. Size of the library area
  - b. Natural light
  - c. Lights
  - d. Noise level

- e. Air Conditioning
  - f. Ambience
11. Please rate the impact of the following features in the library on students' learning experience, on a scale of 5, where 1 stands for least and 5 stands for most.
- a. Natural light
  - b. Artificial lights
  - c. Sound
  - d. Air Conditioning
  - e. Ambience
  - f. Comfortable furniture
  - g. Colourful walls
  - h. Café/food joint
12. Do you think that space in the library would be better utilised if the print books/journals are kept in compact shelving? Please give your response on a scale of 5, where 1 stands for least likely and 5 stands for most likely.
13. What kind of furniture do you prefer in the library? Please give your response on a scale of 5, where 1 stands for least desirable and 5 stands for most desirable.
- a. Large index tables with 4-6 chairs
  - b. Small round tables with 2-3 chairs
  - c. Foldable and movable tables and chairs
  - d. Sofas with coffee tables
14. Do you think that the library should have social spaces/lounge/casual setting? Please give your response on a scale of 5, where 1 stands for least required and 5 stands for most required.
15. Please rate how satisfied you are with the library services on a scale of 5, where 1 stands for "least satisfied" and 5 stands for "most satisfied".
- a. Hours of Operation
  - b. Study space
  - c. Range of learning resources in the library (books/journals/videos)
  - d. Library instruction/orientation session with a class to learn about library resources
  - e. Computer workstations in the lab
  - f. Printing facility
  - g. Library services, i.e. circulation, reference
16. Please assign numbers (1-5) to each component; our library should have, where 1 stands for least desirable and 5 stands for most desirable.

S. No.	Feature
1.	Café/refreshment zone
2	Video conferencing room
3.	Flexible spaces/movable furniture
4.	E-learning Classrooms
5.	Group study zones
6.	Silent study areas/study carrels
7.	Smartboards

8.	Big Screens
9.	Small seminar room/s for presentation practice
10.	Video making/ editing suites/ media production
11.	3D printer with software
12.	Library website
13.	Library Mobile App
14.	Scanners
15.	Colour Printers
16.	Makerspace

17. Please give your suggestions for improving the library to enhance your learning experience.

# Learning Tools Interoperability: Paradigm shift of Open Learning

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## Abstract

Educational institutions use different technological resources to support their teaching and learning activities to promote and enhance active learning. On the premise, in today's world even large learning management systems are trying to cooperate with each other in order to perform the best. Research has been done on various protocols and standards for information exchange between these learning management systems. Mapping & ability to work in different systems, that is why gigantic software companies which provide learning applications and academic institutions which host their learning management environment are coming forward to adopt with these standards of learning tools interoperability. This creates opportunities for teacher and students to connect, collaborate and share information in their learning practices, which makes it more relevant in open learning environment, where interaction between teachers and students is crucial.

## Keywords

Learning Tools Interoperability; Learning Management System; Open Learning; Learning Ecosystem; Interoperability standards; Educational Resources; E-learning

## Introduction

Present drifts in technology are deeply modernizing the ways in which people communicate, exchange information, and learn. Web 2.0 tools have made it easy for masses to not only consume information but also to contribute to the existing pool of knowledge and also to contribute new information. (Simpson, 2016). Schools and other institutions of higher education are underway to become accustomed to this new technology as well giving their students, access to high-quality educational practices and resources. ("What is open education? | Opensource.com," n.d.). Learning Object Repositories, a form of digital libraries, are being created to house digital learning objects and Learning Management Software (LMS) provide new ways to visualize and present course materials for both classroom and online education. This E-learning experience

implies a more active, engaging role for student and teacher(Rice, 2015). This serves the most fundamental need of the lifelong learning to have a readily available personal profile to record their course progress and also keep note of future plans. This type of learning ecosystem lets student to connect with their teachers, and teachers can collaborate with their peers for knowledge sharing.(Uden, Liberona, & Eds, 2015). Though there are many Learning Management Systems available in the market and institutions are choosing as per their requirement. But the problem with different platforms and vendors is they use different standards. These systems need to interact and integrate and exchange information with each other.(Olivier & Liber, 2002). Because these tools and platforms are also written in different coding language, and work on different architecture, it required great deal of programming and coding changes in the software in order to connect it to other external service. In case of migration, the task becomes more tedious, because the developers needed to redo all the changes in the new installation of LMS. In this kind of solutions API appear to be a viable solution. But each software vendor uses different API so it becomes difficult to integrate multiple API's of different tools.

Web 2.0 has presented a great leap in creating de facto standard for information exchange and linking in internet based E learning environments (Yen, Neil Y; Shih, Timothy K; Jin, Qun; Hsu, Hui-Huang; Chao, 2010). This takes E-learning to a new dimension of accessibility, flexibility and control over content. A Non-profit organization which is working to standardise the education sector called IMS Global Learning Consortium has come forward to make an interoperability standard for Learning tools, which is called Learning Tools Interoperability. (IMS Global Learning Consortium, n.d.-b)

## Objectives

This paper tries to shed some light on the uses and benefits of learning tools interoperability in various Learning Management Systems and also explores the third-party tool providers that have been certified by the IMS Global learning consortium to make use of the LTI standards. The paper briefly explores the working of LTI on Conceptual bases and also studies its significance, implication and usage in distance education and E-Learning scenario.

### *Literature review:*

In order to establish a conceptual bridge between current state of knowledge and this topic of research it is necessary to go through the research works that are already been done and are close to our research question. During this study, many Primary and secondary sources of information have been refereed.

Bill Olivier and Oleg Liber in their study on lifelong learning says that, Emerging paradigm of the Web server-based learning environment has a crucial role in life-long learning and providing a personalised learning environment. In addition, network sharable contents and learning resources presented a great step forward for eLearning (Olivier & Liber, 2002). Learning Object Repositories (LOR), Open Educational Resources (OER), provide a new way to visualize information, and web based Learning Management Softwares (LMS) creates an active learning environment with help of teacher student interactions. (Rice, 2015).

Miguel Á Conde and others studied that ICT and Web 2.0 opens new gateway of skill development for student and researchers, but lack of However, lack of standards that allow learning content to exchange information among the various learning tools and platforms has been a great problem.(Conde et al., 2014)

Robert T Mason, suggested use of XML, and PHP coding to enable interoperability in LMS like Moodle(Mason, 2011). But a more viable and accepted option of a common and open standard like IMS LTI is suggested by many researchers. (Leal & Queirós, 2011)(Kumar & Sharma, 2016).

LTI standard is increasingly in use across the spectrum of higher education, and many leading colleges and universities worldwide are choosing to use LTI for integrating their own inhouse developed and open Learning management softwares.(Abel, 2013)(JISC- funded, n.d.)

## **Concept of Interoperability**

Interoperability can be defined as the ability of a software or a hardware system of one computer network to communication with other system on other computer networks, each running on different underlaying technologies and protocols.(ALVA, 2005) According to Technopedia, Interoperability is the property of as software that allows the unrestricted sharing of resources between distinct systems. Interoperability with regards to Learning Management Systems (LMS) and Learning tool provider(TP) mean that the LMS and TP are able to communication and exchange important data with each other irrespective of the platform or the programming language on which they are running. (Henrick, 2012).

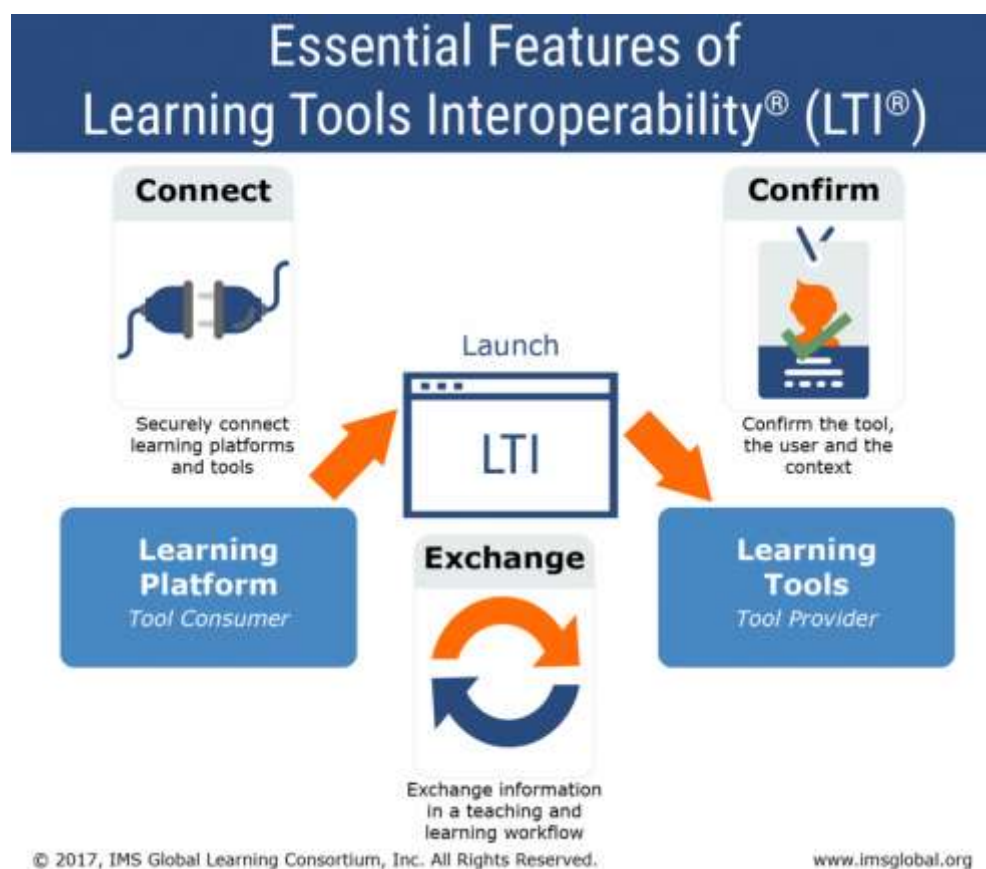
## **What is API**

Many other methods are available to interconnect the LMS withTP and various other web applications, one of which is Application Programming Interface (API), this is a software intermediary that allows two applications to talk to each other, and borrow functionality and data from each other automatically, without doing repeated work. (“What is an API? (Application Programming Interface) | MuleSoft,” n.d.).

## **What is LTI**

IMS Global is a non-profit collaborative organization working in formulating the future of education and learning technology. Learning tools Interoperability (LTI) is an Open standard, developed by IMS, which allows courseware and learning tools from different vendors to be launched from within an application i.e. Learning Management System. LTI is widely used global standard for educational applications and provides a common way to plug applications into LMS. (S. P. Vickers, 2012)

According to IMS official website “the IMS Learning Tools Interoperability (LTI) standard prescribes a way to easily and securely connect learning applications and tools with platforms like learning management systems, portals and learning object repositories on your premise or in the cloud, in a secure and standard manner and without the need to expensive custom programming.”(IMS Global Learning Consortium, n.d.-a). LTI was created as a tool to standardize the interconnection of contents between learning management system platforms like Moodle, Blackboard, Canvas, etc and third-party tool providers to incorporate and accommodate everything to work harmoniously.



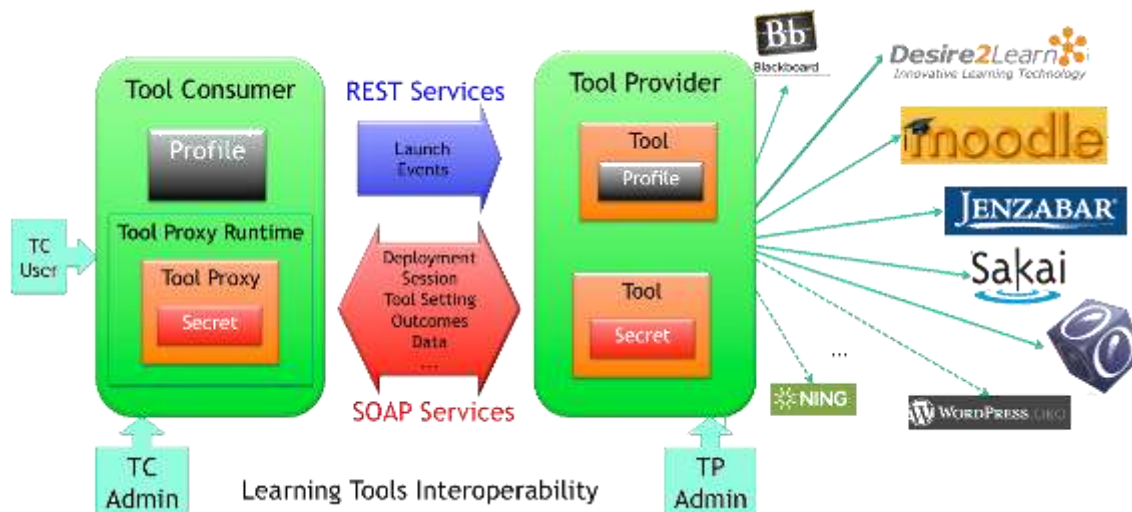
**Figure 1.** Features and Framework of Learning Tools Interoperability. (Source: [www.imsglobal.org](http://www.imsglobal.org))

Tool Provider is an application which delivers features which others can connect and access from the LMS. It can be quizzes, game, simulation, video etc.

Tool Consumer is an application which can link with the 3rd party Tool Provider to borrow functionality and data from it. For example, Moodle, Sakai and other LMS can be tool Consumers.

Before LTI the external learning tools/resources were linked to institutions Learning Management Software by writing an application specific program or making direct changes into

the Code of the LMS Software, which was a very tedious job and was to be done by the Programming experts or software developers only. But with LTI, which works as an API (application programming interface) which acts as a mediator between the LMS and LT and allow these to communicate with each other.(Abel, 2013). With LTI, the external learning tools and learning management software are much easier to integrate, and works so smoothly that it appears like the external learning tools are part of the LMS itself.



**Figure 2.** Features and Framework of Learning Tools Interoperability. (Source: [www.imsglobal.org](http://www.imsglobal.org))

### *Objectives of LTI*

Learning tools interoperability provides a standard way for tools to be launched from multiple learning platforms and that way it allows teachers and students to have a seamless integrated experience. It allows functionality of learning technology to be delivered by a variety of platforms like Moodle, Blackboard, Canvas, etc. (IMS Global Learning Consortium, n.d.-a). the benefits of LTI standards as per different perspectives are as follows:

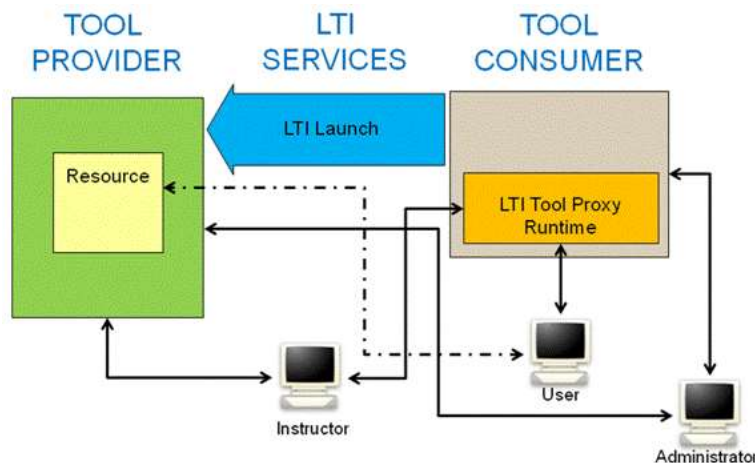
- **Students:** It allows students to use only single sign in to perform all activities in the LMS, so they don't have to create and provide credentials for each course they take, and all its resources they use.
- **Teachers:** it allows teacher to include third-party applications in their courses (resources of other simulations, mock tests, MOOCs for example) that are stimulating for the students and which were not available in the LMS internally.
- **Developers:** it allows the developers to develop single interface or method for interconnection with various Tool Consumers and Tool Providers, and saves the time which was earlier devoted in rewriting a new code for each new application.
- **Administrators:** The system administration can effectively integrate, control and monitor the external tools integrated with the LMS. It also makes Upgradation and migration much easier. (S. P. Vickers, 2012)(S. Vickers, 2011)



LTI provides a common way to perform integration with a vendor neutral approach and allows synchronization to enable rapid deployment of enterprise applications. This simplifies self-registration, enhance data integration and expanded the LMS capabilities.(Rob Abel, 2019). At present there are many applications and products available for LMS that have some of the different IMS certifications for interoperability standards. Many of them are highlighted in the IMS catalogue LMS's like (Moodle, Canvas, Sakai, Blackboard, Desire2Learn, etc.), portfolio tools (Mahara, Chack & Wire, etc.), eBook (Course Smart, Course Load, etc.), collaborative tools (elgg, Piazza, etc), Grading tools (Turnitin). Companies such as Blackboard, Desire2Learn, Wimba and open source tools like Moodle, Sakai, have certified their products with the different versions of LTIs (1.0, 1.1 and 1.3)(Semester & November, 2005)

## LTI now

The initial implementation of LTI was called basic LTI and was developed in 2008 as google summer of code project by Jordi Pigullem under the mentorship of Charles severance(Severance, 2012). Then this whole project was taken care by IMS Learning consortium. LTI 1.0 came in form in May 2010 with Basic Tool launch and Common Cartage 1.1, then LTI 1.1 came out in the last quarter of 2011 with added functionality of exchanging student grades between the LMS and Learning Tool. LTI 2.0 includes even simpler provisioning and installation of tools, expanded grade services, and improved ability to import and export classes.(Severance, 2012a)



**Figure 3.** Scheme LTI v 1.1 (Source imsglobal.org)

## Versions of LTI

Like any software, LTI has evolved over time and what it is able to do continues to mature, which is why there are different versions. And IMS global is tirelessly working and adding new layers of security and functionality to this specification. Following are the versions launched by IMS global.

**Table 1.** LTI Certification timeline with their features

Version	Release date	functionality
1.0 Basic LTI	2008	Secure connection between the Tool Consumer and Tool Provider
1.0 Full LTI	May 2010	Unidirectional communication with Tool Consumer and Tool Provider.
1.1	March 2012	Added functionality to fetch grades and results, and Basic Outcomes.
1.1.1	June 2012	Added functionality of role provisioning
2.0	July 2013	Used Tool Consumer, Proxy and Auto-Registration
1.3 (LTI Advantage)	2017	Use of REST, JSON web tokens and OAuth2

Data sources: (IMS Global Learning Consortium, n.d.-e), (“LTI Advantage Toolkit for HED | IMS Global Learning Consortium,” n.d.), (Behbahani, 2015; IMS Global Learning Consortium, n.d.-f)

The new core LTI version 1.3 was launched in 2017 and it is a package of high-value services align LTI with industry-best security and provides a clear path forward for existing services and new services to pursue the rich integration available between learning platforms and tools. LTI 1.3 is backward compatible with its predecessor, and now IMS Global recommends the use of LTI 1.3 as LTI 2.0 will be deprecated in near future.

## LTI Users

The usage spectrum of LTI is rapidly increasing worldwide many universities, educational institutes are using LTI complaint LMS and many organizations are actively engaged in the strategic development of their tools and resource to comply with LTI standards. The IMS Global website offers a catalogue of products that are certified LTI-compliant, a list that currently includes 18 platforms and hundreds of tools. For this empirical study the data from various institutional websites and IMS global official website is gathered and analysed.

Software that conforms to the LTI standard is increasingly in use across the spectrum of higher education, and more than 100 colleges and universities are actively engaged with LTI at a

strategic development level.(Abel, 2013) Great increase is seen in advancement of Open Education Resources in the last decade. A list is compiled from IMS global website listing their affiliate member institutions, which shows various educational institutes that have an established Learning management system which is in compliance with LTI standards and also making use of the technology. The list also shows the learning management system being used by the institution.

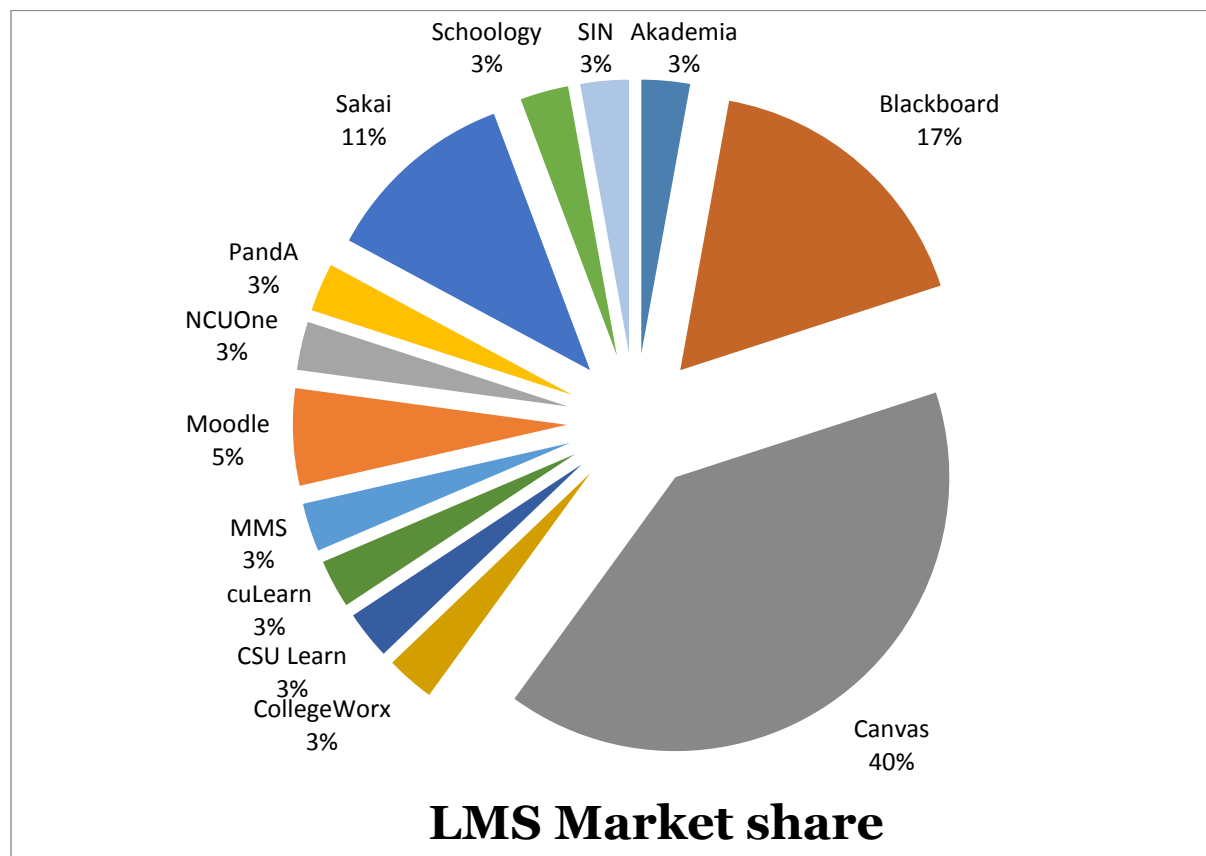
This covers the Open Educational Resources (OER) and commercial resources as well. The collection of data was done from the internet with keeping LTI Certification in mind. The table shows the name of the universities and the Learning Management Software being used by them.

**Table 2.** Country wise Institution using LTI Certified Tools

Country Name of LMS	Count of LMS Installations
<b>Australia</b>	2
<b>Moodle</b>	1
<b>CollegeWorx</b>	1
<b>Canada</b>	2
<b>Blackboard</b>	1
<b>Canvas</b>	1
<b>Japan</b>	3
<b>Moodle</b>	1
<b>PandA</b>	1
<b>Sakai</b>	1
<b>UK</b>	3
<b>Blackboard</b>	1
<b>Sakai</b>	1
<b>MMS</b>	1
<b>USA</b>	23
<b>Blackboard</b>	4
<b>Canvas</b>	13
<b>CSU Learn</b>	1
<b>cuLearn</b>	1
<b>NCUOne</b>	1
<b>Sakai</b>	2
<b>Schoology</b>	1
<b>Netherlands</b>	1
<b>SIN</b>	1
<b>UAE</b>	1
<b>Akademia</b>	1
<b>Grand Total</b>	35

(Source: <https://site.imsglobal.org/certifications>)

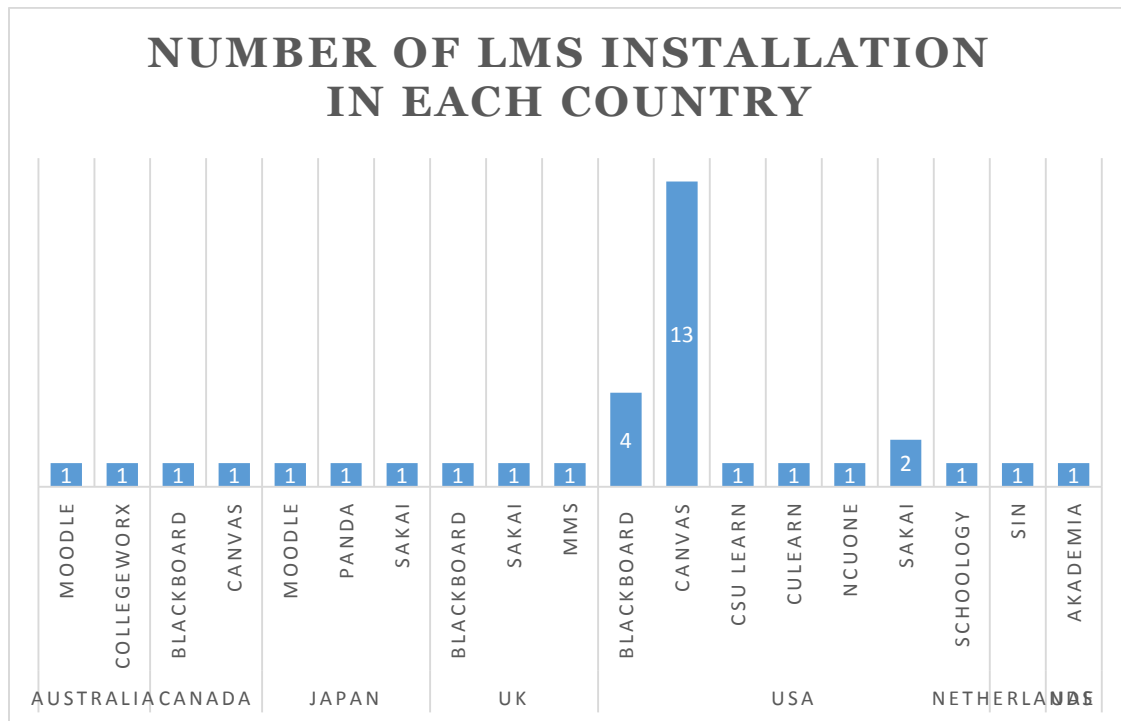
The following Graph no 1 shows that 40% of the institutions are on Canvas, while Blackboard is having total of 17% percent of the total market share, Sakai is on the hot sport with market share of 11% and seven percent. Though Moodle being a popular open source Learning management system, during data collection for this study, it was found that Moodle is being installed at very less number of institutions. This could be because many institutes are using Moodle, but are not consuming its capabilities of linking external tools through LTI, or the institutes have not registered their products for IMS Global's certification. Apart from these, there are some proprietary learning management software as well like Akademia, CSU Learn, cuLearn, and NCUOne which are developed in-house by the respective institutions. The market share of each LMS can be observed just with one look at the Graph no 2.



**Graph 1.** Percentage of market share of LTI certified LMS's.

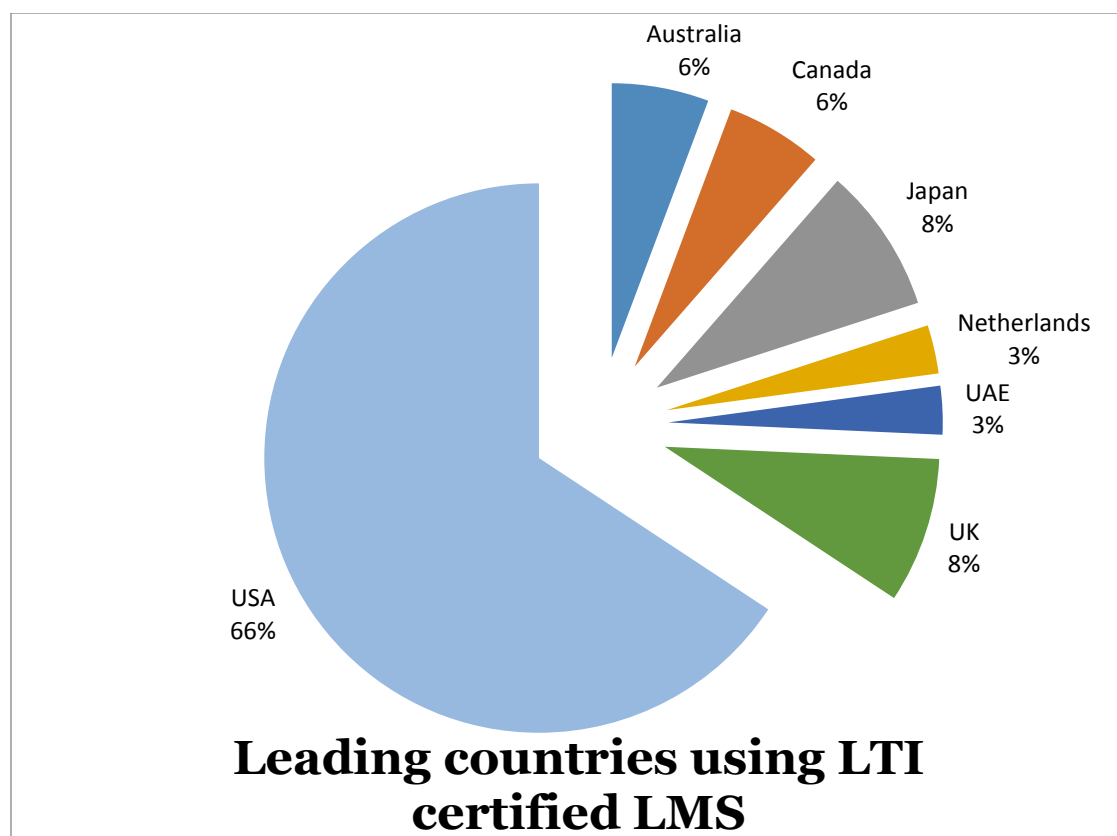
When this data is further analysed it is found that USA being the prominent user of LTI based Learning management software, it uses Canvas at most of its Institutions, then BlackBoard and Sakai as second and third choice respectively.

The Following graph no 2, shows the number of installations of Individual Learning Management Software in each country. It is found that E-learning trend has shifted toward Canvas in recent years, earlier it was blackboard who dominated the market.



**Graph 2.** Number of LMS's Installations in leading countries.

The following graph shows the total percentage of countries that are using established Learning management software in their commercial or Open Educational resources, and that are making full use of LTI standards in their learning tools.



**Graph 3.** Country wise distribution of LTI certified LMS's.

Graph no 3. The graph clearly represents that from a sample size of 35 institutions 66% are American Institutes which are making use of LTI technology in E-Learning environment. United Kingdom and Japan each have 8% share, while 6% share of LTI compatible LMS is of Australia and Canada. Institutions at Netherlands and UAE are also making use of LTI in their education sphere, but their share is minimum at only 3% each. It is found that among the 35 Institutions found on the IMS global website, United states of America is leader in adopting the IMS Interoperability standards. This trend is because of technological advancement and student's inclination towards web based active learning.

## Conclusion

In this study it is observed that due to major technological advancements the institutions of higher education have upgraded their e-learning environments to comply with the latest standards. Without any doubt, United States of America is the leader in adopting the LTI certified learning tools in their educational eco system. A study conducted by Phil Hill shows that 87 percent of institutions and 91 percent of student enrolments rely upon either Canvas, Blackboard or Moodle.(Hill, 2017). Learning tools interoperability has great possibilities in E-learning ecosystem and is more relevant in open learning environment. Although many foreign universities have adopted the interoperability standards to promote active learning in their

educational systems, much more work is yet to be done. Upon studying the data from IMS Global official website, as of now we have not found any Indian educational institute, or even content providers like NDL, EPG Pathshala to deliver their learning contents in compliance with LTI Standards. Although MHRD and RBI has taken some initiative by proposing LTI compatible systems in their specific domains, but these are yet to be formalized. Looking at the vast horizon of possibilities only thing we can now say is that we have a long way to travel.

## References

1. Abel, R. (2013). 7 Things You Should Know About Learning Tools Interoperability. Retrieved from <https://library.educause.edu/~media/files/library/2013/8/eli7099-pdf.pdf>
2. ALVA, S. (2005). Web Services Application Development Interoperability Mobility and Security Issues. University. Retrieved from <http://shodhganga.inflibnet.ac.in/handle/10603/124698>
3. Conde, M. Á., García-Peñalvo, F. J., Rodríguez-Conde, M. J., Alier, M., Casany, M. J., & Piguillem, J. (2014). An evolving Learning Management System for new educational environments using 2.0 tools. *Interactive Learning Environments*, 22(2), 188–204. <https://doi.org/10.1080/10494820.2012.745433>
4. Henrick, G. (2012). Moodle as a the Central Hub of Learning with Tools Plugged in - Learning Tool Interoperability Onto Moodle What are the benefits of having the tool outside of Moodle ? 14–15. Retrieved from <https://research.moodle.net/39/>
5. IMS Global Learning Consortium. (n.d.-a). Learning Tools Interoperability |. Retrieved February 21, 2019, from <https://www.imsglobal.org/activity/learning-tools-interoperability>
6. IMS Global Learning Consortium. (n.d.-b). LTI Advantage FAQ. Retrieved May 1, 2019, from <https://www.imsglobal.org/lti-advantage-faq#components>
7. JISC- funded. (n.d.). EILE (Enabling Integrated Learning Environments) project,. Retrieved April 27, 2019, from <https://www.youtube.com/watch?v=waXuLrmCjzk>
8. Kumar, V., & Sharma, D. (2016). Creating Collaborative and Convenient Learning Environment Using Cloud-Based Moodle LMS: An Instructor and Administrator Perspective. *International Journal of Web-Based Learning and Teaching Technologies*, 11(1), 35–50. <https://doi.org/10.4018/IJWLTT.2016010103>
9. Leal, J. P., & Queirós, R. (2011). Using the Learning Tools Interoperability Framework for LMS Integration in Service Oriented Architectures. *Techeducation11*. Retrieved from <http://recipp.ipp.pt/handle/10400.22/4724>
10. Mason, R. T. (2011). Interoperability Gap Challenges for Learning Object Repositories & Learning Management Systems by Robert T . Mason A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Computer Information Systems G. Nova Southeastern University.
11. Olivier, B., & Liber, O. (2002). Lifelong Learning: The Need for Portable Personal Learning Environments and Supporting Interoperability Standards. *On the Horizon*, 17(3), 181–189. Retrieved from <http://ssgrr2002w.atSPACE.com/papers/14.pdf>
12. Rice, W. (2015). Moodle E-Learning Course Development - Third Edition (3rd ed.). Retrieved from [https://moodle.tneu.edu.ua/pluginfile.php/24988/mod\\_resource/content/3/Moodle - E-learning course development.pdf](https://moodle.tneu.edu.ua/pluginfile.php/24988/mod_resource/content/3/Moodle - E-learning course development.pdf)

13. Rob Abel, E. D. (2019). Learning Impact Blog | IMS Global Learning Consortium. Retrieved May 1, 2019, from <http://www.imsglobal.org/blog/?p=143>
14. Semester, S., & November, M. (2005). WHY PLATFORMS AND TOOLS SHOULD ADOPT LTI. 28(1999), 2005–2006.
15. Severance, C. (2012, July 2). basiclti4moodle - Implements a IMS BasicLTI Consumer for Moodle - Google Project Hosting. Retrieved February 21, 2019, from <https://code.google.com/p/basiclti4moodle/>
16. Simpson, S. M. (2016). HISTORY , CONTEXT , AND POLICIES OF A LEARNING OBJECT REPOSITORY by Presented to the Department of Educational Methodology , Policy , and Leadership and the Graduate School of the University of Oregon in partial fulfillment of the requirements for the deg. University of Oregon.
17. Uden, L., Liberona, D., & Eds, B. F. (2015). Learning Technology for Education in Cloud (Vol. 533). <https://doi.org/10.1007/978-3-319-22629-3>
18. Vickers, S. (2011). An instructor's view of LTI using WebPA. Retrieved April 27, 2019, from [http://www.celtic-project.org/Project\\_blog#/entry/103345062](http://www.celtic-project.org/Project_blog#/entry/103345062)
19. Vickers, S. P. (2012). IMS Learning Tools Interoperability A Briefing Paper. Retrieved from <http://jisc.cetis.ac.uk>
20. What is an API? (Application Programming Interface) | MuleSoft. (n.d.). Retrieved September 11, 2019, from <https://www.mulesoft.com/resources/api/what-is-an-api>
21. What is open education? | Opensource.com. (n.d.). Retrieved September 8, 2019, from Open Source website: <https://opensource.com/resources/what-open-education>
22. Yen, Neil Y; Shih, Timothy K; Jin, Qun; Hsu, Hui-Huang; Chao, L. R. (2010). Trend of E-Learning: The service Mashup. Internation Journal of Distance Education Technologies.



# Reinforcing Health Sciences Librarianship Education in India: Meeting Global Standards

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## Abstract

Health Sciences librarianship education is changing around the globe. Preparing students who wish to work in health information field, it requires a specific curriculum and skill set so that they progress in their careers. The Medical Library Association, a non-profit educational organisation based in the United States has revised professional competencies for health information professionals in 2017. Keeping those competencies as the foundation, a course curriculum relevant for library schools and institutions of India to incorporate in their syllabus is proposed.

## Keywords

Curriculum Contents; Elective Courses; Library & Information Science; Core Courses; Syllabus; Professional Competence, Curriculum reform; Skills

## Introduction

Advancements in health sector is rapid. These advancements may be in disease diagnosis, treatment, investigations etc. which frequently leads to the changes in theory and practice in medicine. These effect to massive information generation in health sciences. Librarians engaged in this sector manage, organize, deal with health information along with it stay abreast with new and evolving issues of emerging technologies, scholarly communications, data management and other areas of importance to the diverse communities. Within the academic institutions, librarians work as research collaborators, research experts, liaison librarians involved in range of tasks and settings, (Ma et al.,2018) They serve as mediators between doctors, patients and caregivers seeking health information. With all these expansions, librarians in developed nations are prompt in designing responsive services visualizing the changes happening in the current knowledge environment. The Library and Information Science (LIS) educators in universities exhibit changes in their curriculum so that their courses remain relevant and students capable to face the challenging and competitive environment. However, In India, medical librarians and educators are unable to cope up with the advancements happening in health sciences

librarianship as comparable to western countries. The curriculum, its instructional resources and facilities offered by LIS departments and information services by libraries are not current and in sufficient depth. It has not evolved enough unlike other branches of librarianship and the elective (optional) courses offered in MLIS programs of LIS curriculum in Delhi University and other universities in India has become the least taught subject by teachers and students prefer not to choose this paper for their studies.

Curriculum is the totality of the content of an area of study to be imparted to its intended learners. Curriculum development involves considerations about curriculum relevance. It offers series of courses, opportunities to gain and demonstrate professional competencies which are a part of the educational programmes. Developing curriculum its planning and delivery, quality resource provision, evaluation processes are a daunting task for the LIS educators and practicing librarians. The International Federation of Library Association and Institutions (IFLA) in 2012 offered guidelines –the larger frame and core requirements in LIS programmes and useful curriculum elements to be included in teaching programmes. In India, University Grants Commission (UGC) set up committee under chairmanship of Professor Karisiddappa to formulate a model curriculum for LIS in 2001. This committee has suggested several changes and brought into focus the modular approach to curriculum design and expanded it to suit the local needs.

It is perceived that the specialization in medical librarianship is valued when students who prefer this course of study have an interest, aptitude, intellectual and educational background in the subject. For educators, preparing their students to work in health information environment and equipping them with sufficient understanding of health information scenario and practices demand special skill set. Petrinic& Urquhart (2007) highlighted that particular attention should be given to librarians with a first degree in non-scientific subjects in terms of time allocated for continuing professional development, quality of training and access to reliable mentorship.

In the U.S., there are a diversity of LIS courses and degrees, specializations, university independence with more focus on research. Their LIS departments/school are commonly known as schools. Health Librarianship programs are offered by the University of North Carolina-Chapel Hill, University of Pittsburgh, Drexel University, University of Kentucky, University of Michigan, University of North Texas and many other universities <https://www.mlanet.org/page/1> Most Universities offer undergraduate, masters and doctoral degrees in LIS. In India, LIS courses are offered by numerous universities but they do not have much advanced curriculum although universities hold almost similar degrees and courses. The Department of LIS, Delhi University have elective course *on health science library and information system* in their masters curriculum. The other universities offering health librarianship course are University of Mysore. Their MLISC elective paper is on *Biomedical libraries and Information Centres* whereas Aligarh Muslim University offers course in *Information Sources and Systems in Medical Sciences*.

## Objective

- To examine the health librarianship curriculum of LIS schools of India
- To compare health librarianship curriculum with the MLA competencies standard
- To provide evolving roles for health libraries and information professionals in changing health sciences environment
- To inform strategic workforce planning, post-graduate education and professional development of the profession

**Methodology:** We identified LIS departments providing health librarianship training programme in India, broadly studied the curriculum offered in postgraduate courses in MLIS programmes. A comparison with the course content is studied across departments. We compared it with MLA competencies for lifelong learning and professional success. The strength and weaknesses of the systems studied. Resources: LIS prospectus of Delhi University, Course structure on LIS schools/ departments website of the university.

**Literature Review:** There are several journal articles published on the design and development of LIS curriculum. Most papers are on analysis of the LIS curriculum across the Universities. There are few significant papers found on comparison of LIS curriculum with the western world. Foremost relevant study is by Kumar, Sudhir et al (2013) on the LIS institutions offering medical librarianship courses in India. They observed that medical librarianship paper is listed in the syllabus of few institutions. They also suggested model syllabus for course on medical and health sciences librarianship. Continuing development programmes and training for library professionals in the country are conducted by different institutions like INFLIBNET, NISCAIR, the Rajiv Gandhi Health Science University started with offering PG diploma in health science librarianship courses but that too short lived and former institutions have no course on medical librarianship and training. A study by Varalakshmi, RSR(2009) presented an analytical study on curriculum for digital libraries in Indian LIS Curricula. Walia and Siddiqui (2013) examined the status of library and information science postgraduate courses in India and UK. Yadav and Gohain (2015) discussed the recent trends and developments of LIS education and training in India. Pradhan, S (2015) highlighted the perspective and the challenges in LIS education by analysing LIS courses, its structure, availability of faculty, research contribution, infrastructural facilities etc. Bhatt and Walia (2016) covered analysis of ICT content in MLIS Curriculum in North India. Deka and Mazumdar (2016) discussed that existing LIS curriculum. They reported that present curriculum is incapable to develop skills among the LIS students as is required in the job market. Kar, Bhakta and Bhu (2016) reviewed course structure, curriculum, infrastructural facilities of LIS curriculum in Vidyasagar University, West Bengal its present status in the light of UGC Model curriculum 2001.

Reviewed international studies are Chu (2006) analyzed curricula of LIS programs in the USA. He found that more elective courses are offered while the core requirements are reduced as few as two courses. Technology and user centred approach to information systems design and services have received greater attention in LIS curriculum in the United States.

Laton (2014) emphasized that library associations have an important role in reviewing the competencies for health librarians and it is essential to understand and accept the range of skills of knowledge in response to the changing requirements of users. Ma et al.(2018), represented nine distinct categories that emerged from their review of librarians roles. They are in (1) clinical and medical information provision (2) instruction, reference, and medical education; (3) informatics collaboration; (4) library management; (5) liaison, outreach, and inclusion; (6) research and scholarly publishing; (7) patient support and advocacy; (8) web presence and scholarly communication; and (9) data management. Detlefsen (2004) reviewed masters level curricula of the 58 ALA accredited library and information science programs and iSchools for evidence of coursework and content related to library instruction. Myers and Rodriguez(2016) demonstrated that formal library and information studies is important for success of early career health sciences information professionals. Murphy (2011) invited authors from different parts of the world to present developments in health sciences librarianship. A series of these articles are featured as '*International perspectives and initiatives*' published in Health Information and Libraries journal. The trends identified by each source were (i) Establishing partnerships(ii) Shift from print to digital collections (iii) Financial pressures (iv) Education & Training (v) Role of librarians – expanding (vi) Professionalism (including future of profession; professional development) (vii) Space/physical library – rethinking, redesigning (viii) Librarians – skills needed (education/ training needs) (ix) Evidence- based medicine, evidence based nursing (x) Journals – concerns (xi) Pressures on health science librarians (xii) Librarian's role – changes (xiii) Social upheaval – impact (xiv) Library users – changes (xv)Public/consumers (xiv) Electronic health records.

With the changing academic environment, there are changes in titles of librarians, changing duties, job requirements. Some of the positions that librarians hold are metadata librarian, systems librarian, clinical librarian, Informationist, data librarian, systematic review librarian, expert searcher. The other roles librarians perform are in providing consumer health information, library outreach, embedded librarianship and more recently critical librarianship has evolved to introduce concept of diversity and inclusion in libraries.

Paper – M-110 (d) - HEALTH SCIENCE LIBRARY AND INFORMATION SYSTEM  
 UNIT – I: Health Science Libraries and their Development Objectives and Functions  
 History and Development of Libraries with Special Reference to India Role of Medical  
 Libraries Information Policies in Health and Family Welfare Agencies and their Role in  
 the Promotion and Development of Medical Libraries in India UNIT – II: Collection  
 Development and Management Periodicals, Conference Literature, Grey Literature,  
 Patents, Standards, Specifications and Government Publications Non-Book Materials  
 Electronic Resources and Online Databases UNIT – III: Library Organization and  
 Administration Organizational Structure Staff Manual, Library Surveys, Statistics and  
 Standards, etc. UNIT – IV: Information Services CAS, SDI, Abstracting and Indexing  
 Services Library Bulletin, Newspaper Clipping Services Computerized Services  
 Resource Sharing and Networking Information Literacy Programmes UNIT – V:  
 Financial and Human Resource Management Determination of Finance, Sources of  
 Finance Types of Budget Nature, Size, Selection, Recruitment, Qualification and  
 Training

*Source:* <http://dlis.du.ac.in/Download/MLISc%20II.pdf>

**Figure 1.** Contents of Elective Course of Delhi University, Delhi

Bio-Medical Libraries and Information Centers Unit 1 - Introduction to health Science  
 Libraries: Growth and development of health Science Libraries . Types of health Science  
 Libraries/Information centres. - Information services : Current Awareness Service, SDI  
 service, Indexing and abstracting service, Literature search. Users of health Science  
 Information. Unit 2 - Health Science Information sources: Sources of Information - Print,  
 Non-print and Electronic media, Institutional Sources of Information. Electronic Sources –  
 e-journals, e-books, databases, Websites – identification, Selection and access. Open  
 Access Sources Unit 3 - Health Science Information Institutions: National Medical Library.  
 WHO. UNICEF, ICMR. Department of Biotechnology. Council of Ayurveda and Siddha.  
 Council of Homeopathy. National Institute of Health and Family Welfare. CDRI. CFRI.  
 CFTRI. NIN.NII. NIC 22 Unit 4 - Information Systems and Networks: HELLIS,  
 MEDLARS, BIOSIS. Trends in Health Science Information System. Application of  
 Hypertext, Hypermedia, Multimedia. Expert System and Artificial Intelligence- PubMed,  
 Open access in Biomedical. Health Information Networks and Resource Sharing and  
 Consortia approaches. HELINET Consortium, HeLLIS, Northeast Florida Health  
 Information Consortium

*Source:* <http://uni-mysore.ac.in/assets/Downloads-2012/February-2013/LIS-syllabus.pdf>

**Figure 2.** Contents of Elective Course of Mysore University, Karnataka

In the nation, efforts by LIS educators and practicing librarians in designing LIS curriculum relevant to present times, more particularly health librarianship course are less significant especially to meet the global standards. The Medical Library Association MLA in 2017 revised *Competencies for Lifelong Learning and Professional Success*. It highlighted competence required in the following seven areas for health information professionals.

- **Health Sciences and Health Care Environment and Information Policies**
- **Leadership and Management Theory and Techniques**
- **Health Sciences Information Services**
- **Health Sciences Information Resource Management**
- **Information Systems and Technology**
- **Curricular Design and Instruction**
- **Research, Analysis, and Interpretation**

**Figure 3.** MLA Competencies for Lifelong learning and Professional Success

Drawing on the findings of a research on existing curriculum of Medical Librarianship in the country a career focused training programme that are capable of meeting western standards is proposed. This course curriculum is adapted based on MLA competencies framework.

**Unit 1. Health Sciences and Health Care Environment and Information Policies** introduce central concepts, theories, principles, research issues associated with the practice and study in health sciences education and health care environment

*Module 1:* Types of medical libraries- academic medical centre, hospital, government, research, corporate, nursing, pharmacy, community health, dentistry

*Module 2* Various health and health related library association - national and international- EAHIL, MLA, CILIP-HLG

*Module 3:* understanding medical environment-clinical, research, cultural, ethical, economic and legal issues in medical education and organizations-MCI, WHO

*Module 4:* Health Science databases and resources- PubMed, Cochrane, CINAHL, NICE.

*Module 5:* NLM in medical education, Medical humanities

*Module 6:* Library Services-Literature Search, Research data services, Critical Appraisal

*Module 7:* Open access, subscription and purchase policies

*Module 8:* Citation databases- Web of Science, Scopus, Point of Care databases

*Module 9:* Information sources- Grey literature, Patents, Government Publications

*Module 10:* Courses on Clinical trials, understanding of systematic reviews

**Unit 2. Leadership and Management Theory and Techniques** Leadership is a necessary facet of professional practice for health library and information professionals. Students to understand the application of leadership, finance and management theory and techniques in different situations are to be taught. Students to understand development needs in communicating with stakeholders, conflict resolution, using body language and being assertive. The other facets are (i) facility management and planning (ii) assessment on architectural design, technological needs, budgeting, disaster management and (iii) professional ethical conduct and professionalism to be the part of course curriculum proposed.

**Unit 3. Health Sciences Information Services” LIS curriculum** LIS faculty should teach student services that meet users’ information need. Like creation of libguides and writing blogs, information skills to locate, evaluate, synthesize and deliver authoritative information in response to biomedical and health inquiries.

**Unit 4. Health Sciences Information Resource Management** LIS faculty should teach students about resources management in a broad range of formats

- Collection development- selection, acquisition and control of resources including the licensing of resources and negotiations
- scholarly publishing, copyright, privacy and intellectual property issues
- conservation, preservation and archiving of materials in all formats
- technical services- cataloguing, classification, assigning metadata, abstracting and thesaurus construction and knowledge representation
- national and international standards and conventions
- information formatting, production, packaging and dissemination
- Knowledge Management, Institutional Repository, Data management

**Unit 5. Information Systems and Technology** Making students aware about the use of technology in managing all forms of information. The courses on website creation with knowledge of HTML, Python, CSS to be included in the curriculum. Word Processing softwares, Digital library softwares- DSpace, Greenstone, Library Management softwares like Koha, LibSys. Dataware houses- Data mining and metadata, web content archiving, Managing web content, digitizing text and developing thesauri, online publishing and application of social networks in education are to be covered in syllabus.

**Unit 6. Curricular Design and Instruction** a LIS pass out student should have be taught ways to access, organize, evaluate and use information. Information skills training will manifest in multitude of ways in imparting learning to the communities to the institutions they serve in future. Use MESH and conduct PubMed search, Systematic reviews would add to students’ professional success.

**Unit 7. Research, Analysis, and Interpretation** student must be apprised of ways to design research proposals. They should be taught about scientific methods, scientific integrity, scholarly writing, Information ethics, scholarly communications and making them capable to be the part of institutional review committees, training them about statistical tools in the data analytics era would add to students expertise further. Dissertation on medical information system is also suggested to make the LIS student competent to face the challenging health environment.

## Conclusion

This study equips the teachers with enhanced knowledge to guide students. The development of a training curriculum for students in long term means better health information service delivery to all sectors of the society. It draws attention of regulatory authorities of higher education to focus on developing faculties and facilities in this direction. It also suggests International cooperation for offering opportunities for librarians and educators to understand health information environment in their libraries and teaching schools in universities. A strong joint partnership among national and international associations for curriculum development is essential if the profession has to grow holistically.

There is need for the UGC to set up curriculum development committee in LIS discipline and bring out model curricula which has not happened for long. Medical Council of India (MCI) has nothing new added for medical libraries roles and responsibilities. Syllabus should highlight the learning outcomes which often neglect emerging demands and challenges happening in the knowledge environment. Application of ICTs, IR Management, copyright and intellectual property rights is to be focussed in LIS education as there are large number of health science institutions in the country. Considering the importance medical librarians and LIS educators owe to the academic communities the curriculum for preparing competent workforce in the ever changing health environment is proposed. Although the Indian system of postgraduate LIS education caters to the numerous graduates that pass through the institution, there is much to improve on and learn from LIS education system of the western world.

## References

1. Barr-Walker J, Sharifi C. Critical librarianship in health sciences libraries: an introduction. *J Med LibrAssoc* [Internet]. 2019 Apr [cited 2019 Aug 27];107(2):258–64. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6466494/>
2. Bhatt PC, Walia PK. ICT Components in MLIS Curriculum in North India: A Content Analysis. In 2016. *IOSR Journal Of Humanities And Social Science (IOSR-JHSS)* volume 21, Issue 8, Ver. 7 (Aug. 2016) PP 26-37
3. Chu, H. (2006). Curricula of LIS programs in the USA: A content analysis. In C. Khoo, D. Singh & A.S. Chaudhry (Eds.), *Proceedings of the Asia-Pacific Conference on Library & Information Education & Practice 2006 (A-LIEP 2006)*, Singapore, 3-6 April 2006 (pp. 328-337). Singapore: School of Communication & Information, Nanyang Technological University.
4. Detlefsen EG. Teaching about teaching and instruction on instruction: a challenge for health sciences library education. *J Med LibrAssoc* [Internet]. 2012 Oct [cited 2019 Aug 30];100(4):244–50. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3484960/>
5. Karisiddappa, C.R. Library and information science curriculum for the developing countries. In 69 th IFLA Congress, 2003.
6. Kroth PJ, Phillips HE, Eldredge JD. Leveraging change to integrate library and informatics competencies into a new CTSC curriculum: a program evaluation. *Med Ref Serv Q*. 2009 Jul;28(3):221–34.



7. Kumar S, Jain KB, Shah L. Education and training for medical librarianship in India. IFLA Congress, 2013<http://library.ifla.org/194/1/197-kumar-en.pdf>
8. Lawton A, Burns J. A review of competencies needed for health librarians – a comparison of Irish and international practice [Internet]. *Health Information & Libraries Journal*. 2015 [cited 2019 Aug 30]. Available from: <https://onlinelibrary.wiley.com/doi/abs/10.1111/hir.12093>
9. Ma J, Stahl L, Knotts E. Emerging roles of health information professionals for library and information science curriculum development: a scoping review. *J Med LibrAssoc* [Internet]. 2018 Oct [cited 2019 Aug 30];106(4):432–44. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6148628/>
10. Medical Library Association. MLA competencies for lifelong learning and professional success [Internet]. Chicago, IL: The Association [rev. 2017]. <https://www.mlanet.org/page/test-competencies>
11. Murphy J. International trends in health science librarianship part 17: a comparison of health science libraries with academic and research libraries [Internet]. *Health Information & Libraries Journal*. 2015 [cited 2019 Aug 30]. Available from: <https://onlinelibrary.wiley.com/doi/abs/10.1111/hir.12125>
12. Myers BA, Rodriguez B. How do early career health sciences information professionals gain competencies? *J Med LibrAssoc* [Internet]. 2016 Jul [cited 2019 Aug 30];104(3):215–20. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4915639/>
13. Petrinic T, Urquhart C. The education and training needs of health librarians—the generalist versus specialist dilemma [Internet]. *Health Information & Libraries Journal*. 2007 [cited 2019 Aug 30]. Available from: <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1471-1842.2007.00717.x>
14. Singh JP, Shahid SM. Changing Needs of Library and Information Science Curricula in India. In 2010. *Library Philosophy and Practice* 2010 (May) <http://digitalcommons.unl.edu/libphilprac/357>
15. Smith K, Hallam G, Ghosh SB. Guidelines for professional library/information educational programs-2012. IFLA Education and Training Section, IFLA, The Hague, available at: [www.ifla.org/publications/guidelines-for-professional-libraryinformationeducational-programs-2012](http://www.ifla.org/publications/guidelines-for-professional-libraryinformationeducational-programs-2012) (accessed 25 August 2014). 2012.
16. Siddiqui, Suboohi and Walia, Paramjeet K., "A Comparative Analysis of Library and Information Science Post Graduate Education in India and UK" (2013). *Library Philosophy and Practice* (e-journal). 941. <http://digitalcommons.unl.edu/libphilprac/941>
17. University Grants Council (2001). UGC model curriculum: Library and Information Science. New Delhi: UGC. [https://www.ugc.ac.in/oldpdf/modelcurriculum/lib\\_info\\_science.pdf](https://www.ugc.ac.in/oldpdf/modelcurriculum/lib_info_science.pdf)
18. Varalakshmi RSR. Curriculum for Digital Libraries: An Analytical Study of Indian LIS Curricula. *D-Lib Magazine* [Internet]. 2009 [cited 2019 Aug 30];15(9/10). Available from: <http://www.dlib.org/dlib/september09/varalakshmi/09varalakshmi.html>
19. Yadav AKS, Gohain RR. Growth and Development of LIS Education in India. *SRELS Journal of Information Management* [Internet]. 2015 Dec 1 [cited 2019 Aug 30];52(6):403–414–414. Available from: <http://www.srels.org/index.php/sjim/article/view/84316>

# A Systematic Review of Literature on Massive Open Online Courses (MOOCs)

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## Abstract

*“Never Stop Learning”.*

The paper dwells on the needs and importance of Massive Open Online Courses (MOOCs) which provides free online courses to collegiate and non-collegiate students, a way for them to acquire new skills and career advancement. Paper reviews the acceptability of MOOCs among students and the role libraries' play in facilitating its access to people who wish to continue with self-learning. The current initiative taken by govt. of India in promoting MOOCs at the national level is also been discussed including the SWAYAM.

The study has reviewed peer-reviewed articles published during 2014 - 2019 through searches carried out in July and August 2019 on various LIS databases. Out of a total of 150 papers, 30 were filtered on the basis of specific inclusion and exclusion criteria. Furthermore, it focuses on varied characteristics of MOOCs, user perceptions, research trends, challenges; training, development and implementation and roles of various stakeholders, and various applications of MOOCs. Paper concludes that MOOCs provide invaluable educational opportunities to thousands of capable students and will extend to grow with the passage of time. The responsibility for assessing the nature of participation and even the completion of these online courses falls squarely on the shoulders of the student whereas probably a certification agency could do a better job to improve the quality of content and method of delivery.

## Keywords

Massive Open Online Courses; MOOCs, E-learning; Higher education

## Introduction

The MOOCs stands for Massive Open Online Courses for self-learning. These are free online courses for anyone to get enrolled and enhance it knowledge and skills for career advancement. The courses are available for an individual or could be customized for collective corporate learning or targeted training. In addition to online courses, Master's Degree and Certificate Program are also offered under MOOCs<sup>1</sup>.

Historically, MOOCs were made by academic institutions, the most of the active and early MOOC makers are Stanford, MIT, and Harvard which later caught the fancy of the some of the big commercial companies, financial institutions, non-profit organizations etc., such as Microsoft, Google, Google Cloud, IBM, IEEE, Linux Foundation, World Bank, IMF, etc. In India, the IGNOU, IITs, UGC were among the first ones to commence such courses. But to bring MOOCs fore, there are course providers such as, Coursera, edX, FutureLearn, Udacity are the some of the prominent ones.

In line with “never Stop Learning”, MOOCs offer flexibility of convenience to start the courses at any time at own self-pace. A few start at regular intervals — every few weeks or months with schedule time frame. At the same time there are aberrations also, some MOOCs providers reappear after a year of absence and some stop entirely. The course material is provided from time to time to assist the students in their self-learning. Some MOOCs provides virtual classroom teaching also. The assessments are also held and grading is provided

## Methodology

The paper presents a systematic literature review on MOOCs and analyses the topic based on opinion provided by professionals, researchers and practitioners. Survey of books, scholarly articles, reports, conference proceedings, online databases, and formal and informal contact, has been carried out. The study has reviewed peer-reviewed articles published during 2014-2019 through searches carried out in August 2019 on WoS databases on search topic “MOOC\*”. Out of a total of 1290 papers, 30 were filtered based on specific inclusion and exclusion criteria. The authors, who are librarian by qualification, and professionals in the Govt. Institution has also contributed through her professional experience acquired on the job.

## MOOCs Initiatives in India

“The lifelong learning is no longer an option but a necessity” - there is no denying of the fact that MOOCs play a pivot role in transforming the face of education in the country. The urbane, migratory, semi-urban, rural population all need to continually upgrade themselves if do not want to be left behind in their career and social upliftment. MOOCs initiatives in India have

benefitted a substantial number of young millennium through online courses. There are 13 online courses being offered by one of the most coveted engineering colleges of India, the IITB (Indian Institute of Technology Bombay). The courses are provided through edX and NPTEL course providers. The curriculum encompass very topical and job creation courses, like, Algorithms, Signals, Thermodynamics, Programming Basics, Signals and Systems, Quantum Information and Computing, Implementation of Data Structures, Microwave Integrated Circuits, Proteins and Gel-based Proteomics, Foundations of Wavelets and Multirate Digital Signal Processing, Mass Spectrometry based Proteomics and Foundations of Data Structures.

Indian Institute of Technology Kanpur (IIT-K) is another top Indian institute which has developed its MOOC platform since 2012 called MOOKIT. Education courses in various streams like agriculture, computer science, aerospace engineering, biological sciences and bio-engineering, civil engineering, electrical engineering, etc have been covered in the purview of this MOOKIT. Arch4cloud, an online course on building cloud-based applications and [MOOC on MOOCs](#), a course about key concepts, methods and practices in MOOC programs are the two trial courses initiated through this MOOKIT<sup>2</sup>.

National Programme on Technology Enhanced Learning (NPTEL) is a joint initiative of the 7 IITs and Indian Institute of Sciences. Through this initiative, there are 1300 online courses in 23 disciplines and certification courses. These courses are free for all and a minimum fee is charged for certification. A wide array of online courses include the disciplines like biological sciences and bioengineering, civil and aerospace engineering, computer science and engineering, electrical, electronics and communication engineering, etc<sup>3</sup>.

A combined initiative undertaken by the University Grants Commission (UGC) and, the Consortium for Educational Communication (CEC) which is an Inter- University Centre is to work towards the development of e-content in 29 Undergraduate subjects, along with ongoing development in 58 subjects in four quadrants. The UGC is also in the process of completing e-content in 77 Post Graduate subjects<sup>4</sup>.

Indian Institute Management of Bangalore (IIMB) provides free online courses under various domains in varied disciplines. The courses can be availed for free with a nominal charge for verified certification. The various management courses offered are highly reputed with immense market value. Amongst the 30 courses, 10 falls under the domain of engineering, 8 pertain to Sciences, 4 under computer science, 2 each prevail under art & design, data science and programming. Individual courses for mathematics and social sciences are also available.

Amongst the 19 courses offered by Indian Institute of Management Calcutta (IIMC), 15 fall under the domain of business management with individual courses in Computer Science, and health and management.

National Institute of Information Technology (NIIT) in association with edX, utilises MOOCs as a learning tool to impart technical skills to a major section of Indian working professionals. The Indian IT firm Infosys trains 194,000 of their workforce in collaboration with Udacity, edX and Coursera for their skill upgradation.

The Hon`ble President of India on 9th July, 2017 has launched 'Study Webs of Active Learning for Young Aspiring Minds' (SWAYAM) platform, which will provide one integrated platform and portal for online courses. This covers all higher education subjects and skill sector courses. The objective is to ensure that every student in our country has access to the best quality higher education at the affordable cost. Academicians from hundreds of institutions throughout the country are involved in developing & delivering MOOCs through SWAYAM in almost all disciplines from senior schooling to Post Graduation wherein it is intended to develop world-class content. At present about 1550+ MOOCs courses are listed on SWAYAM of which 800+ courses are already delivered. About 34 Lakhs students have enrolled in these courses<sup>5</sup>.

DESIDOC on behalf of DRDO had already taken initiative in this direction and developed it's e-learning portal in the year 2012. The audio video lectures, study materials and technical contents of various events, seminars, workshops, conferences and continuing education programmes organized within DRDO have been recorded in this portal (Fig 1). These multimedia files have been uploaded online and can be accessed by DRDO fraternity on Intranet<sup>6</sup>.



**Figure 1.** DRDO E-Learning Portal

## Review of Literature

Various studies from India and abroad have been reviewed as under:

Liu, Zha and He<sup>7</sup> (2019) examined two vital contributors teaching and operation among the administrators and faculty in 50 higher educational institutions in China in the expansion of MOOCs. Findings of the study revealed that both govt. and institutions carried either individual or coupled leadership in the development and operation of MOOCs. While colleges and universities in China have set up definite criteria to advance and manage

MOOCs, certain problems came into being including inadequate technical support; insufficient syllabus and absence of national syllabi design standards besides platform standards.

Analysis of students' behavior regarding the completion and school dropout rates from a MOOC on Health Emergencies was conducted by Chan *et al*<sup>8</sup>. (2019). The students enrolled with MOOC showed full enthusiasm and eagerness to seek knowledge about the entire content by using different educational resources equipped with videos, interactive sessions; animations etc. The participants were keen and eager to go with continued learning process through MOOC.

The development procedure of MOOC as an optional tool in higher education and its usage was evaluated by Azami and Ibraheem<sup>9</sup>(2019) through questionnaire method. The development process was based on analysis, design, development, implementation and evaluation (ADDIE) model. The results concluded that maximum users were satisfied with this developed MOOC and ease of learning was reported to be the most beneficial characteristic of it.

To understand users' perceptions of E-learning Environments and Services (ELES) effectiveness, Haq *et al*<sup>10</sup>. (2017) developed a theoretical framework that highlights the positive aspects leading to the acceptance of e-learning. As a result of the study it was affirmed that user interaction in a meaningful way was considered more useful than just the availability of networking and other technical opportunities for an enriching learning experience. With the complexity of design, technologies and user expectations, the significance of diverse teaching requires more attention to increase the value of informed users and practitioners in this domain.

Gameel<sup>11</sup> (2017) examined factors that impact learners' satisfaction with massive open online courses (MOOCs) and analyzed data collected from 1,786 learners enrolled in four MOOCs. The study shows that the learner perceived usefulness; teaching and learning aspects of the MOOC, and learner-content interaction were factors for user satisfaction. On the contrary, learner-learner interaction and learner-instructor interaction proved ineffective as far as sample's learner satisfaction with the MOOC is concerned.

Awareness and attitude of hospitality students and faculty regarding MOOCs were explored by Annaraud & Singh<sup>12</sup> (2017). The study found significant differences for various properties and behavioral characteristics. Collectively there was more enthusiasm among students when compared to faculty regarding MOOCs. One of the many reasons that faculty have may be a deeper understanding of the MOOCs concept and the challenges that they may impose.

Yadav *et al.*<sup>13</sup> (2017) identified and perceived the procedure through which higher education institutions acquire assistance by using MOOCs with the integration of literature search. The exhaustive literature review proposed that communication technology (CT), massive open online courseware (MOOCs), social networking sites (SNSs), blogs, real simple syndication (RSS) and YouTube have devised an advanced leadership and pathway by revamping the traditional class and teacher-centric system into a collaborative and interactive one.

To evaluate the effectiveness of MOOCs on real data, Jiang, Miao & Li<sup>14</sup> (2017) adapted the modernized cutting edged techniques to MOOC settings. The authors also made an effort to identify that up to what extent the MOOC resources support keyword extraction models, and the count of individual/physical inputs desired to make the models perform accurately. It was found by the authors that the various characteristic of the data e.g. subtitles and PPTs, should be excessively documented because they have different model abilities each. Further study showed that the keywords extracted from learning resources are not as domain specific when compared to those extracted from teaching resources, still they can emphasize the topics which are lively executed in online forums. The visual demos, when integrated into a real MOOC platform, have the potential to improve learning efficiency.

Sawant<sup>15</sup> (2017) compiled a list of non-library and information science (LIS) massive open online courses (MOOCs) beneficial for working staff and learners. The process scanned useful MOOCs among major MOOCs platforms that proved useful for LIS professionals. Throughout 12 distinct courses were located by the researchers in heterogeneous fields including management, marketing and research and technology.

A case study employing text analysis of interview transcripts by Shapiro *et al.*<sup>16</sup> (2017) revealed the genuine opinions of participants that facilitated in gathering a deeper insight behind the motivation and barriers hindering to learning engagements experienced by participants in MOOCs. The authors took an initiative to resonate the course choices leading to identification of both inside and outside factors resulting in effective involvement in learning. Majority of the interviewee revelations were impartial in attitude. Amongst these, as an output of the sentiment analysis of the transcripts, it was established that 80 percent of the statement were found to be more inclined towards the positive response.

Results of the study discerned that graduates are more optimistic about MOOCs when compared to students with less formal education. It was further revealed that knowledge; work, convenience and personal interest were the deciding factors behind involvement of students in MOOCs. On the contrary, lack of time was reported to be the most prevalent barrier. In addition to these previous bad classroom experiences with the subject matter, inadequate background, and dearth of resources such as money, infrastructure, and internet access were found to be the other challenges faced.

Another case study conducted at Univ Carlos by Munoz-Merino<sup>17</sup> (2017) in collaboration with the Khan Academy Platform among students in a remedial Physics course in engineering education disclosed that students grades and satisfaction improved majorly when used MOOCs technology. Additionally, it was discovered that better levels of interaction with the platform and task distribution for different topics was satisfactory.

In a study based on how service providers design social interaction among participants, Zhang *et al.*<sup>18</sup> (2017) measured the general influence of similar interaction on service quality. The survey was conducted on more than 30,317 students from 183 countries and analysis was carried out based on three randomized experiments. The outcome of these experiments showed that higher social engagement, higher quiz completion rates, and higher course grades were experienced by a large proportion of students. Taking these results into consideration, it was determined that an additional board visit, in general enhances the chances of a student finishing the quiz in next



week by up to 4.3%. To increase efficiency, a third experiment on small group interaction inspired students to engage in one-one discussions. This motivated quiz completion rates and quiz scores largely by 10% in the subsequent week.

Sunar *et al.*<sup>19</sup> (2017) monitored learner's social behavior in MOOCs and their influence on involvement in course completion. Initial results of the study remarked that repetitive learner interaction would lead to lower dropout count. Further review of prediction models on application of social network analysis techniques identified online involvement of learners deciding individual achievements of participants. Two deciding factors predicting the completion model state that learners should interact and follow with other fellow learners completing the same course, leading to an increased probability of finishing the task.

Based on learner profiles in a MOOC, Watson *et al.*<sup>20</sup> (2017) focused on attitudinal learning. The outcome of the varied factors induced that MOOC learners depicted diverse alternatives for instructor-directed instructional strategies. Based on conclusions of attitudinal learning, it was acknowledged that learners perceive MOOCs as an entertainment resource rather than a serious education tool.

In an effort to explore the expansion of MOOCs in China, Tian & Xia<sup>21</sup> (2017) attempted to present a general summary of the subject. They discerned their association with higher education to discover the major characteristics and trends. University MOOCs building has agreed upon a five-point consensus stating firstly, that development of MOOC platforms in China are a mandatory decision. Secondly, MOOCs involve a structured teaching process and participation apart from basic open video classes. Thirdly, acceptance of flipped classroom and O2O included learning model. Next, teacher training was focused to strengthen about constructing online course designs. Lastly, the expense of course construction and other inevitable operations need to be monitored. Concluding the study, optimization of MOOC platform in China is vital to complement relevant Chinese requirements.

The research progressions in the area of open and distance learning (ODL) evidenced in periodical articles were analysed by Wong, Zeng & Ho<sup>22</sup> (2016). Research articles published in 2005 and 2015 were compared and findings represented limited massive research in the field of globalization and cultural facets of ODL but international collaboration found to be rare during both years 2005 and 2015. Nevertheless, an escalation in international collaboration was seen in evolving macro-level research. Empirical research employing quantitative methods developed into predominant procedure. Certain new keywords e.g. massive open online courses which were hardly used became frequent in 2015.

On the basis of administrative data gathered from the Coursera platform, derived from four courses by the National Research University, Higher School of Economics (Feb- June 2014) Semenova & Rudakova<sup>23</sup> (2016) established strong interconnection between accomplishment of online courses and educational experience. The outcome displayed higher rates of course consummation amongst men with similar and proficient educational disciplines.

In an endeavor to propagate information literacy instruction (ILI) module into a substantially MOOC, Huang, Lee & Zhou<sup>24</sup> (2016) undertook an array of structured



methods on a teaching project. A comparative analysis between the ILI module in Wuhan University in conjunction with a renowned Library and Information School in China showed that ILI is massively outspread and extremely useful for post-college professionals in various sectors along with university graduates. In a nutshell, with innovation and interactive procedures, MOOCs have raised the standards of education imparted.

Ong & Jambulingam<sup>25</sup> (2016) examined the cost reduction related to employee training & development with the implementation of MOOCs. The aftereffect suggested that several giant companies/organisations have already amalgamated MOOCs with their basic training strategies. Concluding this study, MOOCs resulted in a cost-effective training paradigm/tool for employee training.

Ackewrman et al<sup>26</sup> (2016) found a strong association between the University of Wisconsin-Madison and Wisconsin Library Services, provided open access online learning to thousands of persistent beginners everywhere in the state of Wisconsin.

The obstructions that come up with MOOCs in effective delivery of LIS education like shortage of teachers, fluctuating skills levels, paucity of funds and finite infrastructure were explored by Pujar & Tadasad<sup>27</sup> (2016). A great deal of excitement regarding MOOCs was exhibited among Indian LIS professionals, though the utilisation of MOOCs in Indian LIS schools is still in its infancy. The latest policy announced by the Government of India has made it mandatory for LIS schools to initiate testing with this new channel of education.

The role of MOOCs in professional development, among eight companies in diverse sectors and networks that collaborated with Higher Education Institutions in establishing open courses in independent financed projects was figured out by Olsson<sup>28</sup> (2016). The study discovered that managers & HR specialists have a positive attitude towards open courses which have the potential to deliver professional development and acknowledged the openness of MOOCs not as a notable problem. The workers were aware of what can be shared and what can't be. The favorable situations however, differed on the basis of company type and inter-organisational rapport.

The application of MOOCs in the certification of students' former learning through online content delivery at international extensions and for lecturer's professional development in transnational higher education was reviewed by Annabi & Wilkins<sup>29</sup> (2016) at United Arab of Emirates. The investigators presented that for accredited prior learning MOOCs were not found convenient but they may be favorable as an additional source for student learning and professional development. A strong opinion was raised by the international campuses across students in UAE, claiming MOOCs as an efficient substitute to contemporary programme acquisition methods. Students strongly felt that MOOCs lack the potential to satisfy their course requirements.

To identify factors that encourage student participation in MOOCs discussion forums Baek & Shore<sup>30</sup> (2016) performed a field experiment on the edX platform. The findings of this research revealed that a core deciding parameter in coordinating user involvement is the strength of participants in a single online location. Overall, the results suggested that

students in bigger communities involve in more mutual user interaction which further increments user review and performance.

Based on the accessible technology approaches assisting in the design of miscellaneous learning situations, a contrast of MOOCs platforms was done by

Ivanova<sup>31</sup> (2016). Amongst the five MOOCs platforms surveyed, Udemy and Versal, were found efficient for individual educators; whereas OpenEdX and Coursera were best suited for organisations imparting large-scale curriculums. Lastly, a special learning management system (LMS) known as Moodle crafted to undergo parallel running courses was studied. The five major division criteria were (1) content authoring, (2) content delivery, (3) assignments, (4) assessment, (5) communication, (6) collaboration.

Moodle proves to be a complex MOOC platform as it intends to be taken as a LMS, not focused entirely on MOOCs purposes. The prospects of course development multiply with a diverse set of learning designs. Unlike Moodle, OpenEdX and Coursera are utilized for typical MOOCs scenarios, but they are not so flexible. Similarly, Udemy and Versal are employed for course preparation and delivery with relatively simple features. Externally many file format types are imported for added functionality.

To study student's experience based on higher education, an application studying its conceptual model was proposed by Vigentini<sup>32</sup> (2016). Results of the study from over 8900 participants displaying varied response rates focused on how universities compare MOOCs experience with contemporary ones.

Nisha & Senthil<sup>33</sup> (2015) examined how technology has changed over the years and transformed the face of distance learning. They have analysed various MOOCs platforms in India and at Global level. Authors concluded that MOOCs and online education has prominent capabilities that would assist in promoting and safeguarding social cohesion and empirical development. With the little support of the government of India, every citizen may get benefitted from online education through MOOCs.

In-depth research based on the study of the influence of teaching orientations of interaction and instructors' participation. Example suggested comprehensive use of videos on Coursera and edX while Future Learn and OpenLearning had massive active social interaction. The findings confirmed the realization of these highlighted pedagogic factors. MOOCs platforms on various courses was conducted by Wong<sup>34</sup> (2015). Four major MOOC platforms— Coursera, edX, Future Learn and OpenLearning were chosen for this study where pedagogic features of 32 courses were examined. Results displayed courses differences based on duration, learning activities, assessment, social

A sophisticated review of the various roles adopted by information professionals in the past 14 years was conducted by Vassilakaki & Moniarou-Papaconstantinou<sup>35</sup> (2015). This assisted in identification of roles reported in the literature associated advancements in the LIS work environment. The procedure realized new and emerging roles in the context of libraries.

A study on the space transformation of the HKUST library into a learning commons was pursued by Chan & Spodic<sup>36</sup> (2014). It led to the encouragement of engaging academics and supporting units to multiply learning activities by a substantial rate. The study revealed that with digitization, academic libraries can be majorly renovated for better access and opportunities. With the integration of latest technologies and improved design, there is an increased inclination of new participants.

## Discussion and Conclusion

This study basically illustrates the reviews on various analytical and factual aspects of MOOCs. MOOCs are the future of Online Learning. The advantages that open online courses offer are immense over the conventional educational system. It has Scalability, flexibility, Optimal resource utilization, Self-paced, and offer financial ease over highly inflated education system. The courses through MOOCs are generally prepared in line with the current job market.

However, there is a caveat. In a classroom learning system the teacher gets to know their students - their interests, their power, and their eagerness, enabling them to provide nuanced feedback and engage with them more fruitfully. The MOOC learning cannot hope to provide meaningful feedback and assessment to students participating in these courses<sup>37</sup>. In conjunction with the inadequacy of learner assessment, the aspects of one-to-one communication with teachers and other students remain absent. There's also the research aspect of these courses which may necessitate access to vendor databases and journals, plagiarism is said to be a major issue in these courses. Where, a classroom is an opportunity for a global, collaborative, constructive, peer dialogue avenue. The same model cannot be scaled up for an online course being taken concurrently by thousands of students. So, there is a challenge how to ensure personalized guidance and mentorship which leads to lack of an effective system to measure and validate the progress of the learners and uptake, usefulness to his career. However, there are some efforts on teaching face-to-face courses. Following brick-and-mortar classrooms and using a similar method of face-to-face conversation combined with online interaction, the students have opportunities to meet and discuss ideas with one another and with the teachers and mentors. In the USA, colleges and universities are considering accreditation to MOOC courses to supplement to traditional college courses and other prerequisites for enrolling in traditional courses and offering their own MOOCs for distance learning courses.

In India's context, the vision paper, "MOOCs and the Future of Indian Higher Education" which FICCI's Higher Education Committee prepared in August 2014, conclusively observed that the MOOCs has made a remarkable mark at the global stage since its inception in 2008 and India cannot afford to remain oblivious of this phenomenon when nearly 2 million Indians constitute the second largest group of MOOC learners worldwide. India also has to devise a structured framework to organize the MOOC based education system and redefine the technology to achieve learning aspirations of young population of learners. Country has to nurture the nuances of technology enabled learning to transform the

potential of millennium population into a skill workforce. MOOCs could be an instrument for the country to achieve hundred percent literacy and offset the challenges to surmount the deficiency in system such as faculty shortage, weak infrastructure, affordability, equity and lack of high quality digital content and lack of employability.

MOOCs have established that they provide invaluable educational opportunities to thousands of capable students and will extend to grow with the passage of time. In spite of their innumerable benefits, MOOCs do pose considerable challenges. The responsibility for assessing the nature of participation and even the completion of these online courses falls squarely on the shoulders of the student whereas probably a certification agency could do a better job to improve the quality of content and method of delivery<sup>38</sup>. However, the larger question remains whether unabated proliferation of MOOCs would impact college teaching and would make the conventional teaching redundant; and, how the future higher education of college would sustain the onslaught of MOOCs e-invasion? And, what is the fate of basic research? Do MOOCs yield improved learning?

## References

1. Free online courses from Indian Institute of Bombay. <https://www.class-central.com/university/iitb>, (Accessed on 21 August 2019).
2. Pai, Vivek. (2014). IIT Kanpur developing its own MOOC platform MOOKIT, Medianama, <https://www.medianama.com/2014/12/223-iit-kanpur-mooc-platform-mookit/>
3. National Programme on Technology Enhanced Learning (NPTEL), 2019, MHRD, [https://swayam.gov.in/nc\\_details/NPTEL](https://swayam.gov.in/nc_details/NPTEL), (Accessed on 21 August 2019).
4. Massive Open Online Courses An initiative under National Mission on Education through Information Communication Technology (NME-ICT) Programme: Guidelines for Development and Implementation of MOOCs, <https://www.aicteindia.org/downloads/MHRD%20moocs%20guidelines%20updated.pdf>, (Accessed on 21 August 2019).
5. Subrahmanyam, VV; & Swathi, K. MOOCs Initiative of IGNOU Using SWAYAM. *In* National Conference on Digitization: Envisioning Technology and Accelerating Growth in Business Transformation (NCD'16), Sri Guru Tegh Bahadur Institute of Management & Information Technology, New Delhi. 2016. Volume ISBN: 978-81-906342-6-7
6. DRDO E-Learning Portal. DESIDOC Services, Available on Intranet (Accessed on 08 Oct 2019)
7. Liu, MZ ; Zha, SH; & He, W. Digital Transformation Challenges: a Case Study regarding the MOOC Development and Operations at Higher Education Institutions in China, *Techtrends*; 2019, **63**(5), 621-630. DOI: 10.1007/s11528-019-00409-y
8. Chan, MM et al. MOOCs, an innovative alternative to teach first aid and emergency treatment: A practical study, *Nurse Education Today*; 2019, 79, 92-97. 10.1016/j.nedt.2019.05.008

9. Azami, HHR & Ibraheem, Roslina. Development and Evaluation of Massive Open Online Course (MOOC) as a Supplementary Learning Tool: An Initial Study, *International Journal of Advanced Computer Science and Applications*; 2019, **10**(7), 532-537.
10. Haq, Anwar ul ; George, Magoulas; Majeed, Jamal; Arshad Asim; Diane, Sloan. Users Perceptions of E-Learning environments and Services Effectiveness: The emergence of the concept functionality model. *Journal of Enterprise Information Management*; 2017, **31** (1), doi: <https://doi.org/10.1108/JEIM-03-2016-0074>
11. Gameel B. Learner Satisfaction with Massive Open Online Courses. *American Journal of Distance Education*; 2017, **31**(2), 98-111. doi: <https://doi.org/10.1080/08923647.2017.1300462>, (Accessed on 21 August 2019).
12. Annaraud, Katerina & Singh, Dipendra. Perceptions of Hospitality Faculty and Students of Massive Open Online Courses (MOOCs), *Journal of Hospitality & Tourism Education*; 2017, **29**(2), 82-90. doi: [10.1080/10963758.2017.1297714](https://doi.org/10.1080/10963758.2017.1297714)
13. Yadav, Rajan; Pradeep, Tiruwa; Suri, Kumar. Internet based learning (IBL) in higher education: a literature review. *Journal of International Education in Business*; 2017, **10**(2), 102-129. doi: <https://doi.org/10.1108/JIEB-10-2016-0035>
14. Jiang, Z; Miao, C; Li, X. Application of keyword extraction on MOOC resources. *International Journal of Crowd Science*; 2017, **1**(1), 48-70. doi: <https://doi.org/10.1108/IJCS-12-2016-0003>
15. Sawant, Sarika. Non library oriented MOOCs useful for LIS professionals and students. *Library Hi Tech News*; 2017, **34**(9), 19-20. doi: <https://doi.org/10.1108/LHTN-05-2017-0032>
16. Shapiro, HB *et al* . Understanding the massive open online course (MOOC) student experience: An examination of attitudes, motivations, and barriers. *Computers & Education*, 2017; **110**, 35-50. doi: [10.1016/j.compedu.2017.03.003](https://doi.org/10.1016/j.compedu.2017.03.003)
17. Munoz-Merino, PJ *et al*. Flipping the Classroom to Improve Learning With MOOCs Technology. *Computer Applications in Engineering Education*; 2017, **25**(1), 15-25. doi: [10.1002/cae.21774](https://doi.org/10.1002/cae.21774)
18. Zhang, DJ *et al* . Does Social Interaction Improve Learning Outcomes? Evidence from Field Experiments on Massive Open Online Courses. *M&SOM-Manufacturing & Service Operations Management*, 2017; **19**(3), 347-367. doi: <https://doi.org/10.1287/msom.2016.0615>
19. Sunar, AS *et al*. How Learners' Interactions Sustain Engagement: A MOOC Case Study. *IEEE Transactions on Learning Technologies*; 2017, **10**(4), 475-487. doi: [10.1109/TLT.2016.2633268](https://doi.org/10.1109/TLT.2016.2633268)
20. Watson, EL *et al* . Learner profiles of attitudinal learning in a MOOC: An explanatory sequential mixed methods study. *Computers & Education*; 2017, **114**, 274-285. doi: [10.1016/j.compedu.2017.07.005](https://doi.org/10.1016/j.compedu.2017.07.005)
21. Tiang J. & Xia, Z. MOOCs in China's Universities: Practice, Characteristics and Trends. In 3rd International Conference on Information Management; Apr 21-23 2017, IEEE; Univ Westminster, Chengdu, PEOPLES R CHINA
22. Yuen Yee Wong, Jing Zeng, Chun Kit Ho. Trends in open and distance learning research: 2005 vs 2015. *Asian Association of Open Universities Journal*; 2016, **11** (2), 216-227. doi: <https://doi.org/10.1108/AAOUJ-09-2016-0035>
23. Semenova, T.V.; & Rudakova, L.M. Barriers to Taking Massive Open Online Courses (MOOCs). *Russian Education & Society*; 2016, **58**(3), 228-245, doi: [10.1080/10609393.2016.1242992](https://doi.org/10.1080/10609393.2016.1242992)

24. Hunag, Ruhua; Li, Baiyang; Zhou, Lihong. Information literacy instruction in Chinese universities: MOOCs versus the traditional approach. *Library Hi Tech*; 2016, **34**(2), 286-300.  
doi: <https://doi.org/10.1108/LHT-02-2016-0013>
25. Ong, David; & Jambulingam, Manimekalai. Reducing employee learning and development costs: the use of massive open online courses (MOOC). *Development and Learning in Organizations: An International Journal*; 2016, **30**(5), 18-21. doi: <https://doi.org/10.1108/DLO-08-2015-0066>
26. Ackerman, Steven et al. Libraries, massive open online courses and the importance of place, *New Library World*; 2016, **117**(11/12), 688 - 701
27. Pujar, Shamprasad M, Tadasad, Prahalad G. MOOCs – an opportunity for international collaboration in LIS education: A developing country's perspective. *New Library World*; 2016, **117**(5/6), 360-373.  
doi: <https://doi.org/10.1108/NLW-07-2015-0048>
28. Olsson, Ulf. Open courses and MOOCs as professional development – is the openness a hindrance. *Education & Training*; 2016, **58**(2), 229-243. doi: <https://doi.org/10.1108/ET-01-2015-0006>
29. Annabi, Carrie Amani, & Wilkins, Stephen. The use of MOOCs in transnational higher education for accreditation of prior learning, programme delivery, and professional development. *International Journal of Educational Management*; 2016, **30**(6), 959-975. doi: <https://doi.org/10.1108/IJEM-05-2015-0057>
30. Baek, J & Shore J. Promoting student engagement in MOOCs. In Proceedings of The Third (2016) ACM Conference on Learning @ Scale (L@S 2016), April 25 - 26, 2016, Univ Edinburgh, Edinburgh, Scotland, UK. <https://dl.acm.org/citation.cfm?id=2893437> (Accessed on 21 August 2019).
31. Ivanova, Malinka. Technology Landscape in MOOCs Platforms. In 19th International Symposium on Electrical Apparatus and Technologies (SIELA), 2016, May 29-Jun 01, 2016, Bourgas, Bulgaria.  
<http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=7543014> (Accessed on 21 August 2019).
32. Vigentini, L & Zhao, C. Evaluating the student's experience in MOOCs. In 3rd Annual ACM Conference on Learning at Scale, Univ Edinburgh, Edinburgh, Scotland, 2016, Apr 25-26, 2016
33. Nisha, Faizul & Senthil, V. MOOCs: Changing Trend Towards Open Distance Learning with Special Reference to India, *DESIDOC Journal of Library and Information Technology*; 2015, **35**(2), 82-89, 10.14429/djlit.35.2.8191
34. Wong, Billy T.M. Pedagogic Orientations of MOOC Platforms: Influence on Course Delivery. *Asian Association of Open Universities Journal*; 2015, **10**(2), 49-66. doi: <https://doi.org/10.1108/AAOUJ-10-02-2015-B005>
35. Evgenia Vassilakaki; Moniarou-Papaconstantinou, Valentini; A systematic literature review informing library and information professionals' emerging roles. *New Library World*; 2015, **116**(1/2), 37-66, <https://doi.org/10.1108/NLW-05-2014-0060>
36. Chan, Diana L.H.; Spodick, Edward. Space development: A case study of HKUST Library. *New Library World*; 2014, **115**(5/6), 250-262. doi: <https://doi.org/10.1108/NLW-04-2014-0042>
37. Are MOOCs Really the Future of the University? *EdSurge*, <https://www.edsurge.com/news/2013-05-21-opinion-are-moocs-really-the-future-of-the-university> (Accessed on 21 August 2019).
38. Davidson, Cathy N. (2013). Future of MOOCs, Open Education Database. <https://oedb.org/ilibrarian/the-future-of-moocs/> (Accessed on 21 August 2019).

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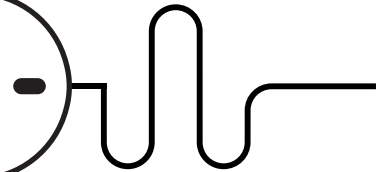
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# Big Data: Opportunities, Issues and Challenges before the Libraries

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## Abstract

This article discusses the concept of big data, its history and opportunities along with issues and challenges before the libraries. How they are going to handle the present situation in terms of deriving meaningful insight from data, challenges in data storage, retrieval and security especially in absence of proper trained staffs? All these issues have been discussed in length to understand the problems of handling big data in the field of libraries.

## Introduction

Due to advances in technologies data is growing faster than ever before. According to an article appeared in Forbes Magazine, by the year 2020 about 1.7 megabytes of new information will be created every second for every human being. Now let us understand what is 'Big data'? The Big Data is basically a term that refers to large amount of data. 'Big data' describes innovative techniques and technologies to capture, store, distribute, manage and analyze datasets that traditional data management methods are unable to handle. Data Scientists use tools and algorithms to make sense of these data which are utilized for better decision making, business strategies, etc. Some business organizations which are making best use of big data are Google, Facebook, Amazon, Flipkart, Uber and Ola, etc. They are the potential user of big data. More and more such organizations are likely to gain competence in dealing with Big data revolution. Because of its complexity, even the innovative corporations may not imagine how the data will be utilized in future, who is going to use it, its implications, etc. Besides it is also simultaneously important to safeguards it's ethical and privacy related issues. It is imperative to develop systems and processes to avoid such issues well in advance.

The concept of big data was first coined by Laney in his research note. He described the characteristics of big data as 'Three Vs', i.e., Volume, Velocity and Variety which cannot be processed by traditional data management tools. Further study on big data have expanded this 'Three Vs' to 'Five Vs': Volume (size of data), Velocity (speed of data), Variety (types of data), Veracity (integrity of data) and Value (usefulness of data). However, the most important are still the first three Vs.

Big data is not a new concept. Organizations have already been using it in order to provide their services effectively and efficiently in personal and timely manner. Likewise there is a huge opportunities for libraries as well. Using big data or data 'mash-ups' libraries can better understand the needs of their users and customized their services accordingly. Big data can help

libraries to formulate strategies and decision. The decision so taken will be entirely evidence based and thus the library can become much more systematic, streamlined, efficient and effective. The decision based on the data can't fail as it is said that 'efficiency is driven by accuracy and the data does not lie'. However, it is always challenging to choose the right data to enhance the library services. But in any case if you have data you may have more choice to exploit and attract users and provide them what they want. If you know what your users want then it becomes easy to satisfy them with your services. The collected data enables the library to understand the comprehensive view of its users, identify patterns and trends and also determine future strategies.

## **Big Data Opportunities**

Data is revolutionizing just about every industry. Libraries are also service industry and hence it cannot leave behind. Like other industries, how can libraries best use data to their advantage? There are three core areas of library where data can be utilized for improvements; these are:

- Decision making,
- Operations/ functions, and
- Monetizing data

First, big data can enable libraries to collect much better insights about their users need, what they use, how they use and also what they think about those resources and services. This information can be used to formulate significant strategies. Second, big data can help libraries to gain efficiencies and improve operations/functions from selection of reading materials to its delivery even recruiting the professionally trend persons. Big data can improve internal efficiency and operations of library across its different sections. Like other business organizations, libraries can also install sensors to track staff movement, their stress, health and even who they communicate with and also the tone of voice they use, etc. These data can be used to improve employees as well as users satisfaction and productivity. Third, data can also provide opportunities for libraries to build big data into their products thereby monetizing the data itself which will not only benefit its customers but also as a new product offering. Regardless of the size of libraries, the key to getting the most out of data is having a clear and robust strategy that relates data to the libraries long term goals. It will also help libraries to successfully formulate and implement strategies to make better decisions, improve their operations and exploit opportunities.

## **Issues and Challenges**

In this digital world a large number of data is being produced every second. The amount of data produced makes it challenging before libraries to store, manage, analyze and utilize it. Simply storing this large data is not going to be useful and therefore organizations are looking at options like big data analysis tools which can help them in handling big data to a great extent. The challenges of the big data management may be summarized in the following points:

- **Problems in Synchronizing the Disparate Data Source-** Data set are becoming bigger and more so it becomes difficult also to incorporate them into an analytical platform. If this problem is overlooked, it will create gaps and lead to wrong messages and insights. Hence a proper synchronization across different data sets is needed.
- **Crisis of Professional for handling Big Data Analysis-** Due exponential rise of data, a huge demand of Big Data Analyst has been created in the market. Library also needs to hire a data scientist who has knowledge of data analysis techniques. But the problem is there is an acute shortage of data scientists in comparison to the amount of data being generated.
- **Getting Meaningful Insights by using the Big Data Analytics-** Another big challenge before the libraries is getting meaningful insights through the big data analytics which can be utilized for improvement of the services and functioning of the library.
- **Uncertainty in the use of Data Management Technology-** New technologies are emerging for handling big data every day. The big challenge before the libraries in handling Big Data is to find out which technology will be appropriate for them without facing much difficulty.
- **Challenges in Data Storage and Quality-** The amount of data is increasing at a tremendous pace and the storage of this massive data is becoming a real challenges. Data storage options like data warehouses are commonly used to store large quantities of both structured and unstructured data in its original format. The problem arises when the warehouse try to combine these two types of data which leads to certain types of errors as missing and inconsistent data, duplicate data which affects data quality also
- **Data Security and Privacy-** The Big Data Tools make use of disparate sources for analysis and storage of data as a result it becomes vulnerable resulting in high risk of exposure of data which increases the privacy and security concern to these voluminous data.

## Conclusion

Big data is not a new concept in other industries but it has started gaining popularity in the field of libraries also in recent times. Organizations world over are using big data to better understand their client's needs. They customize their services in order to serve them efficiently, effectively and in a time bound manner. Moreover the utilization of big data saves lot of funds and resources as well. As the community evolves and the demands from users shift, libraries also have to think beyond their traditional services by forecasting the needs of their users. The smart users and smart libraries generate a huge amount of data. The collected data enables the library to understand the comprehensive view of its users, identify patterns and trends and also determine future strategies. Libraries can also remove any kind of guess work by using data 'mass-ups' because the decisions so taken will be entirely evidence based. The decision taken on the basis of data seldom fails as it is said that the 'efficiency is always driven by accuracy'.

## References

1. Ashish Kumar (2018). "7 Top Big Data Analytics Challenges Faced By Business Enterprises". <https://elearningindustry.com/big-data-analytics-challenges-faced-business-enterprises-7-top>
2. C. Wang, S. Xu, L. Chen and X. Chen (2016). "Exposing library data with big data technology: A review," *IEEE/ACIS 15th International Conference on Computer and Information Science (ICIS)*, Okayama, 2016, pp. 1-6.
3. Hacken, Richard (2015). "Big Data: Challenges and Opportunities for Digital libraries". *All Faculty Publications*. <https://scholarsarchive.byu.edu/facpub/1580>

# Design and Development of Archive on Homoeopathy: An Initiative by CCRH

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## Abstract

Central Council for research in Homeopathy (CCRH) is an apex research organization under Ministry of AYUSH, Govt of India. This paper discusses the experiences in designing and developing an archive on homeopathy, as an extension to digital library and institutional repository from the point of view of a research institute (CCRH) in the field of homeopathy. The project is aimed to be a knowledge hub for Homeopathy and boost homeopathic research. It further addresses various basic principles which should be followed in the creation of digital archive in an Indian Knowledge management ecosystem and brief detail of methodology are provided along with information about the open source software used. This paper appraises the planning of an Archive, which acts as a meeting point of research institutional repository, digital library and further collections of homeopathic research material of national and global significance.

## Keywords

Design, DSpace, Archive, Homoeopathy, Research, Institutional Repository

## Introduction

Homeopathy has been growing leaps and bounds as an alternative medical system since its inception in 1700s. Millions of people around the globe subscribe to it and community has seen exponential growth over the last century even so in India.

It is currently used in more than 80 countries. It has legal recognition in 42 countries as an individual system of medicine and is recognized in 28 countries as a part of complementary and alternative medicine.

Homoeopathy, which was introduced in India approximately two centuries ago, is an important component of India's diverse health care system. The Government of India has made sustained efforts for growth and development of Homoeopathy as a part of AYUSH (Ayurveda, Yoga, Naturopathy, Unani, Siddha and Sowa Rigpa). These sustained efforts resulted into

establishment of an institutional framework of Homoeopathy at the Centre as well as in all the states. There exists a highly exemplary infrastructure in the form of 195 undergraduate and 43 post graduate homeopathic medical colleges with regulatory mechanism for quality university education, autonomous research council with 22 institutes and units; 2,83,840 registered homoeopathic practitioners; drug safety regulations with 403 drug manufacturing units.

The Government of India has several programmes and initiatives for promotion of AYUSH systems. Since the last two decades there is a consistent focus to enhance quality of services, with initiatives to upgrade education, research and drug development and escalate health care delivery for which many initiatives have been taken up by the Government of India.

Central Council for research in Homeopathy (CCRH) is an apex research organization under Ministry of AYUSH, Govt of India which undertakes, coordinates, develops, disseminates and promotes scientific research in Homeopathy

The Council articulates and conducts research programs; collaborates with national and international institutes of excellence to undertake evidence based research in fundamental and applied aspects of Homoeopathy; monitors extra mural researches and propagates the research findings through monographs, journals, newsletters, I.E.&C. materials, seminars/workshops. Studies comply with the modern scientific parameters and research is undertaken with the goal that the outcome of research translates into practice and the benefit of the research is extended to the profession and the public.

Taking the next step towards the development of homeopathy in India, the council is building a hub of homeopathic knowledge through this archive accumulating documents from all corners of world under one roof for the purpose of public and professional consumption.

Under this initiative, 'Archive on Homeopathy' has been developed for capturing, digitizing & online sharing of the library resources in order to cater to the increasing need of the scientific/research/teaching community.

The Archive on Homeopathy, an endeavour by CCRH, is a result of passion towards homeopathy and knowledge management. In 40 years of CCRH's existence, the council has published several documents in its mission to propagate research findings.

'Archive on Homeopathy' is a digital repository of accumulated knowledge in homeopathy, having collection of old and valuable books, old journals, research articles, popular articles, event impressions, success stories, case studies, annual reports, newsletters, bulletins and other grey literatures spread all over the world

## **Purpose**

India has had a rich history in Homeopathy and the archive aims to bring forth the work of Indian Homeopaths along with their global counter parts. Archives are essential research infrastructures for any field. Under this initiative, 'Archive on Homeopathy' has been developed

for capturing, digitizing & online sharing of the archival resources in order to cater to the increasing need of the scientific/research/teaching community.

Archive content is highly valuable as it enables researchers to delve into the past, transforming historical research into up to date knowledge. While the tangible documents are carefully preserved, their digitisation has led to increased discoverability. Researchers no longer need to travel to the location of material, allowing for quicker, easier and more in-depth research. Artefacts from the past are carefully retained to ensure the transparency and reliability of research. Without archive content the wealth of current research would cease to exist in the future. Not only does preservation of past research enable us to track academic developments, it also secures the future of research happening today.

### **Key Objectives**

- Preserve and conserve historical documents on Homoeopathy for future use.
- Mobile access of valuable content
- User friendly retrieval system
- Support Research and education in the field of Homoeopathy

## **Methodology**

Considering the growing trend of digitisation of information, it was decided in the early stages of conception, to design it as a digital archive keeping in mind limitations of a traditional physical archive particularly onerous accessibility for end users and requirement of dedicated space.

Consequently, the archive was designed on the lines of digital repository while still being able to hold multiple documents of different nature and historical values. For the purpose different repository software were researched and reviewed including Eprints, Fedora, Greenstone and DSpace. It was concluded that DSpace had all the characteristics required for the project including easy and seamless customization, multiple language support and multiple format support (PDF, JPEG, MPEG, TIFF)

After five days training at NISCAIR to understand operations of DSpace and with basic operational knowledge of HTML and CSS, the software was installed on a local system in library and customized as per the portal requirements and later migrated on a virtual server

After consultation with homeopathic archive expert from Institute for History of Medicine, Robert Bosch foundation, Stuttgart, Germany and to get a deeper understanding of public and private archive management, a 6-week course in Archive management was completed from National Archives of India.

## Significant steps taken

### ***Acquisition & Creation***

Acquisition of archivable material is the most significant step of digital archiving. Persuading researchers, institutes, collectors or any other community stakeholder to share material is one major challenge which requires patience and persistence.

Most of archival material becomes available in tangible paper format as a first-hand fact, data, evidence in the form of manuscript, printed book etc which was converted into digital form for the purpose of preservation and providing online access worldwide. This act of producing the information product from the available physical document for incorporation in digital archive is called creation.

### ***Procurement Policies***

A guideline was put into practice for procurement of content as not all available material is archivable. The guidelines help the archivist set boundaries on the relevance of content as per the archive subject. The council is open to different methods of procurement viz gift, donation and purchase.

### ***Protection Policies***

To avoid any legal or copyright issue, a guideline was prepared for incorporation of content in the archive. Copyright clearances, necessary permissions and documentation must be secured in case of such material. ID and password protection should be applied to protect copyrighted content. Digital Library section the “Archive in Homeopathy” is password protected and restricted to registered researchers because of the same

### ***Metadata***

Once the material has been acquired, it requires identification and cataloguing. The organization of archive is enabled by both identification and cataloguing to manage the digital objects over the time. A unique key is assigned by identification for finding the object and linking the object to other related objects. Some forms of metadata are used for description, organization and administration of archive object. Metadata is the key to ensuring that resources continue to be accessible into the future. The software used for archive development, DSpace, allows import and export of only Dublin core metadata schema defaults which is universally accepted form of metadata.

## Collection of archives

The collections are composed of rare and unique documentary materials created by CCRH as well as accumulated from individuals and organizations external to the Council. The purpose of this approach is to provide the homeopathy community with the rare and unique research materials as per their current and anticipated future research needs.



Collection strengths are reflected in the Council Archives, rare material like books, journals, articles, photographs and videos and Govt. notifications etc. Areas of strength include the following:

***Institutional repository:*** Institutional repository of an institute forming the archive is a key component of the archive as the research institute continues to contribute in research and development of the field.

***Rare Material:*** Rare books, journals and articles and more such material which are inactive are spread across the community through archives. Some part of collection dates to 1837 AD.

***Digital Museum:*** Collections of photographs, video or any other form of multimedia which establish the journey of Homeopathy through the eyes of homeopath stalwarts.

***Digital Library:*** Old journals which have been inactive and not readily available through the internet has been included in the digital library. The council has access to it as the council has been subscribing to such journals since 1979 for our research scholars.

***Govt Notifications:*** Acts and Laws pertaining to Homeopathy, Parliamentary discussions on Homeopathy, newspaper clipping and other such material focussing on national policies and development on Homeopathy. This collection contains notifications and policy updates starting from 1955.

## Challenges faced

### ***Acquisition***

Finding/attracting and convincing material holders to contribute remains one of the most challenging aspect of archive development. The archivist is responsible for ensuring the safety and preservation of the material to avoid loss of content and thereby ensuring material holder is comfortable in sharing of content and that the creators' legacy is carried into the future.

### ***Technical Skill Development***

To avoid outsourcing and huge costs attached with it, the council built this in-house, by training personnel and equipping the technical knowledge required for software customisation and archive management.

### ***Technological Obsolescence***

With rapidly changing technology, software is often replaced by a newer one. Once newer technology becomes universal, older format should also be replaced by new format. Similarly, the modes of information access will also change over time as has been the case over the last decade as apps are now fast becoming information/service access mode over website.

## Way ahead

Material acquisition and archive update is a continuous process. Several practices are put in place to further develop the collection. The council has plans to acquire content from all over the globe under which the council will communicate with different regions of homeopathic significance. The council has entered an MoU with Institute for History of Medicine, Robert Bosch foundation, Stuttgart, Germany for content exchange as Germany being the birthplace of Homeopathy is the most significant Homeopathic region. The council intends to be a one stop solution for homeopathic researchers all over the world for their research material needs.

## References

1. Abdul Azeez TA. 2003. **How to Design Digital Library**. *SRELS Journal of Information Management*. 40(3) : 267- 273.
2. Ahmad, P., Aqil M and Siddique, M.A .(2012). **Open institutional repositories in Saudi Arabia: Present and future prospects**. *International Journal of Digital Library Services*. 2(2): 58-68.
3. Anuradha KT.2013. **Design and development of institutional repositories: A case study**. 37(3): 169-178.
4. Bansode SY.2011. Developing institutional repository in university library: a case study of University of Pune. *International Journal of Information dissemination and technology*.1(4): 188-92.
5. Biradar BS, BanateppanavarKoteppa. 2012. **Design and development of institutional repository using Dspace : A case study of Kuvempu University, India**. *International Journal of Digital Library System*. 3(3): 1-13.
6. KAWATRA, P.S. 2000. *Textbook of information science*. New Delhi : APH Publishing Corporation; pp.323.
7. LYNCH,C.A. 1994. **The integrity of digital information: Mechanism and definitional issues**. *Journal of American Society of Information Science* 45(10) 737-44.
8. Moghaddam, GG. 2010. **Preserving digital resources : issues and concerns from a view of librarians**. *Collection Building*. 29(2): 65-69.
9. Murugathas K, Balasooriya H.2014. **Developing an institutional repository : Experiences at the library, Faculty of Medicine, University of Jaffna**. *Journal of the University Librarians Association of Sri Lanka*. 18(1):39-50.
10. Raitt David. 2000. **Digital Library initiatives Across Europe**. *Computers in Libraries*. 20(10): 26-34.
11. Shiri, A.2003. **Digital library research: Current developments and trends**. *Library Review*. ; 52(5): 198-202.
12. Wasiwasi J Mgonzo, Zaipuna O Yonah. 2014. **Design and development of a Web Based Digital Repository for Scholarly Communication: A case of NM-AIST Tanzania**.*International Journal of Knowledge Content Development & Technology*. 4(2): 97-108.
13. Xia Jingfeng, Sun Li. 2007. **Assessment of self archiving in Institutional repositories: Depositor ship and full text availability**.*Serial Review*. 33(1):14-21.

# **Use of Web 2.0 Tools by Visually Impaired Students at Aligarh Muslim University, Aligarh: A Study**

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## **Abstract**

Web 2.0 is the next generation of internet application which provides a diversity of use and inclusive web-based services. It gives access to a number of resources spread over web in a humanised service environment and is considered as an effective mode of learning. In this connection the study is conducted with the aim to know the use of web 2.0 tools by visually impaired students at Aligarh Muslim University, Aligarh. The study followed survey technique in which structured interview method is followed to collect data from 76 visually impaired students and analysed using 'SPSS version 23'. The findings of the study revealed that mostly 89.5% students are using 'Whatsapp and You Tube'. Web tools are used for different purposes such as 92.1% are using these tools for academic purposes and 90.8% are using for sharing knowledge and 85.5% for seeking job opportunities. With many other findings the study also highlights that the major problem faced while using these tools is compatibility issue with screen readers and non-availability of JAWS software in different languages. It is anticipated that the findings of the study will be helpful for libraries to approach their visually impaired users with the help of most used tools.

## **Keywords**

Web 2.0, Web 2.0 tools, Visually Impaired, Aligarh Muslim University.

## **Introduction**

Internet has brought a revolutionary change in every facet of human existence especially in the mode of learning; advanced functionalities of web 2.0 can be used for effective learning

(Downes 2005). Web 2.0 is the second generation of the World Wide Web, where the static HTML pages moved to interactive and dynamic web experiences which enable people to collaborate and share information online via social media, blogging and Web-based communities. It also represents a more populist version of the Web, where new tools made it possible for nearly anyone to contribute, regardless of their technical knowledge. (Casey and Savastinuk 1967). With the advancement in ICT, traditional libraries are also moving towards e-learner-oriented stance with changes in participation and sharing, it can be said that 'earlier libraries were library-centric and now they transformed to user-centric', as it is undeniable that a library is an important place for social education.

The use of web 2.0 tools are increasing worldwide day-by-day and Web environment is creating a new gateway for visually impaired people as well to access information quickly and easily without any barriers and getting support from experts and friends. Moreover, advancements have enhanced the education system for visually impaired students. According to Friend (2009), "Visually impaired is a term which is used to describe the people who are partially-sighted or completely blind". World Health Organisation (WHO 2018) estimate that globally the count of people with some sort of vision impairment reach up to 1.3 billion and of those with mild vision impairment reach approximately up to 188.5 million. The estimate of people with ordinary to acute vision impairment is about 217, nearly 36 million people are completely blind and 826 million are with near vision impairment. It was also stated that majority of people with vision impairment are above the age of 50 years. However, around 80% of total vision impairment is considered as avoidable or curable. Visually Impaired persons cannot remain isolated in this Information technology era. Recently, researches are particularly relevant on visually impaired students because number of these people are increasing who pursuing personal development and independence through higher education. Thus, the study is conducted at Aligarh Muslim University, Aligarh to identify the use of web 2.0 tools by visually impaired students and whether they are able to use these advanced technologies properly. AMU is one of the premier Universities in India; it has a long and distinguished history and accredited grade 'A' by National Assessment and Accreditation Council (NAAC).

## Literature Review

Web 2.0 is the next generation of internet access which is a current topic of study as it provides a platform for academic interaction to sighted people as well as provides an opportunity to visually impaired people to actively interact socially with friends, family, professionals and subject experts. The study reviewed chronologically the studies related directly or indirectly to the present topic of study.

### ***Transition from Web 1.0 to Web 2.0***

Since the dawn of internet it is quite interesting to note that it enables communication timeless as well as enhancing the methods of learning and it is getting modified from web 1.0 to web 2.0 as it increasing the opportunities. Ribera, Porras, Boldu, Termens, Sule and Paris (2009), compared the Web Content Accessibility Guidelines (WCAG) 1.0 and 2.0 on the basis of personal

experiences and found that WCAG 2.0 is more educational and technically interactive. WCAG 1.0 had limitations in its origin; transformation from 1.0 to 2.0 provides new priorities as well as new elements. Web 2.0 guidelines will be useful for government and its user-centred design help in achieving the goal of accessibility. Murray, Liang and Haubl (2010) reviewed researches on technology 1.0 and 2.0 and concluded that advances had been made in the technical designs, also there are substantial barriers to wide-scale consumer adoption of such tools that need to be verified. In particular, future Assistive Consumer Technology (ACT) designs will need to better integrate current research in human judgment and decision making to improve the ease with which such tools can be used.

Rodriguez (2011), highlighted the consequences taken into consideration in transforming academic activities into a public sphere and examining how the rules that govern academic freedom and behaviour translate in today's dynamic environment. Balaji, M.S., B.G. and J.S. (2019), examined use of web 2.0 in 75 academic libraries of Asia through their library websites, the ranking criteria followed by them was a library web service index was developed, benchmarking, resources discovery tools, web 2.0 application, library guides, digital reference services, mobile application and revealed that two-third of Asian university libraries were using Web 2.0 applications and their popularity and implementation vary greatly as most widely used Web 2.0 applications were Facebook, RSS, Twitter and YouTube and least applied tools were instant messaging and podcasting.

### ***Web 2.0 tools and Visually Impaired***

Web 2.0 tools are used by visually impaired for educational purposes as well as for social interaction, if accurate accessibility is provided to them. Fuglerud (2011), conducted study on 28 visually impaired in Norway to determine the benefits and barriers of ICT usage, focus was on internet services, mobile phones, Kiosks, ticket machines, ATMs and queuing management systems and put forth that visually impaired in using ICT services such as e-banking, e-forms and learning materials encounter major accessibility problems in registration mechanism, authentication; escalation of typical technologies as well as the problem of training were mentioned. Dermody and Majekodunmi (2011) discussed that designing of websites should be done by considering the group of user, when designing for visually impaired user group web page must not contain lot of information nor had many links as visually impaired users spend more time in searching and browsing the web depending on the design of page. Bashir, Fatima, Malik and Safdar (2014), highlighted that the social networks are good learning sources for visually impaired by conducting study on sample of 35 visually impaired of different universities of Punjab (selection of sample was through snowball sampling technique) as most of those persons were using Facebook as a tool and majority of them were using social tools for academic purposes, communicating their friends, family, enjoying music as well as to participate in online seminars and conferences. Persons with low vision use these tools for sharing photos and videos, the problem mentioned was non-availability of JAWS software in Urdu, in some institutions JAWS was not installed.

Babu (2014), put light on social media usability and illustrated the application for evaluating Facebook for visually impaired through verbal interaction with 6 visually impaired persons which revealed that how visually impaired persons were using social media and how they

perceive in performing common task, it would be helpful for improving non-visual user interface to increase access of social media. Voykinska, Azenkot, Wu and Leshed (2016), explored visually impaired persons experiences and difficulties regarding visual content on web tools through interview of 11 visually impaired and survey of 60 visually impaired persons. Difficulties encounter were prevalence of photos without sufficient text description and inferring photos content from textual cues and interaction. Pacheco, Lips and Yoong (2018), discussed that transition 2.0 provides an opportunity to visually impaired students as they can make use of digital technologies for their higher education which includes social media as well as mobile devices that enable students to participate actively and enhance their ability to get educated.

## Objectives

The objectives to be covered in due course of the study are as follows:

- To identify the web 2.0 tools and record the frequency of use of web 2.0 tools by Visually Impaired Students.
- To identify the purpose for using these tools.
- To determine the problems faced while using web 2.0 tools

## Scope and Methodology

The study was conducted by using convenience sampling, to determine the use of Web 2.0 tools by visually impaired students at AMU. Total of 76 visually impaired students enrolled in PhD, post graduate, under graduate programmes taught in the university during the year 2018-19 (as per the record of Disability Unit, AMU) are considered for the study.

The study followed survey method and made use of structured interview to gather the precise data from the students at Braille section of central library and also from the departments in which the visually impaired students were enrolled. The questions asked in interview were designed on following parameters:

- Use of Web 2.0 tools
- Frequency of its usage
- Purpose and problems faced in using

The responses thus received were analysed using SPSS (version 23) for making conclusion and interpretations.

## Analysis and Interpretations

To make it more understandable results and interpretation of the analysed data is divided in respective headings.

### ***Demographic Information of the Respondents***

The study was conducted on 76 visually impaired students, among those 52 (68.4%) were males and 24 (31.6%) were females. Students under study were enrolled in different courses of study viz. 16 (21.1%) in PhD, 23 (30.3%) in post graduate and 37 (48.7%) in undergraduate programmes.

**Table 1.** Demographic Information of the Respondents

Category	Division	No. of Respondents (N=76)	Percentage	Total
Gender	Male	52	68.4	76
	Female	24	31.6	
Course	PhD	16	21.1	76
	Post Graduate	23	30.3	
	Under Graduate	37	48.7	

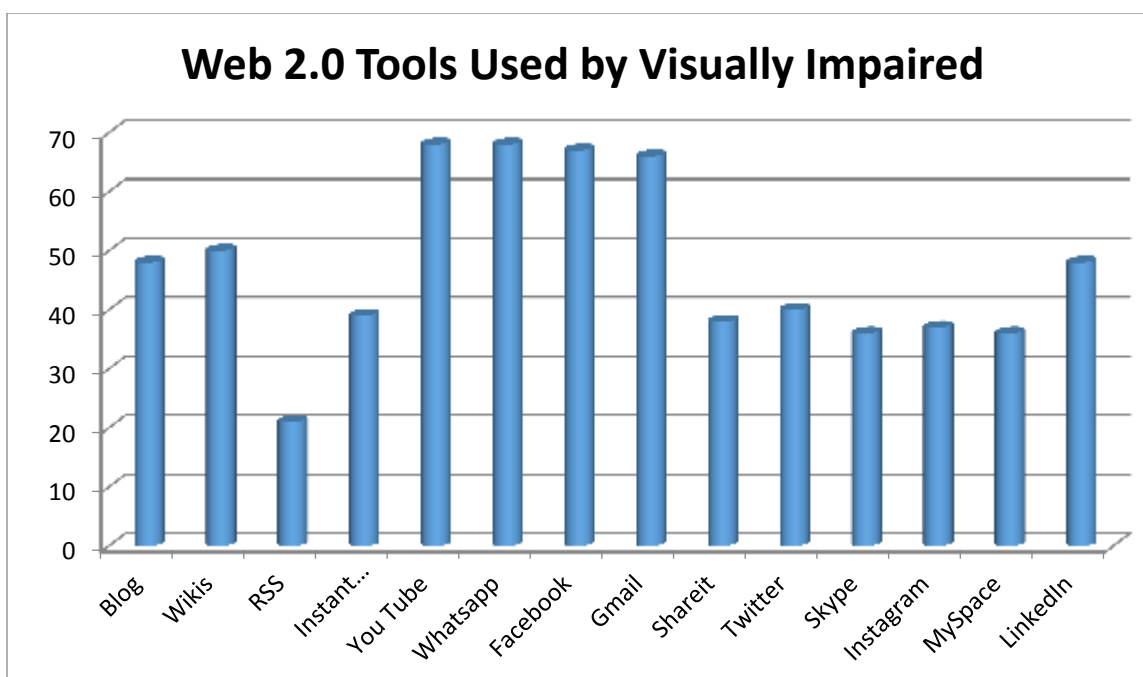
### ***Web 2.0 Tools Used by Visually Impaired Students***

Web 2.0 tools become an integral part of well-being; they are used in each sector. Therefore, visually impaired students were asked that what are the tools they are familiar with and making use of.

**Table 2.** Web 2.0 Tools Used by Visually Impaired Students

Web 2.0 tools	Frequency (N=76)	Percentage
Blog	48	63.2
Wikis	50	65.8
RSS	21	27.6
Instant Messaging	39	51.3
You tube	68	89.5
Whatsapp	68	89.5
Facebook	67	88.2
Gmail	66	86.8
Shareit	38	50
Twitter	40	52.6
Skype	36	47.4
Instagram	37	48.7
MySpace	36	47.4
LinkedIn	48	63.2

Note: Multiple responses were allowed



**Figure 1 .Web 2.0 Tools Used by Visually Impaired Students**

From table 2 it is revealed that the most used web tool is ‘Whatsapp and You Tube’ with 89.5% of students followed by ‘Facebook’ with 88.2% students and the least used tool is RSS feeds with 27.6% of students.

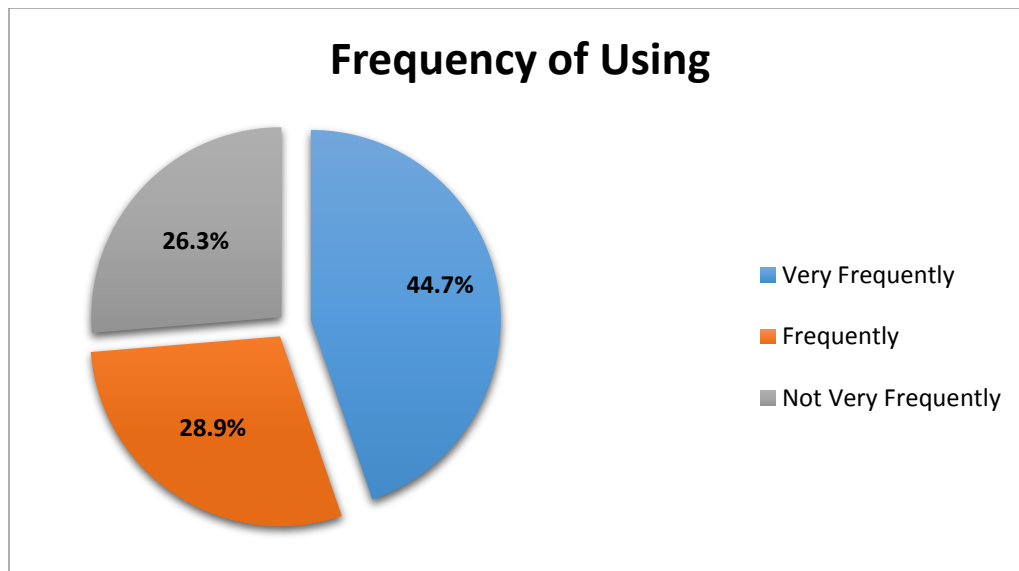
### ***Frequency of Using Web 2.0 by Visually Impaired Students***

Visually Impaired students were asked about the frequency of using web tools, in terms of very frequently, frequently and not very frequently.

**Table 3. Frequency of Using Web 2.0 by Visually Impaired Students**

Frequency of Using Web 2.0 Tools	Frequency (N=76)	Percentage
Very Frequently	34	44.7
Frequently	22	28.9
Not Very Frequently	20	26.3





**Figure 2.** Frequency of Using Web 2.0 Tools

It is revealed from table 3 that maximum number of students i.e. 34 are using web tools very frequently followed by frequently and not very frequently with 22 and 20 students respectively.

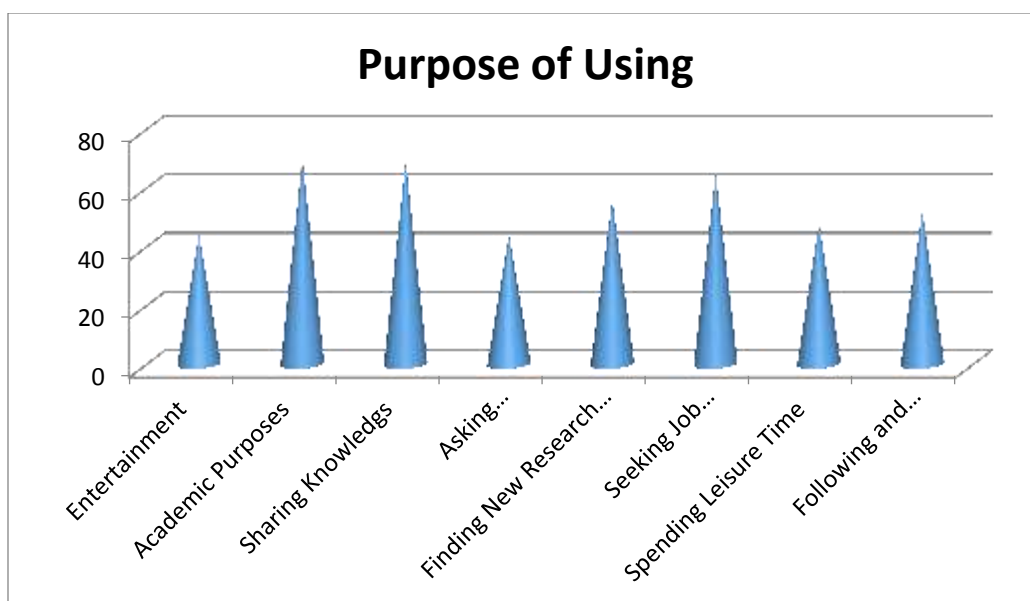
### ***Purpose of Using Web 2.0 Tools by Visually Impaired Students***

Web tools are being used for different purposes by different users. Thus, visually impaired students were asked that what are there purposes for using such tools.

**Table 4.** Purpose of Using Web 2.0 Tools by Visually Impaired Students

<b>Purpose of using</b>	<b>Frequency (N=76)</b>	<b>Perentage</b>
Entertainment	44	57.9
Academic Purposes	70	92.1
Sharing Knowledge	69	90.8
Asking Questions/Getting answers	44	57.9
Finding new research ideas	56	73.7
Seeking job opportunities	65	85.5
Spending Leisure Time	48	63.2
Following and Contacting Experts	52	68.4

Note: Multiple responses were allowed



**Figure 3.** Purpose of Using Web 2.0 Tools

The majority of the students i.e. 92.1% are using these tools for academic purposes followed by sharing knowledge, seeking job opportunities and finding new research ideas with 90.8%, 85.5% and 73.7% students respectively and the least mentioned purposes by these students were entertainment and asking questions/getting answers with 57.9% students (Table 4)

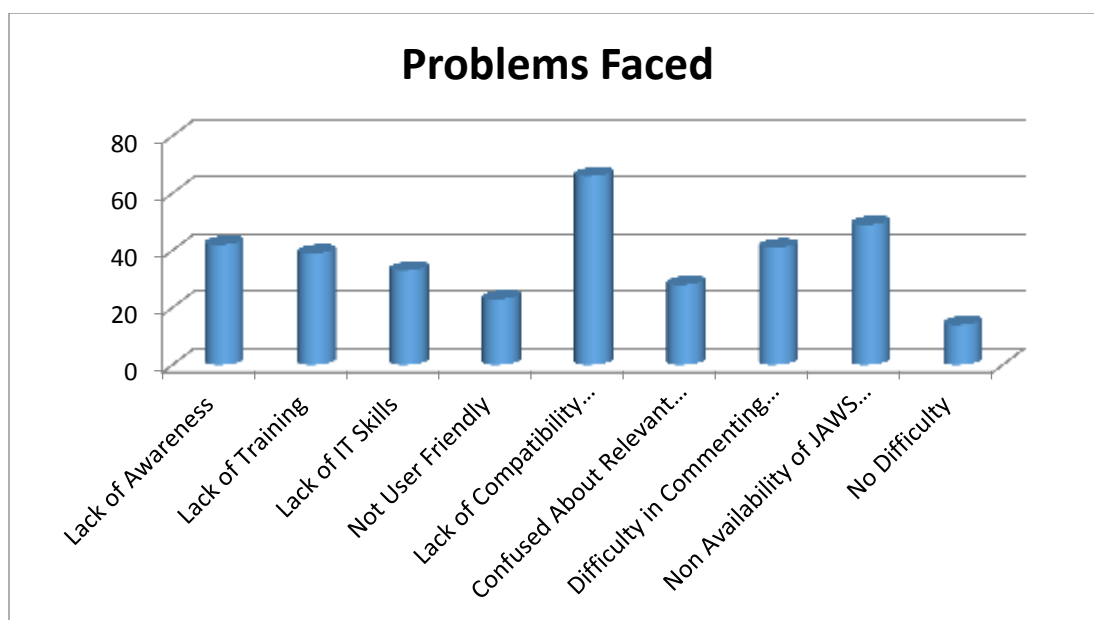
### ***Problems Faced by Visually Impaired Students While Using Web 2.0 Tools***

Though web services are available equally for visually impaired students as for others, but these people cannot use such tools with ease as their sighted colleagues can. Therefore, they were asked to mention the problems faced by them while using these tools.

**Table 5.** Problems Faced by Visually Impaired Students While Using Web 2.0 Tools

<b>Problems Faced</b>	<b>Frequency (N=76)</b>	<b>Percentage</b>
Lack of Awareness	42	58.3
Lack of Training	39	54.2
Lack of IT Skills	33	45.8
Not user friendly	23	31.9
Lack of compatibility with screen readers	66	91.7
Confused about relevant fields	28	38.9
Difficulty in commenting on videos and photos	41	56.9
Non Availability of JAWS Software in all languages	49	68.1
No difficulty	14	19.4

Note: Multiple responses were allowed



**Figure 4.** Problems Faced While Using Web 2.0 Tools

Findings from the table 5 revealed that majority of these students i.e. 91.7% face compatibility problems of such tools with screen readers and 68.1% mentioned the problem of non-availability of JAWS software in all languages and the least mentioned problem is confusion regarding relevant fields with 38.9% students whereas only 19.4% student mentioned that they are having any problem while using such tools.

## Major Findings and Suggestions

The present study is conducted on visually impaired students at Aligarh Muslim University to identify the use of web 2.0 tools, frequency of using them and to determine the purpose and problems in using such tools. The study used structured interview method to collect data from 76 visually impaired students among them 52 (68.4%) were males and 24 (31.6%) were females, enrolled in different courses of study viz. 16 (21.1%) in PhD, 23 (30.3%) in post graduate and 37 (48.7%) in undergraduate and the collected data was analysed using 'SPSS version 23'. The findings of the study revealed that these students are using 'Whatsapp and You Tube' with 89.5% of students followed by 'Facebook' with 88.2% students and majority of them viz. 34 are using very frequently followed by frequently and not very frequently with 22 and 20 students respectively. Web tools for different purposes such as 92.1% are using these tools for academic purposes followed by sharing knowledge, seeking job opportunities and finding new research ideas with 90.8%, 85.5% and 73.7% students respectively. The study also highlights that the major problem faced while using these tools was compatibility issue with screen reader as mentioned by 91.7% students and non-availability of JAWS software in all languages mentioned by 68.1% students.

Following suggestions are given on the basis of the major findings:

- Visually impaired students should be encouraged to use web 2.0 tools as the findings reveal that most of these persons are using only 'whatsapp and you tube'.
- ICT infrastructure and training should be provided to visually impaired students to enhance their understanding regarding such tools.
- Designers must ensure the accessibility of their websites with screen readers.
- JAWS software in different languages should be installed in computers used by persons with visual impairment.

## Conclusion

Web tools play a vital role in the social, academic, personal and professional uplift for visually impaired people. It is a proven fact that a large number of persons with visual impairment use social networking for academic purposes, sharing knowledge, seeking job opportunities, finding new research ideas as well as following and contacting experts some of them are using it for entertainment and for spending their leisure time. Majority of the persons face screen reader compatibility problem, problem of non-availability of JAWS software in all languages, lack of awareness and difficulty in commenting on videos and photos is also one of the major problem mentioned by these people, some of them face difficulty to find relevant fields. The study provides suitable suggestion to improve the situations and to enable visually impaired students to maximize the use of web 2.0 tools.

## References

1. Babu, Rakesh. 2014 **Can Blind People Use Social Media Effectively? A Qualitative Field Study of Facebook Usability** *American Journal of Information Systems* Vol. 2 (2): 33-41, DOI: DOI:10.12691/ajis-2-2-2
2. Balaji, B. Preedip, M.S., Vinay, B.G., Shalini and J.S., Mohan Raju. 2019 **Web 2.0 use in academic libraries of top ranked Asian universities** *The Electronic Library*. <https://doi.org/10.1108/EL-12-2018-0248>
3. Bashir, Rukhsana, Fatima, Ghulam, Malik, Misbah and Safdar, Mahwih. 2014 **Social Networking as a Learning Resource for Persons with Visual Impairment** *Academic Research International*, vol. 5 (3): 223-230, eISSN: 2223-9553.
4. Casey, Michael E. and Savastinuk, Laura C. 1967 **Library 2.0: a guide to participatory library service** New Jersey: Information Today.
5. Dermody, Kelly and Majekodunmi, Norda. 2011 **Online databases and the research experience for university students with print disabilities**. *Library Hi Tech* vol. 29 (1): 149-160. DOI 10.1108/0737883111116976
6. Downes, Stephen. 2005 **E-Learning 2.0** <http://www.downes.ca/post/31741> (accessed on 28 November, 2008)
7. Friend, Christopher. 2009 **Meeting the Needs of the Visually Impaired Persons: What Challenges for IP?** (Paper presented at a meeting hosted by WIPO in Geneva on 13th July 2009) [http://www.wipo.int/meetings/en/2009/vip\\_ge/presentations/chris\\_friend.html](http://www.wipo.int/meetings/en/2009/vip_ge/presentations/chris_friend.html) (accessed on 03/04/2019).

8. Fuglerud, KristinSkeide. 2011 **The Barriers to and Benefits of Use of ICT for People with Visual Impairment** Vol. 6765: 452-462. DOI: 10.1007/978-3-642-21672-5\_49.
9. Murray, Kyle B., Liang,Jianping and Haubl, Gerald. 2010 **ACT 2.0: the next generation of assistive consumer technology research***Internet Research*, Vol. 20 (3): 232-254, [https:// doi.org/10.1108/10662241011050696](https://doi.org/10.1108/10662241011050696)
10. Pacheco, Edgar, Lips, Miriam and Yoong, Pak. 2018 **Transition 2.0: Digital technologies, higher education, and vision impairment***The Internet and Higher Education*, vol. 37: 1-10. DOI <https://doi.org/10.1016/j.iheduc.2017.11.001>
11. Ribera, Mireia, Porras, Merce, Boldu, Marc, Termens, Miquel, Sule, Andreu and Paris, Pilar. 2009 **Web Content Accessibility Guidelines 2.0: A further step towards accessible digital information***Program*, Vol. 43 (4): 392-406, <https://doi.org/10.1108/00330330910998048>
12. Rodriguez, Julia E. 2011 **Social Media Use in Higher Education: Key Areas to Consider for Educators***MERLOT Journal of Online Learning and Teaching*, vol. 7 (4): 539-550
13. Voykinska, Violeta, Azenkot, Shiri, Wu, Shaomei and Leshed, Gilly. 2016 **How Blind People Interact with Visual Content on Social Networking Services**. In *CSCW USA: ACM*. pp. 1584-1595 [Proceeding of the 19<sup>th</sup> ACM Conference on CSCW, San Francisco, California, USA, February 27-March 2, 2016]. ISBN 978-1-4503-3592-8/16/02. DOI: <http://dx.doi.org/10.1145/2818048.2820013>
14. WHO. 2018 **Blindness and vision impairment**<https://www.who.int>(accessed on 18 July, 2019)

# **Digital Library Services to turn the existing problems: its solution and the plan of action need to be taken. Bangladesh perspectives.**

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## **Abstract**

The purpose of the present study is to search the problems, needs of users and its developments under the Government. Among those libraries which called departmental special libraries. It was issued common questionnaires is direct among the 26 library professionals and 40 members of user. The mentioned libraries as follows are collecting the data, based on users and professional's point of view. It was happening personnel visit and draw a personal interview.

This paper focusing the current scenario of the Government special libraries are functioning with 20 Ministries. They have a separate entity in the government organs, during the survey period author observed the discussed departmental special libraries are far behind from the Academic libraries i.e. University level. The author observed during the survey time it may low budget allocation or lack of proper concentration from the management. The survey focused the countrywide professional education system and discussed about the role of professional Associations. Hence, the library education is cantered two public Universities in Bangladesh, which is Dhaka, and Rajshai University. The mentioned universities are offering 4 years Hons, 1-year masters, and PhD degree also. They offered the said degrees under the department of Library and information Science the above Universities. In the other hand one year Post, graduate Diploma degree offered by the National University under of 10 affiliated institutes in countrywide.

Author discovered higher educated students are working in the survived libraries but they are mostly unsatisfied to their own positions and job. Because there are no any incentives/ promotion scope of their whole service period. However, two professional organizations are playing a vital role to bargain with the Government; unfortunately achievements rate are very low till today. The aim of this paper is to show its current scenario and how to resolve the running problems. Here draw with some recommendations, which are relating to departmental special libraries. At the digital age, it needs to resolve as soon as possible for sustainability of that library for future need.

## **Key words**

Library modernization, developing country, Bangladesh perspective.

## Introduction

Bangladesh was a part of India (as East Bengal) until 1947, then became East Pakistan. Independence was proclaimed in 1971. After a nine-month long bloody battle with the Pakistan Army, the brutal regime of the Pakistan Army, a few years back in 1958, the East Pakistan Library Association introduced a 6(Six) month certificate course in librarianship in Dhaka that would become the foundation for an undergraduate library Science degree. The next year, Dhaka University began its one-year Postgraduate diploma course that became a master's degree Program in 1962 and a two-year masters Program in (in 1976 after it was that great Liberation war period), 1974-75 the University of Dhaka approved a two-year masters of philosophy (Mphil) program (University of Dhaka, 1974), beginning with the 1975-1976 sessions (University of Dhaka, 1976). At the end of 1975-76, the University of Dhaka endorsed a two-year M.A. course which was called a 'Masters of Arts in library Science. Library and Information Science introduced as a subsidiary subject in degree (Pass) and honours level for affiliated colleges beginning in 1987-1988 session. (University of Dhaka, 1990)

The University of Dhaka started the 3-year B.A (Honours) course in 1987-88 session. Then a one-year diploma Course was restricted to Library and Information Science graduate students but the diploma programme was handed over to the Library Association of Bangladesh (LAB) from the session 1989-1990. The National University affiliated the Diploma course during 1997-1998 session. In 1997-98, 98 to align itself with the western education system, the University initiated a four-year B.A (honours) course in Information Science and Library Management to replace three-year B.A (University of Dhaka, 1999). In 1999-2000 the four-year B.A was declared the Professional degree. To take effect in 1997-98 (University of Dhaka, 2000). The University of Dhaka introduced 2-year M.Phil degree since 1976, regular basis and PhD course for library science graduate from 1979. It needs to be mentioned that the said department abolished M.A Preliminary courses when introducing the 4-year integrated B.A (Honours) a 1-year Masters degree programme in 1997-1998 session.

The University of Rajshai (est-1953). In the northwest region of the country, started a one-year Post Graduate diploma (PGD) course in library science beginning with 1991-92 (University of Rajshai 1992), the University added a three-year Bachelor of Social Science (BSS) with honours in library and Information Science from 1992-93 under the faculty of social and established the full fledged Department of library and Information Science in that same session (University of Rajshai, 1993). In 1995-96 a one-year Master of Social Science (MSS) course was introduced for its now library science graduates only (University of Rajshai, 1996). After that, the Bachelor program was converted into a four-year course beginning with 1997-98 (University of Rajshai 1999). The University of Rajshai introduced Mphil and PhD courses for library science graduate from 2006-07.

The National University (est. 1992) began to offer (600 MARKS) in library and information science as an, optional subject in the B.A (Pass degree) beginning in 1998-99, initially. It was started 400 Marks of the same discipline, National University, 2015. At least fifteen different college under the National University offering that program before the end of this decade gradually. Besides this National University one-year offered a twelve-months post graduate diploma (PGD) course for library and information science, 1992 under supervision of national university by ten diploma institute across the country, the National University offering the program under their direction.

## **Role of the professional Association and contribution for building up their professional skill**

Beyond University level education, New born library professionals have to need for basic continuing education. Much of this training process is unfortunately absent, there is no training institute established by Government, (eg, Professional Training institute like as any other Professionals, till date a few of this training has been met by the library Association of Bangladesh (LAB) which was established in 1958 and has a membership of more than 3000 and above, newly added Association of Bangladesh Librarians, Documentalist (BALID) are try to trained up library Professional, basically it is on IT based Training Program. Which is established 1986 and has membership of more than 600 and above, if it was founded since 1986 but its number of membership not up to the mark because only honours masters are eligible to meet its membership in the other hand many fellows are not too eager in library profession due to unrealistic or insufficient promotional scope in whole service period of direct recruited librarians. This is the true and real causes of its lag behind. Though many limitations of both of the two professional Association which is namely Library Association of Bangladesh (LAB) another one is Association of librarians, Information Scientists and Document list (BALID, namely), both of those are try to enhanced the library professionals skill by their highest effort it is library based IT training program. Eg, Library Association of Bangladesh, organised a training program under 'UNESCO Participation Program 2014-2015 Training of Library Professional of Non-government Higher Secondary Level College of Bangladesh on Information Communication Technology' among from the 120 non-government colleges higher secondary level colleges, this is short listed from above 1257 number of colleges from 55 district out of 68 districts. Another professional Association of librarians, Information Scientists and Document list (BALID) are organised couple of training program on Library automation, eg; Koha, MAARC-21, Jomla and Dspace. Both of the organisations are play a vital role to promote the profession but not it up to the mark, due to their logical limitations. In addition the library association of Bangladesh (LAB) hosted an Annual General Meeting, which governed by an elected executive council that meets couple of months, and published a journal twice yearly 'The Eastern Librarian' and often LAB organised national and international seminars, symposium in the other hand BALID also offered several types of Training program which is putting more skill library professionals by the way, it's a more significant and good initiatives of them. As befitting the profession and professionals will benefit from this training, Experts believe the library would increase in the coming days, and such training will come the good old days in this profession. We believed they always try to open a new door



through offering new item which is ensured skill manpower at the digital era. This is true for the developments of govt: libraries there is no any significant policy was not found during the survey tenure. Although at the stage, has have some limitations i.e. modern equipments, skill manpower and no any promotion scope of direct recruited library professional, they have tried their best and made effects to provide good service.

## **Current scenario of ministries/division and attached departmental libraries are as follows**

Departmental special libraries, National and public libraries are functioning under ministries/division and attached departments across the country. Now, below is a brief description of the status of the mentioned libraries is described. During the study, we have tried to make sense of this library is the real situation. Unfortunately, there is no record to support did not notify us. So in most cases the professionals working in the oral interview was given on the basis of the information produced. This study is an attempt to highlight the name of the organization, authorized manpower, the number of employed workers, the number of books, technical facilities, training and promotion opportunities, etc. There are said organisations are namely as follows:

- The National library of Bangladesh.
- Directorate of Public Libraries.
- Ministres/Division and Departmental Libraries.
  - Hon'able Prime Minister office Library.
  - Ministry of Finance (ERD), Documentation Centre.
  - Ministry of Law Justice & P/A Library.
  - Ministry of Public Administration Library.
  - Ministry of Labour & Employment Library.
  - Ministry of Foreign Affairs Library.
  - Ministry of Shipping Library.
  - Ministry of Agriculture Library.
  - Ministry of Education Library
  - Ministry of Health and Family Planning Library.

- Ministry of Land (Land Appeal) Library.
- Ministry of Primary & Mass Education Library.
- Ministry of Planning Library.
- Ministry of Commerce Library.
- Cabinet Division.
- Ministry of Woman & Children Affairs Library.
- Ministry of Local Government.(LGED Division).
- Ministry of Water Resource Library.
- Ministry of Commerce Library.
- Ministry of Information Library.
- Ministry of Cultural Affairs.

Present Status Of above Government Libraries at a glance)as Follows:

Sl no.	Name of the organisation.	Sanctioned Post.	Existing manpower.	No of books & others.	Technical support.	a)Job Trainingb)Promotion scope.
1.	The National library of Bangladesh.	98	86	500000+	Positive mood.	a).Inadequate. b).Inadequate
1.1	The National Archives.(Directorate of National Achieves).	36	32	100000+	Positive mood.	a).Inadequate. b) .Inadequate
2.	Directorate of Public Libraries.	?	?	22,39,105+	Positive mood.	a).Inadequate. b).Inadequate.
3.	Ministers/Division and Departmental Libraries.	03	03	34000+	Positive mood.	<u>a).Positive.</u>  <u>b).block post:as 'Librarian'</u>
3.1	Hon'able Prime Minister office Library.					
3.2	Ministry Of Finance (ERD), Documentation Centre.	03	03	18000+	Inadequate	a) Inadequate  b). blockpost: as'Deputy Director.
3.3	Ministry Of Law Justice & P/A Library.	03	02	26000+	Inadequate	a). Inadequate  <u>b).block post: as 'Librarian'</u>
3.4	4 Ministry Of Public Administration Library.	14	12	54000+	Inadequate	a). Inadequate  <u>b).block post: as 'Librarian'</u>
3.5	Ministry Of Foreign Affairs Library.	04	02	18000+	Inadequate	a). Inadequate  <u>b).block post: as 'Librarian'</u>
3.6	Ministry Of Labour & Employment Library.	02	01	25000+	Inadequate	a). Inadequate  <u>b).block post: as 'Librarian'</u>
3.7	Ministry Of Shipping Library.	01	<u>Vacant for cause of retirement.</u>	10000+	Nil	a). Inadequate  <u>b).block post: as 'Librarian'</u>

3.8	Ministry Of Agriculture Library.	01	01	10000+	Inadequate	a). Inadequate  b).block post: as <u>'Librarian'</u>
3.9	Ministry Of Education Library.	02	01	25000+	Inadequate	a). Inadequate  b).block post: as <u>'Librarian'</u>
3.10	Ministry Of Health and Family Planning Library.	02	01	20000+	<u>NIL</u>	a). Inadequate  b).block post: as <u>'Librarian'</u>
3.11	Ministry Of Land (Land Appeal) Library.	02	01	10000+	<u>NIL</u>	a). Inadequate  b).block post: as <u>'Librarian'</u>
3.12	Ministry Of Primary & Mass Education Library	02	01	11000+	Inadequate	a). Inadequate  b).block post: as <u>'Librarian'</u>
3.13	Ministry Of Planning Library.	05	04	25000+	Inadequate	a). Inadequate  b).block post: as <u>'Library officer'</u>
3.14	Ministry Of Commerce Library.	01	vacant	6000+	Nil	a).Nil  b).block post: as <u>'Librarian'</u>
3.15	Cabinet Division.	01	01	5000+	NIL	a). Inadequate  b).block post: as <u>'Catloguer'</u>
3.16	Ministry Of Woman & Children Affairs Library.	01	01	<u>New established.</u>	Nil	a). Inadequate  b).block post: as <u>'Librarian'</u>
3.17	Ministry Of Local Government.(LGED Division).	01	01	3000+	Inadequate	a). Inadequate  b).block post: as <u>'Asst.Librarian'</u>
3.18	Ministry Of Water Resource Library.	01	01	12000+	Nil	a). Inadequate  b).block post: as <u>'Asst.Librarian'</u>
3.19	Ministry Of Jute & Textile Library.	01	01	1200+ <u>New established)</u>	Nil	a). Inadequate  b).block post: as <u>'Asst.Librarian'</u>

3.20	Ministry Of Information Library.	01	01	1000+( new established).	Nil	a).NIL  b).block post: as 'Catoguer'
3.21	Ministry Of Cultural Affairs.	03	02	15000+	Nil	a). Inadequate  b).block post: as 'Librarian'

**A Short brief of those above libraries at the digital era namely as follows.**

**Directorate of Archives and Libraries** Government of the People's Republic of Bangladesh



## **General Information of National Library**

**NLB Building** -The Foundation stone of the National Library Building was laid down in 1978, construction of the Building was completed in 1985 and the National Library started functioning in its own New Building in 1986.

**Wing Activities:** All technical/professional activities relating to National Library of the Directorate are coordinated through Chief-Bibliographer/Deputy Director as the head of the library wing.

**Manpower Strength:** The total number of approved posts is 63, including Director and establishment section (Chief Bib/Deputy Director - 1. Officers- 6 and Staff- 55)

**Book purchase Allocation:** For buying National and International publication for National Library is Tk. 0.4 million.

**Rules, Regulations and Laws Concerning NLB:** National Library enjoys and exercises the power of Legal deposit regulation under the Copy Right Law of the Country. The National Library Law of its own is now under the consideration of the Government.

**Collection Items:** Intellectual property (Printed) i.e. Books, Journals, Newspapers , Magazines, Manuscripts, Puthies, Maps, First published research oriented foreign books, Books written by Non-Resident Bangladeshies (NRB), and any book Published abroad pertaining to Bangladesh etc.

**Total Collection:** Approximate Collection number of National Library is about 0.5 million, however the number of processed and usable titles are more than 0.2 million.

**Beneficiary:** Research scholars, writers, Publishers, Literary Persons, Professionals, Learners, Cultural Activists, Administrators, Policy Makers, Intelligentsia and General Citizen, Libraries of other Departments of government are the beneficiaries of NLB

**International Concerned:** National Library is member of IFLA, ISBN International ISBN Agency, CDNLAO, UNLNET, ACCU, LC.

**Ongoing project and PPNB-** One Development Project titled “Modernization of Bangladesh National Library” and One Programme on “Training for Skill Development of National Library Personnel” are recently implementation.

**Revenue Income:** National Library is also a revenue earning Government wing . Annual revenue income is about Tk. 0.5 million like membership fees, renewal of membership card, photocopy services and library auditorium renting etc.

**Machinery and Equipment:** NLB has procured 6 Scanners, 2 Servers, 3 Photocopy Machines, one Audiovisual Camera Set, C.C.T.V, Intercom System, Projector, Automatic Fire Detection and Protection System, Access Control System etc under the project.

**Website:** Directorate of Archives and Libraries has its own website where NLB is one of two wings. However, another dynamic Website is at the final stage of preparation which will be exclusively used for the National Library of Bangladesh.

**Software-** The National Library of Bangladesh has adopted 2 (two) Software i.e. Koha for integrated Library systems and services and Greenstone for online Digital Library System Services.

**Training-** All officers and 32 staffs of National Library have undertaken in house professional Training on various topics from 2012-13 to 2013-14 fiscal year.

## **\*A Brief History of National Library(NLB).**

After the partition of the sub-continent in 1947 the Government of Pakistan established the National Library of Pakistan in Karachi in 1962 and a provincial book Deposit Branch of the Pakistan National Library was established in Dhaka in 1967. In fact that book deposit branch is the embryo of the National Library of Bangladesh which came into being after the independence of the country in 1971. After the Liberation War of Bangladesh, it was keenly felt by all quarters that a

National Library is indispensable for the newborn nation. Considering the necessity and importance, the Government of the Peoples Republic of Bangladesh resolved to set up the National Library of Bangladesh in Dhaka. The Library started functioning with the manpower and resource materials inherited from the Provincial Book Deposit Branch in Dhaka. Later on, in 1972 the two national Wings namely (i) The National Archives of Bangladesh and (ii) The National Library of Bangladesh started functioning in the name of the Directorate of Archives and Libraries under the Sports and Culture Division, Ministry of Education. The construction proposal of National Library Building was approved in country's ever first Five year plan and the Foundation Stone was laid in 1978 on top priority basis. Accordingly the own building for the National Library of Bangladesh was built in 1985 and the Library was shifted in 1986 to its new place called The Jatiya Granthagar Bhavan. (The National Library Building) at Agargaon Sher-e-Bangla Nagar, Dhaka. Pro. Dr. Mazharul Islam is the Architect of NLB Bhaban.'

Although most of centralized library structure dates back of the country's history as Pakistan from 1947 to 1971. In the late 1960, the government of East Pakistan established a central library in Dhaka to deposit 1 ( one) books under the copy right Act 1960. Which is now amended up to era of 2000 .That was an unique history about to born of Bangladesh, though it was glories 1971 but 9 months long bloody liberation war, Bangladesh became and independent sovereign nation in 16, December, 1971 was born a new country in the world map, meanwhile the central library of Dhaka was developed as the national library of the new born country. The directorate of Archives and libraries, under Ministry of cultural Affairs, consists of National library of Bangladesh and the National Archives of Bangladesh. 'The National Library of Bangladesh is one of the largest libraries in the country. It is an institution of national importance, now under the Ministry of Culture Affairs, Government of the People's Republic of Bangladesh. The library is designated to collect, disseminate and preserve the printed material produced in the country. It also holds an extremely valuable collection of incunabula, manuscripts, illustrations, drawings, photographs, audio recordings, musical scores, etc. All you need to view these holdings is a reader's card. They are to expand your knowledge, plan to visit the Library to see the world of information produced within this country.'

Now a days, 'the principal functions of the National Library of Bangladesh are as follows:

- to collect and preserve all publications within the country in accordance with the Bangladesh Copyright Act, 1974 (amended 2000), to manage them properly and make them available to the readers and researchers;
- to prepare and publish a national bibliography;
- to act as the guardian of all the libraries in the country;
- to make contact with all the libraries home and abroad and share and exchange resources and information with all of them;
- to prepare and publish an index of all the editorials and important articles published in the national dailies;
- to assist and co-operate for the development of the library science and information service;
- to prepare and publish a library directory; (8) to allocate International Standard Book Numbers (ISBN); and
- to prepare and publish a Union Catalogue for Bangladesh.

The National Library of Bangladesh has several sections namely the Bibliography Section, Library Section, Binding Section, Processing Section, Computer Section and Microfilm Section. It has undertaken an automation programme for its collection and information through Foxpro, Visual Foxpro and CDS/ISIS systems. A scanning programme through computer has also been adopted for preserving many rare books and documents.

It has also undertaken a microfilming programme for conserving rare materials especially the old newspapers. For this purpose it has very recently acquired a modern microfilm unit with computerised camera, a data processor, microfilm reader and printer.

**Collection and preservation** The National Library has a collection of some 400,000 books including rare books and manuscripts and about 100,000 copies of learned journals collected from various sources. The collection of journals is one of the major items of its acquisition programme. The Library has also received a large collection of rare books, journals and manuscripts from individuals as donations. It has also collected old daily newspapers, books and magazines from various government agencies and foreign sources like UNESCO, World Bank and ILO. The Library has a good collection of Urdu, Arabic and Persian books as well as manuscripts and a large number of old maps of Bangladesh and that of the Indian subcontinent. All the collections of the National Library are preserved in a seven-storied air-conditioned stack block equipped with modern facilities.

The National Library has various reader services and other facilities. It has four large Reading Rooms covering an area of some 743.22 sq m. It also has a temporary Exhibition Hall and a 300-seat capacity air-conditioned auditorium.

The National Library organises special exhibitions, seminars and symposia for all kinds of readers and users of the library, both children and adults, on a regular basis. Besides, it takes part in all national book fairs as well as in other relevant exhibitions within the country.

Although the National Library within the short period of its existence has successfully carried out its responsibilities, yet it is handicapped by the absence of any legislation in the country regarding the administration and development of libraries. An effort has recently been made to pass a new legislation in this connection. Meanwhile, the libraries including the National Library of Bangladesh are at present being run in accordance with the existing laws and usage of the country, inherited from the colonial rule which are not adequate enough to cope with the ever-changing socio-cultural environment of a newly independent country.

The National Library is headed by the Director of the Directorate of Archives and Libraries and has some 40 officials and staff. At present the National Library is situated in 32, Justice SM Murshed Road, Agargaon, Dhaka. Except Weekly and government holidays, it remains open from 9 am to 5 pm everyday. [Sharif Uddin Ahmed] ‘

To-day the National Library of Bangladesh employees have 98 staff members and has a good collection of books i.e., 500,000, bound journal 6000, News paper 2000 in Bangla and English. As per copyright Act all published books in the territory, as mandatory deposited in the national



library one copy each. National library coordinates to Published National bibliography yearly, since 1972- till date, National library is continuing to publish the National bibliography in English and Bengali, however publication of National bibliography has been delayed 10 years( 1985-1995) lack of budget allocation. The mentioned collections are preserved by manually and through Foxpro, Visual Foxpro and CDS/ISIS systems but it is inadequate at the digitalage

.(Ref;<https://www.google.com/search?q=NATIONAL+LIBRARY+OF+BD&btnG=Google>).

## Collection of NLB

### Collection

The Collection of Bangladesh National Library (NLB) is the nation's asset. The principal characteristics of its collection are that it covers all major disciplines and branches of human knowledge i.e. Literature, Cultural Heritage, History, Arts, Archaeology, Science and Technology, Medical Science, Engineering, Economics, Agriculture, Library and Information Science, Management, Development Administration, Environment, Woman Affairs, HRD, Law, Service, Rule, Gazette and Private Collection etc. The Collection is preserved in scientific manner. In addition to the country's all new publications every year, the library also acquires foreign books especially on Asian countries and more specifically those related to South Asian Studies. The library enriches its collections by various means i.e. acquiring publications under copyright act, purchase, institutional/personal donation, complimentary copies etc.

## Total Collection

**Books: Approximate number of information materials is above 0.5 million** , however number of processed and usable titles are more than 0.2million

• Number of preserved Bengali Daily Newspaper	103 Titles
• Number of preserved English daily Newspapers	31 Titles
• Number of preserved Bengali Periodicals	150 Titles
• Number of preserved English Periodicals	8 Titles
• District Gazetteers (from British period)	309 Titles
• Number of Maps	1687 Copies
• Microfilm Roll	59 nos.(1875-1926)
• Microfiche	1500 nos. (1985-1992)
• Total Collections under Copy Right Law (1968-2012):	<b>63570 nos</b>
• Total Collections under Copy Right Law (2013):	<b>3645 nos.</b>

*Last updated: 18th November 2015*



## Digitization (Library)

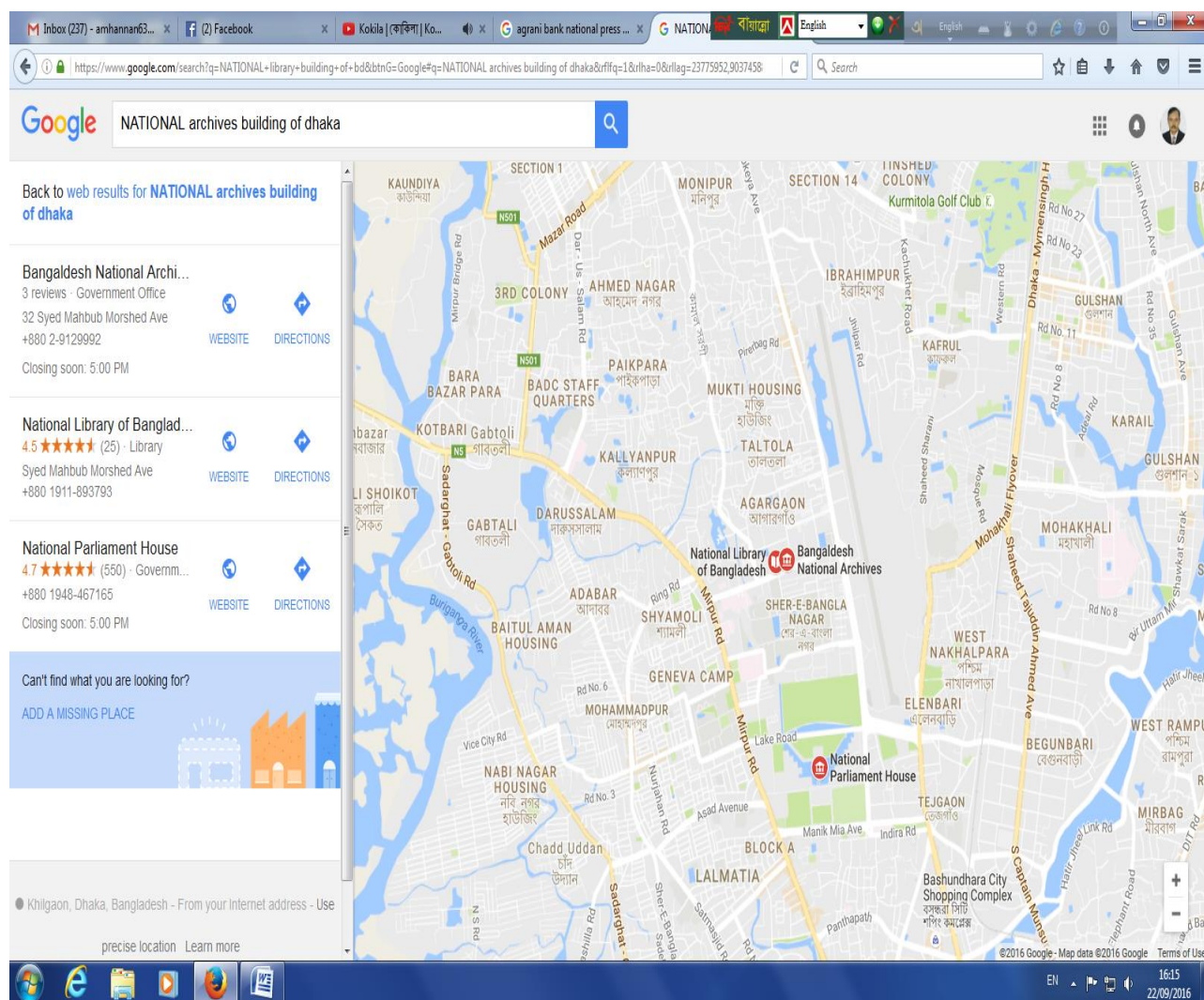
Libraries are the storehouse of knowledge as they maintain the books and other knowledge resource available - mostly in printed form. However, with the advent of digital technology and Internet connectivity, the National Library scenario is changing fast. Digital technology, Internet connectivity and physical content can be merged resulting in Digital Library. Data available in physical form has been preserved digitally in Digital Library. Digital Libraries have the ability to enhance access to information and knowledge. They also bridge barriers of time and space. NLB is now digitizing maps, newspapers, magazines, rare books. gazetteers etc.

National Library of Bangladesh preserved physical documents. But now NLB is trying to meet the Government MDGs manifesto by establishing Digital Library System. For this NLB has already started its journey to digitize the traditional Library.

## Statistics of Digitized Records

SN	Digitized Item	Copy/Volume	Number of Image
1	Book	1036	366967
2	Binding Newspaper	576 Vol	304681
3	Newspaper Clippings	29 Vol.	4625
4	District Gazetteer	40	2820
5	Book (Dhanbari Collection)	1245	430194
6	Secretariat Documents	745	178469
7	Maps	1687	2091
	<b>Total</b>	<b>5338</b>	<b>1271989</b>

## National Archives of Bangladesh (location map)



জাতির জনকবঙ্গবন্ধু শেখ মুজিবুর রহমান ১৯৭২ সালের নভেম্বরে আরকাইভস ও গ্রন্থাগারঅধিদপ্তরটি প্রতিষ্ঠা করেন। প্রতিষ্ঠালগ্নে অধিদপ্তরটি শিক্ষা মন্ত্রণালয়েরঅধীনে ছিল। পরবর্তীতে এটি সংস্কৃতি বিষয়ক মন্ত্রণালয়ের অধীনে আসে। ১৯৮৬সালে জাতীয় গ্রন্থাগার ভবন নির্মাণ হওয়ার পূর্ব পর্যন্ত অধিদপ্তরটি একটিভাড়া বাড়িতে এর কার্যক্রম শুরু করে। জাতীয় গ্রন্থাগার ভবন নির্মাণ কাজ শুরুহয় ১৯৭৮ সালে এবং নির্মাণ কাজ সম্পন্ন হয় ১৯৮৫ সালে। ২০০৫ সালের পূর্বপর্যন্ত জাতীয় আরকাইভস-এর কার্যক্রম জাতীয় গ্রন্থাগার ভবনে সম্পাদন হয়। গণপ্রজাতন্ত্রী বাংলাদেশ সরকারের প্রধানমন্ত্রী শেখ হাসিনা, এমপি ২০০১ সালেজাতীয় আরকাইভস ভবন নির্মাণের ভিত্তি প্রস্তর স্থাপন করেন। জাতীয় আরকাইভসভবন নির্মাণের প্রথম পর্যায় ২০০৪ সালে এবং ২য় পর্যায় ২০১২ সালে শেষ হয়। বর্তমানে জাতীয় আরকাইভসের কার্যক্রম ৫তলা বিশিষ্ট প্রশাসনিক ভবন এবং ৭তলাবিশিষ্ট স্ট্যাক ভবনে সম্পাদন হচ্ছে যা আগারগাঁও, শেরেবাংলা নগর, ঢাকা-১২০৭-এ অবস্থিত।

Father of the Nation Bangabandhu Sheikh MujiburRahman, the Department of Libraries and Archives was established in November 1972 . The organization was under the Department of the Ministry of Education . Later it came under the Ministry of Cultural Affairs . In 1986, the Department of the National Library of buildings in a rented house until the start of the program .National Library building began in 1978 and construction was completed in 1985. 005 until the National Archives at the National Library of the activities are performed. People's Republic of Bangladesh Prime Minister Sheikh Hasina, MP 2001 in the National Archives building laid the foundation stone. The first stage of the National Archives building is over 2004, and in ii phase was completed in 2012 . The 5- storey administrative building of the National Archives and styaka 7 -storey building , which is being performed which is shere-Bangla Nagar , Dhaka- 1207 is located in .

**Ref:** From Wikipedia, the free encyclopedia

**The National Archives of Bangladesh (NAB)** are based in Dhaka and contain 225,000 volumes of documents in addition to books, microfilm rolls and newspaper clippings.<sup>[1]</sup> The archives were founded in 1973 by the government of Bangladesh and are administered by the Directorate of National Archives and Libraries. Located in a rented building near the campus of Dhaka University until 1985, the collections are now housed in a purpose-built part of the National Library of Bangladesh complex in Sher-e-Bangla Nagar.

## Mission and Vision of National Archives

### ***Mission***

To collect, preserve and maintain the historical and other value contained documents as the Cultural/Archival heritage of Bangladesh and to provide research and reference service of the National Information Services.

### ***Vision***

Our Vision is to become a modern National Center for Archives, Archival Documentary, Cultural Heritage and related researches to ensure high value Government and private records. Maintaining proper preservation for the posterity, with a vision to lead our National Archives into a Digital world.

REF; ([https://en.wikipedia.org/wiki/National\\_Archives\\_of\\_Bangladesh](https://en.wikipedia.org/wiki/National_Archives_of_Bangladesh)).

‘Welcome to the Directorate of Archive and Libraries, Ministry of Cultural Affairs, Government of the People's Republic of Bangladesh. This Website has beet for information to the World viewers particularly for those who have in history and cultural heritage. The National Archives and the National Library are the two most important national institutions of Bangladesh. These are entrusted with the collection and preservation of our national document heritage? official and non-official records, historical documents, and the creative works of arts, literature, science and technology. In short, these are the depositories of our cultural heritage and they bear the memories of our nation. These are also centers of learning land research.Sanctioned post are total 98.

The national library and Achieve Dhaka Bangladesh was built in 1978 – 1979. The site of the project is very near to the parliament building designed by Louis I Kahn and in an area which would have been a part of Kahn's master plan. In this project Muzharul Islam finds a way to be harmonious with Kahn's project and master plan, and this is reflected in its strong geometry configuration and its choice of material. The formality of its geometry is broken down with beautiful fissures that make way for light and air to reach deep in to the building. The manipulation of the form rising from understanding of the climate and needs of the program, not only creates wonderful arrangements in plan and space but also sculpts the building in a beautiful way.

## **Bangladesh National Library**

“The National Library is a centralized volume of a sharp geometric configuration situated near Louis Kahn's National Capital Complex. It was commissioned by the Ministry of Cultural Affairs as part of a complex, which is to include the yet- not built National Archives.

The project, with its stereotomic earth-hugging character, differs sharply from the skeletal quality of Islam's earlier projects, bringing a different quality of geometric and spatial complexity. The parti of the Library began as a pure square from which was slowly and deliberately distorted to acknowledge the contradictory demands of climate, place, and program. The distortion of the idealized form itself became the generator of architecture; from the compact square core of the configuration, one proceeds towards the periphery with its fissures, incisions, and cutouts.

The process of distortion also suggest a new opening in Islam's steadfast materialist ideology; it reveals a surreptitious triumph of the empirical over the rational, and of the accidental over the planned, and invokes, almost grudgingly, a metaphorical, if not the metaphysical, dimension.

The seven-story central volume supported by concrete shear walls and housing the concrete stacks, forms the core of the library. It is surrounded on all sides but the north by three-story load-bearing brick structures. The enveloping walls of the central volume are cut away at the corners. These corners incisions, which continue diagonally into the heart of the building, serve to bring light into that heart as well as to divide the building into separate functional components; reading rooms and display areas to the south, administration and processing areas to the east, and storage and supporting facilities to the west.”

Reference: “An Architecture of Independence: The making of Modern South Asia” By KaziKhalee ([http://www.muzharulislam.com/projects/bangladesh\\_national\\_archive.html](http://www.muzharulislam.com/projects/bangladesh_national_archive.html))

## **National Archives**

Present scenario of Archives : Bangladesh is born 1977 as Independent country a huge of devotion of life and wealth during the liberation struggle in 1971, since the liberation struggle in 1971 is the new nation of Bangladesh has focused on chronicling in the early history in 1973. The Government established the national Archives and, in 1983 issued an ordinance as ‘ the National

Archives ordinance, and administration of the non- current ( i.e 25 yrs,old documents) and permanently valuable records and archives of the Government, To- day deposited among the 600000 documents and records,in the National Archives are the offices record,maps, gazettes,pressclipping,newspapers,and microfilms, as per advisory council the government collect on relating matters to deposition of materials from the several government offices's .ince 1985, the National library and National Archives have been hoysed

## **Collection of National Archives**

Government/Semi-Government/Other Documents/Private Collections/Bangla, English, Persian other Foreign Language Books/Rare Books/Science & Technology/Official Documents/Newspapers and Periodicals/Manuscripts/ Maps & Prints/Microfilms

The National Archives & The National Library have inherited and collected a vast amount of documents, records and books within a short span of only thirty (30) years. So that it has now become one of the largest resource centers on South Asian Studies in particular and World Studies in general. The subcontinent countries can also be greatly benefited by the resources of Bangladesh Studies with the aid of the collections.

### ***District Records***

Several thousands of district records dating from 1760s are available at the National Archives of Bangladesh. The district records are the correspondences from and to the district. The district records assumed the character of local diary with the development of the East India Company's administration in general and the establishment of the Collectorship in particular. They consisted of letters both received and sent, memoranda, reports, petitions and official documents prepared by the District Collectors, his subordinate officials and the local people on various aspects of district administration and local condition. The District Records are mainly in manuscript with the exception of some circular letters, which are in print. We are pleased to report that these valuable documents are now being digitized for permanent preservation and putting on the web-site. We also plan to digitize the rest of our important documents in the long run.

### ***Government of Bengal Proceedings / Files***

The National Archives of Bangladesh has collected a considerable number of proceedings volumes from the Bangladesh Secretariat Record Room dating from 1859 to 1964. The proceedings volumes mainly contain letters, orders, resolutions, rules, reports etc. of the Government of the East India Company and Government of Bengal.

### ***Dhaka Divisional Commissioner's Records***

The National Archives has also a good number of valuable historical records, which have been collected from the Dhaka Divisional Commissioners Office. These records cover the period from 1898 to 1971 and deal with the events occurred in the rural Bangladesh.

## National Archives Service

### **Research Services**

The National Archives of Bangladesh extends research and reference facilities to researchers from within the country and abroad. The research scholars are given all the facilities of research and reference on the materials available in the National Archives. There are various Catalogues in the research room. Following catalogues are available

#### **District Record (Manuscript Form)**

<b>Sl.No</b>	<b>Name</b>	<b>Year</b>
I	Chittagong District Record	1760
II	Rangpur District Record	1777
III	Comilla District Record	1782
IV	Dhaka District Record	1783
V	Dinajpur District Record	1786
VI	Rajshahi District Record	1782
VII	Mymensingh District Record	1787
VIII	Barisal District Record	1790
IX	Faridpur District Record	1799
X	Sylhet District Record	1777
XI	Pabna District Record	1820
XII	Noakhali District Record	1840
XIII	Jessore District Record	1786
XIV	Bogra District Record	1783

#### **The National Archives has also collected various District Collectorate Records like**

- Govt. of Bengal (A,B &C) Proceedings 1858-1964
- Govt. of Bengal Printed - A Proceedings-1859-1932
- Govt. of Bengal Sylhet Proceedings (Assam Secretariat)-1874-1948
- Dhaka Derestricted Records - 1781-1938
- Dhaka Divisional Commissioner Records -1873-1961
- Rajbari District Collectorate Records -1872-1990
- Rongpur District Collectorate& Council Records -1768-1964
- Pabna District Records -1845-1976.
- Dhaka Collectorte Records - 1889-1960
- Jessore Collectorate Records- 1786-1868
- Mymensingh Collectorate Records - 1880-1963
- Faridpur Collectorate Records -1880-1947
- BograCollectorte Records - 1846-1876
- Rangpur Collectorate Records- 1778-1964
- Khulna Collectorate Records - 1832-1920

- Pabna Collectorate Records - 1845-1920
- Sunamganj Collectorate Record - 1818-1970
- Sylhet Collectorate Records - 1793-1972
- Rangamati Collectorate Records - 1900-1960
- Rajbari Collectorate Records - 1872-1990
- Rajbari Collectorate Records - 1872-1990

## **Map Information Service**

### ***Library Service***

National Archives has also a Library where many rare books are available. The researcher can use this library

### ***Photocopy Service***

Researcher can have photocopy service for research purpose at the charge of Tk.2.00 per impression and News Paper Tk. 5.00 per copy.

### ***Advisory Services***

National Archives also gives Advisory services to the different offices

### ***Newspaper Reading Service***

One of the important services to the users is Newspaper reading services, which is given under special arrangement.

### ***Citizen Charter***

How to Use The National Archives of Bangladesh

- A application must be submitted to the Director for permission of using Archives.
- One passport size photo should be submitted with the application.
- A letter from Departmental head or organizational head.
- Photocopy of National ID card.
- A letter from Supervisor for M. Phil, Ph.D researcher.
- Photocopy of passport for foreign researcher.

### ***Access to the Records***

- Public records deposited in the National Archives are open to the scholars and public in general for research purpose.
- Secret or national security records are not given to the scholars or public without permission from the producers.
- Individuals are required to submit applications for permission to consult the records and books in the National Archives.



## *Services*

- The Research/Search Room contains finding aids, summary list, Index and catalogues to all records.
- The National Archives of Bangladesh extends research and reference facilities to researchers from within the country and abroad.
- The research scholars are given all the facilities of research and reference on the materials available in the National Archives.
- Researcher must submit his/her acquisition slip before 2 hours of closing time.
- Some photocopy will be given by permission of the authority.

## **Administration**

### *Director*

The Director is the head of the Organization. Present Director is **Professor Dr. MD. Taibul Hasan Khan**

### **Break up of the post of Directorate of Archives and Library**

1. Director	1
2. Deputy Director (Arc)	1
3. Chief Bib./Deputy Director(Lib)	1
4. Programmer	1
5. Assistant Director (Lib)	1
6. Bibliographer	3
7. Assistant Director (Arc.)	1
8. Research Officer	1
9. Programming Officer	1
10. Microfilm Officer	1
<b>Total 1st class officer</b>	<b>12</b>
Junior Microfilming and Photostatting Officer 1	1
3rd Class Employee	51
4th Class Employee	34
<b>Total</b>	<b>98</b>

Budgetary size - Total Tk. **1,82,00,000/-** (Taka One Crore, Eighty two lac only)

## Digitization

Previously National Archives of Bangladesh used to preserve only physical documents. But NAB are trying to meet the government MDGs manifesto by establishing Digital Archives. For this, NAB already started its journey to digitize its traditional documents.

### Statistics of Digitized Records (By last one year)

S/N	Item	Numbers of Page
1.	Total Scanned Documents	12,28,040
2.	Total Documents preserved in Server	896350
3.	Total number of CD/DVD's that stored documents	585
4.	Total Documents stored in CD/DVD's	10,95000
5.	The Newspaper (AZAD) Scanned	33,350 (125 Volume)
5.	The Newspaper (AZAD) RePrint	340 (1 Volume)

*Last updated: 18th November 2015*

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## General Information of National Archives Ordinance

The Government promulgated a National Archives Ordinance in 1983 (Presently National Archives Act 2013) in order to establish National Archives and operate and regulate as per act.

## International Co-Operation

The National Archives of Bangladesh is a member of the International Council on Archives (ICA), an adjunct to UNESCO. The National Archives of Bangladesh is also a member of the South and West Asian Regional Branch of the International Council on Archives commonly known as SWARBICA.

### ***Using the records***

- The Record Room contains finding aids, summary list, Index and catalogues to all records.
- **Research and Reference Services:** The National Archives of Bangladesh extends research and reference facilities to researchers from within the country and abroad. The research scholars are given all the facilities of research and reference on the materials available in the National Archives.

### ***Access to the records:***

- Public records deposited in the National Archives are open to the scholars and concerned public in general for research purpose.
- Secret or national security records are not given to the scholars or public without maintaining the provisions of law.

## **General Guidelines for using NAB**

- An application must be submitted to the Director Attention: Deputy Director(Archives) for permission of using Archives.
- One passport size color photograph to be submitted with the application.
- For researcher a letter must be submitted from Departmental Head or Organizational head or supervisor.
- Photocopy of National ID card or institutional ID card.
- Photocopy of passport for foreign researchers only.
- Researcher must submit his/her requisition slip before 2 hours of closing time.
- Photocopy service can be provided as per NAB guidelines.

## **National Archives Advisory Council**

According to National Archives ordinance 1983 (Presently National Archives Act 2013), National Archives of Bangladesh has an Advisory Council. Advisory Council meeting held after every three months. Recently the Advisory Council was reformed by the government on 20 April, 2014 by the following:

<b>Serial No.</b>	<b>Member Identity</b>	<b>Title</b>
1.	Secretary, Ministry of Cultural Affairs, Bangladesh Secretariat, Dhaka	Chairman
2.	Mr. Abu Md. Delwar Hossain, Professor, Department of History, Dhaka University	Member
3.	Dr. Imran Hossain, Professor, Department of History and culture, Chittagong University	Member
4.	Mr. Abul Kashem, Professor, Department of History, Rajshahi	Member

	University	
5.	Dr. Md. TaibulHasan Khan, Professor, Department of History, Jahangir Nagar University	Member
6.	Representative, Cabinet Division	Member
7.	Representative, Legislative and Parliamentary Affairs Division, Ministry of Law, Justice and Parliamentary Affairs	Member
8.	Representative, Ministry of Public Administration	Member
9.	Representative, Ministry of Home Affairs	Member
10.	Representative, Ministry of Foreign Affairs	Member
11.	Representative, Ministry of Education	Member
12.	Deputy Secretary, Section-4, Ministry of Cultural Affairs, Bangladesh Secretariat, Dhaka	Member
13.	Director, Directorate of Archives and Libraries	Member Secretary

### ***Museum***

The National Archives of Bangladesh has a room for displaying manuscript called manuscript museum.

### ***Exhibition***

The National Archives of Bangladesh has an exhibition room to display old rare records for the visitors, users and common people. The National Archives of Bangladesh organizing exhibitions in various national and international days' observation and displaying relevant records, papers and books etc.

***Website:*** Directorate of Archives and Libraries has its own website that is under way to open. However, another dynamic Website is [www.nab.gov.bd](http://www.nab.gov.bd) which will be exclusively used for the National Archives of Bangladesh.

***Software-*** The National Archives of Bangladesh has a customized 1 (one) Software.

### ***Modern Equipment***

At present, the National Archives of Bangladesh has the following equipments:-

- Server
- EMC storage 13 TB
- HD A0 Size and A3 Scanner
- Microfilm Machine
- Book Scanner
- Copier Machine (for news paper& Map)
- Modern Computer and Laptop
- Hit Lamination Machine

**NAB Building** - Construction of the National Archives Building by a project sanctioned in 1995. 1<sup>st</sup> Phase construction was completed in 2004, 2<sup>nd</sup> phase in 2012, and Development Project Proposal (DPP) for 3<sup>rd</sup> Phase development is under process.

**Wing Activities:** All technical/professional activities relating to National Archives of the Directorate are coordinated through Deputy Director as the head of the Archives wing.

**Manpower Strength:** The total number of approved posts is 34. A proposal for revision of organogram and additional manpower is under consideration of the Government.

**Total Collection:** Approximate collection of National Archives is about 0.3 million files.

**Beneficiary:** Research scholars, Writers, Literary Persons, Professionals, Learners, Cultural Activists, Administrators, Policy Makers, Intelligentsia and general citizens, various Departments of Government are the beneficiaries of the National Archives of Bangladesh.

## Future Plan

### Future Plan of the Directorate of Archives and Libraries

- To bring structural changes within the organization.
- To get the approval of proposed coordinated law for National Archives and Libraries.
- To bring changes in budgetary structure of the present budget of the Directorate.
- To get the approval of proposed organization structure for sanctioning sufficient manpower for National Archives and National Library.
- To set up a permanent Training Cell for capacity building of the organizational National Archives and National Library.
- To make liaison, participate and share ideas with other international Agencies.
- To publish annual report and journal regularly.
- To provide online public access catalogue.
- To execute the model work plan for both National Archives and National Library.
- Directorate of Archives and Libraries as the Key Point Installation (KPI) zone.
- To declare the organization as KPI to fulfill all the standard.

## Department of Public Libraries.

### *Central Public Library (Dhaka)*



Address:  
Kazi Nazrul Islam Avenue, Dhaka, Bangladesh



### **Central Public Library**

(Bengali: কেন্দ্রীয় গণগ্রন্থাগার (of Bangladesh (between 1996 and 2007 it was named Begum Sufia Kamal National Public Library) is the largest public library in Bangladesh. It also houses the Public Library Department which, with 68 public libraries including the Central Public Library in its jurisdiction, is managed by the Directorate of Public Libraries under the Ministry of Cultural Affairs

The auditorium (Shawkat Osman Auditorium) of the library is a major venue for cultural events in Dhaka, including the International Short and Independent Film Festival. It also houses the Library Training Institute funded and managed by the Library Association of Bangladesh (LAB). It also has a reprography service, in-house bindery and conservation section.

## ***History***

The foundation stone for Dhaka Central Public Library was laid in 1954 with the Registrar of Dhaka University as part-time Librarian. Designated to be the center for the public library system in the then East Pakistan on the basis of the recommendations made by Australian Library consultant Mr. L C Key in 1955, it was opened to the public on March 22, 1958 with a stock of 10,040 books. In 1978 the library moved to its building near the Shahbag Intersection from its original building designed by pioneering Bangladeshi architect Mazharul Islam, which went on to house the Dhaka University Central Library. The Department of the Public Libraries was established with Bangladesh Central Public Library as its headquarter in 1984. Between 1980-85 UNESCO provided nearly 9.9 million Bangladeshi taka to develop the library.

## ***Collection***

<b>Country</b>	Bangladesh
<b>Established</b>	1954
<b>Location</b>	<u>Shahbag</u> , <u>Dhaka</u> , Bangladesh
<b>Branches</b>	64

### **Collection**

<b>Size</b>	119,750 (as of March 2007)
<b>Website</b>	<u><a href="http://centralpubliclibrarydhaka.org">centralpubliclibrarydhaka.org</a></u>

## ***Collection***

As on March 2007, the Library has 119,750 books in collection, including old and rare books with historical value, along with a small valuable collection of 40 to 50 manuscripts titles for research and reference services. Books in the collection are mostly in Bengali and English, as well as other languages including Urdu, Hindi, Arabic and Persian. As a depository library, it deposits all Bangladeshi publications under the Copyright. The Library receives most of the Bangladeshi daily newspapers and periodicals. It also has a special collection of juvenile material and is providing separate reading facilities for children. The Dewey Decimal Classification (DDC) system with minor modifications is used to organize library materials.

## ***Library hours***

The library remains open from 8:00 a.m. to 8:00 p.m. on all days except Fridays and national holidays. On July 26, 2003 started 24 hours reader service, which ceased on March 1, 2004 since drug abusers were taking opportunity of those hours. The district and branch libraries managed by the Department of the Public Libraries remain open from 11:00 a.m. to 6:00 p.m. on all days except Fridays and government holidays. Lending facilities were introduced in 1994. As of 2004, the average number of readers was about 2,500 a day.

## Department of Public Libraries » Mission and Vision

Mission and Vision Library Department under the Ministry of Cultural Affairs of the People's Republic of Bangladesh sbamahimaya exposed to a charity. For education, an educational institution library to educate the nation and the eternal motto of the library (Moto) ahead of the public library as well as a provision for the culture of the country and the nation, culture and tradition is recognized as a social institution. Efficiency of society to eradicate illiteracy in the country's democratic institutions, libraries, as well as an integral part of the organization for society. By providing information services to the country's socio-economic development, culture, heritage, culture and lifelong learning DEPARTMENT bidhimuktabikasakalpe statutoryrole and accredited. Religion, caste, race, gender Public Library is a unique institution that single mention of UNESCO's program. Ahead of UNESCO's program of the Department of Library Information Services operates in Bangladesh. Considering the highest in the nation, providing learner information service website was developed. The reader who sought knowledge through the website of the Directorate of Public Libraries pathasamagri, learn about the activities and services. Always dedicated to providing information services to all Department of Public Libraries.

### ***Vision***

Public library activities expanded to the level of the Union, set up in each village library socially motivated programs, digital public library system, and all the people of the country have been taken to increase the reading and learning and cultural development of the country.

### ***Mission***

- Liberation War have enough books for children featuring a rich collection of books, organization, formatting, and distribution;
- services, such as expansionary Book reviews, book reading contest, keeping the dibasamuha, various competitions, thus acting as a cultural center;
- readers to reference and instructional services;
- The creation and development of all walks of life reading public;
- and government institutions to research and reference services;
- special services to the disabled;
- The readers of libraries for use in a variety of mutual pathasamagrira necessary and appropriate computer tathyabyabastha / database to be made;
- The benefits of information communication technology (Internet, e-mail, website) to be introduced to the readers;
- The introduction of digital library services.



- for the implementation of the Mission / implemented projects / programs are as follows:
  - i) district public libraries development (3rd stage); Project meyada July, from 005 in June, 01
  - ii) information and communication technology to implement government ganagranthagarasamuhe.
  - iii) on the national level from the college / madrassa students reading program aimed at increasing awareness.
  - iv) program to provide primary school library books.
  - v) of the basic knowledge and the creative initiative of the Directorate of Public Libraries of books titled bastabayana program review activities.

## **Shorter Reviewing of the following libraries are focusing a real scenario of those libraries at the digital age as follows:**

### ***Hon 'able Prime Minister Office's library (PMO).***

Hon' able Prime minister offices of Peoples Republic of Bangladesh, have a good library, To-day have 35000 books, all national daily news paper, many on-line journals are available of their library website , on-line library services are provided by the skill library professionals. There are working three staff members, top post is librarian another one is professional cataloguer, they have no promotional scope, gradually developing its collection.

### ***Ministry and division libraries in Bangladesh.***

In Bangladesh has had 45 ministries, this is the focal point of government administration, out of the 45 ministries, 20 ministries have library, which is mostly attached with the own management, duly the books, journals, periodicals, Atlas, Gazetteers, daily news papers, and grossed documents, methodology of library collection followed by PPR (purchase Procurement Rule) as per need of patrons and management. There are a short brief of those as follows.

#### ***a) Ministry of law Justice & P/A.***

The Ministry of law justice and Parliamentary Affairs, divided two Division, Justice Division another is Legislative and Parliamentary Division under the divisions have a library which controlled by Justice Division. Under the justice division have 68 session and district judge court and 68 chief metropolitan courts in Bangladesh, they have a library attached with the every court. Hence, the Ministry library was founded since 1947 with some books and journals, which is called ILR( Indian law report), CWN(Calcutta Weekly Note),AIR namely. It was received from the Calcutta writers building( which was called provincial secretariat)during the period of 1947 as well as quo sharer. To-day above 26500 books,6(six) daily,3000 bound books e.g. Gazettes, Annual collection and many grossed documents have preserved in the library, the libraries have 4 staff members top post is librarian but he has no promotion scope. Recently installed open source soft ware KOHA installed.

*b). Ministry of public Administration.*

Since 1948 have a good collection library in the Ministry of Public Administration which was Ministry of Establishment. This housed in Secretariat building dates back it was along with record room, now it has a separate entity. To-day 14 staff members and has have 54000+collections with 6 daily news papers. Under the Ministry have 68 District Commissioner office, attached with the office have a library but librarians are top most they have no promotional scope.

*c).Ministry of education*

From the very beginning of the Ministry of education functioning a library and have 20000 books and 4 newspapers. To-day 2 staff members in the library, librarian is a top executive but served in block post, a open source soft ware KOHA installed.

*d). Ministry of labour and employment*

Ministry of labour and employment have a library, basically they engaged in manpower export and skill development of human resources, Now a days have 25000 books and 6 daily news papers and have 3 staff members, librarians are direct recruited but no promotion scope. The library partially maintained by open soft warekoha.

*e). Ministry of Finance (ERD)*

Under the Ministry of fiancé have many division among one of its external resource Division(ERD) have a documentation centre and have 18000 books and treaties 2317 collections, and have journal, official grossed documents. To-day 4 staff members are in the documentation centre, a deputy director was direct recruited but no promotion scope till-date. They used CDS/ISIS soft ware in the documentation centre. Rest of the 10 libraries are working their ministries closely they handsome collection but no promotion scope according to the recruitment rule.

*f). Ministry of Agriculture*

Ministry of Agriculture have library, basically they engaged in Country wide agricultural development. and skill development of human resources, Now a days have 10000 books and 5 daily news papers and have 2 staff members, librarians are direct recruited but no promotion scope. The library partially maintained by the open soft warekoha.

*g). Ministry of health and family Planning:*

From the very beginning of the Ministry of health and family planning functioning attached with a library and have 15000 books and 3 newspapers some of them health relate journals. To-day 2 staff members in the library, librarian is a top executive but served in block post, and there is no software use in the library.

*h). Ministry of Land (Land appeal Board)*

Under the Ministry of Land have couple of board and division, Land appeal board among have one of them, have 10000 books and 22000 file collections, and have journal, official grossed documents. To-day 2 staff members are in the library. Librarian is direct recruited but he has no promotion scope till-date. They used traditional library methods, there is no any soft found in the library. Rest of the 12 libraries are working their ministries closely they handsome collection but no promotion scope according to the recruitment rule.

A survey of the government-attached departmental special libraries in Bangladesh 2014 Isolated some major problems facing those libraries are:

- Specified 20 Ministries have no uniform recruitment rule e.g.: no promotion scope in whole service.
- Extremely low budget allocations (Ministries) and out dated library materials and poor concentration from the management.
- Inadequate training opportunities for library staff and officer's.
- Lack of library automation and suitable soft ware uses of those libraries. (It depends on management).
- Lack of resource sharing system and proper networking buildings.

Since 2009s during the present government ruled, has been passed of "Right to Information Act2009, the main views of the act has determined to develop a knowledge based society in Bangladesh. in addition to the act has prevail and ensuring the of all information seekers demand( except state policy which restricted by act).In the other hand ICT act 2006 and National ICT policy2008has adopted the acts and policy uses as auxiliary force for ensuring the information to the peoples. it made marginal impact on reducing the cost, time and hassle for citizens in accessing government service, it made by the UNDP's technical support, under the PMO ( prime Minister office) in on going project a2i(Access to information)it is a powerful enabler for the nation socio-economic transformations.

The projects have taken many major tasks among the others: which might be a direct determine from the library and resource centres are urges the core jobs: In the 21<sup>st</sup> century no nation can prospect without involves of electronic tools and its proper infrasuctureal developments, Bangladesh is roaring but in the mean time world is becoming a digital planet its true we are in leg behind, almost every stat is running to become a knowledge based society by 2015. Bangladesh can't remain out of it; the state

Policy is made a digital Bangladesh with in 50 years independence celebration-of Bangladesh by up –coming vision 2021 which is declared by Hon' able Prime Minister Sheikh Hasina in her party manifestos, it is pledges to develop a digital Bangladesh.

The philosophy of digital Bangladesh comprises ensuring peoples democracy, digital library system, human rights, transparency, accountability and establishing justice and ensuring delivery of government (e.g. e-governance, e-banking and e-library system etc). During this period 3G is also established by government in this perspective we are firmly believed a digital library can properly help to build up a digital nation. Bangladesh went on line since 1996 so, private sectors (Private universities) are raised in way but departmental libraries are lag behind. We analyze a few barriers are as follows.

- a. Poor Tele columniation Infrastructure.
- b. Lack of IT based skill man power in the libraries.
- c. Inadequate promotion scope.
- d. Extremely low budget allocation.
- e. Lack proper job Training.
- f. Lack of a separate library cadre service.
- g. Lack of uniform recruitment rule.

## **Current status of library education and profession in Bangladesh**

At present there are 2 professional degrees are provided in the library profession. From The olds university is located at the capital city at Dhaka University, along with department of library and information science founded in 1959 with one year post graduate diploma course, since 1962 masters degree was introduced, in 1976 one year masters of Arts degree become a two years course, the school introduced a doctoral program in library science in 1979.in 1988, a three year Hon's course in instead information science and library management. The north west region of Bangladesh since 1992, Rajshai University nearer in Indian border started other library science program 4 years Hon's course, in the other hand out of 65 private universities, only 2 universities initiated 2 years masters degree, under national university of Bangladesh, offered one year post graduate diploma degree by 12 institutes. Two professional Association in Bangladesh to serve the professionals demands one of them Library Association of Bangladesh (LAB), Its members is above 3000, another one is Association of librarians and document list ( BALID), it has 500 members.

## **Finding of the study**

The article has been prepared based on the interview result of library professionals and various categories of users (office staff, patrons and users of the library) because the no significant official survey in the field conducted 26 library professionals engaged in different offices, and ministries of Bangladesh, major finding of article and focused on library professionals and its current scenario.

## **Recommendations**

Evident from the discussions that modern society making depends on its library developments, for almost their social cultural, political economic and legal activities too. It is universally true all kinds of knowledge preserved in library/documentation centre resource center for the next generation indeed. 21<sup>st</sup> centuries are digital information era world is changing rapidly from traditional library service and its procurement changes also. the finding from the surveys contemporary libraries are not only store house of printed books, and information only but they have also been transformed into information center/resource centers. It is over times, emergence of information's and communication technology (ICT) has significant role in the transformation, in the mean time users of modern society libraries in advanced countries of the world are transformation there library tasks. Bangladesh is now a middle income based country, hopefully it will be introduced under a2I Project (access to Information) which is through by present Government and it is a top priority project. Its to go a digital Bangladesh within in the vision 2021. Authors also strongly recommended that the government libraries will go to the same umbrella to serve the nation at the digital era.

The quality and quantity of a library collection have always been associated with the departmental prestige and ranking: A library collection should be viewed as an investment and worked out considering returns on investment. A library exists because of the benefits it makes possible. And benefits come essentially from building most appropriate collection developments. The best way is to match the collections development with the needs and interest of the users, so this is the high time to explore an IT based library and resource centers with all the government offices. Hopefully the present government have made a unique declaration to make a digital Bangladesh by 2021 it might be a huge development in library sector during the period. Therefore, library is an integral part of the society and its essential branch of knowledge management, so without uplifting of libraries never develop a society. To build up a fruitful libraries environment it should take the following measures.

- High speed data communication infrastructure set up for data transferring.
- Every department should have need to build up a digital Archives and e- library system.
- To improve the job training program among the library professionals.
- IT skilled manpower needed.
- To establish computer and internet connections.
- Uniform recruitment/service rule needed.
- A separated library cadre needed.
- Dissolution of block post methods from the library sector.
- Change the name of libraries and Librarian in the government sector which may substitute by” library and Archives/ Library and resource centre, post name should be change and considered.

## Conclusion

The role of a librarian in the departmental special libraries has need good environment and information at the digital age. It is very diverse as he/she displays skills and knowledge in providing library Service and materials that enable her/him to meet the changing information needs of the patrons, as well as need to logistics support from of the management. Therefore need to show his/her intellectual ability and skills, which is enable them accomplish key objectives that are aimed at contributing to the offices/departmental mission and vision. Survey result is very positive for developing said libraries and along with a-2i project, (Access 2 information) is a more significant to build up a digital Bangladesh before time framed. Many of the professionals are deemed to comprise the existing departmental library sector will be included the future plan. Though the libraries are an integral part of a Nation, so that it is pledges to develop a digital Bangladesh by the desired time framed.

## References

1. Muthysudha s, Digitization: a practical experience at the National Tuberculosis Institute Bangladesh Information studies,2005.( 2,11p.).
2. Ahmed, Nasiruddin.” Library Education and Training: Its Present position and pattern in Bangladesh. “International Information & library Review, 24,99p.
3. Huq, A.M Abdul” special Libraries in Bangladesh,1986:65 70p.
4. Bangladesh Bureau of statistic Report-2013.
5. Copy Right Act, Bangladesh-2013.
6. Right to information Act, Bangladesh-2009.
7. Islam, K.M Saiful,” Public library Systems and services in Great Britain and Bangladesh” Herald of library Science,190,164-73p.

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# Rejuvenate Library Service with Mobile Apps: Opportunities for Library Users

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## Abstract

With the advancement of ICT, the usage of mobile application has increased significantly which leads to change our life style mainly about the interaction with others and information seeking pattern. On the other hand, Library and Information Science Professionals start to incorporate such recent trends in the field of library and information centres with an idea "Libraries in Hand".

Till date, no too much usage of libraries mobile apps can be seen; even which mobile applications or apps are in use, most of them are inactive form. But the various recent surveys show us the tremendous growth of the usage of mobile application among people throughout the world, which leads to create new pressure among Library and Information Professionals. It is the demands of the era that Library and Information Professionals should incorporate such mobile application technology in their day to day services. To overcome the problem, Library and Information Professionals should establish the link between library apps technology with patrons requirements.

On this ground, an attempt is taken to understand the needs and recent development of library services with advance Library Mobile Apps. Further, this study will help us to understand the various issues and aspects of Library Mobile Apps. This, study also gives us an idea about how to create best Library Mobile Apps by considering various parameters such as appearance, usages, friendly looks and others important features for our libraryusers.

## Key words

Rejuvenate Library, Library Service, Apps Service, Mobile Apps.

## Introduction

With the changing and dynamic role of Information Communication Technology, the Library and Information Professional faces various challenges to become up to date with the challenges. Soon after introduction of mobile technology into the mankind, the prospective of people changes dynamically for getting the best services with user friendly or smart technology. Mobile App is an example of it. A mobile applications, is basically known as an app, is a type of application software which is designed to run on a mobile device, such as a smartphone or tablet computer. Mobile applications frequently serve to provide users with almost similar services to those accessed on computer. Apps are generally less in size, individual software units with multiple functions. From children to adults, we are now installing and finding information with the mobile app. According to an American monetization company report, people now spend two hours for using apps in a day. So, 86% of mobile user's time is spent using mobile apps. Thus, mobile apps are everywhere, and their number is increasing day by day.

At the same time, libraries also planning to develop mobile library apps for its users to provide the best service. The 2014 NMC Horizon Report (library edition) identifies mobile apps as an important development in technology for academic libraries. It also identifies as a key challenge the task of rethinking the role and skills of academic librarians. (1) In the higher education edition of the same report, the shift from students as consumers to students as creators is identified as a key trend. (2) Also in 2014, the American Library Association announced that it supports makerspaces in libraries. (3) The makerspace movement encompasses not only 3-D printing, but all kinds of content creation--everything from supporting local writers to offering digital media labs for creating multimedia content. Libraries are becoming more integrated into their communities by offering services like these.

## Why We Need Mobile App for Library?

One of the best ways to increase library activities, relevance and good remark from patrons is by developing a good and efficient mobile app. A mobile app is thus an ideal way to get patron's attention. Mobile apps not only allow libraries to connect with patrons but also feel patrons a refresh service. So, library mobile app is a benefit for both the librarians and the patrons. It can provide a wide array of library services to its users as shown below:

- **Access and View of Library Account:** Like other apps, using a mobile app within library, library users can check due dates, place a hold, renew a book, and even get alerts when books are due or hold become available.
- **Book Identification:** Library users also can locate and find branch location of book within shelves and its availability.
- **Browsing of Database:** It provides access to a variety of library resources and database. Thus, library users can enter any search terms and view results that are designed specifically for mobile viewing. This type of service includes OPAC service, Web-OPAC service, integrated search, and document search, etc.
- **Catalogue Search:** Library users can search the catalogue as they can through computer by author, title, publisher, subject, ISBN, or keyword. They can also view the book review, cover images, available copies and more.

- **Notification Alerts:** Library users get various kinds of alerts services on latest news, events, and notices via SMS or MMS wherever there is a events. They also have a provision to select the choice of types of service they need.
- **Reference service:** Library users can get reply of their inquiries that require brief responses, such as dictionary definitions, facts or service information by providing instant answers, with possible hyperlinks to articles/references in shortest time.
- **Referral service:** Library users also can get reply of their inquiries if document are not even available within the library by providing hyperlinks or reference of the link to articles/references for nearest library.

## Types of Mobile Apps

Mobile apps can be broadly categorised into three categories as discussed below:-

- NativeApp
- Web App
- HybridApp

**Native App:** Native applications refer to applications that are specifically written and developed for a specific mobile operating system. In order to create true, native applications, the Java programming language must be used for Android, the Objective C programming language for iOS, and the .NET framework for Windows Phone.

**Web App:** Web app refers to for mobile versions of websites. It runs by a browser and typically written in HTML5. Web apps became really popular when HTML5 came around and people realized that they can obtain native-like functionality in the browser. Social Media site face book web application example of such type of app.

**Hybrid App:** A hybrid web app is an application that is neither truly a mobile web app nor a native app. Hybrid apps are a way to expose content from existing Web sites in app format. It is basically an application written with the aforementioned web techniques of HTML5, JavaScript APIs, and CSS, but it runs inside a 3rd party native app container. Some of the well-known and used hybrid mobile frameworks are PhoneGap, Appcelerator, and Appspresso. (Mishra, 2017)

## Mobile Apps: Features

There are various kinds of Mobile Applications which are continually added to web day by day to provide best service. Marketers are also experimenting with their own app experiences process. It is also found that the investment of mobile application is around \$3 billion on app install advertising in 2015, an increase of 80% from 2014; which shows massive shift in consumer behavior. It's become very tough for apps developers and brand marketers to get people to find and download their apps successfully for long. As many as 25% of app users open an app once and never return back to it.

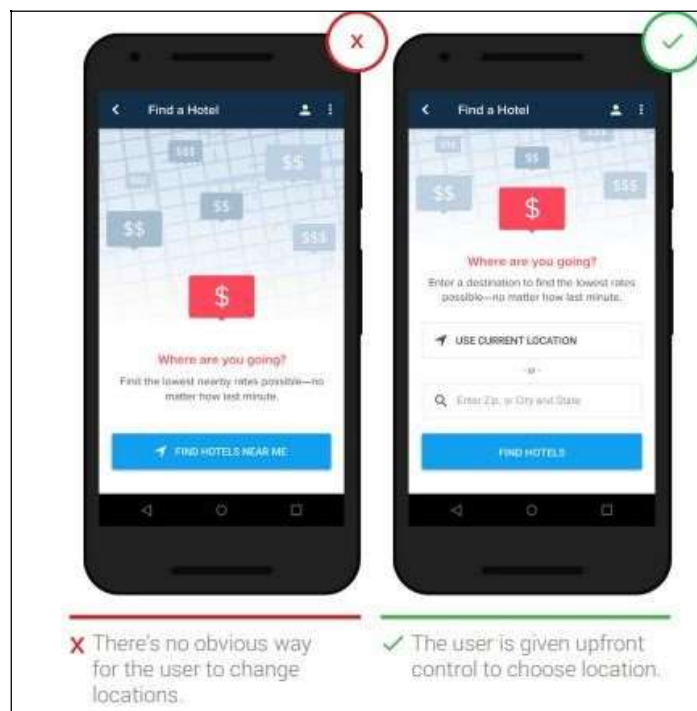
Jenny Gove, UX Research Lead, Google describe the various feature of Apps into six main categories such as app navigation and exploration, in-app search, commerce and conversions, registration, form entry, and usability and comprehension. Similarly we can incorporate the feature at Library Mobile Apps.

## Factors Incorporate before the Development of Library Apps:

We can reveal the points mentioned by Gove while explaining the categories and feature of Mobile Apps into Mobile Library Apps, as mentioned below:

**Show the value of app at upfront:** Engage library users by addressing tasks clearly, placing calls to action up front and center. Highlight app's key and new features in context at the appropriate place such as OPAC, Circulation, Events, etc. rather than by creating frustration and confusion on the firstpage.

**Organize and label Menu and Sub-Menu user-friendly:** Library users most of the time struggle to interpret menu and sub-menu as the library terms such as OPAC, Referral Tool, etc. are not commonly known to the users. So, Menu shouldbecategories such a way which should be clear from user's prospects with no overlapping.



(Source:<https://www.thinkwithgoogle.com/marketing-resources/experience-design/chapter-1-app-navigation-and-exploration/Page.7>)

- **By allowing to “Go back” easily:** Sometime, users want to go back one or more steps as they use the app. Apps should leverage back functionality so that users don't feel forced to have to start over from the home screen, which, in some cases, results in losing any unsaved data.
- **Auto-detection of location:** This is most vital feature for library apps. If we can create library apps such a way that it can locate the book items from shelves, this will solve the problem of accessing material in least possible time.
- **Friendly Access among mobile apps and web:** Library users sometime get confused or frustrated when an app and web of the same looks and feel differently in layout. It is also a good idea to make similar looks and layout as much as possible for both web and apps.

- **Prominently display the search field:** Library users mostly will look for specific search of an item. They often prefer to go for browsing. Apps that do not have a prominently placed search box at from beginning page can cause user frustration and slow the userdown.
- **Retrieval Result of Information:** It must be ensure that search results are useful. If possiblelibraryappsshouldprovidesearchdisplaywithartificialintelligence.Thesetools can reduce the likelihood of user errors. They will also help speed up the search process and keep users on-task toward conversion.
- **Easy Password Authentication Process:** Users most of the time get annoyed, when they have to go through an arduous or multi-step task to set up or reset a password. Reduce the risk of abandonment by simplifying the authentication experience during login.
- **Control the level of Zoom:** Users most of the time also wants to be able to control the level of zoom when they view an image or document. They can become frustrated if there is no perfect level of zoom. So, we must put users in control by allowing user to zoom in as theyprefer.

Moreover, A good User Interface is the key to an app's success. Steve Jobs famously said that the design is not just what it looks like or feels like, design is how it works” and we couldn't agree more. An app with a good design doesn't just mean an app that looks good but really, an app that delivers the results it promises in a smooth, seamless manner, guiding the user from one step to another with ease and reaching the destination, be it a sale, conversion, sign-up or download, without overwhelming the user.

## Examples of Some Library Mobile Apps:

**LibAnywhere:** LibAnywhere is a mobile library app that allows patrons to access library information such as catalogues, hours, branches, and events, and to contact reference librarians. It is available for mobile devices that run on the android phone. There is also a version compatible with any device that can access the internet.

**Redcube:** ReadCube is also a program on this scene. ReadCube users can search PubMed and Google Scholar from within the program itself. Users can take notes on their PDFs as they read, and can later search within their own annotations.

**Endnote:** EndNote is a subscription based reference management tool of Thomson Reuters. End note provide web based and desktop program to manage the citations.

**E-Resource Publisher App:** The application of mobile based app provide easy solutions for easy and full time access to e-resources. The use of e-resources in the academic world has become fashion of the day at the present technological era or information era. Library users easily can interact and download the full-text information as they needs in the electronic format.

**ScienceDirect:** The Elsevier contents ScienceDirect Mobile application SciVerse, ScienceDirect provide Apple; Android mobile application.

**ACS Journals:** The American Chemical Society launched the mobile based app called “ACS Mobile”. ACS Mobile used Apple; Android platform, the app provide full-text access when connected using internet.

Some other publisher like: Springer (Mobile app; Springerlink), Aggregator Ebsco (Mobile app; EbscoHost) provide the mobile based application to share the universe of knowledge

## Conclusion

Mobile Apps are the needs of the hour. Though there are various kinds of mobile library apps available for us; but it is yet to be popular. Mobile apps allow libraries to connect with users by feel user a refresh and new service. Thus, library and information Science must take the necessary steps to make apps more convenient for library users so that both the librarians and the users can be benefit from it. There is also need to proper marketing of the mobile apps service among the users community, library should take the proper steps in this regards.

## Reference

1. Glassman, N. R. (2012). The mobile medical library: Is there an app for that?. *Journal of Electronic Resources in Medical Libraries*, 9(2),147-154.
2. <https://www.apteligent.com/wp-content/uploads/2016/07/PRINCIPLES-MOBILE-APP-DESIGN-WP.pdf> (Accessed on 21/08/2019)
3. <https://www.inflibnet.ac.in/caliber2009/CaliberPDF/33.pdf> (Accessed on 21/08/2019)
4. <https://www.moveoapps.com/ultimate-guide-to-mobile-app-design-principles> (Accessed on 21/08/2019)
5. <https://www.thinkwithgoogle.com/marketing-resources/experience-design/principles-of-mobile-app-design-introduction/> (Accessed on 21/08/2019)
6. <https://www.thinkwithgoogle.com/marketing-resources/experience-design/chapter-1-app-navigation-and-exploration/> (Accessed on 21/08/2019)
7. Khare, Nidhi (2012). Libraries on Move: Library Mobile Applications. 7th International CALIBER-2009.272.
8. Zhu, W., Marquez, A., & Yoo, J. (2015). Engineering economics jeopardy! Mobile app for university students. *The Engineering Economist*, 60,291-306.

# **Application of mobile Augmented Reality (AR) in Libraries: A study of seminar library of DLIS, AMU ALIGARH**

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## **Abstract**

This study has undertaken the use of augmented reality in different areas of the library. There are so many sections in the libraries where the application of augmented reality has been used for providing better services to the users. Researcher choose the AR software “Aurasma” for the use of Augmented Reality after analyzing various software like Wikitude, Aurasma, Creative AR, Layar, iSkull, AR EdiBear, Stiktu, Shelv AR, Blippar and Augment 3D, concurrently the study has found that possible use of AR among the different areas within the library like video demonstration of RFID, virtual tour of the library, provide self list, publicity of material, book reviews, book trailers, library's directional map, assistance to user, assistance to staff and location of the collection.

## **Keywords**

Augmented reality, Aurasma, Mobile technology, Virtual reality,

## **Introduction**

Augmented reality (AR) is a relatively new technical concept. This was first mentioned in 1965 when Evan Sutherland developed such a technique that it was possible to overlay the virtual images on the real world (**Billinghurst& Kato, 2002**). It is a technique that supplements reality by superimposing virtual objects in it. Augmented reality is closely related to virtual reality, because the concept of Augmented Reality has evolved into the conversion of Virtual Reality. The purpose of Virtual Reality is to present an artificial world that the user can explore interactively. On the other hand, augmented reality supplements the real world with the content generated from the computer, instead of creating a completely virtual world (**Milgram et.al, 1995**). At this time, due to the increasing popularity of Augmented Reality, there are many

applications for Mobile Augmented Reality in the market. Mobile augmented reality applications represent a profound opportunity for increased access to print and digital library collections. AR applications can provide an attractive and interactive information experience. Overlays are suited for application as library engagement with graphical data as well as for real-world interaction with site content. These applications bring about a greater melding between the physical and digital environment. This interrelation is a desirable feature in our era because many library resources are present in the digital form and many libraries maintain large heritage print archives and provide access to both (**Hahn, 2012**).

The number of applications using Augmented Reality is increasing and results in many domains like health care, business, education and entertainment are clear. In libraries, many potential areas for using augmented reality with the help of AR software and mobile technologies (**Massis, 2015**). With the help of augmented reality, the user easily shows the virtual tour of the library, book reviews and shows book trailers in the video when the book is scanned by mobile. After the mobile device has scanned the special image for new users, the library's directional map is provided at the library's entrance. It provides images of different types of places within the library with more information and also provides the location of the collection. With the help of a mobile device, searching can be guided, refinement filters and results with arrows and notes on the computer screen can be provided. In the library, this technique provides assistance to the staff of the library in different areas (**Morris, 2001**). In the library, when the library staffs works on a computer in the technical or circulation section, then it can help at the time of cataloguing and borrower registration. It shows different areas that need to be completed. It has been designed as a quick check for employees to ensure that this is done accurately.

## Literature Review

Sungkur, Panchoo and Bhoyroo(2016)gives information about various potential areas of application of AR and ultimately offers an AR application that gives a completely different learning experience for the learners. Through this developed AR application, learners are able to see what is happening and experience a different form of learning, where the focus is on learning "learning by doing" and the ability to imagine the full set is on the steps involved for a particular operation. Karamanet. Al.(2016) discussed the design of the Android-based Augmented Reality app, in particular its performance is analyzed in terms of resource usage compared to similar applications. They discussed the related sales campaigns of traders on the screen within the close proximity of the user's location along with the application display, merchant and branch information of a Turkish bank. His study uses the developed application GPS, Compass, Gyroscope, Accelerometer sensor, and uses a precise tagging algorithm.

Huang et. al.(2016) offers an overview of self-regulated learning theory, which realizes the essential principles of self-regulated learning model in the library and has developed a learning system that uses the concept of combines mobile augmented reality (AR), indoor navigation and data mining algorithms. The proposed study system uses AR and innovative indoor positioning techniques to meet the target of navigation inside a library and solve problems of the local and



learning domain. The system developed in this study provides the means of learning on related virtual educational information services and screens, through the camera lens, looking at the actual scenes inside the library and guiding the public to learn self-regulated learning. Massis(2015) describes the background of libraries to consider the benefits of applying the use of virtual reality (VR) or augmented reality (AR) in libraries to support the teaching of information literacy. The researcher highlighted a detailed analysis of literature reviews and commentary on this topic, which has been addressed by professionals, researchers and practitioners. The results of the study show that VR and AR are not gimmicks; they are used by libraries to engage their audience, not only with the latest technology but also with the goal of ensuring a proper approach to information literacy.

Shatte, Holdsworth, and Lee(2014) have indicated in their experiments that Agent-based mobile augmented reality is a promising tool for context-aware library management. They investigated the effectiveness and usefulness of agent-based programming to provide context-sensitive information to mobile AR applications. It was acquired through the design and development of an app called Libagent. The last prototype was able to help in difficult sorting tasks, while searching books and providing reference-sensitive information about the missing books and books on loan. Alkhamisi and Monowar(2013) have provided a comprehensive study of AR in their letters, including history, architecture, applications, current challenges and future trends. They are considered to be a potential for augmented reality which has been for many years. Augmented reality is still in its initial stage; and thus the upcoming potential app is endless. Many AR products have been presented in many different types and spread throughout the world. The level of 3D location information completely creates new experiences in the world, and supports extensive trans-sessions of computing from desktop to mobile devices, as well as new related to new opportunities for access to information and learning.

Hahn(2012)suggests the use of mobile augmented reality applications in library settings to develop models of display prototype interface, where example museums and archives information science, computer science applied research, and computer vision research as well as original research and development Work has been taken from undergraduate Library at the University of Illinois. Studies have found that mobile augmented reality includes identity software to make physical book stack browsing, library navigation, optical character recognition, face recognition, and libraries experience. Carmignianiet. al.(2011) described some methodology that is being done by many and various research groups for the purpose of creating many augmented reality applications. It surveys the challenges of mobile augmented reality systems and requirements for successful mobile systems. To go from laboratories to the industry, each of these applications has to face augmented reality, as well as the future challenges that we can discuss in this paper.

## **Aims and Objectives of the study**

The present study is aimed at using AR technology in different services of the seminar library of Department of Library and Information Science, Aligarh Muslim University, Aligarh and is laid down by following objectives:

- (i) To use AR in cataloguing of the seminar library.

- (ii) To use AR in shelf arrangement of library material.
- (iii) To provide AR based book trailer/ book reviews.
- (iv) To provide virtual tour of the library throw video demonstration.
- (v) To provide location of collection using AR in the library.
- (vi) To provide directional map of the library.
- (vii) To provide screen based services to users through images and videos.

## Scope and Limitations of the study

There are so many sections in the libraries where the application of augmented reality has been used for providing better services to the users. Researcher choose the area for the use of Augmented Reality within the library like video demonstration of RFID, virtual tour of the library, provide self list, publicity of material, book reviews, book trailers, library's directional map, assistance to user, assistance to staff and location of the collection. Researcher choose a software, “Aurasma” from the number of AR software like Wikitude, Aurasma, Creative AR, Layar, iSkull, AR EdiBear, Stiktu, Shelv AR etc. The scope of the present study is limited to the use of AR software “Aurasma” for application of Augmented Reality in the Seminar Library of Department of Library and Information Science, Aligarh Muslim University, Aligarh.

## Methodology

After analyzing content on the select topic, through reviewing the literature available both print as well as online, the researcher has studied various software and gone through the review of about 10 software like Wikitude, Aurasma, Creative AR, Layar, iSkull, AR EdiBear, Stiktu, Shelv AR, Blippar and Augment 3D, concurrently the study has found that among the different software available ‘Aurasma’ is easy and user friendly. Also, Aurasma is a free app that can be downloaded on any iOS or Android device. The Aurasma app has been designed with a new experience to scan, create, and share augmented reality experiences. The app has more space to create auras and easy to use. Within app, there are some universal Auras created by company and are hosted in the app are accessible to anyone who downloads the app. Besides this, The present study selected the seminar library of Department of Library and Information Science, Aligarh Muslim University, Aligarh. Seminar Library have fulfil the requirement of present study because seminar library of the department is rich in collection consisting of 5594 books, 403 bound volumes of periodicals and about 9 current journals of national and international repute. The library has been automated with Alice for Windows since 2003, when it was designated as the first fully automated library of Aligarh Muslim University and ther infrastructural facilities include access to online public access catalogue (OPAC) and CD Rom dataases, Internet facilities for staff and students. Finally, AR software “Aurasma” was selected for the application of augmented reality in different areas e.g. cataloguing, shelf arrangement, library tour, book trailer, location of collection, directional map, and video demonstration etc. in the seminar library of Department of Library and Information Science, Aligarh Muslim University, Aligarh.

## Data Analysis and Interpretation

This study has undertaken the use of AR software “Aurasma” with its possible application of augmented reality in different areas of the library e.g. cataloguing, shelf arrangement, library tour and other services etc. Aurasma is a free app that can be downloaded on iOS or Android device. This is an easy-to-use AR platform. Upon downloading the application, the user creates the original content (which is called "auras") or from the library of pre-recorded content; Selects a specific, static image (called "target"); and then overlays the Aura for the goal, and when the user points to a device on the target and keeps it steady, the Aura center appears on the screen, thus a recording is presented to add the AR component in the image targeted by the original component. In the seminar library of DLIS, AMU Aligarh, the researcher has selected eight areas for the application of Augmented Reality with the help of Aurasma software. There are eight areas where the application of AR in seminar library of DLIS, AMU Aligarh has been taken into consideration and these are discussed as below:

### Video Demonstration

Through the video demonstration we can easily understand any topic. In Seminar library, the Investigator selected a book on RFID and downloaded a video from YouTube related to RFID process. After that the video was targeted on the cover page of the book. When we scan the cover page of the book then automatically the video starts about the RFID process.



Cover Page

Scan the cover page then the video starts like this.....



### Shelf list

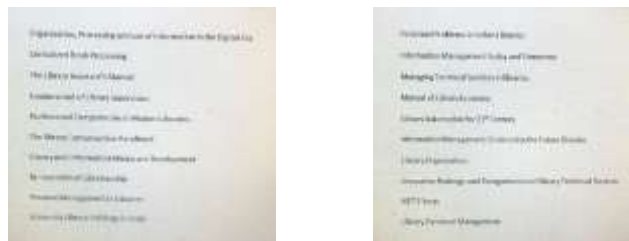
The shelf list is a bibliographic record organized by call number, that is, the entries are arranged in the same order as the materials on the shelves.

In the seminar library Investigator listed many books of Management and Information Technology from the shelf (Class no 022.30-025.04) and create the video through images of the listed books. After that, the video was set on the range of class no. given on the shelf. Whenever we scan the class no, an AR video of the whole list is being played.



Class no.

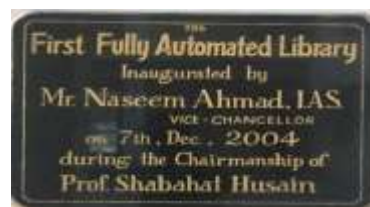
### Result in AR video form



### Virtual Tour of the Library

A virtual tour is a simulation of an existing location, which is usually composed of a sequence of videos or still images. It can also use other multimedia elements like sound effects, music, narrations and text. This is different from the use of live television to affect tele-tourism.

For the application of AR on virtual tour, the investigator took take images of the seminar library and arranged all images on a proper sequence. After this, a video of all the images was created and set on the foundation stone of the library so when we scan the foundation stone then the video of seminar library collection and other materials will start like the physical touring of the library.

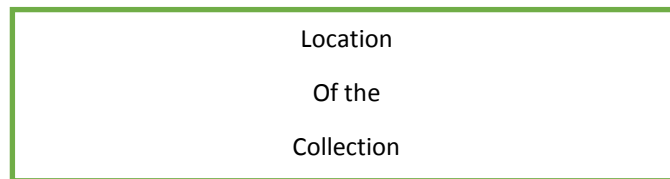


Foundation Stone

### Result in AR video form

#### Location of Collection

In the seminar library, the investigator collected the images of different types of collection within the library and created a video of those images. After that, a paper pasted behind the OPAC terminal written with “Location of Collection” and added the video on this paper through Aurasma application. When we scan that paper with Aurasma app the video shows the location of collection in the seminar library.



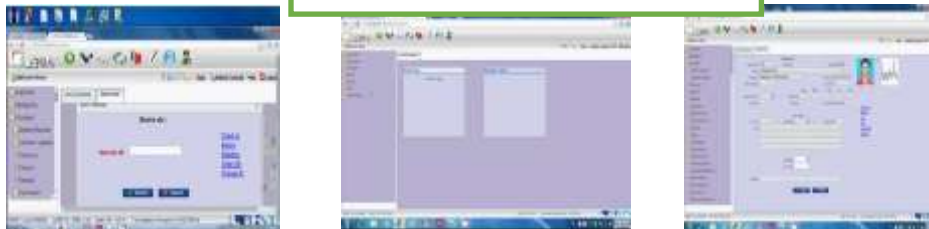
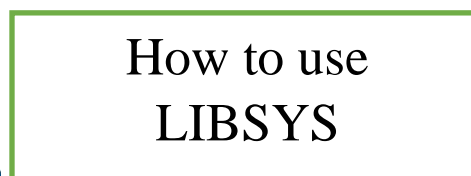
#### Pasted paper



### Result in AR video form

#### Staff Assistance

In the seminar library, the investigator has prepared a demo about how to use the LIBSYS software through video. A video was downloaded from YouTube related to “How to use LIBSYS” and the video was made to start from a paper inscribed with “HOE TO USE LIBSYS”.



### Result in AR video form

## **Cataloguing**

The present study applied the AR technique on books, journals and dissertations. The images of whole bibliographical details such as author, title, publisher and year etc. along with images of content page, first page of each chapter, bibliographies, index and first page of the article (if journals) in seminar library of DLIS, AMU, Aligarh. After that, videos of books, journals and dissertations were created and added on the spine of the books and on the cover page of journal and Dissertation with the help of AURASMA software. After scanning the spine or cover page of the document, a video of all the images starts playing and gives the details of the documents in their actual form.

## **Helps to User**

In the library, Augmented Reality can be used help to user in many ways through video demonstration, cataloguing, shelf arrangement, etc. but in this study a video demonstration has been used to provide help the user at the time of searching on web of science. The different videos were downloaded from the YouTube on web of science and added the videos on different type of images of web of science.

## **Publicity of latest materials**

Publicity of latest documents encourages the users for reading the newer documents. In the seminar library, the images of latest journals were collected and a video was created the video of those images. After that, added the video on the board of “New Arrivals” with the help of Aurasma. When the user scan as board of new arrivals then a video showing the cover pages of the new arrivals will start to show the newer documents.

## **Conclusion**

In modern times, the use of mobile technology has become very popular. In libraries, many potential areas have been dealt with through the application of software and mobile technologies, which are supported by augmented reality applications. Augmented reality should be viewed technically as a valid addition, which can be used by libraries to engage its audience, not only with the latest technology, but also aiming to ensure a proper approach to information literacy. Augmented Reality is a phenomenon that has been in various stages of development over the years, and it benefits those libraries who are expecting full rich services in the future. The present study applied the AR technique on books and journals in the seminar library. After applying AR technique, the study has found that whole bibliographical information and other detail can be accessed through video of images with the help of Aurasma software. Through the video demonstration, it is easy to understand any topic, the investigator has selected a book available on RFID and with the help of AR technology and the investigator demonstrated the practical aspects of RFID through a virtual video. With the help of Aurasma software, it can provide the information related to list of books and “Location of Collection” available in the seminar library with the help of AR technology. Augmented Reality provides help to staff of the library in

reducing the work and save the time. AR can be used in assistance to staff through video demonstration of the library functioning and software used in the library. Augmented Reality can also be used to help user in many ways through video demonstration, cataloguing, and shelf arrangement, etc. The users services can be provided through screen based services at the time of searching and also provide the list of new arrivals in library.

## References

1. Azuma, R. T. (1997). A survey of augmented reality. *Presence: Teleoperators & Virtual Environments*, 6(4), 355-385. Retrieved 06 May 2019 from <https://www.mitpressjournals.org/doi/pdf/10.1162/pres.1997.6.4.355>
2. Alkhamisi, A. O., & Monowar, M. M. (2013). Rise of augmented reality: Current and future application areas. *International journal of internet and distributed systems*, 1(04), 25. Retrieved 01 May 2019 from [http://file.scirp.org/pdf/IJIDS\\_2013112914255991.pdf](http://file.scirp.org/pdf/IJIDS_2013112914255991.pdf)
3. Billinghurst, M., & Kato, H. (2002). Collaborative augmented reality. *Communications of the ACM*, 45(7), 64-70. Retrieved 09 May 2019 from <https://blog.roziqbahtiar.com/wp-content/uploads/2013/09/2002-CACM-CollabAR.pdf>
4. Carmigniani, J., Furht, B., Anisetti, M., Ceravolo, P., Damiani, E., & Ivkovic, M. (2011). Augmented reality technologies, systems and applications. *Multimedia Tools and Applications*, 51(1), 341-377. Retrieved 01 May 2019 from [http://www.scirp.org/\(S\(351jmbntvnsjtlaadkposzje\)\)/reference/ReferencesPapers.aspx?ReferenceID=1019770](http://www.scirp.org/(S(351jmbntvnsjtlaadkposzje))/reference/ReferencesPapers.aspx?ReferenceID=1019770)
5. Hahn, J. (2012). Mobile augmented reality applications for library services. *New library world*, 113(9/10), 429-438. Retrieved 10 May 2019 from <http://www.emeraldinsight.com/doi/pdfplus/10.1108/03074801211273902>
6. Huang, T. C., Huang, T. C., Shu, Y., Shu, Y., Yeh, T. C., 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. Retrieved 02 May 2019 from <http://www.emeraldinsight.com/doi/pdfplus/10.1108/EL-08-2014-0148>
7. Karaman, A., Erisik, D., Incel, O. D., & Alptekin, G. I. (2016). Resource Usage Analysis of a Sensor-based Mobile Augmented Reality Application. *Procedia Computer Science*, 83, 300-304. Retrieved 03 May 2019 from <https://www.infona.pl/resource/bwmeta1.element.elsevier-882e3248-7523-3920-961c-b2f0ebb7ee84>
8. Kose, U., Koc, D., & Yucesoy, S. A. (2013). An augmented reality based mobile software to support learning experiences in computer science courses. *Procedia Computer Science*, 25, 370-374. Retrieved 02 May 2019 from <https://www.sciencedirect.com/science/article/pii/S1877050913012507>
9. Massis, B. (2015). Using virtual and augmented reality in the library. *New Library World*, 116(11/12), 796-799. Retrieved 03 May 2019 from <http://www.emeraldinsight.com/doi/pdfplus/10.1108/NLW-08-2015-0054>
10. Morris-Knowler, J. (2001). Selling the wow: Albert R. Mann Library's virtual tour. *New library world*, 102(3), 83-87. Retrieved 07 May 2019 from <http://www.emeraldinsight.com/doi/full/10.1108/03074800110383750>
11. Noh, Y. (2015). Imagining library 4.0: creating a model for future libraries. *The Journal of Academic Librarianship*, 41(6), 786-797. Retrieved 07 May 2019 from <http://www.sciencedirect.com/science/article/pii/S0099133315001780>

12. Shatte, A., Holdsworth, J., & Lee, I. (2014). Mobile augmented reality based context-aware library management system. *Expert systems with applications*, 41(5), 2174-2185. Retrieved 11 May 2019 from <http://www.sciencedirect.com/science/article/pii/S0957417413007471>
13. Sungkur, R. K., Panchoo, A., Panchoo, A., Bhoyroo, N. K., & Bhoyroo, N. K. (2016). Augmented reality, the future of contextual mobile learning. *Interactive Technology and Smart Education*, 13(2), 123-146. Retrieved 01 May 2019 from <http://www.emeraldinsight.com/doi/pdfplus/10.1108/ITSE-07-2015-0017>
14. Yuen, S., Yaoyuneyong, G., & Johnson, E. (2011). Augmented reality: An overview and five directions for AR in education. *Journal of Educational Technology Development and Exchange*, 4(1), 119-140. Retrieved 09 May 2019 from <http://austarlabs.com.au/wp-content/uploads/2014/01/AR-anoverview-five-directions-for-AR-in-ed.pdf>
15. Zverevich, V. (2012). Real and virtual segments of modern library space. *Library hi tech News*, 29(7), 5-7. Retrieved 11 May 2019 from <http://www.emeraldinsight.com/doi/full/10.1108/07419051211280027>



# Cloud Computing: Path Breaking Initiatives in Present Libraries

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## Abstract

*Cloud computing technology came up as a boon for libraries and is offering various opportunities for libraries to connect their services with clouds. Implementing cloud computing, libraries will significantly reduce cost, save energy, register a global outlook on the web optimize their services and expose library patrons to multi-variant Information resources. This study tries to provide understanding on the general relevance of cloud computing to libraries and how libraries can be transformed into smart institution. Cloud computing is a platform solution for management of all libraries Systems, including circulation, cataloging, acquisitions, serials, digital resources, internet service, thin client architecture, wireless access point, analytics for data in the system and digital librarian are considered as prerequisites for cloud computing deployment. Cloud computing initiatives for libraries such as OCLC WorldShare Management Services (WMS), Ex Libris, Polaris Integrated Library System, Dura Cloud, LibLime, the 3M Cloud Library App and "dark archive solution" CLOCKSS and PORTICO.*

## Keywords

Cloud computing, Digital Library, ICT, Information security, Cloud Librarian, cloud and its applications.

## Introduction

Cloud Computing is the stepping stone to Lancaster's forecasted 'Paperless Society'. The importance of cloud computing may occur due to the information explosion, problems in accessing the information, save the time of the users and staff, resource sharing problems, problems in library resources management, complex demand of users and attraction of users towards cutting edge technologies. The Librarianship is confronted with tough challenges in regard to constant change of technologies has made the role a library manager more practical and

pragmatic to the services which they offer to patrons on day to day basis (Liu et 2013; Grant 2013). The cloud computing gives an opportunity to use more than one service from more than one location and cloud environment we can use multiple resources from multiple location via multiple network for multiple users.

According to **NIST** “Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models”.

According to **Buyya** defined “Cloud computing is a parallel and distributed computing system consisting of a collection of inter-connected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on Service Level Agreements (SLA) established through negotiation between the service provider and consumers.”

According to **Kroski** “Cloud computing is a way to use off-site computer processing power to replace content creation and servers that were traditionally hosted onsite. It does not own the physical infrastructure rather they get it on rent from a third party provider. Simply, cloud computing is using web services for computing needs.”

### Objectives

- To define the concept of cloud computing.
- To discuss the main models of the cloud computing.
- To discover the library services that are clubbing with cloud computing technology.
- To investigate present situation of libraries in order to adopt cloud computing into their library services.

## Cloud Computing Models

Two models are working for the cloud computing a) Deployment Models b) Service Models.

### Cloud Deployment Models

- **Public Cloud Model:** The public cloud model allows systems and services to be easily accessible to general public. The whole cloud computing infrastructure is fully controlled by the third party providers. E.g. Google, Amazon, Microsoft offers cloud services via Internet.
- **Private Cloud Model:** The private cloud allows systems and services to be accessible within an organization. The private cloud is operated only within a single organization. But it may be managed internally or by third party. This cloud offers more security as it is implemented within the internal firewall.
- **Hybrid Cloud Model:** This cloud is a mixture of public and private model. On critical activities are performed using public clouds while the critical activities are performed using private cloud. The organization uses the public cloud services along with its own cloud to perform resource intensive applications.

- **Community Cloud Model:** This cloud allows system and services to be accessible by group of organizations. Third party or member organizations provider can hold the responsibility of managing the cloud. It shares the infrastructure between several organizations.

### **Cloud Service Model**

**SAAS:** Software as a Service (SAAS) is a cloud service providing remote access to software and its functions. SAAS is often referred to as software-on-demand and it can be termed as using it on rent rather than purchasing it. With traditional software applications, it is required to purchase the software package and install it on the computer before being able to use it. The software is used to store, back-up and transfer the data there is widespread usage of SAAS because there are usually no starting costs involved.

Examples of SAAS are: Google, Twitter, Facebook, Flickeretc.

Benefits:No additional hardware costs, pay for what you use, Automated Updates,Accessible from any location

**PAAS:** Platform-as-a-Service (PAAS) can be defined as a computing platform in which web application can be created quickly and easily without the need of purchasing and maintaining the software and infrastructure required for it. In this hardware, operating systems, storage and network capacity are hired over the Internet. In PAAS, the virtualized servers and associated services are rented by the customers to run the existing applications or to develop and test new applications.

Benefits:Don't have to invest in physical infrastructure, Teams in various locations canwork together, Security, Adaptability

**IAAS:**In Infrastructure as a Service (IAAS) cloud computing infrastructure servers, storage,network and operating systems are delivered as an on demand service. In IAAS, theequipment used to support operations, including storage, hardware, servers and networking components are outsourced by organizations. The equipment is owned by the service provider and the responsible for housing, running and maintaining it also lies withthe service provider. The client typically pays on a per-use basis.

**Benefits:** On-demand self-service, broad network access, Measured Service.

## **Application of cloud computing in Libraries**

- Cloud computing is completely a new technology and it is known as 3rd revolution after PC and Internet. Cloud computing is an enhancement of distributed computing, parallel computing, grid computing and distributed databases. Cloud computing services such as acquisitions, cataloguing, process system, digital contents and provision for inclusion of cutting edge technologies used in libraries and also support various standards such as MARC21, XML, Z39.50, and Unicode.
- **Building Digital Library/Repositories:** In the present situation, every library needs a digital library to make their resources, information and services at an efficient level to ensure access via the network. In connection to cloud based digital library software, DuraSpace is having

two software namely Dspace and Fedora Commons but Dspace is widely used for building digital libraries/repositories relative to Fedora Commons. Dura cloud provides complete solutions for developing digital libraries/ repositories with standard interfaces and open source codes for the both software.

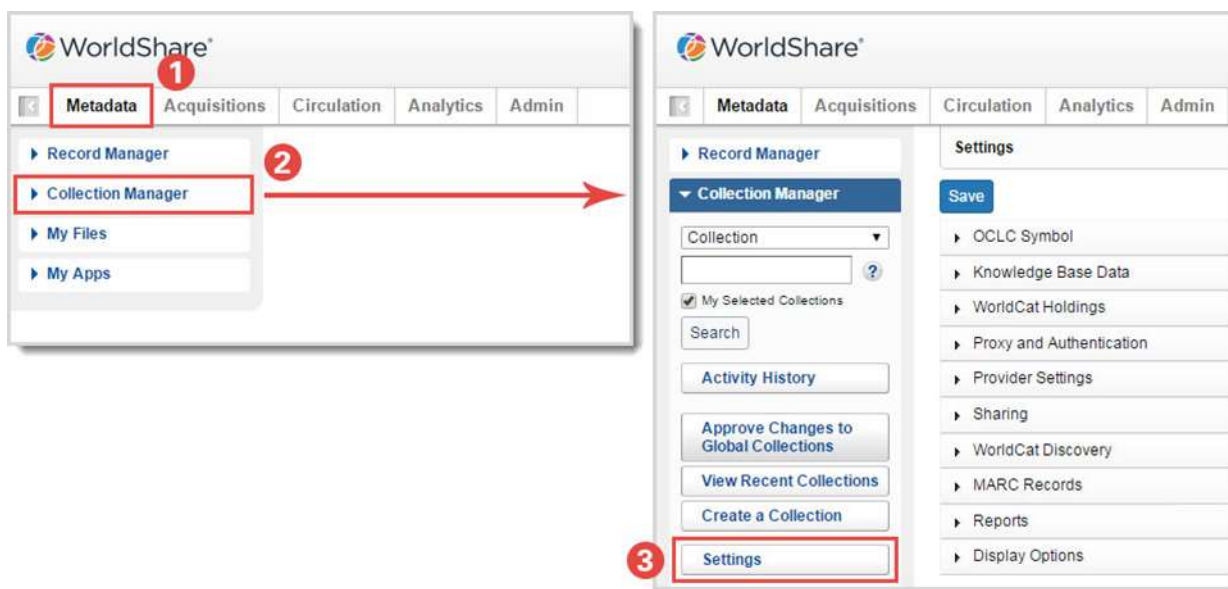
- **Searching Library Data:** OCLC is one of the best examples for making use of cloud computing for sharing libraries data for years together. For instance, OCLC WorldCat service is one of the popular service for searching library data now is available on the cloud. OCLC is offering various services pertain to circulation, cataloguing, acquisition and other library related services on cloud platform through the web share management system. Web share management system facilitates to develop an open and collaborative platform in which each library can share their resources, services, ideas and problems with the library community on the clouds.
- **Website Hosting:** Website hosting is one of the earliest adoptions of cloud computing as many organizations including libraries preferred to host their websites on third party service providers rather than hosting and maintaining their own servers Google Sites serves as an example of a service for hosting websites outside of the library's servers and allowing for multiple editors to access the site from varied locations.
- **Searching Scholarly Content:** Knimbus is cloud based research platform facilitates to discover and share the scholarly content. Knimbus stands for Knowledge Cloud which is dedicated to knowledge discovery and collaborative space for researchers and scholars. Knimbus is currently used in over 600 academic institutions and R&D labs by scholars, researchers and scientists as well as over 50,000 researchers. Knimbus is a collaborative platform for researchers to discover and share knowledge with peers and facilitates to find and access millions of journal articles, patents and eBooks, for the users tagging, sharing and discussing of these contents with their peers.
- **File Storage:** To access any files on the internet, cloud computing present number of services such as Flickr, Dropbox, Jungle Disk, Google Doc, Sky Drive and so on. These services virtually share the files on the web and provide access to anywhere and anytime without any special software and hardware. Therefore, libraries can get advantages of such cloud based services for various purposes. For instance, LOCKSS (Lots of Copies Keeps Stuff Safe), CLOCKSS (Controlled LOCKSS) and Portico tools are extensively used for digital preservation purpose by libraries and other organizations.
- **Building Community Power:** Cloud computing technology offers great opportunities for libraries to build networks among the library and information science professionals as well as other interested people including information seekers by using social networking tools. The most famous social networking services viz. Twitter and Facebook which play a key role in building community power. This cooperative effort of libraries will create time saving, efficiencies and wider recognition, cooperative intelligence for better decision making and provides the platform for innovation and sharing the intellectual conversations, ideas and knowledge.
- **Library Automation:** For library automation purpose, Polaris provides variant cloud based services such as acquisitions, cataloguing, process system, digital contents and provision for inclusion of cutting edge technologies used in libraries and also supports various standards such as MARC21, XML, Z39.50, Unicode and so on which directly related to library and information science area. Apart from this, nowadays many of the software vendors such as Ex-

Libris, OSS Labs are also offering this service on the cloud and third party services offering hosting of this service (SaaS approach) on the cloud to save libraries from investing in hardware for this purpose.

- **Union /Shared Catalogue/OPAC:** Network libraries can use same platform and give access to their collection on one platform. Through cloud computing creation of union catalogue becomes very easy.
- **Enterprise resource planning (ERP):** Use of Cloud in ERP comes into existence when the business of any organization grows. The work of managing applications, human resources, payroll etc becomes expensive and complex. To overcome it service providers can install ERP in the cloud itself.

## Initiatives adopting Cloud computing in Libraries

- **WorldShare Management Services (WMS):** WorldShare Management Services (WMS) an integrated suite of cloud-based library management applications of OCLC offer libraries cost savings, workflow efficiencies and the ability to deliver new value to users by sharing data and work across many member libraries. Traditional ILS systems often require costs to maintain servers and software and these costs are eliminated with WMS. WMS subscription includes serials management, course reserves, openURL resolver, A-Z list services, and WorldCat Discovery Services with available options for group views, remote database search and custom reporting.



Ref. Google image

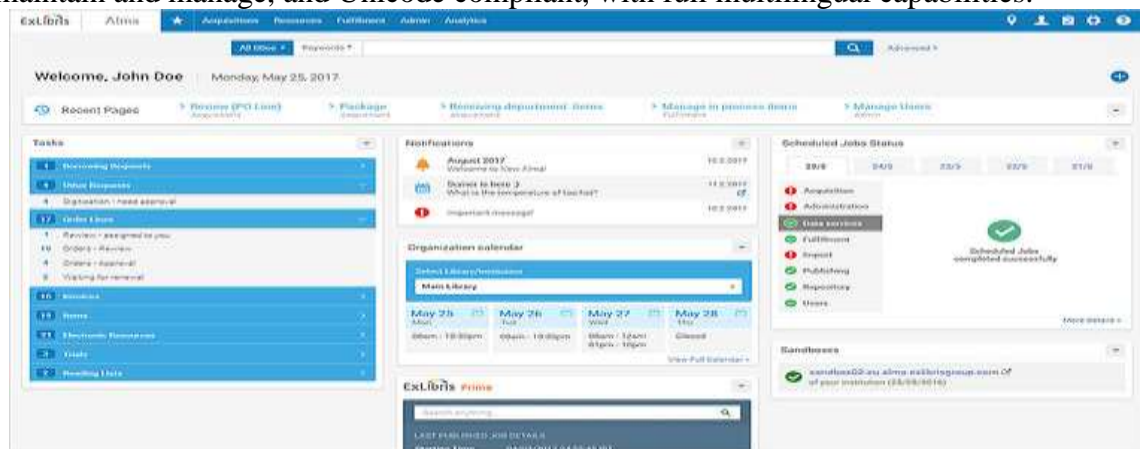
- **WorldCat:** WorldCat is the world's most comprehensive database of information about library collections. OCLC delivers quality, discoverability and value to members of the libraries. OCLC's team of expert catalogers and data quality specialists constantly enrich WorldCat records with new and corrected information to ensure that it contains the highest

quality records possible. By enabling libraries to share high quality library metadata and bibliographic records with each other, WorldCat has helped librarians dramatically reduce the time.



### Ref. screenshot of WorldCat

- **Ex Libris:**Ex Libris Group is a leading provider of library automation solutions, offering comprehensive product suite for the discovery, management and distribution of all materials print, electronic, and digital. Ex Libris caters to libraries of all type and size and to large consortia. It is built on open architecture and are flexible, customizable, easy to maintain and manage, and Unicode compliant, with full multilingual capabilities.



Ref. Google image

- **Polaris Integrated Library System:** The Polaris ILS built on a Microsoft SQL server database platform with documented APIs is open to connections with third-party vendors, with patrons and their social media, and with resources beyond the walls. Its integrated expanded functionality enables direct access to e-content, shared collections, and outside systems. One can integrate the system with seamless patron access to resources by utilizing INN-Reach or a consortium network; direct patron access to 3M Cloud Library,

Overdrive and Axis 360E content; and APIs that power direct connections to outside systems.



### Ref. Google Image

- **DuraCloud:** DuraCloud is an open source platform developed by DuraSpace which was released broadly as a service in 2011. It provides on-demand storage and services for digital content in the cloud for academic libraries, academic research centers, and other cultural heritage organizations. DuraCloud enables digital preservation, data access, transformation and data sharing. It helps to move copies of content of any shape or size into the cloud and store them with several different providers and offers compute services.



### Ref. screenshot of DuraCloud.

- **Bibliovation:** Bibliovation is a highly flexible Library Services Platform (LSP) offered as a SaaS solution. Bibliovation is highly customizable in order to support a variety of different library workflows. Users can select individual system components (i.e., Acquisitions, MARC21 Cataloguing Editor, Discovery Layer, Digital Content Management module, etc.), or the entire suite of services can be provided for a complete Library Services Platform. Bibliovation's Digital Content Management module delivers a digital document repository capable of ingesting scanned and 'born digital' documents making your electronic resources and digital collections visible to the world.





Ref. Screenshot of Bibliovation

- **LibLime:** LibLime, founded in 2005, owned by Progressive Technology Federal Systems, Inc.(PTFS) from 2010 , is a commercial entity providing implementation and development services around the open source Integrated library system Koha, which is generally considered to be the earliest. It is one of the most innovative technology platforms which bring new realities of open access, interoperability, rapid and flexible development.



Ref. screenshot of LibLime Koha page.

- **The 3M Cloud Library Application:** The 3M Cloud Library application is an innovative way to browse borrow and read popular fiction and non-fiction eBooks from local public library. Patron should have a valid library card to use the 3M Cloud Library App and the library needs to have a subscription to the 3M Cloud Library service. Users can use the 3M Cloud Library PC Software to transfer eBooks to their Nook Simple Touch, Kobo eReader, or Sony eReader. The 3M Cloud Library automatically syncs to all your devices that have the 3M Cloud Library App downloaded to them. The application has the ability to transfer content to a personal e-reader using either an existing Adobe ID or using the 3M Cloud Library ID.

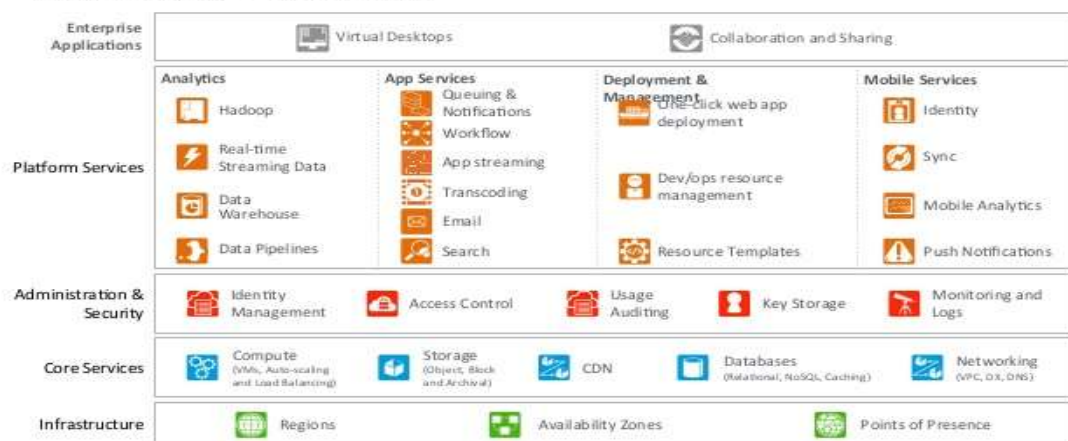




Ref. Google Image

- **Amazon Web Services (AWS):** Amazon is a major player of cloud computing. It offers a wide range of prominent services, for example, simple storage service (S3), elastic compute cloud (EC2), simple DB and simple queuing service (SQS). AWS provides a scalable and reliable low-cost platform of infrastructure in the cloud that powers hundreds of thousands of businesses in countries around the world. Some of the solutions offered by Amazon through cloud computing include application hosting, web hosting, backup and storage, enterprise IT, content delivery, and databases.

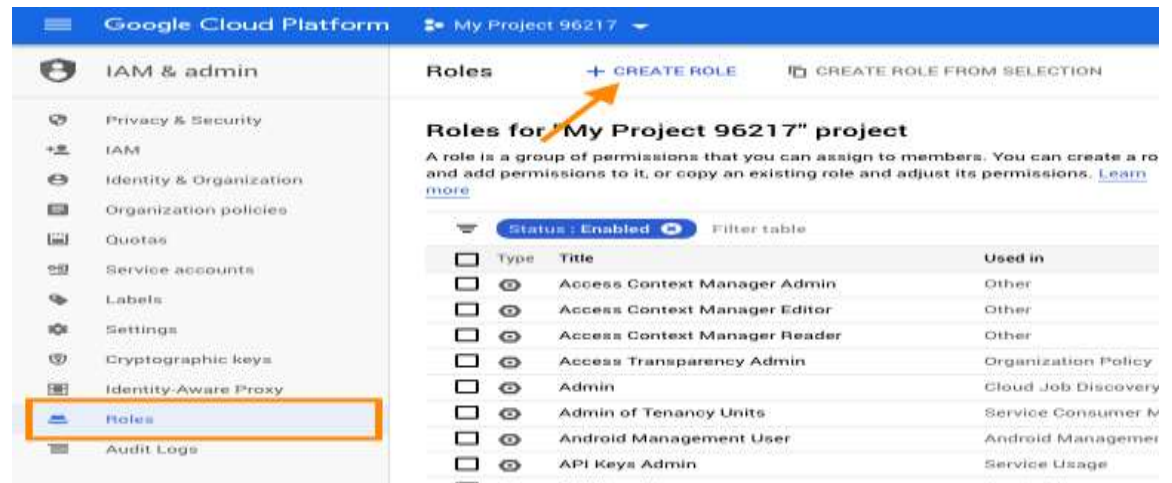
## The AWS Platform



Ref. Google Image

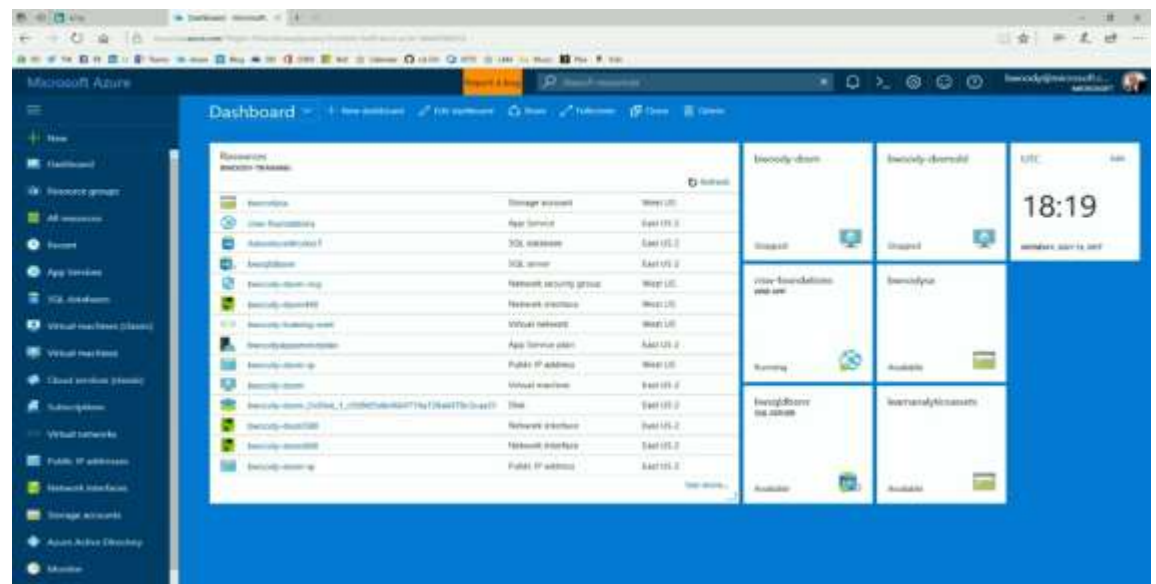
- **Google Apps:** Google Apps cloud services, a multi-tenant, internet scale infrastructure, offers faster access to innovation, superior reliability, and security, and maximum economies of scale as compared to on-premises, hosted and software plus services technologies. Google Apps is available free for individuals and organizations educational

institutions and US non-profitable organizations and for a price to businesses and organizations. Google apps offer Gmail which is now most preferred email service. It also provides Google Docs, Google Sites, Google video and other services. Google Apps helps organizations to move their e-mail services, web services and office applications.



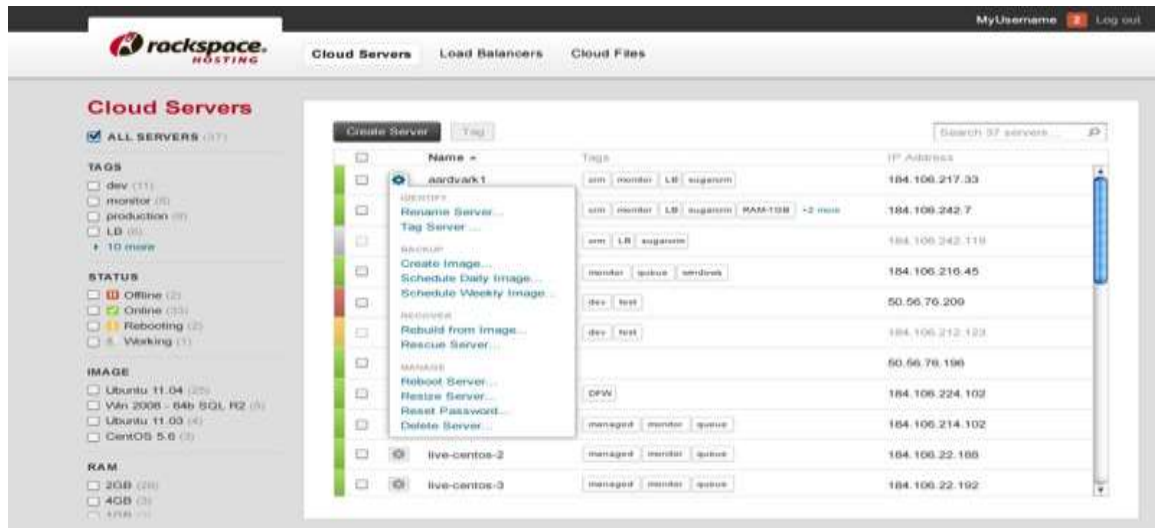
Ref. Google Image

- **Microsoft Windows Azure:** Microsoft Corporation has created its own cloud platform on 1st February 2010 which was named as Windows Azure before 25 March 2014. After this it is renamed as Microsoft Azure. Microsoft provides this service through its datacenters. In this platform, organizations can develop and run applications itself with unbounded scalability. Some of the scenarios offered by Windows Azure for businesses and organizations include SaaS, storage, computing, database management etc.



Ref. Screenshot of Microsoft azure

- **Rackspace Cloud:** This cloud platform offers three types of services for organizations and businesses viz. cloud servers, cloud files and load balancers. It offers free architecture assistance to its users with every account. Cloud servers are available to organizations in different sizes. It uses content delivery network (CDN) to globally deliver the stored media and files. Its third service Cloud balancer helps organizations to enhance their server capacities and to balance the load factor and this service is extended only on-demand.



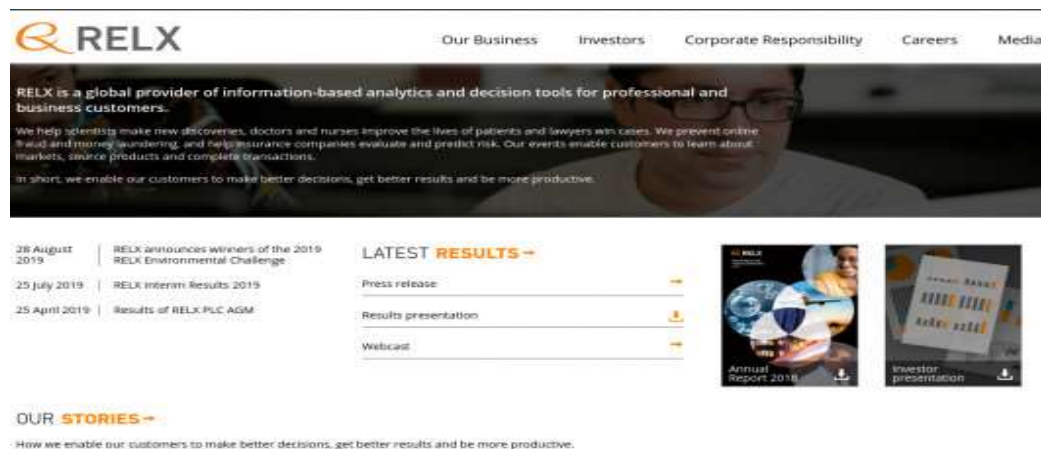
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- **OSS Labs :** OSS labs from India is using Amazon elastic cloud computing platform owing to the various capabilities of Amazon such as high durability of data, ISO standards based strong information security and flexibility. It is expected that the OSS labs will be able to provide robust open based solutions to demanding customers. OSS Labs offer hosting and maintenance services for Koha ILS and Dspace IR. OSS Labs use Amazon's cloud services. Library operations have become very cost effective and the library staff needs not to worry about maintenance of software etc.
- **LibraryThing:** It is one of the sites that combine aspects of social networking and cloud computing is LibraryThing, originated by Tim Spalding. LibraryThing offers services which are just like social networking site, authorizes people to contribute information and suggestion about books and allows them to interconnect globally to share interest.



Ref. Screenshot of LibraryThing

- **RELX:** RELX publishing company (plc) is a corporate group comprising companies that publish scientific, technical and medical material, and legal textbooks; provide decision-making tools; and organize exhibitions. It operates in 40 countries and serves customers in over 180 nations. It was previously known as Reed Elsevier, and came into being in 1992 as a result of the merger of Reed International, a British trade book and magazine publisher, and Elsevier, a Netherlands-based scientific publisher. Reed Elsevier is a service provider for scientific information working with hospitals to provide point in time information to medical technicians as they need the information.

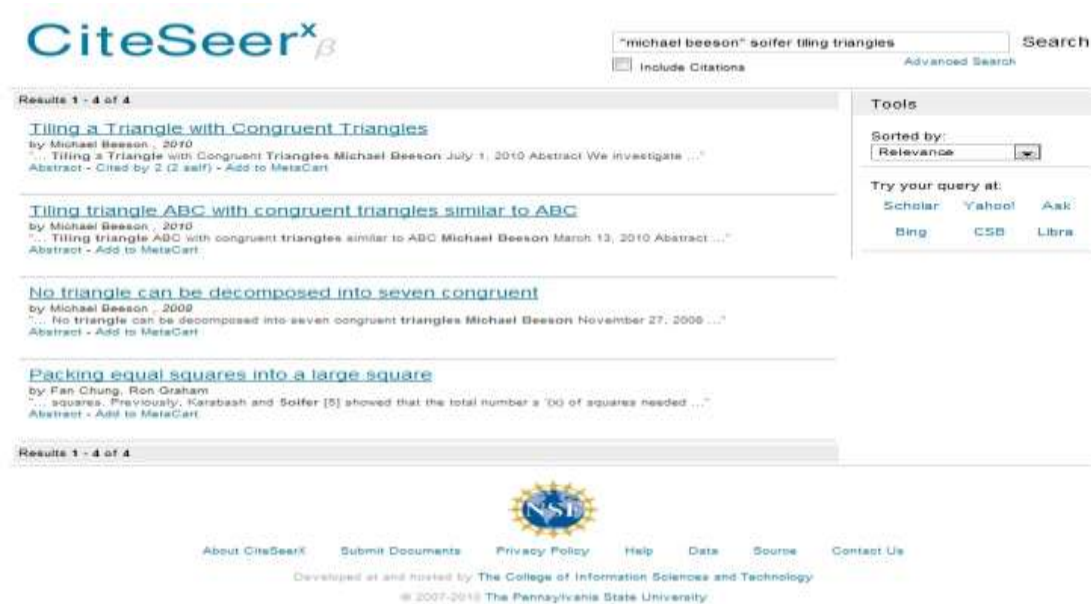


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- **Kindle and Mobile Me services:** In the electronic book arena Amazon is providing some reading services with “Kindle”. If one have wireless connection, can purchase and read a rapidly growing list of books and periodicals from the Kindle, no matter for the location. With this service largest text can be downloaded in seconds. Another like service is “Mobile Me” provided by Apple computing.



- **SeerSuite:** SeerSuite was developed as a result of extensive research and development with the goal of enabling efficient dissemination of scientific information and literature. SeerSuite refers to a collection of open source tools that provide the underlying application software for creating academic search engines and digital libraries such as CiteSeerX, etc.



Ref. Google Image

## Digital Archive Solutions: LOCKSS, CLOCKSS, and Portico

The LOCKSS (Lots of Copies Keep Stuff Safe) initiative was developed at Stanford University. The basic principle of LOCKSS is that content is continuously compared among servers at hundreds of member libraries and differences are corrected. The system regularly crawls target publication sites to verify content and add new material. Content is preserved in the format supplied by publisher. At LOCKSS libraries, requests for materials are sent to the publisher site, and if the content is not retrieved for any reason, the LOCKSS copy is provided. Publishers must agree to participate in the LOCKSS program.

CLOCKSS, or Controlled LOCKSS, is an offshoot of the LOCKSS program. Content is archived at publisher sites and a group of selected libraries. The LOCKSS software verifies and updates content within this small network of participants.

PORTICO emanated from the JSTOR project as its archiving program. The basic principle of Portico is to create an archive from publisher source files that have been converted to a standard format. Portico is a dark archive, allowing access only when content is no longer available because of a trigger event, such as a publisher ceasing operations or its delivery platform fails. The trigger event must result in a sustained loss of access.

## Case studies: Cloud Computing in India

**Institutional Repository:** Institutional Repository is the digital archive of the research output of our scientists. This knowledge base covers journal articles, conference papers, technical reports, presentation/lectures, preprints, Thesis, images etc. One can browse the documents by author, division, subject, date and document type. Both simple and advanced search facilities have been provided. Their scientists are welcome to submit their publications on their own by registering in IR. The registered members can access and upload their publications from anywhere outside the campus using the interface installed at ICAST.



Ref. Google Image

**Union Catalogue of Serials – CSIR & DST labs:** This is a tool to access Journals holdings information of CSIR & DST organizations for the purpose of resource sharing. The collection covers both print Electronic (Individual labs 'Online only' and those free with print) journals. Apart from this it also covers the NKRC (National Knowledge Resource Consortium) online titles of NAL only.



## Ref. Google Image

**EZproxy:** This is a tool for accessing the held e-resources at the centre to authenticated users from outside NAL-ICAST. This allows library patrons outside the 3 campus of NAL from any corner in the world. This tool allows to download the required documents like journals articles, conference papers, e-books, standards, patents, presentations, publications etc.



## Ref. Google image

## Conclusion

Libraries have to integrate and manage electronic, digital, and print resources; optimize workflows through shared data and collaborative services; and extend the range of library services to support rural masses regardless of location; as well as transmit resources within and outside their institutions in direct support of teaching, learning, and research goals of the nation.

On utilizing cloud computing to deliver library resources, services and expertise to users to their fullest satisfaction at their pace, libraries can be liberated from managing technology and can focus on collection building and other innovative services. With cloud computing, library services will have a new leap in future; and it will become more effective, user-centric, sophisticated and more professional.

## Reference

1. Nandkishor Gosavi, Seetal S. Shinde. (2012). Use of cloud Computing in library and information science field. *International Journal of Digital Library Services*, 2(3), 51-60. Retrieved from [www.ijodls.in](http://www.ijodls.in).
2. Fatemeh Nooshinfard, & Mahboubeh Ghorbani. (2014). Cloud computing in National Library and Archives of Iran: easiness, security and flexibility in distribution of knowledge for libraries, citizens and the society. In *IFLA 2014 LYON* (pp. 1-11).
3. Dillip K. Swain. (2014). Cloud computing and its application in library management. *E-Library Science Research Journal*, 2(4), 7-16. Retrieved from <https://www.researchgate.net/publication/298721580>

4. DudekulaDastagiri, & S. Praveen Kumar. (n.d.). Impact of Cloud Computing Applications in Academic Library and Library Services. *International Journal of Library and Information Studies*, 7(3), 225-236. Retrieved from <http://www.ijlis.org>
5. Richard ChukwhuOgbu, & Ahmed Lawal. (2013). Cloud Computing and Its Applications in e -Library Services: Nigeria in focus. *International Journal of Innovation, Management and Technology*, 4(5), 475-479.
6. Suman, &Parminder Singh. (2016). Cloud computing in Libraries: an overview. *International Journal of Digital Library Services*, 6(1), 121-127.
7. Anna Kaushik, & Ashok Kumar. (2013). Application of Cloud Computing in Libraries. *International Journal of Information Dissemination and Technology*, 3(4), 270-273.
8. Ibrahim Wada. (2018). Cloud computing implementation in libraries: A synergy for library services optimization. *International Journal of Library and Information Science*, 10(2), 17-27. Retrieved from <http://www.academicjournals.org/IJLIS>
9. Steven K. Bowers & Elliot J. Polak. (n.d.). The Future of Cloud-Based Library Systems. *Digital commons*, 43-55. Retrieved from <http://digitalcommons.wayne.edu/libsp/78>
10. Kasturi S. Mate. (2016). Use of Cloud Computing in Library Services. *International Journal of Engineering Science and Computing*, 6(5), 4693-4697.
11. MahipalDutt. (2015). Cloud Computing and Its Application In Libraries. *International Journal of Librarianship and Administration*, 6(1), 19-31.
12. Raghavendra, R., Indrani, V., & Poornima Narayana. (2017). Impact of Cloud Computing Technology for Library Services. 2017



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# **Publishing Behaviour of Scientific Elites: Comparative Study of Citation Laureates and Fields Medallists**

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## **Abstract**

For dissemination of research results to the wide audience it becomes pertinent to get them published. These publications form the foundation of knowledge dissemination, besides being important indicators for evaluation and assessment, fund allocation and position elevation (Abbott et al, 2010). Since every researcher contributes significantly in the execution of their research works and the data analysis, the work of only a few reaches the mark of recognition and rewards. These elites, with their research publications lay a substantial impact on the overall working of the research trends in their respective fields. In this milieu, current study makes an attempt to analyze and compare the publication trends and patterns of Citation Laureates (in the field of Mathematics) and Fields Medallists, to capture the overall trends of their publishing behaviour. The study endeavours to analyze the productivity, citation impact, h-index and collaboration pattern of publications of these two eminent scientist groups. The study reveals that citation laureates outperform in publication productivity, average citations and h-index than Fields Medallists and also collaborate more. Among the studied citation laureates Agarwal, R tops in publication productivity with 797 publications while Fields Medallists- Figalli, A and Avila, A, top with 121 publications, both. From the studied Citation laureates, 165.63 average citations for Zou, H and h-index of 60 for Ma Wen-Xiu were traced as the highest scores while the highest average citations and h-index among selected Fields Medallists were traced to be 54.84 and 28 for Villani, C, respectively.

## **Keywords**

Scientific elites; Citation Laureates; Field Medallists; Scientometrics; Research output; Citation impact; Publication pattern, collaboration.

## Introduction

Publications form the key agents of communication for authors. Besides, these allow scientists to gauge the reliability of their research findings, attain relative significance of their works and receive the response from the larger audience. Accordingly, publications fetch scientists' rewards, recognition, prestige, promotions etc. Research works get formal acceptance only after their production in the form of publications which get assessed, evaluated and acknowledged by the scientific community (**Biradar & Tadasad, 2015**).

The evaluation and assessment of scientists and their research works is performed in a number of ways and scientometric analysis is the most prevalent one. It is simply a quantitative assessment of science. The scientometrics, as defined by **Nalimov and Mulchenkov (1971)**, include "the quantitative methods of the research on the development of science as an informational process". It focuses to interrelate the intellectual levels of scientific research in order to provide connections among authors, institutions etc (**Kalaiappan, Kaliyaperumal & Rajasekar, 2010**). Scientometrics applies various indicators for assessments, which include- quantity indicators (determining productivity), quality indicators (determining impact) and structure indicators (ascertaining collaborations) (**Durieux & Gevenois, 2010**). Thus individual research works are assessed on the basis of productivity i.e., number of publications; scientific impact i.e., number of citations etc.

Examining and assessing the research output of elite scientists in any field presents a picture of the current trends and functioning of the field to the scientific community as well as to the science policy makers. Therefore, present study is an endeavour to analyze and assess the publications of citation laureates in the field of mathematics and Fields Medallists- the two eminent scientist groups. Fields Medal is a prize conferred, since 1950, to a maximum of four mathematicians, up to the age of 40, at International Congress of Mathematicians for the recognition of outstanding mathematicians with an aim to inspire future achievements and to discover the potential for future research directions (**Fields Medal, 2019**) and is regarded as the highest honour in the field of mathematics. Therefore, examining publications of citation laureates, also considered as prestigious scientists in their respective fields, in relation to those of Fields Medallists besides presenting a broad view of their publication trends would reveal their contribution and influence among scientific community.

## Literature review

Various studies pertaining to individual research assessments and evaluations have been conducted ranging from single researcher evaluations to groups of scientists.

**Kumar, Ruhela and Kumar (2018)** conducted scientometric analysis of Nobel Laureate Jaffrey C Hall- an American geneticist, for which data comprised 201 publications spanning over 1972-2008. The study found 200 total publications for the said scientist with 18896 citations. The collaboration coefficient was traced to be 0.89 with 22 single authored publications. Similarly, **Parvathamma, Baun and Kauser (2013)** conducted bibliometric analysis on Atul H. Chokshi

for which data analyzed comprised 76 research articles and 34 conference papers. The publications were found to have received 2820 citations which made him figure among the top 100 citation laureates in materials science.

**Kademani, Kalyane, Kumar, and Mohan (2005)** studied the publication productivity and collaboration pattern of eight Nobel Laureates revealed that Nobel Laureates mostly prefer collaborations in their research works. Similarly, **Mazlowmian, Eom, Helbing, Lozano and Fortunato (2011)** assessed the publications of 124 Nobel laureates, for evaluation of citation data, for the time period 1990-2009. The study found prize-winning having a positive impact on the citation count of the laureates publications produced before winning the prize. **Borjas and Doran (2013)** compared the productivity of Fields Medallists with that of matched sample of non-winners and found similar publication productivity for both the groups till the award year with decline in productivity of winners after the prize reception. **Egghe, Guns and Rousseau (2011)** conducted a study on uncited works of Nobel Laureates and Fields Medallists for which the data comprised of 18 Fields Medallists between 1990 and 2006, 16 and 15 Nobel Laureates in Physics and Chemistry, respectively, for time period 2004 to 2010 and 26 Medicine Nobel Laureates for 1999 to 2010. The study revealed that both the scientist groups possess large number of publications uncited and further found h-index positively correlated with the number of uncited publications. **Vanclay (2012)** undertook a study to assess the publication pattern of forest scientists for which 79 scientists having received various prizes in the field were studied for the time period 1990-2010 and found a significant research performance of the scientists for the decade before and after receiving the award. Accordingly, **Wagner, Horlings, Whetsell, Mattsson and Nordqvist (2015)** examined the publications of Nobel Laureates in Physiology and Medicine to assess and compare their publication productivity and extent of collaboration with a matched sample of non-award winning scientist group. The study reveals that Nobel Laureates produce less publication with higher citation impacts and possess more of the solo publications during both pre and post award-winning. **Ma and Uzzi (2018)** in their study to understand the relation of prizes and scientists with the knowledge extension and field expansion, collected data pertaining to 3000 scientific prizes from multiple fields and assessed 10,455 prize winners from all over the world for time period of over 100 years. The study reveals that prizes, despite having considerable increase in number, are being awarded to significantly small groups of elite scientists and as such these small groups extend the science. **Prpic (2000)** under took an empirical study on a sample of 840 young Croatian scientists to gauge their publication productivity. The findings reveal that the present day young scientists are more productive than those of nineties. These scientists were found to comprise of less number of highly-productive scientists- producing almost half of the publication productivity and majority of low productive scientists.

Thus, these studies confirm the increasing interest of researchers in evaluating and assessing the individual research works of elite scientists, thus, benefiting the wider scientific community and field as a whole.

## Problem

Research leads to the production of knowledge and this knowledge very often takes the form of scientific publications for its effective dissemination and utilization and publications make acknowledgements of research works possible. Such publications of elite scientists get the key consideration from every scientist. Analysing the patterns of these publications would reveal the extent of engagement of these eminent scientists with their respective fields and would bring to fore different features and dimensions of their publications that would serve as the general guidelines for the rest for improving their work, since, accomplishments of prestigious and outstanding scientists are taken as benchmarks and yardsticks to measure one's own successes and achievements (**Hermanowicz, 2005**). Therefore, the current study attempts to analyze the publication trends and characteristics of citation laureates in the field of mathematics and Fields Medallists, both the eminent scientist groups in the field of mathematics. The study, further, endeavours to compare the two groups for effective elucidation of the publication characteristics of the different groups of scientists within the same discipline.

## Scope

The scientific publications of the Field Medallists, for the years 2010, 2014 and 2018, and of the selected citation laureates from the field of mathematics, for the years 2015, 2016, 2017 and 2018 have been analyzed. The publications of the two scientist groups have been harvested from the database- Web of Science (WoS) and gauged using scientometric indicators of quantity (productivity), quality (citations) and Structure (collaboration).

## Objectives

The aim of the present study is to demonstrate the pattern and extent of publication activity of the Fields Medallists and citation laureates in the field of mathematics for which the objectives set are as:

- To assess the publication productivity of the Fields Medallists and citation laureates in the field of mathematics.
- To assess the citation impact of the two scientist groups.
- To gauge the degree of collaboration in the research works of the two scientists groups.
- To compare the publication performance of the two groups based on the above indicators.

## Methodology

The data for the study, which include publication details of the Fields Medallists and citation laureates in the field of mathematics, were harvested from the citation database- WoS on 15 July 2019. The data retrieval involved following steps:

*Phase 1*

The official web-site of Clarivate analytics- a global, information-driven company which provides subscription based services that aid in multiple sectors including scientific and academic research, was explored. From its 'products' section, given at the top of the web-site, that lists all its services and products, 'Essential Science Indicators' category was selected. From the web-page of Essential Science Indicators, 'highly cited researchers' option was browsed. Furthermore, from the 'resources' category located on the 'Highly Cited Researchers' page, 'Archived HCR Lists' was browsed and from there Web of Science highly cited researchers lists, given year wise, were downloaded in excel file format, individually, for years 2015, 2016, 2017 and 2018.

*Phase 2*

From each downloaded list, three citation laureates, from each of the four years, constituting total of twelve citation laureates, from the Mathematics field section were selected. Moreover, from the official web-site of International Mathematical Union (IMU), Fields Medallists, listed chronologically, were selected for years 2010, 2014 and 2018, which also collectively constitute total of twelve scientists. It is to mention here that Field Medals is awarded after every four years.

*Phase 3*

The names of both the scientist groups were run in the author search feature of the WoS database. The results retrieved were refined for article types only up to year 2018. Accordingly, citation reports were generated, individually, for each author using the 'Create Citation Report' feature of the database and the results retrieved were downloaded and saved to excel file, individually for each scientist, using the 'Export Data' option of the database. Finally, the details pertaining to publications like citations, collaborations etc were analyzed and interpreted in accordance with the set objectives of the study.

## Results and Discussion

### Publication productivity

The data, as presented in table 1., reveals that majority of the studied citation laureates have published more than hundred papers with Agarwal, R having the highest (797) publication count and Levina, E the least number (39) of publications.

For field medallists, almost all investigated by the study have less than hundred publications with exception of two scientists – Figalli, A and Avila, A, having 121 publications, each. Chau, NB was found to have the least productivity with only 4 publications.

Thus, it becomes clear that citation laureates in the field of mathematics are more prolific authors than the elite group of Field Medallists.

**Table 1** .Publication productivity of Citation Laureates and Field Medallists.

Citation Laureates	Total Publications	Field Medallists	Total Publications
Anh, V	221	Birkar, C	21
Ayoli, H	106	Figalli, A	121
Ma Wen-Xiu	260	Scholze, P	18
Agarwal, R	797	Venkatesh, A	35
Liu, F	179	Avila, A	121
Yau, H	56	Bhargava, M	31
Altum, I	96	Hairer, M	73
Levina, E	39	Mirzakhani, M	14
Zhou, DX	124	Lindenstrauss, E	44
Abbas, M	203	Chau, NB	4
Liao, S	118	Smirnov, S	27
Zou, H	63	Villani, C	57

## Citation impact and h-index

Among the citation laureates under study, Zou, H has the highest (165.63) average citation score per publication followed by Liao, S having 68.47 and Levina, E having 65.33 average citations, while the highest average citation impact for the selected Field Medallists has been traced for Villani, C (54.84) followed by Smirnov, S (43.93). Citation laureates Zou, H and Levina, E despite having low publication productivity have highest citation impact. Abbas, M has the least (12.24) average citation score among the citation laureates while among Field Medallists, citation impact scores least (6.25) for Chau, NB.

As for the h-index is concerned, among citation laureates Ma Wen-Xiu has the highest (60) score followed by Lia, S having h-index of 44. Levina, E despite having high average citation rate has the least h-index score while among the studied Field Medallists, the h-index scores highest at 28 for Villani, C followed by 23 for Figalli, A and Avila, A, each, as illustrated in the table 2. Thus, among the two scientist groups citation laureates greatly out-score in both the indicators i.e., citation impact and h-index with some Field Medallists having single digit h-index score.



**Table 2.** Average citations and h-index scores for Citation Laureates and Field Medallists

Citation Laureates	Average citations	h-index	Field Medallists	Average Citations	h-index
Anh, V	26.53	37	Birkar, C	24.81	8
Ayoli, H	18.77	23	Figalli, A	13.87	23
MaWen-Xiu	39.93	60	Scholze, P	11.11	7
Agarwal, R	13.85	49	Venkatesh, A	13.49	13
Liu, F	36.07	42	Avila, A	15.75	23
Yau, H	42.75	29	Bhargava, M	13.1	11
Altum, I	14.31	17	Hairer, M	23.16	23
Levina, E	65.33	18	Mirzakhani, M	22.43	8
Zhou, DX	23.94	28	Lindenstrauss, E	20.16	15
Abbas, M	12.24	24	Chau, NB	6.25	2
Liao, S	68.47	44	Smirnov, S	43.93	15
Zou, H	165.63	24	Villani, C	54.84	28

## Degree of Collaboration (DC)

The degree of collaboration is the ratio of the number of collaborative research papers to the total number of research papers during a certain period of time. Table 3 presents the lucid picture of the data pertaining to degree of collaboration. Citation laureates mostly show the highest collaboration trends. The DC was found maximum for Liu, F and Levina, E i.e., 1 for each, which means having no single author publication, followed by Anh, V, Agarwal, R and Abbas, M having 0.99, each, while for Field Medallists the DC is found to score highest at 0.89 for Figalli, A followed by 0.88 for Avila, A. Liao, S has the least DC with 0.61 among the investigated citation laureates while Chau, NB shows the least (0.5) DC Majority of the field medallists prefer collaboration to a great extent with some displaying moderate collaboration trend. The DC is found to score highest at 0.89 for Figalli,A followed by 0.88 for Avila, A. Thus, citation laureates are found to collaborate much higher than Field Medallists, though, Field Medallists also show conspicuous DC.

**Table 3.** Degree of Collaboration for Citation Laureates and Field Medallists

Citation Laureates	DC	Field Medallists	DC
Anh, V	0.99	Birkar, C	0.43
Ayoli, H	0.95	Figalli, A	0.89
Ma Wen-Xiu	0.78	Scholze, P	0.55
Agarwal, R	0.99	Venkatesh, A	0.86
Liu, F	1	Avila, A	0.88
Yau, H	0.95	Bhargava, M	0.71
Altum, I	0.93	Hairer, M	0.86
Levina, E	1	Mirzakhani, M	0.57
Zhou, DX	0.77	Lindenstrauss, E	0.77
Abbas, M	0.99	Chau, NB	0.5
Liao, S	0.61	Smirnov, S	0.85
Zou, H	0.94	Villani, C	0.74

## Conclusion

Recognition of scientists in the form of credits and awards forms the basis to motivate and encourage scientists. Scientists get recognition from the scientific community only after publicizing their research works and findings in the form of publications. The current examination of the publications of the two elite scientist groups displays the overall functioning pattern in the field of mathematics. High productivity, though, is found to be a characteristic of citation laureates, Field Medallists, the outstanding scientists, publish less. Besides, the significant citation impact to the publications of citation laureates as compared to those of Fields Medallists may be, to some degree, due to their higher collaborations as elucidated from their publications. Since, citations are generally regarded as a proxy of quality, therefore, more importantly, it may also signify the lacuna in awarding Fields Medal to a few scientists while missing or snubbing others of the equal or more worth, which the study could not discern properly due to the age limit of the award up to 40 years only. Since, the role of award system in the present day science, which is highly collaborative, is being discussed, the current study is a small initiative in the area.

## References

1. Abbott, A., Cyranoski, D., Jones, N., Maher, B., Schiermeier, Q. & Noorden, R. V. (2010). Do metrics matter? *Nature*, 465(7300). Retrieved from: <https://www.nature.com/news/2010/100616/pdf/465860a.pdf>
2. Biradar, N., and Tadasad, P. G. (2015). Authorship Patterns and Collaborative Research in Economics. *Journal of indian library association*, 51(4), 21–29.
3. Borjas, G & Doran, K. (2013). Prizes and Productivity: How Winning the Fields Medal Affects Scientific Output.
4. Durieux, V., & Gevenois, P. A. (2010). Bibliometric Indicators: Quality Measurements of Scientific Publication. *Radiology*, 255(2). Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/20413749>
5. Egghe, L., Guns, R. & Rousseau, R. (2011). Thoughts on Uncitedness: Nobel Laureates and Fields Medallists as Case Studies. *Journal of the american society for information science and technology*, 62(8), 1637–1644. DOI: 10.1002/asi.21557
6. Fields Medal. (2019). Retrieved from: <https://www.mathunion.org/imu-awards/fields-medal>
7. Hermanowicz, J. (2005). Classifying universities and their departments: A social world perspective. *Journal of Higher Education*, 61(1), 26–55. Doi: 10.1353/jhe.2005.0005.
8. Kademani, B. S., Kalyane, V. L., Kumar, V., & Mohan, L. (2005). Nobel laureates: their publication productivity, collaboration and authorship status. *Scientometrics*, 62(2), 261–8.
9. Kalaiappan, V., Kaliyaperumal, K., & Rajasekar, V. (2010). Scientometric Analysis of Literature Output of Prof. G.N. Ramachandran in the Subjects of Biophysics and Crystallography. *DESIDOC Journal of Library & Information Technology*, 30(6), 3–11.
10. Kumar, M., Arun Ruhela, A., & Kumar, S. (2018). Nobel Laureate Jeffrey C Hall: A Scientometric Portrait. *Library Philosophy and Practice (e-journal)*.
11. Ma, Y., & Uzzi, B. (2018). Scientific prize network predicts who pushes the boundaries of science. doi/10.1073/pnas.1800485115
12. Mazlounian, A., Eom, Y. H., Helbing, D., Lozano, S., & Fortunato, S. (2011). How citation boosts promote scientific paradigm shifts and nobel prizes. *PLoS ONE*, 6(5).
13. Nalimov, V. and Mulchenko, B. (1971). “Measurement of Science: Study of the Development of Science as an Information Process”. Washington DC: Foreign Technology Division
14. Parvathamma, N., Banu, N., & Kauser, S. (2013). Research contribution of Prof. Atul H. Chokshi to materials science: a scientometric study. *DESIDOC J. Lib. Inf. Technol.*, 33(5), 378–384.
15. Prpic, K. (2000). The publication productivity of young scientists: An empirical study. *Scientometrics*, 49(3), 453–490.
16. Vanclay, J. K. (2012). Publication patterns of award-winning forest scientists and implications for the Australian ERA journal ranking. *J Informetr*, 6(1), 19–26.
17. Wagner, C. S., Horlings, E., Whetsell, T. A., Mattsson, P., & Nordqvist, K. (2015). Do Nobel Laureates create prizewinning networks? An analysis of collaborative research in physiology or medicine. *PLoS ONE*, 10(7):e0134164.

# Text Analysis of ETDs in ProQuest Dissertations and Theses (PQDT) Global (2016-2018)

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## Abstract

The information explosion in the form of ETDs poses the challenge of management and extraction of appropriate knowledge for decision making. Thus, the present study forwards a solution to the above problem by applying topic mining and prediction modeling tools to 263 ETDs submitted to the PQDT Global database during 2016-18 in the field of library science. This study was divided into two phases. The first phase determined the core topics from the ETDs using Topic-Modeling-Tool (TMT), which was based on latent dirichlet allocation (LDA), whereas the second phase employed prediction analysis using RapidMiner platform to annotate the future research articles on the basis of the modeled topics. The core topics (tags) for the studied period were found to be *book history*, *school librarian*, *public library*, *communicative ecology*, and *informatics* followed by text network and trend analysis on the high probability co-occurred words. Lastly, a prediction model using Support Vector Machine (SVM) classifier was created in order to accurately predict the placement of future ETDs going to be submitted to PQDT Global under the five modeled topics (*a* to *e*). The tested dataset against the trained data set for the predictive performed perfectly.

## Keywords

Latent Dirichlet Allocation (LDA), Prediction Modeling, Text Network Analysis, Trend Analysis, Topic Modeling

## Introduction

In addition to journal articles, Electronic Theses and Dissertations (ETDs) are the most frequent type of educational resource which is consulted by the scientific community from time to time. “The submission of theses and dissertations in electronic format has opened the door for the user community to have an entrance to the knowledge implanted in these works through different national and international ETDs and databases” (Haneefa and Divya, 2018). “They are well

defined and well-referenced administrative documents on both the national and international level. They play an important role in research by adopting a Knowledge Organization System (KOS) architecture to enhance Information Retrieval (IR) systems and their performance” (Gunjal and Gaitanou). As the number of textual data including ETDs are increasing exponentially every day over the Web, the issue of organizing, managing and disseminating information has attracted attention and led to many efforts, including the Knowledge Management, Content Analysis, Text Analysis, Text Classification, Text Categorization, Search Strategy, Linked Data, and Semantic Web, etc. to enhance information retrieval systems and their performance for decision making.

“During the last decade, the growth of ETDs has been increased tremendously among universities and other organizations all over the world”(Gunjal and Gaitanou).The information explosion in the form of ETDs poses the challenge of management and extraction of appropriate knowledge for decision making. Thus, this study forwards a solution to the above problem by applying topic mining and prediction modeling tools to ETDs submitted in ProQuest Dissertations and Theses (PQDT) Globaldatabase during 2016-2018 in the field of library science.This present study (i) discovers the hidden topical pattern, (ii) performs text network and trend analysis for the highest frequency words generated by topic modeling; and (iii) presents a best fitted predictive model for the ETDs retrieved.

## Literature review

Some of the prominent studies existing in literature on the topic mining with respect to ETDs are by Lamba and Madhusudhan (2018), “applied topic modeling to Library and Information Science (LIS) theses submitted to Shodhganga (an Indian ETDs digital repository) to determine the five core topics/tags and then the performance of the built model based on those topics/tags were analysed”. Sugimoto et al. (2011), “identified the changes in dominant topics in library and information science (LIS) over time, by analyzing the 3,121 doctoral dissertations completed between 1930 and 2009 at North American Library and Information Science programs. The authors utilized Latent Dirichlet Allocation (LDA) to identify latent topics diachronically and to identify representative dissertations of those topics”. Morgan et al. (2008), used “OSCAR3, an Open Source chemistry text-mining tool, to parse and extract data from theses in PDF, and from theses in Office Open XML document format”. Brook et al. (2014), emphasized on the fact that the “main barriers against the uptake of TDM were not technical, but, primarily a lack of awareness among the academics, and a skills gap. They further elaborated on the legal issues around the copyright, database rights, and to some policy choices of restrictions being implemented by publishers”. Schöpfel et al. (2015), highlighted that “the legality of mining ETDs has to be ensured by a legal Text Data Mining exception; moreover, the issuing of prescription rules should systematize a third party agreement to clear rights in a mining context. Prescription rules could also ease the feasibility by proposing application standards and by promoting rich metadata and text structures”. Nanni and Paci (2017), studied the “hermeneutic and text mining practices while analyzing one of the primary research output of European universities, namely doctoral theses and present an enriched dataset”.

Some of the studies which apply prediction modeling are by Lamba and Madhusudhan (2019), who “described the importance and usage of metadata tagging and prediction modeling tools for researchers and librarians. 387 articles were downloaded from DESIDOC Journal of Library and Information Technology (DJLIT) for the period 2008–17. This study was divided into two phases. The first phase determined the core topics from the research articles using Topic-Modeling-Toolkit (TMT), which was based on latent dirichlet allocation (LDA), whereas the second phase employed prediction analysis using RapidMiner toolbox to annotate the future research articles on the basis of the modeled topics”; Özmanlı and Çavdur (2005), who “proposed an artificial neural network to identify automatically topic-changes in a user session by using the statistical characteristics of queries, such as time intervals and query reformulation patterns”; and Benton et al. (2016), who considered “survey prediction from social media. They used topic models to correlate social media messages with survey outcomes and to provide an interpretable representation of the data. Rather than rely on fully unsupervised topic models, they used existing aggregated survey data to inform the inferred topics, a class of topic model supervision referred to as collective supervision. They introduced and explored a variety of topic model variants and provided an empirical analysis, with conclusions of the most effective models for this task”.

## Methodology

The method followed for this study was a composite one as the study dealt with the three important aspects of the problem (i) information retrieval, (ii) the designing, and (iii) the evaluation with the help of topic mining (Topic-Modeling-Tool, 2011), text network and trend analysis (VoyantTools, 2019), and prediction modeling (RapidMiner, 2019). A total of 263 ETDs were retrieved in the English language for library science subject from PQDT Global dataset for 2016-18. Out of the 2563 ETDs, 10 ETDs were found without advisor's name and 7 ETDs were found without department's name but those ETDs were still included in the study as the incomplete bibliographic details did not compensate the topic and prediction modeling process directly. The study was divided into two phases. In the first phase, ETDs on library science subject for the period 2016-18 were downloaded from PQDT Global database and converted to text format (information retrieval), followed by the analysis of the text corpus according to latent dirichlet allocation (LDA) probabilistic topic modeling method with the help of Topic-Modeling-Tool (designing and evaluation). Five topics were identified for the studied period and each topic contained a probability value. The topics were then ranked by probability values and only the top five representative topics were selected. Similarly, the probability of each word was calculated to represent the association between a word and the given topic and the top five words were chosen as most representative of the topic. Further, text network and trend analysis were made using the 25 high-probability co-occurrence words for all the five topics to have a better insight into the data (evaluation). In the second phase, prediction analysis was performed with the help of a text mining platform called RapidMiner. The process included the following steps (designing and evaluation):

- Pre-processing of the documents (i.e. tokenization, stemming, filtering stop-words, transforming the cases, and generating n-grams per terms);

- Splitting the data into two subsets;
- Training and testing of the data using split validation;
- Application of the appropriate classifier to build the predictive model; and
- Measuring the performance of the model.

### Latent Dirichlet Allocation (LDA)

“This paper focuses on the use of LDA (Blei, Ng, and Jordan 2003), which is based on Dirichlet distribution to model the topics from the corpus of LIS ETDs. In this study, each ETD got represented as a pattern of LDA topics making every ETD appear. LDA automatically inferred the topic discussed in a collection of ETDs and these topics could be used to summarize and organize ETDs. LDA is based on probabilistic modeling and the observed variables are the bags of words per ETD whereas hidden random variables are the topic distribution per ETD” (Lamba and Madhusudhan, 2018). “The main goal of LDA is to compute the posterior of the hidden variables given the value of the observed variables” (Allahyari et al. 2017). “The assumptions of LDA for the study were: (i) ETDs with similar topics would use similar groups of words, (ii) ETDs were a probability distribution over latent topics, and (iii) topics were probability distributions over words” (Lamba and Madhusudhan, 2018).

## Results

### Topic Analysis

On the basis of the output files (present in both CSV and HTML formats) generated by the Topic-Modeling-Tool (TMT), a comprehensive analysis had been performed for the studied period. After topic modeling had been conducted to the full-text corpus of the ETDs extracted from PQDT Global database using the TMT, analysis of the output files had been undertaken to generate knowledge and to assign appropriate *topics* to the group of words generated. Table 1 summarizes the LDA result for the ETDs. “It showed the labeling of the topics, *a* through *e*, which were organized in descending order according to their probability values (where *a* having the highest probability value). It summarized the core topics which might be considered as the hot research trend for the corresponding period. It further listed the word co-occurrence pattern over time and summarized the top five words or the high loading keywords, ranked by the probability value for each period in the descending order. Thus, topic analysis is the process of assigning *topics* to a group of higher frequency words arranged in decreasing order and analyzing the results generated from the automated tool for the purpose of management and organization of the text documents” (Lamba and Madhusudhan, 2019). Further, in addition to the groups of words, representative ETDs were also consulted simultaneously to label the *topics* appropriately. Representative ETDs were the five core ETDs ranked on the basis of the highest topic proportion percentage for the given modeled topic (Table 2).

Five topics were modeled for the studied period (where number of ETDs=263; number of Topics=5;  $\alpha=10.0$ ;  $\beta=0.01$ ) where the evidence from high-loading keywords and most representative ETDs showed that *Topic a* was about *book history* with an emphasis on

americanhistory and library whereas *Topic b* was about *school librarian* with a focus on students, information, and research. *Topic c* was on *public library* with a focus on community. Representative ETDs and keywords for *Topic d* indicated a focus on *communicative ecology* with an emphasis on social, health, media, and family. Lastly, *Topic e* was on *informatics* with a focus on data, research, knowledge, and search.

**Table 1.** Latent dirichlet allocation results for the period 2016–18 (263 ETDs)

<b>Topic a Bookhistory</b>	<b>Topic b School librarian</b>	<b>Topic c Public library</b>	<b>Topic d Communicative ecology</b>	<b>Topic e Informatics</b>
library	students	library	social	information
books	school	libraries	health	data
history	information	public	information	research
book	research	community	media	knowledge
american	librarians	study	family	search

**Table 2.** Titles corresponding to the representative ETDs for 2016-18 (263 ETDs)

	Topic a	Topic b	Topic c	Topic d	Topic e
Representative Title 1	Exploring racial diversity in Caldecott Medal-winning and honor books	Factors that Influence Middle School Mathematics Teachers' Willingness to Collaborate with School Librarians	What Happens When Entrepreneurial Public Libraries Change Directors?	School Librarians' Perception of Adopting E-books in their School MediaCenters : A Multiple-case Study	Bootstrap-Based Confidence Intervals in Partially Accelerated Life Testing
Representative Title 2	Books about music in Renaissance print culture: Authors, printers, and readers	Examining Middle School Teacher Practices and Attitudes Regarding Teaching Information Literacy Skills	Older Voluntarism and Rural Community Sustainability: A Case Study of a Volunteer-based Rural Library	Interactions in Calls to the 9-1-1 Emergency System in Costa Rica	Scripts in a frame: A framework for archiving deferred representations
Representative Title 3	Judging a Book by Its Cover: The Context Book Covers Provide	Female Saudi Pre-Service Teachers' Competency in Information Literacy, Perceptions of Future	After-School Activities Policy and the Atlanta Fulton Public Library System	Information Practices Relative to Parental Mediation and the Family Context	Representing the Search Session Process



		Classroom Practice, and the Role of Librarians		Among Puerto Rican and Dominican Teens	
Representative Title 4	Class Acts: The Twenty-Fifth and Twenty-sixth Earls of Crawford and Their Manuscript Collections	From Information Experts to Expert Educators? Academic Librarians' Experiences with Perspective Transformation and their Teaching Identities	Organizational Culture and Library Chief Executive Officers' Servant Leadership Practices	No End in Sight: A Critical Discourse Analysis of U.S. National Newspaper Coverage of the Iraq War	Research and innovation in West Africa: An informetric analysis within the framework of the Triple Helix model
Representative Title 5	Exploring the Convenience Versus Necessity Debate Regarding SCI-HUB Use in the United States	Academic Librarians' Teacher Identity Development through the Scholarship of Teaching and Learning: A Mixed Methods Study	Diversifying Funds to Enhance Financial Sustainability of a County Library System	Distant close ties: Jamaican immigrants, mediated communication, and the primacy of voice	H3DNET: A Deep Learning Framework for Hierarchical 3D Object Classification

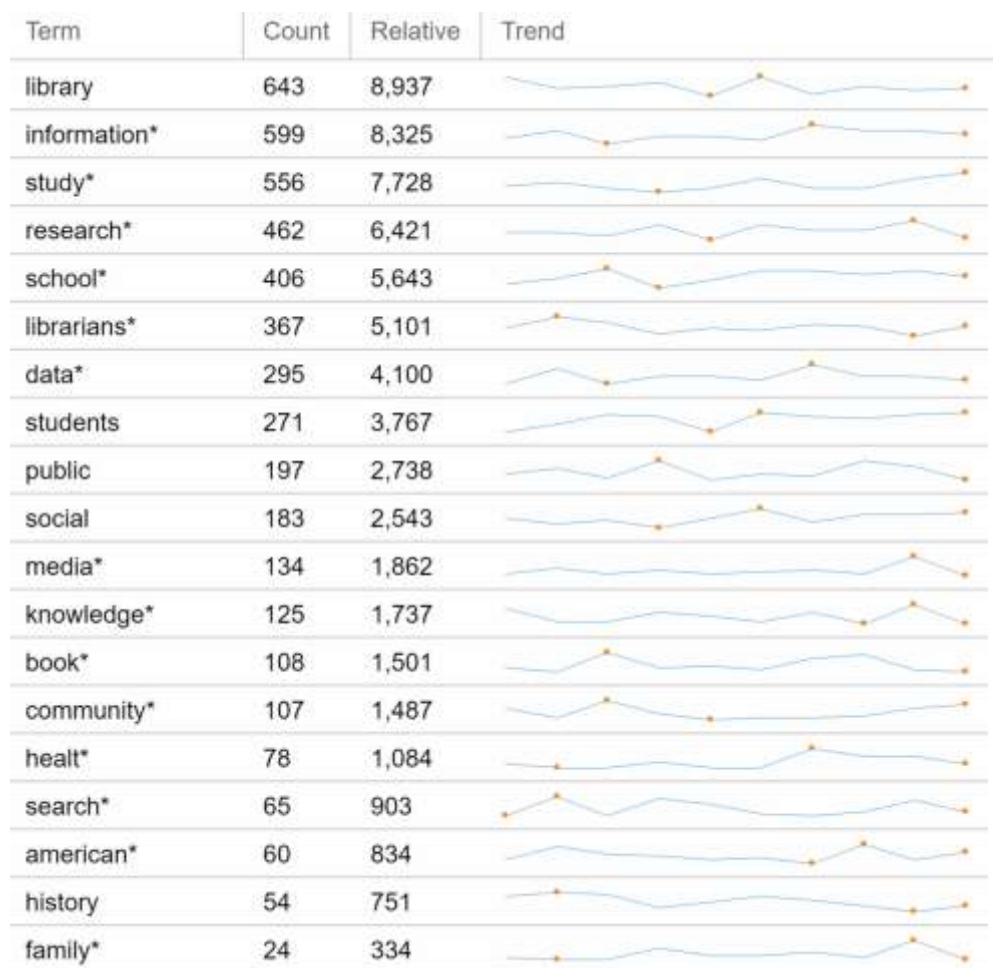
### *Word Analysis*

The co-word pattern generated from TMT was further analyzed using text network and trend analysis to get a better insight into the hidden word pattern. As the data was too big for VoyantTools to process, only bibliographic data including, abstract, title, author, advisor, keywords, subject, etc. was used as the corpus in the VoyantTools. Figure-I shows the trend-line graph for the corpus. “Trend-line graph depicts the distribution of a word’s occurrence across a corpus. It is a visualization that represents the frequencies of terms across documents in a corpus or across segments in a document, depending on the mode. The relative frequency determines the term frequency in a document whereas raw frequency is the absolute count for each document” (VoyantTools, 2019). The asterisk (\*) shows the search syntax to trigger a search for the match terms as one term, for instance, ‘coat’ will match the exact term ‘coat’ whereas ‘coat\*’ will

match terms that start with ‘coat’, ‘coating’, ‘coats’ etc. as one term. Further, “the table view showed the following columns:

- Term: this is the document term
- Count: this is the raw frequency of the term in the document
- Relative: this is the relative frequency (per 10 million words) of the term in the document
- Trends: this is a sparkling graph that shows the distribution of the term within the segments of the documents” (VoyantTools, 2019)

For this study, 19 high-probability co-occurrence words produced by TMT were queried in the search bar to determine the trend-line graph for the corpus. It can be observed from Figure 1 that the word *library* had the highest count and relative values whereas *family\** had the lowest. Further, the top 5 words with the highest count and relative values in the corpus were *library*, *information\**, *study\**, *research\**, and *school\** in comparison to the words *healt\**, *search\**, *american\**, *history*, and *family\** which had the lowest count and relative values.

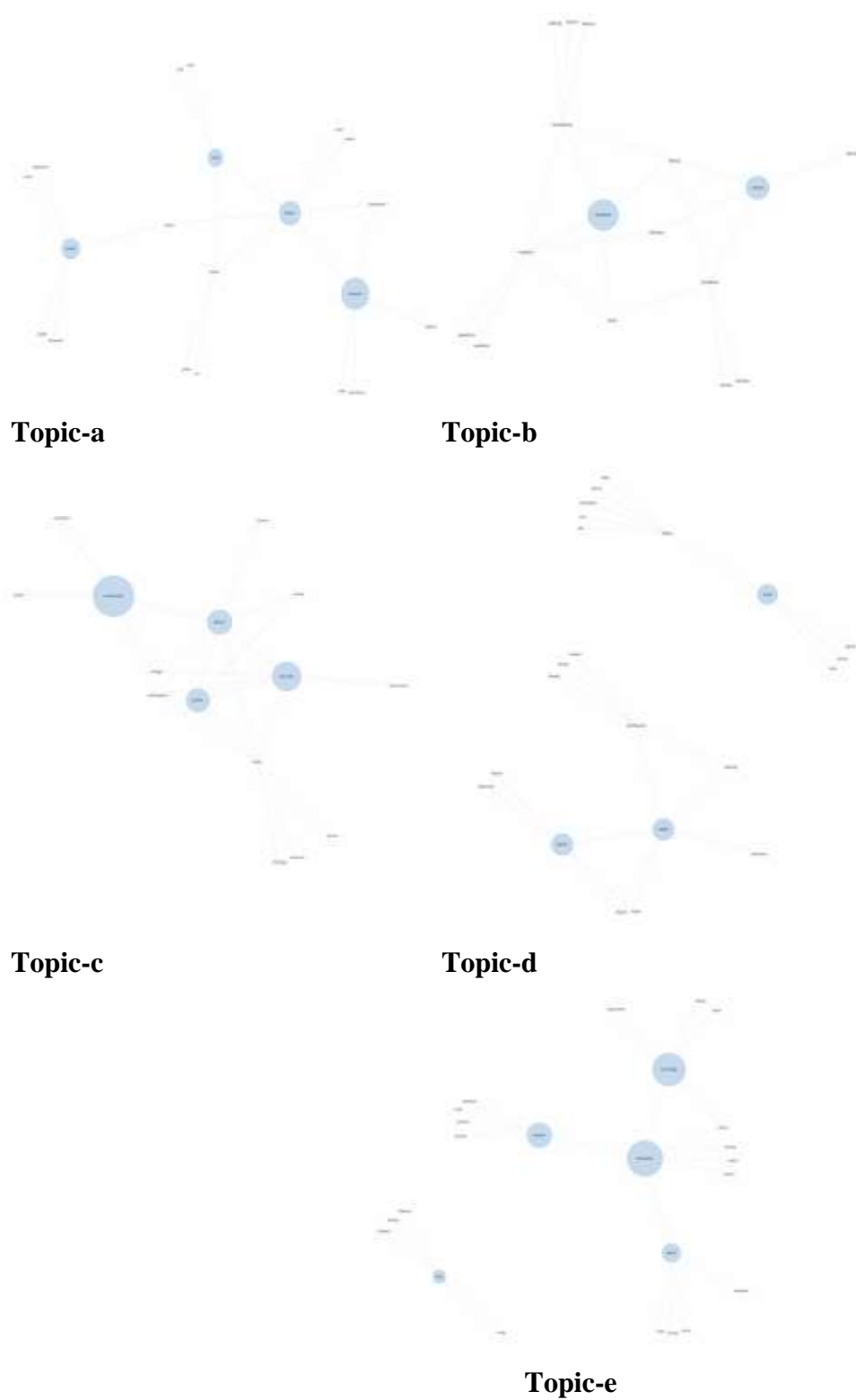


**Figure 1.** Trend-Line Graph for Co-Word Occurrence using VoyantTools

Figure 2 showed a “*collocate graph* which represents keywords and terms that occur in close proximity as a force-directed network graph” (VoyantTools,2019). “The *context slider* in VoyantTools determines how many terms to include for collocation. The value specifies the number of words to consider on each side of the keyword” (VoyantTools,2019). For this study, the context slider was set to its default value of 5 words per query. To make the text network graph for each modeled topic, all the high probability words were added to the query box for the corpus to make the text network graph for the respective modeled topic. Further, the words were centralized for better insight. Further, Table 3 was prepared using Figure-II to determine the associated terms related to the co-occurred words in the text network graph for the respective modeled topics.

**Table 3.** Associated Terms Related to Co-Occurred Words in Text Network Graph

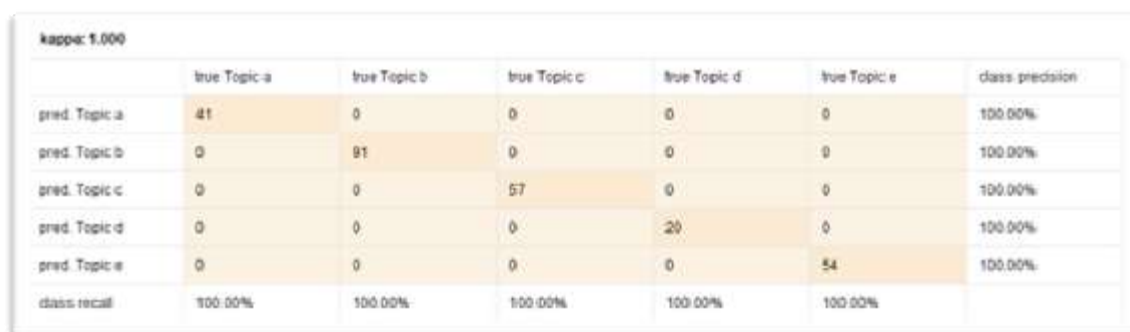
Modeled Topics	High Probability Co-occurred Words(Counts)	Associated Terms in Text Network Graph
Topic-a	<i>library</i> (643)	school, book, history, american, information, study, science
	<i>books</i> (61)	collections, digital, librarians, school, music
	<i>history</i> (4)	public, era, library, book
	<i>book</i> (46)	history, library, club/s
	<i>american</i> (56)	male, athletes, association, information, and library
Topic-b	<i>students</i> (271)	information, research, study, library
	<i>school</i> (361)	library/libraries, librarian/s
	<i>information</i> (33)	seeking, science, literacy, library, research
	<i>research</i> (16)	libraries, study, information, question/s
	<i>librarians</i> (128)	library, study, faculty, teachers
Topic-c	<i>library</i> (643)	study, information, public, libraries, school, science, community
	<i>libraries</i> (253)	library, associations, public, information, college, study
	<i>public</i> (197)	school, library/libraries, study
	<i>community</i> (106)	members, based, college, information, library
	<i>study</i> (31)	library, libraries, public, information, mixed, research, findings
Topic-d	<i>social</i> (183)	capital, justice, data, media
	<i>health</i> (68)	insurance, seeking, information, family
	<i>information</i> (20)	seeking, health, science, library, literacy
	<i>media</i> (34)	static, school, specialists, non, use
	<i>family</i> (23)	health, topics, related, history, behaviors
Topic-e	<i>information</i> (594)	search, library, seeking, science, literacy, research, knowledge
	<i>data</i> (273)	using, collection, analysis, collected
	<i>research</i> (406)	question/s, study, libraries, information
	<i>knowledge</i> (121)	based, domain, organization, library, information
	<i>search</i> (47)	information, mediation, survey, process, social



**Figure 2.**Text Network Graph of Co-Word Occurrence using VoyantTools

## Prediction Modeling

Support Vector Machine (SVM) classifier was used to create the prediction model. The model was created using 263 tagged ETDs (*atoe*), where 70% (184) of the data was allocated to the training set and 30% (79) was allocated to test set randomly using the split validation technique. Once the parameters of the models were finalized, the testing set was run through the model. The actual test class was compared to the predicted class to determine the kappa, precision, and recall values. Figures-III shows perfect values for the tested data set against the trained data set for the predictive model.



kappa: 1.000

	true Topic a	true Topic b	true Topic c	true Topic d	true Topic e	class prediction
pred. Topic a	41	0	0	0	0	100.00%
pred. Topic b	0	91	0	0	0	100.00%
pred. Topic c	0	0	57	0	0	100.00%
pred. Topic d	0	0	0	20	0	100.00%
pred. Topic e	0	0	0	0	54	100.00%
class recall	100.00%	100.00%	100.00%	100.00%	100.00%	

**Figure 3.** Screenshot of Evaluation of Prediction Analysis using RapidMiner

## Conclusion

The study used three different tools to perform topic modeling, text network analysis, trends analysis, and prediction modeling. Topic modeling was performed to tag the corpus of full-text LIS ETDs submitted to PQDT Global for the epoch 2016-18. The core topics (tags) for the studied period were found to be *book history*, *school librarian*, *public library*, *communicative ecology*, and *informatics*. LIS ETDs on the PQDT Global website can be tagged with the modeled topics to have a faster information retrieval searching experience by the users. The limitations of the study include the prior identification of an appropriate number of topics for the ETDs before performing LDA; the incompetence of the Dirichlet algorithm to correlate among topics; and lastly, the manual interpretation of labeling of topics. The present study then applied text network and trend analysis on the high probability co-occurred words to have a better insight into the results. Further, a prediction model using Support Vector Machine (SVM) classifier was created in order to accurately predict the placement of future ETDs going to be submitted to PQDT Global under the five modeled topics (*a* to *e*). The tested dataset against the trained data set for the predictive performed perfectly. The limitation of using prediction modeling for the study was that the dataset was not truly representative of LIS ETDs of the database. The training of the model to learn and fit the parameters could be done perfectly if more data is taken into account. This work will have a broad application to those interested in information retrieval of ETDs. The findings of the study will help the users in faster information retrieval from PQDT Global database by searching the ETDs on the basis of the concept/theme behind each ETD instead of subject, title, keywords, author, year of completion of the ETD, advisor, university, department, etc.

## References

1. Allahyari, M., Pouriyeh, S., Assefi, M., Safaei, S., Trippe, E. D., Gutierrez, J. B., and Kochut, K. 2017. **A Brief Survey of Text Mining: Classification, Clustering and Extraction Techniques**. *ArXiv:1707.02919 [Cs]*. <http://arxiv.org/abs/1707.02919> (accessed on 21<sup>st</sup> July 2019).
2. Benton, A., Paul, M. J., Hancock, B., and Dredze, M. 2016. **Collective Supervision of Topic Models for Predicting Surveys with Social Media**. *In Proceedings of Thirtieth AAAI Conference on Artificial Intelligence (AAAI)*, 2892–2898.
3. Blei, D. M., Ng, A. Y., and Jordan, M. I. 2003. **Latent dirichlet allocation**. *Journal of Machine Learning Research* Volume no 3(1):993–1022.
4. Brook, M., Murray-Rust, P., and Oppenheim, C. 2014. **The Social, Political and Legal Aspects of Text and Data Mining (TDM)**. *D-Lib Magazine*, Volume no 20(11/12). <https://doi.org/10.1045/november14-brook> (accessed on 21st July 2019).
5. Divya, P. and Haneefa, M. 2018. **Digital Reading Competency of Students: A Study in Universities in Kerala**. *DESIDOC Journal of Library & Information Technology* Volume no 38(2):88–94. <https://doi.org/10.14429/djlit.38.2.12233>
6. Gunjal, B., and Gaitanou, P. 2015. **ETDs and Open Access for Research and Development: Issues and challenges**. *In 18th International Symposium on Electronic Theses and Dissertations Evolving Genre of ETDs for Knowledge Discovery*, Delhi, India, organised by Jawaharlal Nehru University. <https://doi.org/10.13140/rg.2.1.2826.4401>
7. Lamba, M. and Madhusudhan, M. 2018. Metadata Tagging of Library and Information Science Theses: Shodhganga (2013-2017). *In ETD 2018 Taiwan Beyond the Boundaries of Rims and Oceans: Globalizing Knowledge with ETDs*, Taipei, Taiwan, organised by National Central Library. [https://etd2018.ncl.edu.tw/images/phocadownload/3-2\\_Manika\\_Lamba\\_Extended\\_Abstract\\_ETD\\_2018.pdf](https://etd2018.ncl.edu.tw/images/phocadownload/3-2_Manika_Lamba_Extended_Abstract_ETD_2018.pdf) (accessed on 21st July 2019).
8. Lamba, M. and Madhusudhan, M. 2019. Mapping of topics in DESIDOC Journal of Library and Information Technology, India: a study. *Scientometrics*. <https://link.springer.com/article/10.1007/s11192-019-03137-5> (accessed on 21<sup>st</sup> July 2019).
9. Lamba, M. and Madhusudhan, M. 2019. **Metadata Tagging and Prediction Modeling: Case Study of DESIDOC Journal of Library and Information Technology (2008-2017)**. *World Digital Libraries: An International Journal* Volume no 12(1):33-89.
10. Morgan, P., Downing, J., Murray-Rust, P., Stewart, D., Tonge, A., Townsend, J. A., and Rzepa, H. S. 2008. **Extracting and re-using research data from chemistry e-theses: The SPECTRa-T project**. <http://www.dspace.cam.ac.uk/handle/1810/230116> (accessed on 21st July 2019).
11. Nanni, F., and Paci, G. 2017. **A Discipline-Enriched Dataset for Tracking the Computational Turn of European Universities**. *In Proceedings of the 6th International Workshop on Mining Scientific Publications*, pp. 29–33.
12. Özmütlu, S., and Çavdur, F. 2005. Neural network applications for automatic new topic identification. *Online Information Review* Volume no 25(1):34–53. <https://doi.org/10.1108/14684520510583936>

13. RapidMiner.2019.<https://rapidminer.com> (accessed on 21<sup>st</sup> July 2019).
14. Schöpfel, J., Kergosien, E., Chaudiron, S., and Jacquemin, B. 2016.**Dissertations as Data**. In *19th International Symposium on Electronic Theses and Dissertations (ETD 2016): "Data and Dissertations"*, Villeneuve d'Ascq, France, July, <<https://etd2016.sciencesconf.org/>>. <hal01400071> (accessed on 21<sup>st</sup> July 2019).
15. Sugimoto, C. R., Li, D., Russell, T. G., Finlay, S. C., and Ding, Y. 2011. **The shifting sands of disciplinary development: Analyzing North American Library and Information Science dissertations using latent Dirichlet allocation**. *Journal of the American Society for Information Science and Technology* Volume 62(1):185–204. <https://doi.org/10.1002/asi.21435>
16. TopicModelingTool.2011.<https://code.google.com/archive/p/topic-modeling-tool/>(accessed on 21<sup>st</sup> July 2019).
17. VoyantTools.2019. <https://voyant-tools.org/> (accessed on 21<sup>st</sup> July 2019).

# Evaluation of Select International Digital Libraries Websites: A Webometric Analysis

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## Abstract

The main aim of the study is to compare and assess the websites of select international digital libraries. The required data were collected from the websites of selected libraries and by using MozLink Explorer and Google page rank as a webometric tool. The study found that among all the ten selected international digital libraries the World Digital Library is leading with the highest page authority, external followed link, linking domains and followed linking domains. Although, Universal Digital Library found with the highest 'domain authority' but on the other side it has lowest linking domains, followed linking domains and total links whereas the lowest domain authority and page authority are from Digital Library of International Research. Similarly, in case of Google page rank assessment, Universal Digital Library secured the highest page rank and Core page review (CPR) score but still found in a low position as among all the select digital libraries it has the lowest referring domains, global rank, indexed urls, trust flow, trust metric as well as weak Page rank (PR) quality.

## Keywords

Digital Libraries, Webometrics, Page Rank, Information Technology, Web Impact Factor.

## Introduction

The expansion of information technology has changed the concept of library and information centers. All the library resources and services are now being offered through digital modes and methods to provide easy accessibility to the ultimate user and such platforms are commonly known as digital libraries in the current context. It provides a suitable interface of information sources and services. It covers a number of various applications and has been used interchangeably for systems like library websites, e-journals platforms, digitized collections,



network databases, etc. (Tsakonas and Papatheodorou, 2008). It is a great challenge for librarians to retrieve and reproduce the non-textual information. Therefore the notion of hypertext has been added to the digital libraries because through hypertext technology it is possible to build and organize the same material in a variety of ways. Information can also be exchanged from one web server to another one with the help of web links or hyperlinks, hence, any library across the world is now accessible with the help of World Wide Web (Fox, Akscyn, Furuta, & Leggett, 1995). In order to understand the efficiency and effectiveness of the digital library an evaluation is the most required aspect. Evaluation is the structured interpretation which helps to recognize areas that require attention and improvement. It systematically determines the merit and significance of a program, project or any other intervention by using standard criteria. Various aspects of performance measurement and assessment are included in this general term. An evaluative study is carrying out on the basis of observation rather on opinion. This type of study can be perform at different levels by including different objectives.

There are a variety of methods and metrics for evaluating digital libraries but for the present study, the webometric have been chose to assess the international digital libraries. The term webometric was first coined by Almind and Ingwersen to measure the web related phenomena. This concept was emerged from the information science field. The four main areas of webometric research are webpage content analysis, link structure analysis, web technology analysis and web usage analysis (Almind & Ingwersen, 1997). In webometric research, data are collected by using webometric tool in fact these tools play a predominant role in conducting a webometric study. In the current study Mozlink explorer and Google page rank has been used as a webometric tool to evaluate selected ten international digital libraries. Mozlink explorer and Google page rank both are the two freely available search engine optimization tools to explore the performance as well as efficiency of any website.

## Review of Related Literature

Overviews of studies conducted at national and international level related to the evaluation of digital libraries are presented according to their level of relevancy. These studies have been carried out on various aspect of digital library assessment. Xie (2008) evaluated the two digital libraries from the user's perspective by applying previously developed criteria. This study identified the connections between the observed importance of digital library assessment criteria and actual assessment of digital libraries as well as the relationships between the evaluation of digital libraries and the use of digital libraries. It has been found that design of digital library is an important factor in user's interaction because it is the actual design that guide or suggest the user how to use a digital library. Tsakonas & Papatheodorou (2008) assessed the usefulness and usability of an open access digital library system by applying a theoretical model for digital library evaluation. For this purpose an attempt was made to evaluate e-print archive and the outcomes proved that along with functionalities, which are commonly found in these systems, several attributes of usefulness like the level & relevance of information and usability like easiness of use & learnability affect the user's interaction as well as satisfaction. Jeng (2005) developed the model of assessing usability for academic digital libraries and also discussed the dimensions of usability, methods applied in evaluating usability of digital libraries along with their applicability and criteria. The study found an interlocking relationship among effectiveness, efficiency, and satisfaction as well as provides operational criteria for effectiveness, efficiency, satisfaction, and learnability. Saracevic (2004) provided an overview of works on digital library

evaluation by analyzing the selected work under the four aspects such as *construct* that were evaluated; *context* of conducting evaluation; *criteria* chosen for evaluation, and *methods* used for evaluation. Each of these aspects of analysis were explored enumerated and almost ranked such as the construct was listed into entities or given processes, context was also presented in a descending order of use in selected studies, various criteria used for evaluation were classified, and finally the identified methodologies were listed and discussed. As a result, a number of reasons were estimated for a limited presence and acceptance of digital library evaluation in research and practice. Hariri & Norouzi (2011) reviewed the literature regarding Digital Libraries and user interfaces in order to identify and suggest a set of criteria for evaluating Digital Library's user interface. As a result 22 different assessment criteria have been recognized.

## Aims & Objectives

The main aim of the study is to compare and assess the websites of select international digital libraries. The main objectives of the study are as follows;

- To analyze the library websites of selected international digital libraries.
- To know the domain and page authority of selected library websites.
- To trace out the 'internal followed links', 'external followed links' and 'total links' of selected library websites.
- To calculate the 'spam score', 'total linking domains' and 'followed linking domains' of selected libraries websites.
- To explore individualized domains of selected libraries
- To examine google page rank of selected libraries websites.
- To find out the web impact factor of selected libraries websites.

## Methodology

In order to fulfill objectives of the study the required data were collected from the library websites of selected international digital libraries and by using MozLink Explorer (<https://moz.com/link-explorer>) software and Google page rank SEO tool (<https://checkpagerank.net/>). The library websites were analyzed and presented in tabular form. The data were collected from Mozlink Explorer and Google page rank. International digital libraries have been chosen for evaluation because in Indian context digital libraries are still in developing stage. There are number of digital libraries available at international level and it's not possible to assess all of them, therefore ten renowned digital libraries have been selected for the study. In case of choosing libraries, a balance has been made in different kinds of digital libraries such as public, special, academic, and children's digital libraries.

The method of calculating Web Impact Factor is formulated as:

- a) Distribution of Data by Internal Web Impact Factor (IWIF) has been calculated by the following formula:

$$\text{IWIF} = \frac{\text{Total No. of Internal Links}}{\text{Total No. of Webpages}}$$

- b) Distribution of Data by External Web Impact Factor (EWIF) has been calculated by the following formula:

$$\text{EWIF} = \frac{\text{Total No. of External Links}}{\text{Total No. of Webpages}}$$

- c) Distribution of Data by Simple Web Impact Factor (SWIF) has been calculated by the following formula:

$$\text{SWIF} = \frac{\text{Total No. of Links}}{\text{Total No. of Webpages}}$$

## Data Analysis and Interpretation

Ten renowned digital libraries available at international level have been chosen for the webometric assessment. These selected libraries comprise all kind of digital libraries such as public, special, university communities, children DL, etc. The library websites were analyzed and presented in tabular form by using a list of check points for the evaluation of web resources in context of information available and the online traffic of these websites.

**Table 1.** Name and websites of the libraries

S. No.	Name of the Digital Library	Websites
1	Universal Digital Library	<a href="http://ulib.isri.cmu.edu/">http://ulib.isri.cmu.edu/</a>
2	World Digital Library	<a href="https://www.wdl.org/">https://www.wdl.org/</a>
3	International Children's Digital Library	<a href="http://en.childrenslibrary.org/">http://en.childrenslibrary.org/</a>
4	Digital Library for International Research	<a href="http://www.dlir.org/">http://www.dlir.org/</a>
5	The European Library	<a href="http://www.theeuropeanlibrary.org/">http://www.theeuropeanlibrary.org/</a>
6	Digital Public Library of America	<a href="https://dp.la/">https://dp.la/</a>
7	Digital Library of Georgia	<a href="https://dlg.usg.edu/">https://dlg.usg.edu/</a>
8	The WWW Virtual Library	<a href="http://vlib.org/">http://vlib.org/</a>
9	Texas Digital Library	<a href="https://www.tdl.org/">https://www.tdl.org/</a>
10	Kurdish digital Library	<a href="http://bnk.institutkurde.org/">http://bnk.institutkurde.org/</a>

### Domain authority and page authority

Domain authority is a quality score that measure the predictive ranking of entire domains or subdomains. It is one of the many search engine ranking factor and measure the power of a domain name. While as the page authority predicts the ranking potential of the page in search engines on the basis of link metric's algorithm. A high page authority score means the page has potential to rank well in search engine. Table 2 shows the Domain and Page Authority of selected digital library websites. It indicated that among all the select digital libraries, Universal Digital Library has the highest Domain authority i.e., 92(14.78%) whereas World Digital Library has the highest Page Authority i.e., 63 (12.25%). The lowest Domain and Page Authority was from the library website of Digital Library for International Research i.e., 4.98% and 6.28% respectively.

**Table 2.** Domain authority and page authority

<b>S. No.</b>	<b>Name of the Digital Library</b>	<b>Domain Authority</b>	<b>Page Authority</b>
1	Universal Digital Library	92(14.78%)	50(9.79%)
2	World Digital Library	77 (12.32%)	63 (12.25%)
3	International Children's Digital Library	62 (9.96%)	60 (11.65%)
4	Digital Library for International Research	33 (5.3%)	35 (6.81%)
5	The European Library	58 (9.32%)	55 (10.71%)
6	Digital Public Library of America	63 (10.16%)	59 (11.42%)
7	Digital Library of Georgia	65 (10.47%)	46 (8.92%)
8	The WWW Virtual Library	56 (9.04%)	58 (11.29%)
9	Kurdish digital Library	54 (8.66%)	35 (6.81%)
10	Texas Digital Library	62 (9.99%)	53 (10.35%)
<b>Total</b>		622 (100%)	514 (100%)

### Internal followed links, external followed links and total links

Table 3 depicts the Internal Followed Links, External Followed Links and Total Links of library websites of selected international digital libraries. The internal followed links are the hyperlinks to another webpage resource available on the web page of same website or domain. It is found that the internal followed links of Digital Public Library of America was the highest with 21,919,587 (47.12%) followed by International Children's Digital Library with 11,790,176 (25.36%), World Digital Library with 6,427,785 (13.83%), Digital Library for International Research with 4,008,676 (8.62%) and the European Library with 1,755,313 (3.72%) whereas the internal followed links of the remaining library websites are comparatively very less. External Links are hyperlinks that point or target at any domain other than the domain the link exists on (source). The External Followed Links of World Digital Library leads with 5,226,759 (41.56%) followed by Digital Public Library of America with 4,276,719 (34.01%), the Digital Library for International Research with 1,365,241 (10.86%), and The European Library with 1,342,155 (10.67%). Comparatively, the rest of the library websites were found with very less external followed links. The total links are the total amount of all types of links to the site. The Total Links of Digital Public Library of America occupied first place with 26,520,323 (44.83%) followed by International Children's Digital Library with 11,991,974 (20.22%) and World Digital Library with 11,869,009 (20.04%). The lowest Total Links was from Universal Digital Library i.e., 5135 (0.01%).

**Table 3.** Internal followed links, external followed links and total links

S. No.	Name of the Digital Library	Internal Followed Links	External Followed Links	Total Links
1	Universal Digital Library	500 (0.04%)	5117 (0.04%)	5135 (0.01%)
2	World Digital Library	6,427,785 (13.83%)	5,226,759 (41.56%)	11,869,009 (20.04%)
3	International Children's Digital Library	11,790,176 (25.36%)	194,879 (1.54%)	11,991,974 (20.22%)
4	Digital Library for International Research	4,008,676 (8.62%)	1,365,241 (10.86%)	5,374,364 (9.02%)
5	The European Library	1,755,313 (3.72%)	1,342,155 (10.67%)	3,182,422 (5.32%)
6	Digital Public Library of America	21,919,587 (47.12%)	4,276,719 (34.01%)	26,520,323 (44.83%)
7	Digital Library of Georgia	2,822 (0.09%)	7,894 (0.06%)	10,896 (0.09%)
8	The www Virtual Library	5,773 (0.04%)	128,991 (1.08%)	150,758 (0.25%)
9	Kurdish digital Library	27,530 (0.05%)	13,820 (0.13%)	41,834 (0.03%)
10	Texas Digital Library	537,662 (1.15%)	12,525 (0.05%)	590,847 (0.96%)
<b>Total</b>		46475329 (100%)	12574100 (100%)	59,146,715 (100%)

### Spam score

The Spam score is an aggregate of 17 different flags. The higher the number of flags on a link, there is a higher chance of the website getting spammy. If a link has 1 or even 5 flags, it means good and if it exceeds 6 or between 7-11, it indicates that the website is not in a good position. Each flag represents a wide range of potential signal ranging from content concerns to low authority metrics. Table 4 shows the spam score of library websites of selected international digital libraries. It indicated that the library website of Digital Library for International Research has the highest spam score of 28%, which means the website is not in a good position, followed by Kurdish digital Library with 16%, The WWW Virtual Library with 15% and International Children's Digital Library with 10%, whereas, the rest of the library websites shows good status.

**Table 4.** Spam Score

S. No.	Name of the Digital Library	Spam Score
1	Universal Digital Library	1%
2	World Digital Library	4%
3	International Children's Digital Library	10%
4	Digital Library for International Research	28%
5	The European Library	-
6	Digital Public Library of America	1%
7	Digital Library of Georgia	1%
8	The WWW Virtual Library	15%
9	Kurdish digital Library	16%
10	Texas Digital Library	1%

**Total linking domains and followed linking domains**

Linking domains refer to as the number of unique external linking domains. Two or more links from the same website are counted as one linking domain. Table 5 shows the total linking domains and followed linking domains of selected international digital library websites and found that amongst all the digital libraries World Digital Library has the highest total linking domains i.e., 26,172 (45.68%) and Followed Linking Domains i.e., 23,026 (45.58%) whereas lowest total linking domains and Followed Linking Domains are from Universal Digital Library i.e., 21(0.01%) and 11 (0.01%) respectively.

**Table 5.** Total linking domains and followed linking domains

S. No.	Name of the Digital Library	Total Linking Domains	Followed Linking Domains
1	Universal Digital Library	21 (0.01%)	11 (0.01%)
2	World Digital Library	26,172 (45.68%)	23,026 (45.58%)
3	International Children's Digital Library	7,337 (12.82%)	6,775 (13.46%)
4	Digital Library for International Research	458 (0.79%)	335 (0.66%)
5	The European Library	6,620 (11.57%)	5,705 (11.29%)
6	Digital Public Library of America	8,472 (14.78%)	7,692 (15.25%)
7	Digital Library of Georgia	141 (0.29%)	78 (0.11%)
8	The WWW Virtual Library	6,086 (10.61%)	5,347 (10.58%)
9	Kurdish digital Library	272 (0.47%)	152 (0.33%)
10	Texas Digital Library	1,708 (2.98%)	1,394 (2.73%)
<b>Total</b>		57287 (100%)	50515 (100%)

### Individualized domains of select libraries

The domain authority of telenet.be with 84 and linking root domains with 63244 is highest in the analysis of individualized domains of *Universal Digital Library*. The result visualized after analyzing the individualized domains of *World Digital Library* that the domain authority of plus.google.com with 99 as well as linking root domains with 13432309 is highest. The domain authority of apple.com with 100 and linking root domains of en.wikipedia.org with 5040632 is highest in *International Children's Digital Library*. The domain authority of en.wikipedia.org, wordpress.org and sites.google.com with 98 for each and linking root domains of wordpress.org with 8685799 is highest in *Digital Public Library of America*. The domain authority of youtube.com with 99 and linking root domains with 15985357 is highest in *the WWW Virtual Library*. The domain authority of microsoft.com with 100 and linking root domains of en.wikipedia.org with 5040632 is highest in *Texas Digital Library*. As far as the individualized domains of remaining libraries is concerned, including *Digital Library for International Research*, *The European Library*, *Digital Library of Georgia*, and *Kurdish digital Library*, it has been found that the domain authority of en.wikipedia.org with 98 and linking root domains with 5040632 is highest.

**Table 6.** Individualized domains of select libraries

Individualized domains of Universal Digital Library			
S. No.	Linking Root domain Names	Domain Authority	Linking Root Domains
1	telenet.be	84	63244
2	uni-lj.si	68	29858
3	csusm.edu	64	14624
4	ulib.org	52	2947
5	movieswithbutter.com	49	1209
Individualized domains of World Digital Library			
S. No.	Linking Root domain Names	Domain Authority	Linking Root Domains
1	plus.google.com	99	13432309
2	en.wikipedia.org	98	5040632
3	sites.google.com	98	1493881
4	mozilla.org	98	1672052
5	github.com	97	1585422
Individualized domains of International Children's Digital Library			
S. No.	Linking Root domain Names	Domain Authority	Linking Root Domains
1	apple.com	100	4130882
2	en.wikipedia.org	98	5040632
3	sites.google.com	98	1493881
4	medium.com	95	912649
5	es.wikipedia.org	95	684848
Individualized domains of Digital Library for International Research			
S. No.	Linking Root domain Names	Domain Authority	Linking Root Domains
1	en.wikipedia.org	98	5040632
2	fr.wikipedia.org	95	489846

3	pt.wikipedia.org	95	332033
4	de.wikipedia.org	94	570346
5	wikia.com	94	467095
<b>Individualized domains of The European Library</b>			
<b>S. No.</b>	<b>Linking Root domain Names</b>	<b>Domain Authority</b>	<b>Linking Root Domains</b>
1	en.wikipedia.org	98	5040632
2	creativecommons.org	97	1403068
3	europa.eu	96	1473195
4	bbc.co.uk	96	1363006
5	fr.wikipedia.org	95	489846
<b>Individualized domains of Digital Public Library of America</b>			
<b>S. No.</b>	<b>Linking Root domain Names</b>	<b>Domain Authority</b>	<b>Linking Root Domains</b>
1	en.wikipedia.org	98	5040632
2	wordpress.org	98	8685799
3	sites.google.com	98	1493881
4	creativecommons.org	97	1403068
5	github.com	97	1585422
<b>Individualized domains of Digital Library of Georgia</b>			
<b>S. No.</b>	<b>Linking Root domain Names</b>	<b>Domain Authority</b>	<b>Linking Root Domains</b>
1	en.wikipedia.org	98	5040632
2	feedburner.com	95	1684126
3	medium.com	95	912649
4	loc.gov	93	317704
5	ajc.com	89	117828
<b>Individualized domains of The WWW Virtual Library</b>			
<b>S. No.</b>	<b>Linking Root domain Names</b>	<b>Domain Authority</b>	<b>Linking Root Domains</b>
1	youtube.com	99	15985357
2	en.wikipedia.org	98	5040632
3	sites.google.com	98	1493881
4	europa.eu	96	1473195
5	uol.com.br	96	513931
<b>Individualized domains of Texas Digital Library</b>			
<b>S. No.</b>	<b>Linking Root domain Names</b>	<b>Domain Authority</b>	<b>Linking Root Domains</b>
1	microsoft.com	100	3628229
2	en.wikipedia.org	98	5040632
3	creativecommons.org	97	1403068
4	github.com	97	1585422
5	es.wikipedia.org	95	684848
<b>Individualized domains of Kurdish digital Library</b>			
<b>S. No.</b>	<b>Linking Root domain Names</b>	<b>Domain Authority</b>	<b>Linking Root Domains</b>
1	en.wikipedia.org	98	5040632
2	fr.wikipedia.org	95	489846
3	de.wikipedia.org	94	570346
4	ru.wikipedia.org	93	336167
5	pl.wikipedia.org	93	124199



## Web Impact Factor

The Web Impact Factor is the part of webometric methodology which is used as a measurement to determine the relative standing of website in a particular field. The higher the Web Impact factor the higher the perceived status of the website. There are three Web Impact factors: the ratio of all links to the number of pages is called Simple Web Impact Factor (SWIF), the ratio of internal links within the website to number of pages is called as Internal Web Impact Factor (IWIF), the ratio of links made from external websites to the main site to a number of pages at the site is called External Web Impact Factor (EWIF). Table 6 illustrates the impact factor of selected international digital libraries which included Internal Web Impact Factor (IWIF), External Web Impact Factor (EWIF) and Simple Web Impact Factor (SWIF). International Children's Digital Library occupies the first place with 2289.36 IWIF followed by World Digital Library which occupied second place with 47.25 IWIF and the third place goes to Digital Public Library of America with 29.43 IWIF. On the basis of External Web Impact Factor The WWW Virtual Library secured first position with 77.28 EWIF followed by World Digital Library which secured second position with 38.42 EWIF and third position goes to International Children's Digital Library with 37.85 EWIF. On the basis of Simple Web Impact Factor International Children's Digital Library occupies the first place with 2328.54 SWIF followed by The WWW Virtual Library which occupied second place with 90.25 SWIF and third place goes to World Digital Library with 87.32 SWIF.

**Table 6.** Web Impact Factor

S. No.	Name of the library	IWIF	EWIF	SWIF
1	Universal Digital Library	2.89	29.06	29.14
2	World Digital Library	47.25	38.42	87.32
3	International Children's Digital Library	2289.36	37.85	2328.54
4	Digital Library for International Research	3.41	1.15	4.69
5	The European Library	27.85	21.24	50.45
6	Digital Public Library of America	29.43	5.75	35.64
7	Digital Library of Georgia	0.19	0.52	0.73
8	The WWW Virtual Library	3.43	77.28	90.25
9	Kurdish digital Library	4.02	2.02	6.15
10	Texas Digital Library	0.54	0.08	0.66

## Google Page Rank

Domain validity was found in all the websites of selected digital libraries and all the selected digital libraries websites are listed in Google directory.

### ***Referring domains***

A referring domain is the domain that backlinks are coming from. If the website find that it's all backlinks are coming from a few referring domains so it means the website has to do some work. World Digital Library has the highest referring domains i.e., 13,333 whereas Universal Digital Library has the lowest i.e., only 13

### ***Global Rank***

Global rank is the rank of website as compared to all other sites in the world. The highest global rank among all selected digital library is secured by Digital Library for International Research i.e., 1,460,592 whereas the lowest is from Universal Digital Library i.e., 3,246.

### ***Indexed Urls***

Digital Library for International Research has the highest number of indexed urls i.e., 1,164,285 whereas Universal Digital Library has the lowest i.e., only 176.

### ***Google Page Rank***

PageRank (PR) is a calculation which evaluates the quality and quantity of links to a webpage in order to determine a relative score of that page's importance and authority on a 0 to 10 scale. Universal Digital Library and World Digital Library has the highest page rank i.e., 7 out of 10 whereas Digital Library for International Research has the lowest i.e., 3.

### ***CPR Score***

CPR score is a core page review score which is a simple way to review the main or core page of the website and bring it back to life. Universal Digital Library has the highest CPR score i.e., 7.7 whereas Digital Library for International Research has the lowest i.e., 3.3

### ***Trust Flow***

Trust flow refers to the number of trustworthy quality backlinks that website got. The links that come from trusted neighborhoods are more dependable when compared to links that come from un-trustable neighborhoods. The WWW Virtual Library has secured the highest position in trust flow with 64 followed by World Digital Library with 60 and International Children's Digital Library with 52 whereas lowest trust flow was from Universal Digital Library i.e., 8

### ***Trust metric***

The WWW Virtual Library has secured the highest position in trust metric with 64 followed by World Digital Library with 60 and International Children's Digital Library with 52 whereas lowest trust metric was from Universal Digital Library i.e. 8.

### ***PR Quality***

Among all the selected digital libraries only Universal Digital Library has the weak PR quality. The Digital Library for International Research, Digital Library of Georgia and Kurdish digital library has the moderate quality while rest of the libraries has very strong PR quality.

**Table 7.** Google Page Rank

S. No.	Name of the Digital Library	Google Page Rank	cPR Score	Trust Flow	Trust metric	Domain Validity	Referring domains	Global Rank	PR Quality	Google Directory Listed	Indexed Urls
1	Universal Digital Library	7/10	7.7/10	8	8	Found	13	3,246	Weak	Yes	176
2	World Digital Library	7/10	7.0/10	60	60	Found	13,333	31,035	Very Strong	Yes	135,924
3	International Children's Digital Library	6/10	6.6/10	52	52	Found	2,915	194,261	Very Strong	Yes	5,150
4	Digital Library for International Research	3/10	3.3/10	28	28	Found	218	1,460,592	Moderate	Yes	1,164,285
5	The European Library	5/10	5.6/10	36	36	Found	4,507	875,606	Very Strong	Yes	63,064
6	Digital Public Library of America	6/10	6.6/10	34	34	Found	5,678	154,028	Very Strong	Yes	744,022
7	Digital Library of Georgia	6/10	6.0/10	23	23	Found	106	4,430	Moderate	Yes	14,114
8	The WWW Virtual Library	6/10	6.2/10	64	64	Found	5,235	395,311	Very Strong	Yes	1,670
9	Kurdish digital library	5/10	5.0/10	23	23	Found	100	864,071	Moderate	Yes	6,854
10	Texas Digital Library	5/10	5.8/10	34	34	Found	4,853	136,453	Very Strong	Yes	915,148

## Conclusion

Webometric is one of the methods for assessing and evaluating websites including the digital libraries and its tools play a significant role in collecting the suitable data for conducting such researches. The present study is an attempt to assess and compare the ten international digital libraries and by using Mozlink explorer and Google page rank as a webometric tool to collect the required data. Thus, it can be concluded from the analysis of the findings that among all the ten selected international digital libraries the World Digital Library is leading with the highest page authority, external followed link, linking domains and followed linking domains. Similarly, Digital Public Library of America secured highest position in Internal followed links as well as total links. Though Universal Digital Library was found the highest domain authority but on the other side it has lowest linking domains, followed linking domains and total links whereas the lowest domain authority and page authority are from Digital Library of International Research. The library website of Digital Library for International Research has the highest spam score followed by Kurdish digital Library, The WWW Virtual Library and International Children's Digital Library which means that these library websites are in trouble, whereas, the rest of the library websites showed good status. As far as the web impact factor of the select digital libraries is concerned, the International Children's Digital Library secured first position in Internal Web Impact Factor and Simple Web Impact Factor whereas on the basis of External Web Impact Factor The WWW Virtual Library is leading the list. The assessment of Google page rank revealed that domain validity has found in all the websites of selected digital libraries and these websites are listed in Google directory. Despite of this fact that Universal Digital Library has the highest page rank and cPR score still found in a bad status because among all the select digital libraries it has the lowest referring domains, global rank, indexed urls, trust flow, trust metric as well as weak PR quality.

## References

1. Almind, T. C. & Ingwersen, P. (1997). Informetric analyses on the World Wide Web: Methodological approaches to Webometrics. *Journal of Documentation*, 53(4), 404-26. doi: <https://doi.org/10.1108/EUM0000000007205>
2. Fox, E. A., Akscyn, R. M., Furuta, R. K., & Leggett, J. J. (1995). Digital Libraries. *Communications of the ACM*, 38(4), 23-28. doi:10.1145/205323.205325
3. Hariri, N. & Norouzi, Y. (2011). Determining evaluation criteria for digital libraries' user interface: A review. *The Electronic Library*, 29(5), 698-722. doi: 10.1108/02640471111177116
4. Jeng, J. (2005). Usability Assessment of Academic Digital Libraries: Effectiveness, Efficiency, Satisfaction, and Learnability. *Libri*, Vol. 55, 96-121. doi: <https://doi.org/10.1515/LIBR.2005.96>
5. Saracevic, T. (2004). Evaluation of digital libraries: An overview. In *Notes of the DELOS WP7 workshop on the evaluation of Digital Libraries, Padua, Italy*. Retrieved 19 July, 2019 from [http://tefkos.comminfo.rutgers.edu/DL\\_evaluation\\_Delos.pdf](http://tefkos.comminfo.rutgers.edu/DL_evaluation_Delos.pdf)
6. Tsakonas, G. & Papatheodorou, C. (2008). Exploring usefulness and usability in the evaluation of open access digital libraries. *Information Processing and Management*, Vol. 44, 1234 -1250. doi:10.1016/j.ipm.2007.07.008
7. Xie, H. I. (2008). Users' evaluation of digital libraries (DLs): Their uses, their criteria, and their assessment. *Information Processing and Management*, Vol. 44. doi:10.1016/j.ipm.2007.10.

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Blended Learning in Education



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# Integrating MOOCs in Blended Learning for New Generation of Learners

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## Abstract

*Massive Open Online Courses (MOOCs) are technologically enhanced and innovative learning courses which provide high quality of teaching learning resources to a large community of learners. Digital India initiatives such as SWAYAM, SWAYAM Prabha (DTH channels) and National Digital Library of India (NDLI) have bridged the digital divide for learners and offer access to quality education to all particularly, for those who were earlier away from the access to the mainstream of knowledge economy. Academic institutions worldwide have adapted blended approach of teaching learning to meet the growing enrolment, quality teaching and equal opportunities of learning to all. MOOCs education can be made effective, attractive and entertaining on a blended mode for teaching, training and research institutions along with the traditional class-room approach. The present paper explores the role of SWAYAM in teaching learning process at National Institute of Educational Planning and Administration (Deemed to be University) and how their potential can be fully utilized in teaching, training and research areas in blended mode.*

## Keywords

massive open online courses, MOOCs, blended learning, technology enhanced learning, open educational resources.

## Introduction

Massive Open Online Courses (MOOCs) are technologically enhanced and innovative learning courses which provide high quality of teaching learning resources to the learners. MOOCs offer multiple benefits to students, researchers and faculty and provide opportunity to be engaged more and more in teaching learning process. They are taken as a key supplement to the learning world. MOOC is a substitute of virtual learning environment with an exception to free and open to all. Faculty, students, scholars, executives and administrators can access their desired online courses free from anywhere at any time. The

growing popularity of MOOCs has made it a topic of ongoing debate and research in both school and higher education from the last decade. MOOCs initiatives worldwide have provided quality education and quality teaching to all, which was not possible earlier. Earlier quality education was gained only by the students of world class institutions but technological advancements such as open educational resources, Virtual Learning Environments (VLEs), OpenCourseWare, open sources software and other tools have opened new avenues to the students and scholars to access quality education.

India has developed a very large system of education, both school and higher after Independence, where growing enrolment, quality teaching, quality learning material and quality infrastructure have become constraints to school and tertiary education. At present there are 1535610 schools including 840241 primary schools, 434844 Upper Primary Schools, 144400 High/Secondary Schools and 116125 Sr. Secondary Schools in the country in 2016 (NIEPA, 2017). At the higher level, there are 993 universities including 47 Central Universities, 127 Institutions of National Importance, 385 State Public Universities, 305 State Private Universities, 124 Deemed to be Universities, 5 institutions established under State Legislation established under Acts of Parliament, Government of India during 2018-19. The number of university level institutions has increased from 20 in 1947 to 993 in the year 2018-2019, the number of colleges has increased from 500 in 1947 to 39931 (university colleges and affiliated college) in 2018-2019, the enrolment of students has increased from 2.1 lakh in 1947 to 373.99 lakhs in 2018-19. The number of teaching faculty in universities and colleges has increased from 15000 in 1947 to 14.16 lakhs in 2018-2019 (AISHE, 2018-19). For such a large system of education, MOOCs initiatives have proved a boon to provide quality education and flexible learning environments to all.

MOOCs are the source of quality education and quality teaching that provide opportunities to faculty to be up-to-date, explore and exploit new technologies of learning, design and develop quality MOOCs and develop wide range of learning resources. Students and faculty use variety of online activities to enhance the learning, understanding and effectively participate in forum for discussion. Digital India initiatives such as SWAYAM and SWAYAM Prabha (DTH channels) have bridged the digital divide for learners and offer access to quality education to all from 9th class to post-graduation particularly, for those who were earlier away from the access to the mainstream of knowledge economy. Academic institutions worldwide have adapted the blended mode of teaching learning to meet the growing enrolment, quality teaching and equal opportunity of learning. This process of teaching learning engage the participants more and more for learning, build relationships between faculty and participants and provide opportunity of a lifelong learning. The present paper explores the role of SWAYAM in teaching learning process at National Institute of Educational Planning and Administration (Deemed to be University) and how their potential can be fully utilized in teaching, training and research areas. NIEPA has been notified by the MHRD as a National Resource Centre (NRC) for online refresher programmes for higher education through SWAYAM. It has launched an Online Refresher Course on Educational Planning and Administration through SWAYAM platform for the professional development of faculty of higher education. This has become a challenge to both faculty and students how MOOCs education can be made effective, attractive and entertaining on a blended mode for teaching, training and research institutions along with the traditional class-room approach.



This 21st century innovative teaching-learning process engages the learners in deep learning, offers variety of learning resources and transforms the youth towards meaningful learning. There is a pressing need to design and develop course content for researchers who are engaged in research in different disciplines. Quality lectures of best and experienced faculty will motivate the researchers to engage more and more in online courses relating to research. It is a challenging task for the faculty to empower students and research scholars to become critical thinkers and innovative researchers. Faculty should be more anxious to the expectations on online learning of the students and research scholars and motivate them to use MOOCs effectively and efficiently to achieve their desired goals. Success of the MOOCs depends largely upon its design, development and quality. Students' expectations and problems will help the faculty to improve the online learning and make it more effective, attractive and entertaining. Some of the popular MOOCs platform are: edX, Udacity, Udemy, Coursera, SWAYAM, etc.

### ***SWAYAM: An indigenous platform for MOOCs***

MOOC is a new ICT driven initiative of 21st Century innovative teaching learning programme in all disciplines offers access to a variety of educational courses, particularly learners of economically weaker sections of society, remote access, geographical dispersed learners free from any financial and technical constraints. This technology enhanced learning initiative has caught the attention of stakeholders and policy makers of higher education worldwide to adopt and work on usefulness and effectiveness of MOOCs. In this direction, India has developed Study Webs of Active Learning for Young Aspiring Minds (SWAYAM), an indigenous platform of the Government of India to host MOOCs, to enable learners to attend online courses from 9th class to post-graduate level including skill sector to empower and benefit to the youth of the country to acquire knowledge and skills in all disciplines through it. It is a Government of India's integrated learning platform for online courses taught by experienced and best faculty. SWAYAM provides top quality learning materials, open and easy access, monitoring, certification and flexible learning environment using multimedia anytime, anywhere. It offers opportunity to participants to interact with faculty and peer group on discussion forums and clarify the doubts, take tests, solve quizzes, submit assignments and earn certificate and academic grades. It provides quality content to learners in blended and fully online mode to enrich their learning. All courses of SWAYAM are of 12-15 weeks or more comprising of four quadrant approach (i) static content (downloadable/printed content, e-books, PDF), (ii) multi-media (video lectures) (iii) self-assessment tests (tests, quizzes, problems, MCQ, assignments, etc.) and (iv) an online discussion forum references and further readings. It is different from other MOOCs, for example, e-PG Pathshala which provides learning content for post-graduates courses in various subjects. These courses can be accessed as open educational resources, where no teacher, no instructor support is available for learners. On the other hand, MOOCs have teachers and instructors support. Group formation is possible of teacher-student groups, peer to peer is possible and learners can earn certificate/credit and academic grade on the successful completion of course on SWAYAM. SWAYAM notifies about online courses on 1st June and 1st November every year for the benefit of learners. All MOOCs of the various

types have been developed by the nine National Coordinators (AICTE, NPTEL, UGC, CEC, NCERT & NIOS, IGNOU, IIMB and NITTTR) on the SWAYAM. These courses can benefit the students, teachers, faculty, research scholars, lifelong learners, through variety of high quality learning resources [<https://swayam.gov.in/about>].

## **Potential Benefits and Challenges of MOOCs for Higher Education Institutions**

MOOC is an area of study for scholars engaged in online teaching and learning in virtual education world. No doubt, MOOC provides high quality of learning resources and experience to a large community of learners engaged in higher education worldwide. Software and tools have enhanced the access to quality education for everyone in the world. Universities have the potential to explore the MOOCs and adopt experience, experiment /new pedagogy of teaching both blended and fully online and strengthen to face challenges of MOOCs both by faculty and students. There are several reasons to teach MOOCs because it offers opportunities to faculty to harness new pedagogy of teaching, massive learning, unlimited enrolment, quality teaching, quality content and technology enhanced learning experience. Lowenthal, Snelson and Perkins (2018) indicated that faculty engaged to teach MOOCs is mainly because of passion, advertisement of courses and institution, and benefits and incentives to them.

### ***New approach of teaching and learning***

MOOCs are the innovative teaching learning approach for faculty and learners who have interest and passion to teach and learn MOOCs. Developing a MOOC is difficult for the faculty to accomplish in the specified time-period, similarity of contents and activities with other MOOCs and acceptance by the community of learners worldwide. “MOOCs served as a vehicle through which instructors could share information they were passionate about and to demonstrate new approaches for teaching” (Lowenthal, Snelson and Perkins, 2018: 7-8). Engagement of faculty in MOOCs is not only because of passion, motivation and incentives but to explore new ways of teaching and learning and keep themselves up-to-date with the emerging challenges of ICT in education, since, all academic and research institutions worldwide have adopted teaching learning process in a blended mode to address the growing enrolment, deliver quality education and flexible learning environment. Online teaching through MOOCs gives exposure to both learners and instructors, enhances the commitment and stature of the university. World Wide Web (WWW) increases the visibility of the online courses, offers opportunity to hire and exchange the talented instructors for the successful launching and completion of the courses.

### ***Challenges to integrate technology in education***

There are several challenges before the faculty to design, develop, implement and employ the potential benefits of MOOCs for their continuity in teaching and learning. Integration of technological tools in education, their implementation and acceptance has challenged the faculty, educationists and policymakers to reconsider the pedagogy of teaching learning process. Developing and teaching a MOOC is a challenging task for the faculty since lot of hurdles such as online teaching, development of quality content, Creative Commons (CC), copyright issues in learning content (intellectual property rights issues), lack of familiarity with ICT tools, lack of academic, administrative and technical support, assessment, evaluation, discussion and interaction with students and individual feedback to the large enrolment of students. Challenge to develop the MOOC on a massive scale and activities related to discussion, assessment, monitoring, instructional strategies, etc. needs adequate compensation, reduce workload of teaching learning and administrative process. Besides all these hurdles, “MOOCs are the future of online learning” (Lowenthal, Snelson and Perkins, 2018: 13).

### ***Course completion as a challenge***

In fact, MOOCs deliver a rich source of content which is equipped and integrated with variety of media such as text, multimedia, video, simulations and discussion forum to solve complex situations and provide exemplary support to learners engaged in deep learning. Instructor must advise the participants to strictly adhere to the planned schedule for timely completion of the course. Instructor should monitor the course completion progress of each of participant, provide constant communication support and advice the participants accordingly and respond to participants’ questions and problems. Completion rate of the MOOCs is very low since most of the participants do little or not participate in the course after enrolment. Earlier completion rate of MOOCs was 5% but Riber’s (2017) study indicated that an average completion rate of participants who were enrolled in the course was 11.4%. “A striking feature of MOOC participation is the number of people who enroll and then do little or nothing else....an overwhelming majority of people

who enroll in MOOC subsequently do not actually participate in it” (Riber, 2017: 1298). To raise the completion rate of MOOCs from 5%, certification/credit should be awarded to those completing the course in stipulated time frame. Rather than providing the MOOCs free; there should be low cost enrolling fee to ensure the completion of the course. A part of the fee could also compensate the faculty for their tireless efforts and countless hours in teaching the course.

### ***Motivation***

Motivation is one of the very important factors for both learners and developers of MOOCs. MOOC participants can rationale for their motivation to complete the online course. Participants engaged in online courses should provide feedback of every course to the faculty to design unique learning environments and activities to achieve their goals. Participants should be encouraged and motivated to use variety of online activities such as forum for communication,

discussion and solving complex situations, quizzes, submission of projects, assignments, assessment, feedback, etc. These activities enhance the students learning, understanding and encourage them to participate in forum for discussions, social interactions and clear doubts and concepts. Social interaction is one of the important factors of successful learning in both small and large online groups of participants. Highly engaged participants in social interactions in online groups gain more in learning and completing courses in prescribed periods (Barak, et al., 2016).

### ***Commitment of learners***

Participation in MOOC is for only serious and committed learners who have commitment to complete the course well in time. MOOC should be developed according to the curriculum of the course where participants can enjoy teaching learning process (technology enhanced learning) like in a traditional classroom approach. Faculty can use the SWAYAM courses during the classroom teaching process to enhance the learning in blended mode. The blended teaching learning process helps to improve the quality of learning. As studies have indicated that completion rates of the MOOC is very low. Only 5% of the 108008 people completed the course who actually registered for the course and 30% of the enrolled did never open the course site (DeBoer, et al., 2014). Reason for not completing the course was enough time to complete their desired course (Riber, 2017: 1300). In fact, participants do not devote desired time as instructed for the completion of the course. So the commitment of learners and instructors is very important to enhance the completion rates of MOOCs at global level.

### ***Organisation and design of the course***

MOOC course should be systematically developed according to curriculum of national reputed institutions so that students enrolled in these courses of varied educational, cultural, professional, linguistic backgrounds get opportunity to attend the lecture and consult reading material in the absence of quality teaching and submit assignments for their further learning. It should be based on the objectives of traditional course design principles. “Design must also address unique challenges, such as the large number of students in a MOOC and their varied backgrounds and range of expectations. Faculty must also consider how they can build a cohesive learning community in an asynchronous learning environment” (Diaz, Brown & Pelletier, 2013: 6). They should focus on effective designing of MOOC by following weekly planned schedule to complete the course and guiding learners consistently to take support of learning community. Well organized and structured design of the course is very helpful and considered as important for the success of MOOC. More and more integration of activities and video assist the participants to understand the concepts and problems. Even videos created for MOOCs can be viewed by participants and used by faculty in classroom teaching learning process. Talented faculty of academic and research institutions should be encouraged to prepare and place their courses on SWAYAM. Course designers of MOOCs also need to recognise that MOOCs should not be prepared only for the students of university or college but be prepared for variety of learners engaged in it. It should remain free from any charge. Participants want high quality, well designed, open access and free MOOCs for their study.

### ***Deep understanding about MOOCs***

Increasing interest of learners to get multiple specialisation, in academic, corporate and professional sectors and innovations in ICT has facilitated the learners to experience variety of learning techniques to enhance the learning to compete with most competitive world. Faculty and learners' deep understanding and engagement with MOOCs help to explore its effective role in teaching and learning. "Overall, research on the impact and value of MOOCs is in its infancy. We need deeper understanding, for example, of the MOOC's role in teaching and learning....Online learning and live learning have their respective strengths.

Online learning, for example, is good for mastery learning" (Diaz, Brown, & Pelletier, 2013: 2, 15). There is a need to examine more technological innovations and tools to make effective use of MOOCs in variety of teaching learning settings and enhance learning face-to-face, blended and fully online.

### ***Assessment***

Assessment of participants in a MOOC is very important to evaluate the performance of the learning of participants. Participants' performance should be assessed with a valid and reliable way and clear instructions to the participants must be given about standards and criteria for peer assessment of MOOCs so that participants can aware themselves about the assessment criteria. Assessments consists of weekly quizzes, self-assessments, peer reviewed assignments and a final exam in the form of assignment or a quiz. It should be based on multiple-choice quizzes and short answer questions rather than open-ended assignments and essay type questions. Assessment of participants can be done by peer to peer and author. Peer assessment is the best way of learning and enhancing the performance of the participants. It is more valid to measure the performance of participant in comparison to self-assessments.

### ***Equal access of learning to all***

MOOC offers opportunity of equal participation of male and female in learning irrespective of economic status, educational background, ability and behavior. It is the best source of quality learning for both male and female participants. All institutions should recognize the MOOCs and instruct students to enroll themselves in at least one or two courses and get credit along with grades. Students, scholars and faculty should be encouraged to join the network of open educational resources such as National Digital Library of India, SWAYAM, DOAB, DOAJ, etc. to access free digital resources while doing class work and preparing assignments.

### ***Collaborative learning and group formation perception in MOOCs***

Grouping of participants means collaboration to some extent and group formation whether in class room and online promote learning and "can affect the way people work together towards a common goal and eventually the learning outcome itself" (Manske, et al., 2015: 183). Since small grouping or collaborative learning and research activities among participants and their social interaction in online platform generates ideas that assist in building the knowledge in technology-enhanced classroom setting. It affects the participants' learning behavior and

experience and their performance in collaborative learning and research activities. “In order for new approaches, tools, resources and environments to transform pedagogy in ways that facilitate student-centered, engaged, meaningful learning, they must be adopted, adapted and infused in practice by educational institutions” (Cavanaugh, Hargis, Munns, and Kamali, 2012: 4).

Collaboration between faculty, students and scholars is helpful to explore courses of research on different disciplines on SWAYAM platform and encourage and make aware the new generation of scholars about technology-enhanced learning.

### ***Blended teaching learning approach***

Blended teaching learning approach is an academic challenge to both faculty and participants since all academic institutions worldwide have adopted the process of teaching and learning in blended mode to address the issues of quality education, quality learning material and growing enrolment. Blended learning can be made effective, efficient, encouraging and entertaining with the integration of SWAYAM MOOCs. Even research area of the universities can be strengthened by participating, developing and integrating courses on research in all disciplines (Thakur, 2018). Online teaching and learning is based on certain standards and expectations and faculty spend significant amounts of time for studying, preparing and transacting the content to enrolled participants to achieve the academic excellence. “Incorporate online learning with classroom presence leads to blended learning scenarios. This gives the opportunity to take the collaborative parts of the learning into the classroom, with all its benefits and challenges for the teacher” (Manske, et al., 2015: 188).

## **Conclusion**

Technology enhanced learning is an innovation of 21st century in teaching learning process that has enhanced the learning process more than traditional classroom learning. It gives variety of learning opportunities such as text, video, quizzes, online assignments and so on. “MOOCs have already proven to be a disruptive force, in a constructive way, by prompting the rethinking of current models and practices and by challenging us to think outside boundaries to envision new ways of delivering education” (Diaz, Brown & Pelletier, 2013: 2). New generation of students still prefer classroom teaching as “two way communication in traditional classroom teaching is far more effective than MOOCs. Classroom teaching promotes healthy discussion at the same time rather than use forum for discussion in MOOCs and wait until the instructor or peer group responds. Classroom teaching gives immediate response to the query of participants than virtual learning environments’ (Vipul Singh Thakur, B.Tech). Several studies of MOOCs have rated 5% successful completion rate of MOOCs which is very low. Rieber’s study indicated that time is one of the significant factors as stated that “people report the most difficult obstacle to overcome when intending to complete a MOOC is time” (Rieber, 2017:1302). In fact, we should not forget that MOOC is a vehicle for learning that offers quality education, quality resources, flexible learning environment along with certificates, credit/grades. Its content developed in variety of forms can augment in traditional classroom mode. It is a great commitment of universities and government to provide quality education and hone the skills of youth. So,

MOOC providers should prioritize the MOOC as high quality, low cost and open access to enrich the learning environment. For the sustainability of free MOOCs, either they need to be made mandatory in the curriculum or be priced for those who are actually enrolled in it.

## References

1. Barak, Miri, Watted, Abeer & Haick, Hossam. (2016). **Motivation to learn in massive open online courses: Examining aspects of language and social engagement.** *Computers & Education*, 94: 49-60.
2. Cavanaugh, C. et al. (2012). **iCelebrate teaching and learning: Sharing the iPad experience.** *Journal of Teaching and Learning with Technology*, 1(2): 1-12.
3. DeBoer, J. et al. (2014). **Changing “Course”: Reconceptualizing educational variables for massive open online courses.** *Educational Researcher*, 43(2), 74-84.
4. Diaz, V., Brown, M. & Pelletier, S. (2013). *Learning and the massive open online course: A report on the ELI focus session.* Retrieved October 4, 2018, <https://library.educause.edu/~media/files/library/2013/5/eli3029-pdf.pdf>
5. India. Ministry of HRD. **All India Survey on Higher Education 2018-19.** New Delhi: MHRD.
6. Lowenthal, Patrick R., Snelson, Chareen and Perkins, Ross. (2018). **Teaching Massive, Open, Online, Courses (MOOCs): Tales from the front line.** *The International Review of Research in Open and Distributed Learning*, 19(3): 1-19.
7. Manske, S. et al. (2015). **Using differences to make a difference: A study in heterogeneity of learning groups.** *11th International Conference on Computer Supported Collaborative Learning (CSCL 2015)*, Jun 2015, Gothenburg, Sweden. <hal-01206688>
8. Available at <https://telearn.archives-ouvertes.fr/hal-01206688/document> Accessed on 7 December 2018.
9. NIEPA. (2017). **School education in India: U-DISE flash statistics 2016-17.** New Delhi: NIEPA.
10. Rieber, Lloyd P. (2017). **Participation patterns in a massive open online course (MOOC) about statistics.** *British Journal of Educational Technology*, 48(6): 1295-1304.
11. Thakur, D. S. (2018). **Virtual Learning Environment: Using MOODLE as a blended learning approach for teaching, training and research institutions in India.** In *Building Smart Libraries: Changes Challenges Issues & Strategies*, edited by Abdul Majid Baba, Raj Kumar Bhardwaj, S. S. Dhaka, Tariq Ashraf and Nabi Hasan. New Delhi: Asian Library Association, pp. 177-188. [Conference Papers of 3rd International Conference of Asian Libraries held at Central University of Kashmir, Kashmir during August 6-8, 2018.]





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# Embracing Open Access: Practices and perception of LIS Professionals in Bangladesh

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## Abstract

**Purpose-**Open access movement has become the center of discussion during the last decade. The objective of this study is to identify the scenario of open access, how professionals are being benefitted through open access system and to evaluate the development of open access initiatives in Bangladesh.

**Methodology-**This study is based on both primary and secondary sources of data. The population of this study is private universities of Bangladesh and we have selected EWU, NSU, BRAC, IUB as sample because they are the most prominent and renowned private universities of Bangladesh. For studying overall scenario of open access, a survey was conducted by using open and closed ended questionnaire techniques.

**Findings-**The results showed that the use of open access among professionals have increased in the last few years. In terms of the use of open access, the study revealed practice among LIS professionals have emerged tremendously and the usage percentage has been increased into 79.3225. It showed more promise of adopting open access initiatives among private universities of Bangladesh. It also explores the motivational factors that influence the LIS professionals and strengthen the role of the librarian as manager of institutional assets.

**Research limitations-**One of the major barriers of this study was to communicate with LIS professionals during survey. Moreover, our study had been restricted only within four private universities of Bangladesh.

**Practical Implication-**The study presents data that can be used by university libraries and information centers to develop support and facilitate access to digital resources.

**Originality/value-**This study will assist in understanding the overall scenario of open access among LIS professionals of private university. Moreover, this study is based on original data so the result of the study could play a great role in the implementation of open access.

## Keywords

Open access, Resource, Practices, LIS professionals, Private University Library.

## Introduction

During the past decade, a remarkable surge of interest in open access has seen around the world, and the adoption of OSS (open source software) has also increased tremendously because of accessibility and utility of internet. Before the information system was not that much developed. The web based information system has been developed through 4 generations. There are two types of software. One type is commercial software and another one is open source software where the source code is open for all so the general people and user can customize the software as the need. The first benefit has been obtained by the LIS community with the arrival of the OA culture. This study will help us to evaluate how LIS professionals are being convenience through open access system. The study revealed practice among LIS professionals have emerged tremendously and the usage percentage has been increased into 60-70%. It showed more promise of adopting open access initiatives among private universities of Bangladesh. It also explores the motivational factors that influence the LIS professionals and strengthen the role of the librarian as manager of institutional assets. Besides this, the study will also show that there is lack of proper training and IT knowledge among the LIS professionals. We have investigated details and important aspects of the overall scenario of open access and it works in the enlightenment of retrieving digital resource, which should be implemented by other academic communities also.

## Open Access

Open access (OA) is a mechanism by way of which research outputs are distributed online, free of value or different barriers and, in its most unique meaning, with the addition of an open license that gets rid of most restrictions on use and reuse.

(Corrado 2005) said that Open access helps to ensure long-term access to scholarly articles. Unlike articles that are licensed in traditional article databases, libraries and others can create local copies and repositories of these resources. Libraries, by working together to make repositories of open access literature, can ensure continued access to these scholarly publications into the distant future.

(Willinsky 2003) Identified nine flavors of open access. The flavors are: 1) e-print archive (authors self-archive pre- or post-prints), 2) unqualified (immediate and full open access publication of a journal), 3) dual mode (both print subscription and open access versions of a journal are offered), 4) delayed open access (open access is available after a certain period of time), 5) author fee (authors pay a fee to support open access), 6) partial open access (some articles from a journal are available via open access), 7) per-capita (open access is made available to countries based on per-capita income), 8) abstract (open access available to table of contents/abstracts, and 9) co-op (institutional members support open access journals).

(Anderson 2004) said that there is no such thing as free information and that there are costs involved in producing scholarly information. However, with the advent of new technologies and software programs, it is becoming increasingly less expensive to compile and distribute scholarly information. By using different funding methods and electronic delivery of journals, the costs can be absorbed by alternative means to subscription fees. One of the great benefits to open access is that libraries in smaller institutions or in economically disadvantaged areas around the world can have greater access to these scholarly resources.

## **Open Source**

Open-source software (OSS) is a kind of laptop software program in which source code is released under a license in which the copyright holder supplies users the rights to study, change, and distribute the software to anyone and for any purpose. Open-source software program might also be developed in a collaborative public manner. Open-source software is a outstanding example of open collaboration.

According to (Corrado 2005) Open source software is software that includes source code and is usually available at no charge. There are additional requirements besides the availability of source code that a program must meet before it is considered open source including: the software must be free to redistribute; derivative works must be allowed; the license can't discriminate against any persons; and the license cannot discriminate against any fields of endeavor. Software that is licensed under an open source license allows for a community of developers from around the world to improve the software by providing enhancements and bug fixes.

## **Open Source Movement**

The free-software movement was once launched in 1983. In 1998, a team of individuals recommended that the term free software have to be changed by open-source software program (OSS) as an expression which is much less ambiguous and more comfortable for the company world. Software builders may additionally favor to submit their software with an open-source license, so that each person may additionally also strengthen the identical software or understand its interior functioning. With open-source software, usually all of us is allowed to create adjustments of it, port it to new operating structures and instruction set architectures, share it with others or, in some cases, market it.

## **Advantages of Open source software**

- Open source software program is typically less complicated to achieve than proprietary software, frequently ensuing in elevated use. Additionally, the availability of an open source implementation of a trendy can extend adoption of that standard.
- Moreover, lower fees of advertising and marketing and logistical offerings are wanted for OSS.
- The OSS development strategy has helped produce reliable, high nice software rapidly and inexpensively.

- Open supply improvement affords the viable for a greater flexible science and quicker innovation. Even if the employer fails, the code continues to exist and be developed by way of its users. Also, it uses open standards handy to everyone; thus, it does no longer have the problem of incompatible codes that may additionally exist in proprietary software.
- It is flexible because modular structures allow programmers to construct custom interfaces, or add new abilities to it.

### **Disadvantages of Open source software**

- It is every so often said that the open supply development method can also no longer be well defined and the ranges in the development process, such as device checking out and documentation may be ignored.
- Not all OSS initiatives have been successful. Software professionals and researchers who are not satisfied by open source's ability to produce quality structures perceive the unclear process.
- It is also challenging to diagram a commercially sound commercial enterprise model round the open supply paradigm. Consequently, only technical necessities may be satisfied and not the ones of the market
- In phrases of security, open source can also allow hackers to be aware of about the weaknesses or loopholes of the software greater without difficulty than closed-source software.
- It depends on manage mechanisms in order to create positive performance of self-sufficient sellers who take part in virtual organizations.

### **Literature Review**

Sarrafzadeh (2006) had identified the general views of library and data science authorities on information management and look at their assessments of its doable values, benefits, possibilities and threats to the profession. The survey observed an elevated consciousness amongst LIS professionals of their workable contribution to know-how management, with a high settlement on its nice implications for both individuals and the profession.

Utulu and Omolara (2009) published that the respondents were conscious of the pre-print and open access journal initiatives than the post-print initiative. In phrases of the use of open get admission to initiatives, although the find out about published insignificant use among the academics, lecturers in sciences showed extra promise of adopting open get entry to initiative as authors and readers of scholarly sources than their counterparts in the humanities.

Shoeb (2010) found that Space is preferred as an IR software program at IUB. Systematic storing and access to the lookup output of IUB will be provided with the aid of the IR, which will be fee effective and centrally managed. This paper small print the first time that an IR has been instituted in Bangladesh from the librarian and university library perspective. This study no doubt will foster extra research on IRs for the enchantment of digital content material management.

Spezi (2013) had explored that the researchers' attitudes towards versions of published journal articles made open access with the aid of open access repositories may also vary depending on whether researchers document behaviors from the viewpoint of an author or a reader. The research discovered that disciplinary cultures, norms and traditions form authors' self-archiving behavior and readers' use of these versions of journal articles held in repositories.

Ruth (2013) has studied on the present impact open access admission to initiatives (OAIs) have on journal cancellations in university libraries in South Africa. The findings revealed that OAIs had a very restrained affect on journal cancellations in South African university libraries

Sahu and Arya (2013) had studied on Open access practices in India and the results showed that India's contribution has expanded in the ultimate few years. It was located that the recognition about such open get entry to information sources and initiatives amongst the lookup neighborhood is increasing. Open access publishing helps researchers' and scientists' get entry to to research literature thru the internet free of cost.

Pinfield (2015) had explored that a number of key topics are identified, including the relationship between “Green” OA (deposit in repositories) and “Gold” OA (OA journal publication), the growing proof base related with OA, researcher attitudes and behaviors, coverage directions, administration of repositories, development of journals, institutional responses and problems round have an impact on and scholarly communication futures. It suggests that present day challenges now center of attention on how OA can be made to work in practice, having moved on from the discussion of whether or not it appear at all.

Chen and DU (2016) indicated that OA journals have turn out to be an an increasing number of necessary phase of LIS journals. Production capability, academic have an impact on and network communication potential are vital factors affecting the excellent of OA journals. These three assessment warning signs of LIS OA journals are high, but many nonetheless have room for improvement.

Jain (2017) found out the primary collaborative activities from the DLIS workforce have been identified as the following: growing recognition of library resources and promoting library usage amongst students, facilitating library cloth resolution and inviting librarians as visitor lecturers to teach in the classroom. The foremost collaborative things to do from practicing librarians had been located to be the following: handing over statistics literacy instruction, offering professional/practical ride to students and information sharing with the DLIS educating staff. The most important challenges had been recognized as the following: one-of-a-kind cultures of educators and librarians, lack of need to collaborate and lack of formal coverage at the branch and the university level.

These literatures are based on the concept of open access and the usage of open access in information institutions. But there is no study on Open Access Practice among LIS Professionals of private University in Bangladesh. This study is on the specific topic and this will show the present status of open access among LIS Professionals of private University in Bangladesh and the applicable suggestions which can play a great role in the implementation or in the development of open access culture in Bangladesh.

## Objectives of the study

The aim of this study is to examine the perception of Information professionals towards the Knowledge Management and open access. The major objectives of the present study are:

- To identify the connection of LIS professionals with Open Access Culture
- To explore the Purpose of using Open Access Resources
- To identify how the Library professionals are being benefitted through open access system
- To evaluate the development of open access initiatives in Bangladesh
- To examine the problems faced by the LIS professionals
- To find out the overall scenario of open access culture among LIS professionals

## Research Questions

- Is there any connections between LIS professionals and open access culture?
- What is the purpose of using open access resources?
- What is the development process of open access in Bangladesh?
- Are the Library professionals are being benefitted through open access system?
- What are the problems faced by the LIS professionals?
- What is the overall scenario of open access culture among LIS professionals?

## Research Methodology

While there are numerous studies that focus on the many challenges of Open Access use in Bangladesh, few investigate the actual use of open access content among Bangladeshi academic libraries.

A survey of Open Access Practice among LIS Professionals of private University in Bangladesh questionnaire was designed to collect data to identify the insight about how they are being benefited by open access resources as well as the existing scenario of open access culture. The population of the study is Private universities of Bangladesh. The universities in Bangladesh are categorized into public and private universities. There are total of 122 universities in Bangladesh (UGC, 2015). We have selected four private universities as a sample of the study so the sampling technique is purposive. Data were collected from East West University Library, International Independence of Bangladesh University Library, North South University Library and BRAC University's Ayesha Abed Library. These libraries were selected because they are the renowned universities and they are taking some noticeable initiatives to make their information center digital and more technology oriented. Questionnaire has been used as a research tool. We have used Google form questionnaire and distributed through Google mail to the LIS professionals. Questionnaire consisted of 8 questions that asked the professionals about the resources they use for open access and so on. It was a mixed questionnaire. Open-ended and Closed-ended both type of questions were in the questionnaire.



**Table 1.** Chart of Sample Universities'

University	Category	Year of Est.	Library professional	F	%
North-South University	Private	1992	7	3	73.85
East-West University	Private	1996	6	5	78.71
Independence University of Bangladesh	Private	1994	8	5	87.5
BRAC University (Ayesha Abed Library)	Private	2001	6	3	77.23
<b>Total</b>	4		27		79.3225

## Findings

This section presents the findings of the study in line with the research questions using the questionnaire. The questionnaire copies were distributed through Google form. We targeted 16 information professionals' from 4 private university libraries in Bangladesh. The response rate was 100%.

The demographic characteristics of the academic librarians were studied to find out how they influence their awareness, which may lead to either negative or positive understanding about Open Access. The characteristics include gender, qualification, position and years of experience.

The findings indicate that out of 16 respondents, 78.6% were males while 21.4 % were females. The researchers have come to an understanding that there were more male academic librarians in private universities than the female counterparts.

**Table 2.** Academic qualification of the respondents

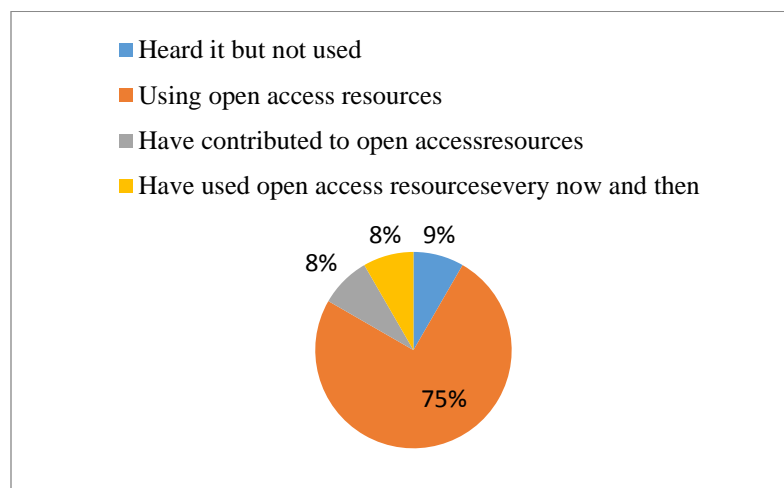
Qualifications	Percentage
M.A./M.Sc.	71.4%
Masters of Social Science (MSS)	7.1%
MSS in Information Science And Library Management	14.2%
Others	7.1%

In terms of the highest academic qualifications attained the findings shows that out of 16 respondents, 71.4% were found to be holders of certificate from M.A./M.Sc. 7.1% have certificate on MSS, 14.2% have certificate from MSS in Information Science And Library Management and the rest of the respondents have certificate from others background.

**Table 2.** Year of experience of the respondents

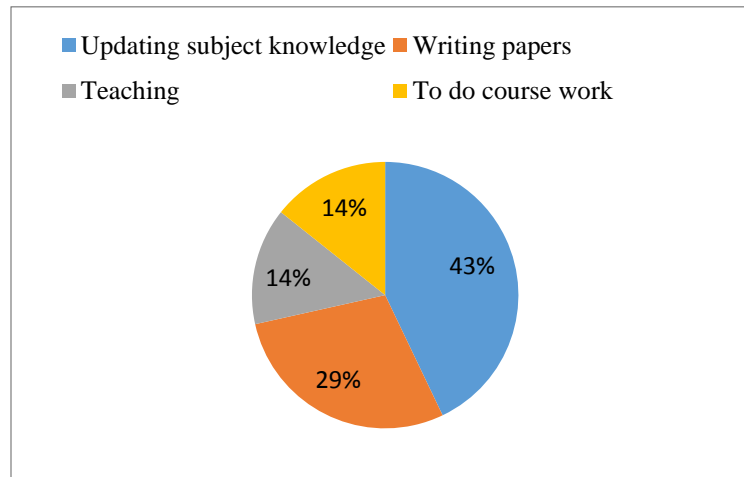
Years of Experience	Percentage
Below 5 years	35.7%
5-9 years	42.9%
9-12 years	7.1%
Above 12 years	14.3%

The findings show that the highest percentage of experience is within 5 to 9 years which is 42.9% and below 5 years percentage rate is 35.7%. From 9 to 12 years rate is 7.1% and above 12 years rate is 14.3%.



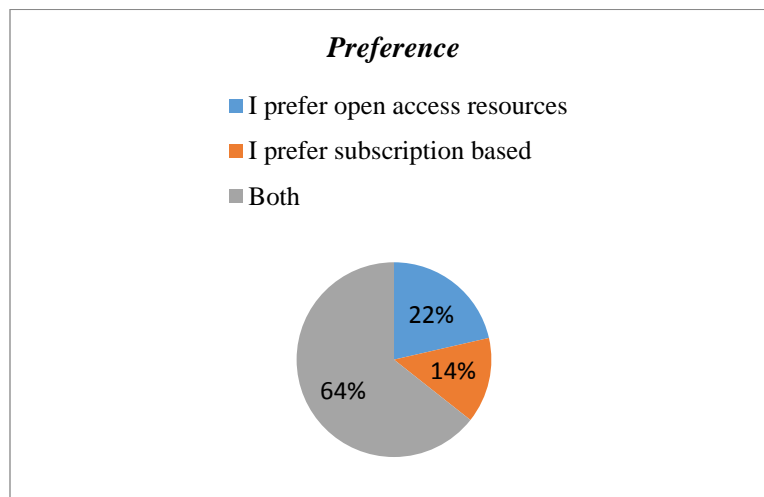
**Figure 1.** present status towards open access resources

In case of present status towards open access resources the majority is using open access resources which is 75% and 9% have heard but don't use. The ratios of contribution to open access resources and the use of open access resources very now and then are same.



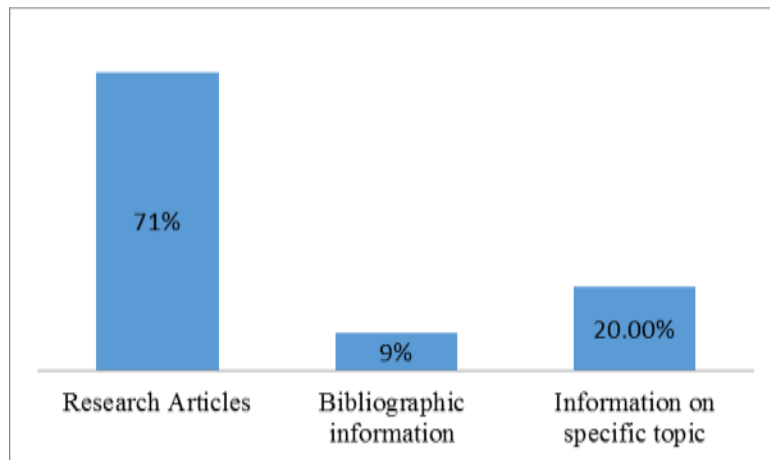
**Figure 2.** Purpose of using Open Access Resources

The major purpose of using resources is for updating subject knowledge and this is 43%. Some professionals' thinks for writing purpose it is 29%. For teaching and course work purpose the percentage is 14%.



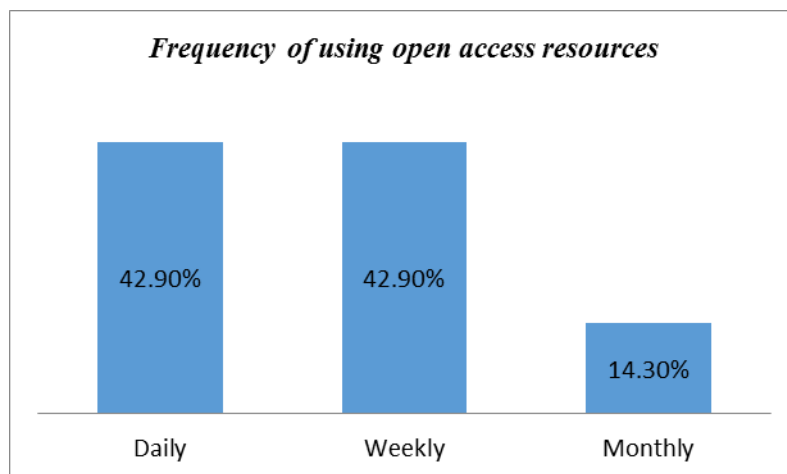
**Figure 3.** Preference between open access and subscription based resources

In terms of preference, 64% professionals prefer both the open access and subscription based resources. Only 22% prefer only open access resources and 14% prefer subscription based resources.



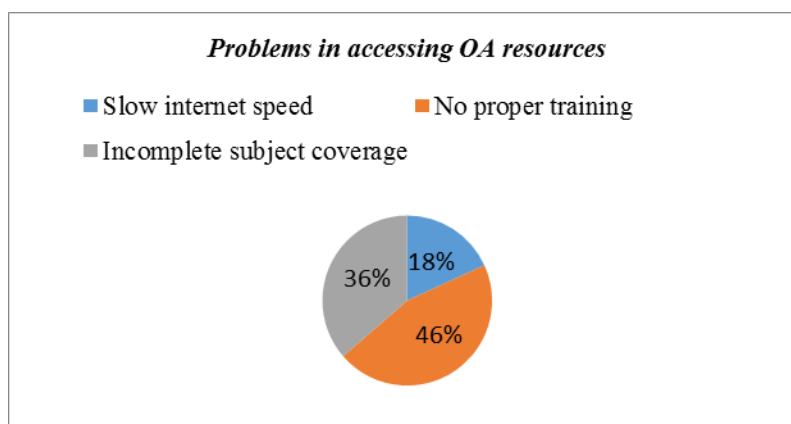
**Figure 4.** Type of information searched by LIS professionals from the open access resources

71% users are using open access for studying the research articles. 20% users are using OA resources for finding the information on specific topic. Bibliographic information are searched by very low percentage users which is 9%.



**Figure 5.** Frequency of using Open Access Resources

In terms of frequency daily and weekly usage percentage is 42.90% and 14.30% use open access resources monthly.



**Figure 6.** Problems faced in accessing open access resources

From the finding it can be said that in Bangladesh professionals are facing guidance problems. They think that the major problem is not having the proper training facilities. The percentage is 46%. 36% have incomplete subject coverage and 18% are facing slow internet speed problems.

## Suggestion and Recommendations

- Many professionals think that there is need to create quality Library & Information professionals for serve the Faculty Members, Students and the community which are engaged in research activities.
- Many thinks as a lot of users do not have any proper idea about open access resources and due to the lack of proper knowledge, training, ICT skills they are not willing to use open access resources. So continuous awareness should be carried out throughout the institutions.
- Some LIS professionals think that guidance and practices of Open access resources are highly demanded as in a developing countries and Bangladesh not beyond this.

## Conclusion

The overwhelming availability and benefits of open access publications cannot be denied. Even at that, studies have revealed a mixed report on its use or adoption by scholarly community. From the current study, it is obvious that the awareness of open access concepts are highly demandable. But open Access Resources are very limited in our country. Moreover people are not interested to make their resources available on online so that users cannot easily access to their required documents. So, this field is not yet matured. More training programs and workshop should be arranged.

## References

1. Corrado, E. M. 2005  
**The Importance of Open Access, Open Source, and Open Standards for Libraries.**  
*Issues in Science and Technology Librarianship* 06-07. doi:DOI:10.5062/F42F7KD8
2. Willinsky, J. 2003  
The nine flavors of open access scholarly publishing  
*Journal of Postgraduate Medicine* 49: 263-267.
3. Anderson, R. 2004  
**Open access in the real world: confronting economic and legal reality.**  
*College and Research Library News* 64(4). Retrieved from <http://dlist.sir.arizona.edu/351/>
4. Corrado, E. M. 2005  
**The Importance of Open Access, Open Source, and Open Standards for Libraries**  
*Issues in Science and Technology Librarianship*, 06-07 doi:DOI:10.5062/F42F7KD8
5. Jain, P. 2017  
**Delivery of library and information science curriculum: A joint endeavour among LISeducators and library practitioners at the University of Botswana**  
*Library Review* 66(6/7): 482-504. doi:<https://doi.org/10.1108/LR-12-2016>
6. Sarrafzadeh, Maryam B. M. 2006  
**LIS professionals and knowledgemanagement: some recent perspectives**  
*Library Management* 27( 9):621-635. doi:<https://doi.org/10.1108/01435120610715527>
7. Chen,Ming and Du,Yunfei 2016  
**The status of open access library and information science journals in SSCI**  
*The Electronic Library* 34(5): 722-739. doi: <https://doi.org/10.1108/EL-05-2015-0070>
8. Pinfield, S. 2015  
**Making Open Access work: The “state-of-the-art” in providing OpenAccess to scholarly literature**  
*Online Information Review*39(5): 604-636. Retrieved from <https://doi.org/10.1108/OIR-05-2015-0167>
9. Ruth, G. H. 2013  
**The influence of open access on journal cancellations in university libraries in South Africa**  
*The Electronic Library* 31(5): 574-592. doi:<https://doi.org/10.1108/EL-10-2011-0142>
10. Utulu,Samuel C. Avemaria and Bolarinwa,Omolara 2009  
Open access initiatives adoption by Nigerianacademics  
*Library Review* 58(9): 660-669. doi: <https://doi.org/10.1108/00242530910997946>
11. Shoeb, M. Z. 2010  
**Developing an institutional repository at a private university in Bangladesh**  
*OCLC Systems & Services: International digital library perspectives* 26(3): 198-213.  
doi:<https://doi.org/10.1108/10650751011073634>
12. Sahu, Surendra Kumar and Arya Satish Kumar 2013  
**Open access practices in India**  
*Library Hi Tech News* 30(4): 6-12. doi: <https://doi.org/10.1108/LHTN-03-2013-0011>

13. Spezi, Valérie, Fry, Jenny, Creaser, Claire, Proberts, Steve and White, Sonya 2013  
**Researchers' green open access practice: a cross-disciplinary analysis.**  
*Journal of Documentation* 69(3): 334-359. doi: <https://doi.org/10.1108/JD-01-2012-0008>
14. Willinsky, J. 2003  
**The nine flavors of open access scholarly publishing**  
*Journal of Postgraduate Medicine* 49: 263-267.

# Institutional Repositories Movement in India: Tips for Sustaining in Challenging Times

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## Abstract

This paper is based on the work carried out by the authors at DESIDOC. The paper highlights the institutional repositories (IRs) movement in India updated till 30<sup>th</sup> June 2019. This paper identifies, lists and enumerates a comprehensive listing of 141 institutional repositories developed by library professionals in India. A majority of these IRs are available for public use via Internet. The Indian IRs were identified through a comprehensive Internet searching and browsing of ROAR and OpenDOAR. A telephonic survey was conducted to examine the number of DRDO labs/esstts, who have already hosted IRs, and those who are planning in near future. The collection size of most of the IRs of India is in hundreds only. DSpace, was found to be most commonly used software for the creation of IRs in India. This paper explores not only benefits of IRs but also challenges faced in operating an IR. The LIS professionals should play a proactive role in increasing the awareness of IR amongst authors to enable IRs to become sustainable in the future.

## Keywords

Gyansrota, India, Institutional Repositories, IR software, Open Access Archives, Open Access Literature, Digital Storage

## Introduction

“Chang (2003) defines an Institutional Repository as a new method for capturing, collecting, managing, disseminating and preserving scholarly works created in digital form by the constituent members of an institution. For the present study, the term ‘digital libraries and repositories’ include digital collection, digital archives developed using digital library and Institutional Repository software packages. Raym Crow (2004) defined as Institutional Repository as a “Digital Archive of intellectual product created by the faculty, research staff, and students of an institution and accessible to end users both within and outside the institution, with few, if any barrier to access. The content is institutionally defined, scholarly, cumulative and perpetual, open and interoperable.”<sup>1</sup>

According to ROAR<sup>2</sup> (as on 30<sup>th</sup> June 2019), there are 4727 registered Institutional repositories in world. Out of total registration, there are 121 Indian repositories listed in ROAR. Another



important database OpenDOAR<sup>3</sup> lists 4150 Institutional repositories across all countries. OpenDOAR lists only 86 registered repositories from India.

Our study lists 141 IRs in India (Appendix-A) of which 125 are hosted on public domain (Internet) and balance 16 on hosted on Intranet/LAN (Table 6). Definitely there will be few more IRs which are hosted on various Institutes Intranet, therefore the general public is not aware of its existence. The leading IRs are developed by Indian Institute of Science (IISC), Defence Research and Development Organisation (DRDO), Indian Space Research Organisation (ISRO), Indian Statistical Institute (ISI), laboratories under the Council of Scientific and Industrial Research (CSIR), Indian Institutes of Technology (IITs), Indian Council Agricultural Research (ICAR), Department of Atomic Energy (DAE), Indian Council of Medical Research (ICMR), etc. List of IRs in India (updated as on 30<sup>th</sup> June 2019) is given at Appendix A.

## **Purpose of Establishing Institutional Repository**

There are many purposes of developing an Institutional Repository: “open access, resource discovery, dissemination of research widely, research evaluation and assessment, institutional and personal impact, information asset management by institutions, process improvements - store once, use many times. Provide a central archive of the work of Institute, increase the dissemination and impact of the research, increases visibility and prestige, acts as an advertisement to funding sources, provides access to the world's research, and ensures long-term preservation of institutes' academic output”<sup>4</sup>

## **Advantages of Institutional Repository**

- It is useful tool for collection, preservation, and dissemination of information resources
- These information resources (Digitally archived) will be accessible anywhere/anytime using Internet
- Improved citation of research publications as the repository will be accessible globally.
- Preservation and control of in-house publications
- To create global visibility for an institutions scholarly research.
- To promote self archiving
- Challenges the monopoly of publishers.
- Institutional Repository increases the accessibility and impact of research among the users
- IR facilitates more timely access to research publications by the users
- IR facilitates multiuser access digitally and simultaneously
- It can also include video and audio formats

## **Objectives of the Study**

- To compile an comprehensive list all Institutional Repositories in India.
- To analyse the software used for creation of these IRs
- To study the progress made by DRDO labs/estts in creating IRs

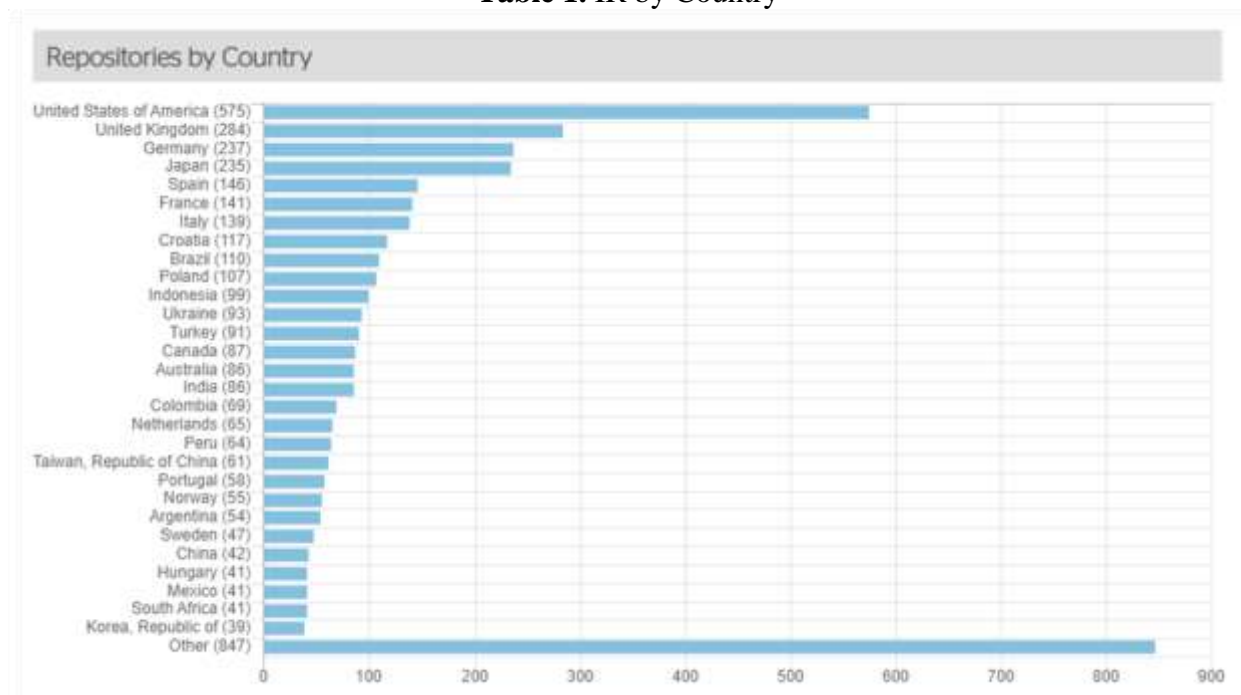
## Scope and Methodology

The authors identified Indian IRs through a study of published articles, which are available through internet searching and browsing. Use of existing ROAR and OpenDOAR databases were extensively used. Authors sent an questionnaire to different DRDO labs/estts to gather data. This was followed by an telephonic survey to a number of DRDO labs/estts. This paper draws on the results of survey conducted in the month of June 2019 with all the existing DRDO librarians across the country.

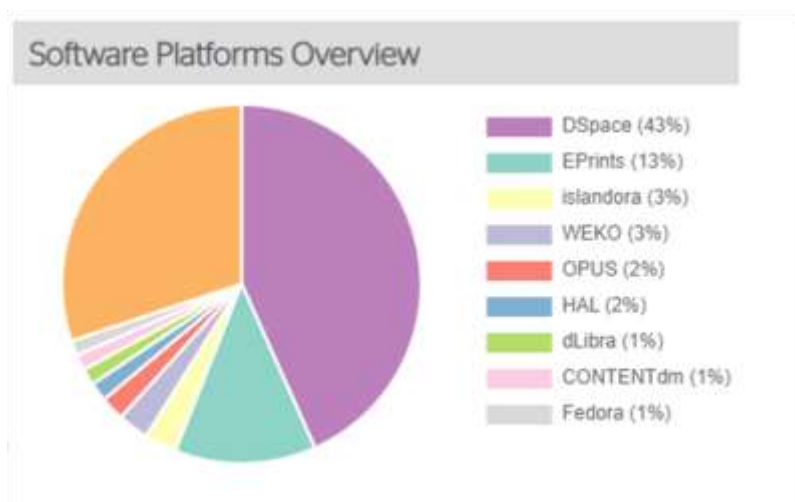
## Present Status

Table 1 to 5 gives details of IR by country, Software platform used across world Vis a Vis in India. Table 4 and 5 explains Language of content of IR across world vis a vis in India, Table 1 clearly shows the country rankings by number of IR developed. Top three countries are USA (66), United Kingdom and Germany. India is ranked at 16<sup>th</sup> number. As far as Software platform used across world and India is concerned Dspace is at top rank followed by Eprints. Table 4 clearly indicates English Language as number one followed by Spanish and German language as language of content of IR across world. Whereas in India (Table 5), English, Hindi and Gujrati are top three languages in which content is deposited in Indian IRs. These tables are primarily based on data from OpenDOAR<sup>5</sup>.

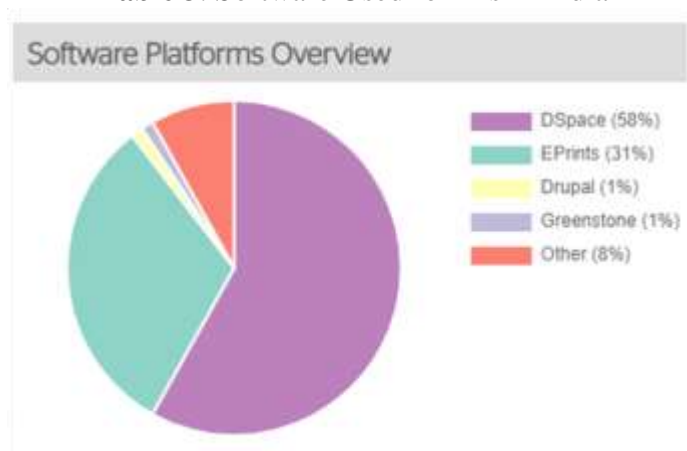
**Table 1. IR by Country**



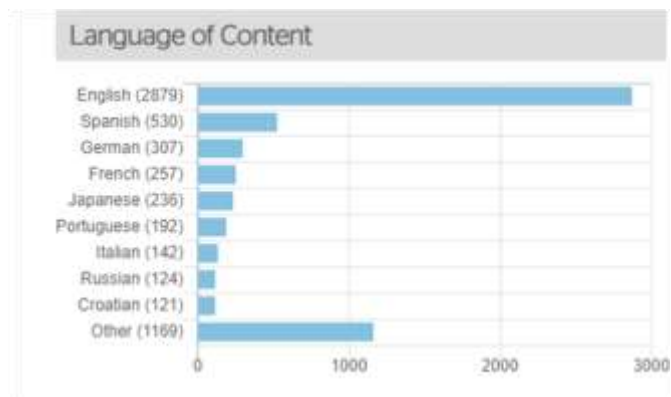
**Table 2.** Software Used for IRs across world

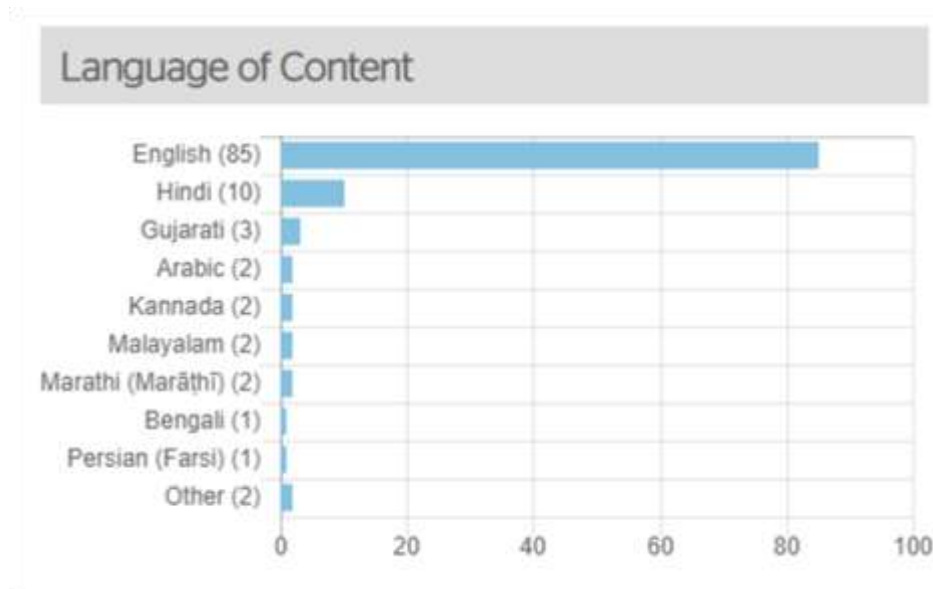


**Table 3.** Software Used for IRs in India



**Table 4.** Language of content of IR across world



**Table 5.** Language of content of IR in India

## IR Initiatives by DRDO

“Defence Research and Development Organisation (DRDO) was formed in 1958 with the amalgamation of Technical Development Establishments (TDEs) of the Indian Army and the Directorate of Technical Development and Production (DTDP) with the Defence Science Organisation (DSO). Today, DRDO with more than 52 labs/estt is engaged in developing defence technologies covering various disciplines like aeronautics, armaments, electronics, combat vehicles, engineering systems, instrumentation, missiles, advanced computing and simulation, special materials, naval systems, life sciences, information systems and agriculture. A number of projects are taken up by these labs for carrying out R&D in these areas”<sup>6</sup>.

Table 6 describes IR Initiatives by various DRDO Labs/Estts, It is seen that Armament Research & Development Establishment (ARDE), Pune and Defence Scientific Information and Documentation Centre (DESIDOC), Delhi are two DRDO laboratories whose IR has a large number of records. The Table also describes IR names and also the software used for development of IRs.

**Table 6.** IR Initiatives by various DRDO Labs/Estts

S.No	Name of DRDO Lab/Estt	Repository Name	Software Used	Number of Records
1	Advanced Systems Laboratory (ASL), Hyderabad	ASL-IR	DSpace	204
2	Aeronautical Development Establishment (ADE), Bengaluru	ADE digital repository	Eprints	267
3	Armament Research & Development Establishment (ARDE), Pune	Digital library@ARDE	DSpace	95370
4	Centre For Air Borne System (CABS), Bengaluru	CABS-Repository	DSpace	513
5	Combat Vehicles Research & Development Establishment (CVRDE), Chennai	IR@CVRDE	GSDL	86
6	Defence Scientific Information and Documentation Centre (DESIDOC), Delhi	Gyansrota	DSpace	8199
7	Defence Food Research Laboratory (DFRL), Mysore	IR DFRL	DSpace	737
8	Defence Institute of Advanced Technology (DIAT), Pune	IR@DIAT	DSpace	280
9	Gas Turbine Research Centre (GTRC), Bengaluru	Digital library@TICL	DSpace	189
10	Institute of Nuclear Medicine & Allied Sciences (INMAS)	Gyan Vikran@INMAS IR	DSpace	895
11	Electronics and Radar Development Establishment (LRDE), Bengaluru	LRDE digital repository	DSpace	1943
12	Microwave Tube Research & Development Centre (MTRDC), Bengaluru	MTRDC publication archives	GSDL	106
13	Naval Physical and Oceanographic Laboratory (NPOL), Kochi	DSpace@npol	DSpace	1942
14	Naval Science and Technological Laboratory (NSTL), Visakhapatnam	Institutional Repository	DSpace	268
15	Research & Development Establishment (Engineers) (R&DE(Engrs), Pune	IR RDE(E)	DSpace	3012
16	Snow and Avalanche Study Establishment (SASE), Manali	HIMGYANSROTA	DSpace	111

## DRDO Institutional Repository (GYANSROTA)

DESIDOC is the knowledge centre of DRDO, which prime responsibility is collection, processing and dissemination of scientific information for DRDO users. DESIDOC is a nodal agency for collecting and preserving of intellectual output of DRDO scientific heritage.

Defence Scientific Information and Documentation Centre (DESIDOC), Delhi, has created and hosted DRDO Institutional Repository (Gyansrota) on DRDO Intranet (DRONA). Institutional Repository of Research Papers/Articles is a digital archive of the knowledge capital of DRDO

which is accessible to the R&D community of the organization on DRDO Intranet. The Repository captures, stores, preserve and disseminate intellectual content/output of DRDO. This includes all published material like research papers, articles, orations, biographies, books, chapters etc. This Institutional Repository is hosted over DRDO Intranet under “Institutional Repository” title on the Single Window Services of DESIDOC. This institutional repository facilitates full-text access of all the documents archived in it. This repository provides data search on the basis of Year, Title, Author, Keywords and Citation. Currently it contains 8199 full text articles published by DRDO scientists and orations of eminent scientists of DRDO.

The advantages of Gyansrota repository are multifold like<sup>7</sup>:

- Serving as a tangible indicator of the institution’s quality and demonstrates the scientific, societal, and economic relevance of its research activities, thus increasing the institution’s visibility, status, and public value
- Long-term preservation of the research output of DRDO
- Providing wider, faster, and simultaneous/multiple access within the DRDO community
- Sharing and reusing of knowledge asset of the organization
- An Increase in citations to one’s research because of the open access on Internet
- Gyansrota is organised into a hierarchical set of communities, sub-communities, and collections:
- Communities: Form the top layer: i.e., DRDO HQrs (150 records), DRDO labs/estt (8049 records)
- Sub-communities: A Directorates and listing of 52 DRDO labs/estts.
- Collections: Each sub-community can contain various collections. These are groups of documents related by content type, i.e. research paper/articles, orations, articles in Hindi, etc.

Significance of Gyansrota institutional repository is as follows:

Individual point of view

- Preservation of intellectual output in digital form for future use
- record of his/her intellectual effort at one place
- More visible
- Get recognition and popularity
- Access to remote user
- Secure storage

Organisational point of view

- Get fame to the organisation
- Acts as central repository of intellectual output of an organisation

#### Laboratory point of view

- Centrally located research contents
- Easy and timely retrieval of documents
- Accountability
- Dissemination of Scientific work, free to the fellow colleagues

#### Professional point of view

- Tool for new R&D areas
- Tool to know the State-of-the Art in a given subject/discipline/area
- To develop network with others working in the same area



## Constraints in Building IRs in India

Some of the constraints in building IRs in India are as follows

- Nature of content: Classified and restricted cannot be uploaded in IR
- Lack of awareness amongst authors
- Absence of a well defined institutional policy
- Lack of IR expertise
- Lack of sufficient funds for building infrastructure
- Lack of awareness among authors of IR.
- A long time consuming IR deposition procedure
- Issue of copyright (lies with the publishers)
- A large number of Indian IRs are on LAN, which do not satisfy larger purpose
- Unwillingness of authors for depositing content in IR
- In case of DRDO: Classified/restricted content cannot be placed in IR
- “Ignorance of users in the absence of appropriate promotion program

- Poor bandwidth
- Inadequacy of generation of digital resources (Slow digital preservation)
- Poor adoption rate by academics
- Non-availability of telecommunications infrastructure
- Difficult to have control over the quality of the content to digitise
- Absence of a well defined contents related institutional policy
- Lack of IR expertise
- Insufficient funds for IT Infrastructure and manpower
- Apathy of authors towards this time consuming procedure.
- Difficulties in managing intellectual property rights
- Problems related to customization of open source software is a major bottle neck”<sup>7</sup>

## Suggestions

Suggestions for establishing sustainable institutional repositories are as follows:

- Most of the IRs particularly in India have not made the content open access due to various reasons.
- Among the IR software adopted DSpace and GNU Eprints are most popular.
- The policy statement should come from top for setting up of IRs in their respective organizations.
- An systematic awareness campaign should be launched for benefit of librarians and the users (contributors).
- Prominent Institutions and Library Associations should conduct workshops and training programs on IR.
- At national level, under the national digital library initiative a core team should be set up to facilitative setting up of IRs.
- BIS should work to arrives at one national standard for IRs in the country.
- It should be made mandatory (by policy) for authors to deposit their research output to IR.
- Later at National level India can set up a Registry of Indian Repositories having good support with ROAR and OPENDOAR.

## Conclusions

An IR is a digital archive of an institution’s intellectual capital. The present study reveals that the collections of the most of the repositories are very small (in the hundreds). For a country with 800 universities and a very large number of world-recognised research/academic institutions, the present number of institutional repositories is far from satisfactory. Strong measures need to be taken to motivate authors to submit their pre/post-prints in their institutional repositories.

Institutional Repositories (IRs) provides golden opportunity for libraries to collect, preserve and disseminate the institutions scholarly output not only to serve in-house clientele, but to serve potential users across the globe. There has been little promotion of open access and IR in India has been largely due to the efforts of librarians. Only a few institutes/organization have mandatory policy guidelines to deposit knowledge in IR. Whatever has been achieved till date it



is all through self motivated librarians of institute who are maintaining IR. I feel the authors should be convinced to deposit their intellectual output in IR which will increase citations to their article and therefore lead to higher impact factors of journals published in India.

At DRDO the major initiatives in the area of establishment of IR are taken by 16 DRDO Labs/Estts across country. They are ASL, Hyderabad (204); ADE (267), CABS (513), GTRE (189), LRDE (1943) and MTRDC (106) at Bangalore; ARDE (95370), DIAT (280) and R&DE (E) (3012) at Pune; CVRDE (86), Chennai; DFRL (737), Mysore; NPOL (1942), Kochi; SASE (111), Manali; NSTL (268), Visakhapatnam; INMAS (895), Delhi and the mother of all DRDO Institutional Repository- Gyansrota by DESIDOC (8199) at Delhi. Other 11 DRDO labs/estts are planning to establish IR in the near future. The only issue with DRDO, (which is working in sensitive military area) is that it's all established IRs are on Intranet and therefore can be used only by DRDO employees. However, it is planned to upload DRDO Institutional Repository- Gyansrota on Internet by DESIDOC by Sept 2019.

## References

1. R Mittal, G Mahesh Digital libraries and repositories in India: an evaluative study - Program, 2008 - emeraldinsight.com Program, Vol. 42 Issue: 3, pp.286-302  
<https://doi.org/10.1108/00330330810892695> (accessed May 12, 2019).
2. <http://roar.eprints.org/> (accessed June 30, 2019).
3. <http://v2.sherpa.ac.uk/opensoar/countrylist.php> (accessed June 30, 2019).
4. S.A. Mandhre, A.B.Rahalkar, M.D.Patil. Development of Institutional Repository for Technical Reports at HEMRL, TIRC: An Overview. <http://www.splup.in/> (accessed May 18, 2019).
5. <http://v2.sherpa.ac.uk/opensoar/> (accessed May 7, 2019).
6. <https://www.drdo.gov.in/drdo/English/index.jsp?pg=genesis.jsp> (accessed May 5, 2019).
7. Vij, Rajeev and Soni, Navin Kumar. Institutional Repositories Movement in India: Tips & Strategies for Success in the Challenging Times. PLANNER 2010, 371-86.Tezpur  
<http://hdl.handle.net/1944/977> (accessed June 27, 2019).

Appendix A: List of IRs in India (as on 30 <sup>th</sup> June 2019)				
S No	Repository Name	Organization	Software Use	URL
1.	Allama Iqbal Library Digital Collection	University of Kashmir	Greenstone	<a href="http://www.kashmiruniversity.net/">http://www.kashmiruniversity.net/</a>
2.	AMU Repository (Knowledge Repository)	Aligarh Muslim Reposiory	EPrints	<a href="http://ir.amu.ac.in/">http://ir.amu.ac.in/</a>
3.	Archives of Indian Labour	V.V.Giri National Labour Institute	HTML	<a href="http://www.indialabourarchives.org/">http://www.indialabourarchives.org/</a>
4.	ARIES, Digital Repository	ABA-NET	Architexturez	<a href="http://www.architexturez.net/">http://www.architexturez.net/</a>
5.	ARIES, Digital Repository	Aryabhatta Research Institute of Observational Sciences (ARIES)	DSpace	<a href="http://210.212.91.105:8080/jspui/">http://210.212.91.105:8080/jspui/</a>
6.	Atmiya Digital Repository	Atmiya Group of Institutions	DSpace	<a href="http://library.atmiya.net:8080/dspace/">http://library.atmiya.net:8080/dspace/</a>
7.	Bhogawati Mahavidyalaya Institutional Repository	Bhogawati Mahavidyalaya, Kurukali	DSpace	<a href="http://61.1.85.128:8080/xmlui">http://61.1.85.128:8080/xmlui</a>
8.	Bioinformation		Other Software	<a href="http://www.bioinformation.net/">http://www.bioinformation.net/</a>
9.	Catalysis Database	National Centre for Catalysis Research (IIT)	EPrints	<a href="http://www.eprints.iitm.ac.in/">http://www.eprints.iitm.ac.in/</a>
10.	CMFRI Digital Repository (Eprints@CMFRI)	Central Marine Fisheries Research Institute (CMFRI)	EPrints	<a href="http://eprints.cmfri.org.in/">http://eprints.cmfri.org.in/</a>
11.	CSIR-AMPRI DRS	CSIR	EPrints	<a href="http://eprints.ampri.res.in/">http://eprints.ampri.res.in/</a>
12.	DeepBlue Knowledge Repository@PDP	Pandit Deendayal Petroleum Univeristy (PDP)	DSpace	<a href="http://spmlib.pdp.ac.in:8080/xmlui/">http://spmlib.pdp.ac.in:8080/xmlui/</a>
13.	Delhi College of Engineering	Delhi College of Engineering	DSpace	<a href="http://202.141.12.109:8080/dspace">http://202.141.12.109:8080/dspace</a>
14.	Delhi College of Engineering Repository	Delhi College of Engineering	Other Software	<a href="http://202.141.12.109/dspace">http://202.141.12.109/dspace</a>
15.	Dhananjayarao Gadgil Library	Gokhale Institute of Politics and Economics	DSpace	<a href="http://library.gipe.ac.in/jspui/">http://library.gipe.ac.in/jspui/</a>
16.	Digital Repository @ IIT Gandhinagar	Indian Institute of Technology Gandhinagar (IIT)	DSpace	<a href="http://repository.iitgn.ac.in/">http://repository.iitgn.ac.in/</a>
17.	Digital Repository National Institute of Technology Goa	National Institute of Technology Goa	DSpace	<a href="http://idr.nitgoa.ac.in:8080/jspui/">http://idr.nitgoa.ac.in:8080/jspui/</a>
18.	Digital repository of Cochin University of Science & Technology (Dyuthi)	Cochin University of Science & Technology (CUSAT)	DSpace	<a href="http://dyuthi.cusat.ac.in/">http://dyuthi.cusat.ac.in/</a>
19.	Digital Repository of Ministry of Earth Sciences, Government of India	Ministry of Earth Sciences, GoI	EPrints	<a href="http://moeseprints.incois.gov.in/">http://moeseprints.incois.gov.in/</a>
20.	Digital Repository of Smt. Akkatai Ramgonda Patil Kanya Mahavidyalaya, Ichalkaranji	Smt. A.R.P. Kanya College, Ichalkaranji	Propriety	<a href="https://earpkmi.in">https://earpkmi.in</a>
21.	Digital repository of West Bengal Public Library Network	West Bengal Public Library Network	DSpace	<a href="http://dspace.wbpublibnet.gov.in:8080/jspui/">http://dspace.wbpublibnet.gov.in:8080/jspui/</a>
22.	DigitalLibrary@CUSAT	Cochin University of Science and Technology (CUSAT)	DSpace	<a href="http://dspace.cusat.ac.in/jspui/">http://dspace.cusat.ac.in/jspui/</a>
23.	DIR@IMTECH	Council of Scientific and Industrial Research, Institute of Microbial Technology	EPrints	<a href="http://crdd.osdd.net/open/">http://crdd.osdd.net/open/</a>
24.	DKR@CDRI	Central Drug Research Institute (CDRI)	DSpace	<a href="http://dkr.cdri.res.in/xmlui/">http://dkr.cdri.res.in/xmlui/</a>
25.	DRS at National Institute Of Oceanography (DRS@nio)	National Institute Of Oceanography (NIO)	DSpace	<a href="http://drs.nio.org/drs/">http://drs.nio.org/drs/</a>
26.	DSpace @ GGSIPU	Guru Gobind Singh Indraprastha University	DSpace	<a href="http://14.139.60.216:8080/xmlui/">http://14.139.60.216:8080/xmlui/</a>
27.	DSpace @ sdmcet	SDM College Of Engineering and Technology Dharwad	DSpace	<a href="http://210.212.198.149:8080/jspui">http://210.212.198.149:8080/jspui</a>

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28.	Dspace @ Vidyasagar University	Vidyasagar University	DSpace	<a href="http://inet.vidyasagar.ac.in:8080/jspui/">http://inet.vidyasagar.ac.in:8080/jspui/</a>
29.	Dspace at Bangalore Management Academy	Bangalore Management Academy	DSpace	<a href="http://bma.ac.in:8080/dspace">http://bma.ac.in:8080/dspace</a>
30.	Dspace at Guru Gobind Singh Indraprastha University	Guru Gobind Singh Indraprastha University, Kashmere Gate, Delhi	DSpace	<a href="http://dspace.ipu.ernet.in:8080/dspace/">http://dspace.ipu.ernet.in:8080/dspace/</a>
31.	Dspace at ICFAI BUSINESS SCHOOL	ICFAI Business School Ahmedabad	DSpace	<a href="http://202.131.96.59:8080/dspace">http://202.131.96.59:8080/dspace</a>
32.	Dspace at IIT Bombay (DSpace@IITB)	Indian Institute of Technology, Bombay (IITB)	DSpace	<a href="http://dspace.library.iitb.ac.in/jspui/">http://dspace.library.iitb.ac.in/jspui/</a>
33.	Dspace at Indian Institute of Geomagnetism (IIG)	Indian Institute of Geomagnetism	DSpace	<a href="http://library.iigm.res.in:8080/jspui/">http://library.iigm.res.in:8080/jspui/</a>
34.	Dspace at Indian Institute of Management Kozhikode (DSpace@IIMK)	Indian Institute of Management Kozhikode	DSpace	<a href="http://dspace.iimk.ac.in/">http://dspace.iimk.ac.in/</a>
35.	Dspace at IUCAA	Inter-University Centre for Astronomy and Astrophysics (IUCAA)	DSpace	<a href="http://repository.iucaa.in:8080/jspui/">http://repository.iucaa.in:8080/jspui/</a>
36.	Dspace at M S University	Maharaja Sayajirao University of Baroda	DSpace	<a href="http://14.139.121.106:8080/jspui/">http://14.139.121.106:8080/jspui/</a>
37.	Dspace at NCRA	Indian Institute of Technology, Bombay	Other Software	<a href="http://ncralib.ncra.tifr.res.in:8080/dspace/">http://ncralib.ncra.tifr.res.in:8080/dspace /</a>
38.	Dspace at University of Hyderabad	IGM Library	DSpace	<a href="http://digilib.uohyd.ernet.in/dspace">http://digilib.uohyd.ernet.in/dspace</a>
39.	Dspace at Vidyandhi	University of Mysore	DSpace	<a href="http://dspace.vidyanidhi.org.in:8080/dspace/">http://dspace.vidyanidhi.org.in:8080/dspace/</a>
40.	DSpace@GIPE	Gokhale Institute of Politics and Economics (GIPE)	DSpace	<a href="http://dspace.gipe.ac.in/">http://dspace.gipe.ac.in/</a>
41.	DSpace@IMSC	Institute of Mathematical Sciences	DSpace	<a href="http://www.imsc.res.in/xmlui">http://www.imsc.res.in/xmlui</a>
42.	DSpace@INFLIBNET	Information and Library Network Center (INFLIBNET)	DSpace	<a href="http://ir.inflibnet.ac.in/">http://ir.inflibnet.ac.in/</a>
43.	DSpace@MDI			<a href="http://dspace.mdi.ac.in/dspace">http://dspace.mdi.ac.in/dspace</a>
44.	Dspace@NITR	National Institute of Technology, Rourkela (NITR)	DSpace	<a href="http://dspace.nitrkl.ac.in/dspace/">http://dspace.nitrkl.ac.in/dspace/</a>
45.	DSpace@TU	Thapar University (TU)	DSpace	<a href="http://dspace.thapar.edu:8080/dspace/">http://dspace.thapar.edu:8080/dspace/</a>
46.	DU Eprint Archive	Delhi University	Eprints	<a href="http://eprints.du.ac.in/">http://eprints.du.ac.in/</a>
47.	E Knowledge Center	Foundation for Democratic Reforms	Drupal	<a href="http://ekcenter.fdrindia.org/">http://ekcenter.fdrindia.org/</a>
48.	eGyankosh	Indira Gandhi National Open University (IGNOU)	DSpace	<a href="http://www.egyankosh.ac.in/">http://www.egyankosh.ac.in/</a>
49.	Electronic Theses and Dissertations at Indian Institute of Science (edt@IISc)	Indian Institute of Science (IISc)	DSpace	<a href="http://etd.ncsi.iisc.ernet.in/">http://etd.ncsi.iisc.ernet.in/</a>
50.	Entrepo	Otolaryngology online journal, ENT Scholar - 2	Eprints	<a href="http://www.rhinology.in">www.rhinology.in</a>
51.	Eprint@NML	National Metallurgical Laboratory	EPrints	<a href="http://eprints.nmlindia.org/">http://eprints.nmlindia.org/</a>
52.	Eprints @MDRF	Madras Diabetes Research Foundation	EPrints	<a href="http://mdrf-eprints.in/">http://mdrf-eprints.in/</a>
53.	Eprints at Atmiya	Atmiya Group of Institutions	EPrints	<a href="http://atmiya.eprints.org/">http://atmiya.eprints.org/</a>
54.	ePrints@ATREE	Ashoka Trust for Research in Ecology and the Environment	EPrints	<a href="http://eprints.atree.org/">http://eprints.atree.org/</a>
55.	ePrints@Bangalore University	Bangalore University	EPrints	<a href="http://eprints-bangaloreuniversity.in/">http://eprints-bangaloreuniversity.in/</a>
56.	ePrints@CFTRI	Central Food Technological Research Institute	Eprints	<a href="http://ir.cftri.com/">http://ir.cftri.com/</a>
57.	Eprints@IARI	Indian Agricultural Research Institute (IARI)	EPrints	<a href="http://eprints.iari.res.in/">http://eprints.iari.res.in/</a>

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58.	EPrints@IICB	CSIR	Eprints	<a href="http://www.eprints.iicb.res.in/">http://www.eprints.iicb.res.in/</a>
59.	ePrints@IIMK	Indian Institute of Management Kozhikode (IIMK)	EPrints	<a href="http://eprints.iimk.ac.in/">http://eprints.iimk.ac.in/</a>
60.	ePrints@iisc	Indian Institute of Science (IISc)	EPrints	<a href="http://eprints.iisc.ernet.in/">http://eprints.iisc.ernet.in/</a>
61.	EPrints@IITD	Indian Institute of Technology, Delhi (IITD)	DSpace	<a href="http://eprint.iitd.ac.in/dspace/">http://eprint.iitd.ac.in/dspace/</a>
62.	eprints@immt	Institute of Minerals and Materials Technology	EPrints	<a href="http://www.eprints.immt.res.in/">http://www.eprints.immt.res.in/</a>
63.	ePrints@MoES:Open Access Digital Repository	Ministry of Earth Sciences, Government of India	EPrints	<a href="http://moeseprints.incois.gov.in/">http://moeseprints.incois.gov.in/</a>
64.	eprints@NAARM	National Academy of Agricultural Research Management	EPrints	<a href="http://eprints.naarm.org.in">http://eprints.naarm.org.in</a>
65.	Eprints@SBT MKU	Madurai Kamaraj University (MKU)	EPrints	<a href="http://eprints.bicmku.in/">http://eprints.bicmku.in/</a>
66.	ePrints@UoM	University of Mysore, Mysore University Library	EPrints	<a href="http://eprints.uni-mysore.ac.in/">http://eprints.uni-mysore.ac.in/</a>
67.	ETD   Electronic Theses and Dissertations of UAS Dharwad	University of Agricultural Sciences, Dharwad		<a href="http://etd.uasd.edu/">http://etd.uasd.edu/</a>
68.	Etheses - A Saurashtra University Library Service	Saurashtra University	EPrints	<a href="http://etheses.saurashtrauniversity.edu/">http://etheses.saurashtrauniversity.edu/</a>
69.	ethesis@nitr	National Institute of Technology, Rourkela (NITR)	EPrints	<a href="http://ethesis.nitrkl.ac.in/">http://ethesis.nitrkl.ac.in/</a>
70.	IACS Institutional Repository	Indian Association for the Cultivation of Science	DSpace	<a href="http://arxiv.iacs.res.in:8080/jspui/">http://arxiv.iacs.res.in:8080/jspui/</a>
71.	ICRISAT Open Access Repository (OAR)	International Crops Research Institute for the Semi Arid Tropics (ICRISAT)	EPrints	<a href="http://oar.icrisat.org/">http://oar.icrisat.org/</a>
72.	IIT Roorkee Repository (Bhagirathi)	Indian Institute of Technology Roorkee, India	DSpace	<a href="http://bhagirathi.iitr.ac.in/dspace/">http://bhagirathi.iitr.ac.in/dspace/</a>
73.	Indian Academy of Sciences: Publications of Fellows	Indian Academy of Sciences	EPrints	<a href="http://repository.ias.ac.in/">http://repository.ias.ac.in/</a>
74.	Indian Institute of Astrophysics Repository (DSpace@IIA)	Indian Institute of Astrophysics	DSpace	<a href="http://prints.iiap.res.in/">http://prints.iiap.res.in/</a>
75.	Indian Institute of Information Technology	Indian Institute of Information Technology	EPrints	<a href="http://eprints.iiita.ac.in/">http://eprints.iiita.ac.in/</a>
76.	Indian Institute of Management Kozhikode Digital Library	Indian Institute of Management Kozhikode (IIMK)	Greenstone	<a href="http://www.iimk.ac.in/gsdli/cgi-bin/library">http://www.iimk.ac.in/gsdli/cgi-bin/library</a>
77.	Indian Institute of Petroleum Institutional Repository	Indian Institute of Petroleum, Dehradun	DSpace	<a href="http://library.iip.res.in:8080/dspace">http://library.iip.res.in:8080/dspace</a>
78.	INFLIBNET's Institutional Repository	Information and Library Network Center (INFLIBNET)	DSpace	<a href="http://ir.inflibnet.ac.in/">http://ir.inflibnet.ac.in/</a>
79.	Institutional Repository of IIPA	Indian Institute of Public Administration	DSpace	<a href="http://172.16.0.15/xmlui/">http://172.16.0.15/xmlui/</a>
80.	Institutional Repository of Intellectual Contributions of Delhi Technological University	Delhi Technological University	DSpace	<a href="http://www.dspace.dce.edu/">http://www.dspace.dce.edu/</a>
81.	Institutional Repository@AIKTC	Anjuman-I-Islams Kalsekar Technical Campus	DSpace	<a href="http://www.aiktcddspace.org:8080/jspui/">http://www.aiktcddspace.org:8080/jspui/</a>
82.	Institutional Repository@CSIO	CSIR-Central Scientific Instruments Organisation (CSIR-CSIO)	EPrints	<a href="http://csioir.csio.res.in/">http://csioir.csio.res.in/</a>
83.	Institutional repository@VSL	Indian Institute of Management, Ahmedabad	DSpace	<a href="http://vslir.iimahd.ernet.in:8080/xmlui">http://vslir.iimahd.ernet.in:8080/xmlui</a>
84.	IR@CECRI	CSIR-Central Electrochemical Research Institute	EPrints	<a href="http://cecri.csircentral.net/">http://cecri.csircentral.net/</a>
85.	IR@Goa University	Goa University	DSpace	<a href="http://irgu.unigoa.ac.in/">http://irgu.unigoa.ac.in/</a>
86.	IR@NEERI	National Environmental Engineering Research Institute	EPrints	<a href="http://eprints.neeri.res.in/">http://eprints.neeri.res.in/</a>
87.	IR@NPL	CSIR - National Physical	EPrints	<a href="http://npl.csircentral.net/">http://npl.csircentral.net/</a>

		Laboratory		
88.	ISI Library, Bangalore	ISI Library, Bangalore	DSpace	<a href="http://library.isibang.ac.in:8080/dspace/">http://library.isibang.ac.in:8080/dspace/</a>
89.	Kautilya Digital Repository at IGIDR (Kautilya@igidr)	Indira Gandhi Institute of Development Research (IGIDR)	DSpace	<a href="http://oii.igidr.ac.in:8080/jspui">http://oii.igidr.ac.in:8080/jspui</a>
90.	Knowledge Repository of Indian Institute of Horticultural Research (E-Repository@IIHR)	Indian Institute of Horticultural Research (IIHR)	DSpace	<a href="http://www.erepo.iihr.ernet.in/">http://www.erepo.iihr.ernet.in/</a>
91.	Knowledge Repository Open Network (KNoor)	University of Kashmir	DSpace	<a href="http://dspace.uok.edu.in:8080/jspui/">http://dspace.uok.edu.in:8080/jspui/</a>
92.	KR@CIMAP	Central Institute of Medicinal and Aromatic Plants	DSpace	<a href="http://kr.cimap.res.in">kr.cimap.res.in</a>
93.	KRISHI Publications and Data Repository	Indian Council of Agricultural Research (ICAR)	DSpace	<a href="https://krishi.icar.gov.in/jspui">https://krishi.icar.gov.in/jspui</a>
94.	KrishiKosh (कृषिकोष)	Indian Council for Agricultural Research (ICAR)	DSpace	<a href="http://krishikosh.egranth.ac.in/">http://krishikosh.egranth.ac.in/</a>
95.	Learning Resource Centre: Digital Repository of Chitkara University	Chitkara University Punjab	DSpace	<a href="http://dspace.chitkara.edu.in/jspui/">http://dspace.chitkara.edu.in/jspui/</a>
96.	Librarians' Digital Library (LDL)	Indian Statistical Institute, Bangalore Centre (ISI)	DSpace	<a href="https://drtc.isibang.ac.in/">https://drtc.isibang.ac.in/</a>
97.	Mahatma Gandhi University Theses Online	Mahatma Gandhi University	(Nitya)	<a href="http://www.mgtheses.org/">http://www.mgtheses.org/</a>
98.	National Aerospace Laboratories Institutional Repository (NAL Repository)	Information Centre for Aerospace Science and Technology (ICAST)	EPrints	<a href="http://nal-ir.nal.res.in/">http://nal-ir.nal.res.in/</a>
99.	National Center for Antarctic Research	National Center for Antarctic Research	DSpace	<a href="http://dspace.ncaor.org:8080/dspace/">http://dspace.ncaor.org:8080/dspace/</a>
100.	National chemical Laboratory	National chemical Laboratory	DSpace	<a href="http://dspace.ncl.res.in/">http://dspace.ncl.res.in/</a>
101.	National Repository of Open Educational Educational Resources	Central Institute of Educational Technology, NCERT, New Delh	Metastudio	<a href="http://nroer.gov.in/">http://nroer.gov.in/</a>
102.	National Science Digital Library (NSDL)	National Institute of Science Communication and Information Resources (NISCAIR)	DSpace	<a href="http://nsdl.niscair.res.in/">http://nsdl.niscair.res.in/</a>
103.	NIPGR Digital Knowledge Repository (NDKR)	National Institute of Plant Genome Research, New Delhi	DSpace	<a href="http://www.nipgr.res.in/ir_ndkr.html">http://www.nipgr.res.in/ir_ndkr.html</a>
104.	NIRT Institutional Repository (EPrints@NIRT)	National Institute for Tuberculosis Research	EPrints	<a href="http://eprints.nirt.res.in/">http://eprints.nirt.res.in/</a>
105.	NISCAIR Online Periodical Repository (NOPR)	National Institute of Science Communication and Information Resources (NISCAIR)	DSpace	<a href="http://nopr.niscair.res.in/">http://nopr.niscair.res.in/</a>
106.	One World South Asia Open Archive Initiative	OneWorld South Asia (OWSA)	EPrints	<a href="http://open.ekduniya.net/">http://open.ekduniya.net/</a>
107.	Open Access Agricultural Research Repository (openagri)	Indian Institute of Technology Kanpur (IIT Kanpur)		<a href="http://agropedia.iitk.ac.in/openaccess/">http://agropedia.iitk.ac.in/openaccess /</a>
108.	Open Access Repository of Indian Theses	CSIR	Eprints	<a href="http://eprints.csirexplorations.com/">http://eprints.csirexplorations.com/</a>
109.	Open Access to Odia Books (OAOb)	National Institute of Technology, Rourkela (NITR)	EPrints	<a href="http://oaob.nitrkl.ac.in/">http://oaob.nitrkl.ac.in/</a>
110.	Open Access: Agriculture Research Repository	ICRISAT	Other Software	<a href="http://www.agropedia.net/openaccess">http://www.agropedia.net/openaccess</a>
111.	OpenMED@NIC	National Informatics Centre (NIC)	EPrints	<a href="http://openmed.nic.in/">http://openmed.nic.in/</a>
112.	Osmania University Digital Library [OUDL]	Osmania University	DSpace	<a href="http://oudl.osmania.ac.in/">http://oudl.osmania.ac.in/</a>
113.	Physical Research Laboratory	Library & Information Services	Greenstone	<a href="http://www.prl.res.in/~library">http://www.prl.res.in/~library</a>

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	Library			
114.	RAIITH	Indian Institute of Technology Hyderabad	EPrints	<a href="http://raiith.iith.ac.in/">http://raiith.iith.ac.in/</a>
115.	Rajiv Ghandi Center For Biotechnology	Rajiv Ghandi Center For Biotechnology	Other software	<a href="http://www.rgcb.res.in">http://www.rgcb.res.in</a>
116.	Rice Knowledge Management Portal	Directorate of Rice Research, Indian Council of Agricultural Research	Other software	<a href="http://www.rkmp.co.in">http://www.rkmp.co.in</a>
117.	RRI Digital Repository	Raman Research Institute	DSpace	<a href="http://dspace.rii.res.in/">http://dspace.rii.res.in/</a>
118.	S.V. National Institute of Technology Repository	S.V. National Institute of Technology	EPrints	<a href="http://eprints.svnit.ac.in/">http://eprints.svnit.ac.in/</a>
119.	Scholarly publications from Indian Institute of Spices Research	Indian Institute of Spices Research	DSpace	<a href="http://220.227.138.214:8080/dspace/index.jsp">http://220.227.138.214:8080/dspace/index.jsp</a>
120.	ShodhGanga: A reservoir of Indian theses	Information and Library Network Center (INFLIBNET)	DSpace	<a href="http://shodhganga.inflibnet.ac.in/">http://shodhganga.inflibnet.ac.in/</a>
121.	Siddha Articles	Bethesda CAM Research Center	Other Software	<a href="http://www.freewebs.com/siddhapapers/">http://www.freewebs.com/siddhapapers/</a>
122.	Social Science Cyber Library	Aligarh Muslim University	Other (CALIBRE)	<a href="http://socscybraryamu.ac.in/">http://socscybraryamu.ac.in/</a>
123.	Uka Tarsadia University Central Library Bardoli	Uka Tarsadia University Central Library Bardoli	DSpace	<a href="http://utulibrary:8080/jspui">http://utulibrary:8080/jspui</a>
124.	Vidya Prasarak Mandal - Thane	Vidya Prasarak Mandal	DSpace	<a href="http://dspace.vpmthane.org:8080/jspui/index.jsp">http://dspace.vpmthane.org:8080/jspui/index.jsp</a>
125.	WeSchool Digital Repository	Welingkar Institute of Management Development and Research	DSpace	<a href="http://dspace.welingkar.org:8080/jspui/">http://dspace.welingkar.org:8080/jspui/</a>

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Digital Transformation for an Agile Environment

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Emerging Trends in Libraries



Organizer



The Energy and Resources Institute





# Attracting the Post-Millennials to the Library: Innovative Practices of an Institute

**Madhu Dogra, Raj Changrani and Birendra Jha**  
New Delhi Institute of Management, New Delhi

Millennials is a term credited to have been introduced by Strauss & Howe (1991, 2000) although American media popularized it. Exact cut-off dates vary but the term usually refers to the generation that was born during 1981 to 1996 and Oxford Living Dictionary describes a millennial as "a person reaching young adulthood in the early 21st century". It is also known by other names such as Gen Y.

Post millennials, born after 1996, is known as Gen Z and even iGen. Many of the young adults are in advanced stage of finishing their higher education and are waiting to be absorbed in the world of work. These young adults are all around us .

Post-Millennials do things differently than the generations that came before them. The Post-Millennials or Gen Z have grown up in a digital world and are also known as Smartphone Generation. San Diego University Psychology Professor Jean Twenge (2014, 2017) observed that today's superconnected kids are growing up less rebellious, more tolerant, less happy and completely unprepared for adulthood.

One can speculate that owing to this unpreparedness about life within and without, Millennials and Post Millennials are turning more towards books and other sources of information and entertainment. As per the Pew Research Centre Internet Survey carried out on US samples in March-April, 2016 , the millennials were found to be fairly voracious readers as compared to their previous generations. They read on average five books per year and they prefer to visit public libraries. Paradoxically, though the book sales have declined for years, worldwide publishing industry is growing approximately about 1 percent annually for the last five years.

With computers first and smart phones later, since 2011, reading became increasingly digital. If we go through the surveys available, 15 percent read on a tablet, 22 percent use their smart phones, 16 percent use desktop or laptop computers and 5 percent use e-book reader.

## Is the scene same in India?

In India National Book Trust entrusted the National Council of Applied Economic Research (NCAER) with Youth Readership survey between the age group 13 -35 . Though this is a decade old data (2009), the highlights of survey on reading habits showed 25 percent of literate youth read books for leisure and out of this 47 percent were from urban India and 53 percent were from the rural India. 46 percent read to enhance the knowledge and the rest for pleasure and relaxation. The preferred language for reading as per survey was Hindi, Marathi, Bengali and English. The survey clearly revealed that the reading habit was declining on account of advent of

television and internet. Smartphones through which young adults remain online often 24 X 7 were yet to appear on the scene during the survey.

Our observations over the years and anecdotal experiences galore showed that reading habits in the Library of the Institute were certainly on the decline at least since 2011. The users of the library were not just young Post-graduate students in a 2-year full-time management programme (Post-millennials) but also research scholars and faculty members of the institute (Millennials). We thought that some major innovations are required by us to attract these young adults in the library for increasing use of the library resources. Discussed below are some steps taken to increase the user footfall.

**(1) Positioning the Library at a highly visible, central, all glass, brightly illuminated premise with moveable, flexi-arrangement colourful furniture system:**

To make the library an attractive destination for all users, the location of the library was changed from peripheral to central at a building that was named Wisdom Block. All interior designs made it bright and the large reading room became multipurpose. Though it was a Management Institute, the glass entry displayed the portrait of Noble Laureate Rabindranath Tagore—a literary icon that any reader could identify. Other than the long tables and workstations aligned with the brick walls, the entire reading room consisted of light-weight tables and chairs which could be reorganized in a jiffy.

**(2) Multiple use of the large reading hall of the library to organize expert meetings, roundtables, seminar or any such co-curricular event to attract students, faculty members and visitors**

Instead of keeping the library reserved only for classical purpose of reading and borrowing books, the facility was extended to other academic events such as Book Release Functions, Lectures by Authors and Invited Experts, Roundtable Discussions, Online Competitive Games, Small Group Seminars and such other allied academic activities. Other than more optimal use of space, manpower and facilities, the purpose was to draw more and more visitors in the library who eventually get attracted to large number of magazines, journals, latest arrivals and the stacks of books. Although such sundry visitors demand more vigil on the part of library staff, they have enthusiastically extended their cooperation as being a part of audience, they also refresh themselves on the latest and interesting things happening in the academic world.

**(3) Making food & beverages areas adjacent to the library and visible from all glass walls:**

The library as of now do not allow food and beverages to be carried inside but such dispensing facilities have been made available just outside the glass walls of the library. The users can easily exit from the library, refresh themselves and return to their seats and tables. Many users save time going to the cafeteria for a small well-deserved break.

**(4) Balancing available fund for new acquisitions to more and more digital and online subscriptions than printed resources:**

In lieu of reduction of budget for declining number of users in the last few years, a thoughtful line-balancing has now been done between digital and printed resources. Many and growing number of journals are being subscribed through online vendor packages, a large number of e-books are being procured regularly along with

dissemination of information about their availability. Such steps have helped users to access library with better retrieval and search facilities implicit in digital resources.

**(5) Availability of several terminals with high-speed wi-fi network to access all digital and online resources:**

The shift to more and more digital resources are accompanied by installations of a large number of terminals in the library with high-speed wi-fi network to access all digital and online resources. The institute already boasts of a well-endowed Computer Lab that had been hosting Smart India Hackathon for the last couple of years in a row sponsored by Ministry of Human Resources Development (MHRD) of Government of India. Similar computing and internet facilities have been extended to the Workstations in the library as well.

**(6) Acquiring digital rights for a large number of online courses from reputed global vendors:** With a conscious decision to supplement all taught courses with allied online courses, including MOOC, the institute had been investing to acquire digital rights of hundreds of online courses from reputed global vendors such as Udemy. As many of these courses are mapped and linked to regular classroom teaching sessions, students and others access library to refer to these courses. This single step has significantly increased the traffic.

**(7) Releasing everyday a compendium of News links to all faculty and students for further exploration and integration with daily learning:** Library staff members as information professionals have assumed the responsibility of disseminating everyday a compendium of all latest news from select Newspapers and Journals before forenoon. Not only the faculty members use these latest news in their daily classes, students also visit library to explore the full story. Similarly, all releases from all chambers of commerce such as ASSOCHAM, CII, FICCI and foreign embassies are also speedily dispatched. Library staff members had been earning laurels for such exemplary, almost real-time, news link dissemination.

**(8) Transforming the sparse and silent library to a vibrant venue for all academic explorations.** With the latest teaching trends of using case study, role play, group presentations, students need to sit in small groups to discuss among themselves. If students are not allowed to sit in groups, the alternate place is either Common Room, Cafeteria or under Open Sky. To attract them to the library, we changed the traditional library of having pin drop silence to have groups to discuss their agenda without raising their voices and disturbing other users.

Some of the above innovative steps have certainly and visibly resulted in greater traffic in the library. Quantitative pre-post data and metrics such as (i) daily number of visitors, (ii) per capita borrowing of books, (iii) per capita number of hours spent in the library, (iv) daily number of books and magazines used off the stacks and left on the tables after use, (v) number of log-ins for digital access, (vi) total number of daily inquiries to the library staff, (vii) number of suggestions/ comments given by the users regarding service quality and requisitions and such others are being collected and computed for future presentation and improvement of service quality.

Many other steps are also in the offing. The Institute is planning to put big silent dynamic screens in the library that will display latest arrivals of journals, books and databases, the rules and regulations of the library, how to reserve books, how to use e-resources and such others. The Institute plans to integrate the availability of smart phones and laptops by almost all users by

providing more and more value-added services such as News-Links, subject-wise Annotated Bibliography and Breaking News etc. Social media is used increasingly such as using WhatsApp for all important announcements. The Institute is beginning to be very active in YouTube, Twitter, Instagram and LinkedIn. The Library service also reflects these modern trends.

As some of the library staff themselves are millennials, we are attempting to mitigate the challenges of transforming the mundane Memory Institution to a more vibrant venue visited by active users and living with the radically new and unpredictable world of post-millennials for all of their academic explorations.

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\*The authors, who are Sr. Librarian, Sr. Librarian & Assistant Registrar and Deputy Librarian respectively of the institute gratefully acknowledge that the paper has been written under the supervision of Dr. J.K.Mitra, Academic Advisor of the Institute. The authors are beholden for all the support from Mr. V.M.Bansal, the Chairman of the Institute

## References

1. Strauss, William; Howe, Neil (1991). *Generations: The History of America's Future, 1584 to 2069*. New York: Harper Perennial. ISBN 978-0688119126., and Strauss, William; Howe, Neil (2000). *Millennials Rising: The Next Great Generation*. New York: Vintage Original. ISBN 978-0375707193.
2. Millenials. <https://www.lexico.com/en/definition/millennial> retrieved on 11th of August 2019
3. Mentoring the Millennials: Psychologists' View. Unpublished Report of the Roundtable Discussion among Invited Psychologists at New Delhi Institute of Management, New Delhi, Chaired by Dr. C.K.Basu and Moderated by Dr. J.K.Mitra, 19th of July, 2019.
4. Twenge, J. *Generation Me: Why Today's Young Americans are More Confident, Assertive, Entitled - and More Miserable Than Ever Before* (2014) ISBN 978-1476755564 and *iGen: Why Today's Super-Connected Kids Are Growing Up Less Rebellious, More Tolerant, Less Happy and Completely Unprepared for Adulthood* (2017) ISBN 9781501151989
5. <https://www.pewresearch.org/search/millennium%20books> retrieved on August 11, 2019
6. [http://www.ncaer.org/publication\\_details.php?pID=188](http://www.ncaer.org/publication_details.php?pID=188) accessed on August 11, 2019
7. <https://www.ndimdelhi.org/ndim-hosts-grand-finale-of-smart-india-hackathon-2018-30-31-march-2018/> accessed on 11th of August, 2019
8. Dempsey, Lorcan (1999). Scientific, industrial, and cultural heritage: a shared approach. *Ariadne*, vol. 5, issue 22, <http://www.ariadne.ac.uk/issue22/dempsey/> accessed on August 11, 2019

# **Innovative Technological Tools in 21st Century: Acme trends in Libraries with Particular Reference to Web 2.0 and Web 3.0 Tools**

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## **Abstract**

Libraries represent the symbol of highest epitome for every nation that nurtures and promotes the culture of learning among human beings from the times of yore which continues in present, and will persist in the future as well. However, due to technological transformations their sustenance is at stake if not managed according changing information needs of tech perceptive user community, which desires enhancements at every single step of learning and accordingly makes it imperative for libraries to revolutionize the way of disseminating information through the adaptation of technologically innovative services. In above milieu present study provides an outline of select Web-based services especially Web 2.0 and Web3.0 that tends to enhance the overall information management cycle. An extensive scan of literature was carried out to attain the objectives of the study. Various international journal databases like Emerald, Scopus and JStor was browsed to extract most authentic information for the same. Besides, various national and international websites, e-books and conference proceedings were also consulted to make the work much more worthy. Modern technological tools like Web 2.0 and Web 3.0 have transfigured the concept of information generation, organisation as well as mode of dissemination. The judicious application of these techy tools facilitates precise and relevant information retrieval to the users in libraries globally.

## **Keywords**

Libraries, Services, ICT, Web, Web 2.0, Web 3.0, Web tools.

## **Introduction**

21<sup>st</sup> century is an epoch of contemporary transformations and innovations that has led to unprecedented changes throughout the globe in one way or the other. One such innovation is the advent of ICT that revolutionised the whole world. In this milieu knowledge-based organization, particularly libraries are no exception to these transformations, which represent the premier

resource of managing the generation and dissemination of information and knowledge in a most effectual manner. Given that, throughout the world information is treated as the most valuable asset of present century (**Hussain, Khan and Zaidi, 2013**) which provides astonishing prospectives that facilitates versatile growth and development of society (**Sharma, Singh and Kumar, 2009**). However, due to incessant changes brought in due to technological transformations the sustenance of are at stake which need to be managed with the introduction of latest technologies that will facilitate better management of information life-cycle for proper utilization of libraries. In wake of technological advancements, libraries need to redefine their roles by incorporating the ICT based innovations particularly the web-based technologies. In this milieu, incredibly chief, remarkable and efficient development of ICT and Web-based innovative services is the improvement in the span and speediness of production, sharing and recycling of information. In other words, it has transformed the fundamental perception of “ownership into access” and “proprietorship into sharing” (**Ndidiamaka, 2013; Patel and Patel, 2012**). These applications diverge significantly, “ranging from web sites where users can add, organize and share, bookmarks (e.g., del.icio.us), references (e.g. CiteULike.org), and photographs (e.g., Flickr.com) to websites which add-up and provide most of the services as a one-stop solution” (**Kataria and Anbu K, 2009**). Consequently, to take the lead and sustain in ever-changing information environment library has to set in motion their authentically priceless resources in terms of services, content as well as expertise of staff from the four walls to a place where patron may prefer to take assistance from them. Accordingly, Libraries can take the benefit of Web 2.0 technologies (**Dora and Maharana, 2008**) along with recent Web 3.0 technologies and put them into practice in the diverse services to persuade the rising prospective of novel generation of user community, which the innovative generation librarians perceive as a grand survivor.

## Problem

An incessant transformation in technologies and their fervent adoption by tech-savvy society has called upon libraries to be epitome of technological transformations centre. Since, they act as a corner stone or rather the building block in handling information transfer cycle. Accordingly, libraries are invariably in state of instability due to the transformations in terms of their adoption and application that are relevant to their patron community as well as to the key aims of organization, they can't afford to lag behind due to their immense essence of being information disseminators. In this perspective, it becomes unavoidable to keep track of these technological transformations as well as their status with regard to their application in libraries. The present study is an effort to explore and identify Web2.0 and Web3.0 tools and compare their features.

## Objectives

- To explore, identify and provide an overview of Web 2.0 and Web 3.0 tools in libraries.
- To reveal the status of application of the tools in libraries

## Literature review

**Khan (2007)** observed that there is a necessitation for appropriate utilization of technologically driven libraries facilities. Since, the ICT based resources and services are being under-utilized by patrons. **Huffman (2006); King and Porter (2007)** intricate that how Web 2.0 tools can be employed resourcefully for improving library services. **Tripathi and Kumar (2010)** reveal that in academic libraries Really Simple Syndication (RSS), Instant Messaging (IM) and blogs are much more accepted. In line with same **Dora and Maharana (2008)** highlight, the findings that in New York State 34.41% of total academic libraries are using Web 2.0 Services among them the key ones embrace Social Networks, Blogs, IM, RSS, Book marking, Wiki, etc. **Rehman and Shafique (2011)** intricate among the information professionals of Pakistan the use of Web 2.0 applications is greater than ever. **Draper and Turnage (2008)** state that for effective promotion of library services Web 2.0 in common and blogs in scrupulously, can be exercised effectively. However, **Rehman and Shafique (2011)** observe that awareness about various Web 2.0 applications among library professionals is not much evident for instance, to make available reference services in online libraries the use of Instant Messaging (IM), is much effective. In above perspective **Madhusudhan and Nagabhushanam (2011)** emphasized that provision of web-based library services in university libraries of India are not up to the mark. **Mirza and Mahmood [21]** bring to light that web-based services in university libraries of Pakistan are in their seminal period. **Ma (2011)** reveal that the proportion of providing Web 2.0 tools in school libraries were very squat in Hong Kong. Accordingly, library services should be redesigned to convene the patron needs and to endow them with contemporary information services driven by ICT (**Siddike, Munshi & Sayeed, 2011**). **Maness (2006)** state that the Web 2.0 implementation of libraries has transformed traditional libraries to library 2.0 that is “not about searching, but finding; not about access, but sharing”. **Naik and Shivalingaiah (2008)** conducted a comparative study of Web 1.0, Web 2.0 and Web 3.0 to draw attention towards the evolutionary phases of Web. **Belling, Rhodes, Smith, Thomson and Thorn (n.d.)** observed that Web 3.0 have paved means for libraries to proffer access to germane as well as interesting collections and services that not only will meet but expectantly, surpass the prospects and requirements of patrons in the approaching periods of time.

## Overview of Web 2.0 and Web 3.0 tools in libraries

With the swift development in ICT and the transforming perceptions of users, the libraries have heaved the necessity of adapting the innovative web-enabled services for better communication as well as dissemination of knowledge and information.

### Web 2.0 notion

The term ‘Web 2.0’ was coined by technology analyst Tim O’Reilly who endeavoured to define it in following words, “Web 2.0 is the network as platform, spanning all connected devices, Web 2.0 applications are those that make the most of the intrinsic advantages of that platform: delivering software as a continually-updated service that gets better the more people use it, consuming and remixing data from multiple sources, including individual users, while providing

their own data and services in a form that allows remixing by others, creating network effects through an ‘architecture of participation’ and going beyond the page metaphor of Web 1.0 to deliver rich user experiences” (O’Reilly, 2005). The key rationale for its development was “Individual production and User Generated Content Harness the power of the crowd, Data on an epic scale, Architecture of Participation, Network Effects and Openness” (Anderson, 2007). As a result, Web 2.0 exploits the web in much interactive and collaborative accentuating peer social interaction and cooperative intelligence, as well as endows with novel opportunities for leveraging the Web and appealing patrons more efficiently (Shukla, Gupta and Sahu, 2009). Moreover, to highlight the characteristics of Web 2.0 (McAfee, 2006) used the short form SLATES referring to the quality of Search, Links, Authoring, Tags, Extensions and Signals.

## Key tools and services encompassing Web 2.0 technology

### *Social Networking*

It engrosses a software based networking of communities, which have universal concern (Kataria&Anubu, 2009; Kataria, Jaiswal&Sehgal, 2009). Social networks are created upon an assumption that there subsists an established networking configuration of how individuals recognize each other (Hanif, 2009). Social networking Websites endow with a “virtual community” for populace concerned in a particular subject or just to "hang out" together (Dash, 2009; Stern, n.d.). It could facilitate patrons as well as librarians to interact potentially along with distribution and exchange resources enthusiastically in an electronic medium (Hanif, 2009; Kataria, Jaiswal&Sehgal, 2009; Dash, 2009). Besides, patron profile can be incorporated to the library catalogue, together with patron’s book reviews or other comments enrich the information Resources (Hanif, 2009). Accordingly, it avails a broad platform for exchange of ideas and knowledge not only within library but also around the globe. The most popular social networking sites are *Myspace* and *FaceBook* respectively (Hanif, 2009; Dash, 2009; Kataria, Jaiswal&Sehgal, 2009) and *LinkedIn* for professional networking (Kataria, Jaiswal&Sehgal, 2009). Moreover, it also facilitates the use of various additional web 2.0 tools like chats, instant messages etc.

### *Blogs*

“A blog is a website where library users can enter their thoughts, ideas, suggestions, and comments” (Hanif, 2009). To explain their utility in academic libraries in a more elaborated manner Hanif (2009) opined that it is a prevailing two-way based tool. In line with the same King and Porter (2007) suggested that in academic libraries blogs could be effectively utilized to make possible internal communication, assist academic discussion and to communicate with user community, marketing latest information resources, providing personalized catalogue searches, current awareness and subject guides.

**Example:** Ann Arbor District Library provides its users with Audio blog, Video Blog and book Blog (Catalogue, 2014)

### *Folksonomies*

“The word ‘folksonomy’ is a blend of the words ‘taxonomy’ and ‘folk’, and stands for conceptual structures created by the people” (Andreas Hotho, 1 Robert J’aschke, 1, 2 Christoph Schmitz, 1 Gerd Stumme 1, 2, n.d.). Thomas Vander Wal, who coined the term folksonomy,



state that “they are created when people tag items online for their own later information retrieval purposes which makes it an exceptionally constructive tool for online personal information management”(Neal, 2007). “Tags are simply labels for web resources, selected to help the user in later retrieval of those web resources” (Noruzi, 2006). Accordingly, choosing a particular tag, a patron can sort out personalized list of bookmarks with the intention that just bookmarks with that tag only are retrieved (Golder and Huberman 2005)

*Some case studies:* One of the foremost library adopters of this tool is University of Pennsylvania (UP) by developing Penn Tags (tags.library.upenn.edu/). It permits faculty, students and staff of UP to bookmark eminent Web sites and then record in online catalogue of UP and accordingly doles out these resources with others (Arch, 2007). Furthermore, the catalogue of Ann Arbor District Library permits users to tag its stuff. A tag cloud of the tags is visible at CiteULike of the Edmonton Public Library’s subject guide pages (Neal, 2007).

### ***Skype casts***

“Skype is a Voice over Internet Protocol (VoIP) communication tool that can be used to conduct audio or audio/video “telephone” conversations between internet-connected computers. It allows conversations to take place anywhere in the world, and both the service and the software are free” (Beaton, 2012). Suber (2006) intricate that that due enormous features associated with “Skype” it has immense significance in knowledge sharing. In this milieu, libraries as knowledge disseminating centers can actively use this tool as two-way communicating device to facilitate the information needs of users in most convenient manner particularly for personal assistance in solving reference and other information queries. A handful of rather well built institutions (UNC at Greensboro, Madison Area Technical College, Framingham State University, St. Edwards University and South-eastern Oklahoma State University) now integrate Skype into their collection of reference services (Beaton, 2012).

### ***Tagging***

“A tag is a keyword that is added to a digital object (e.g. a website, picture or video clip) to describe it, but not as part of a formal classification system”(Sahu, Pathak and Singh, 2010). Anbu (2009) state that “Tagging is described as the process by which the resources in a collection are assigned tags in the form of words, phrases, codes or other strings of characters. This allows users to add and change the data and metadata and at times give a local tinge to data and metadata”. Furthermore to elaborate the advantages of tagging (Sahu, Pathak and Singh, 2010; Anbu, 2009; Arora, 2009) highlight that it mostly help the users by making data easily searchable. Few web-based examples of tagging are Flickr and Delicious (Arch, 2007; Neal, 2007). Besides, to put forward a live example of tagging in particular reference to libraries Arora (2009) highlight about the use of tagging in library catalogue with key aim of making it a more interactive tool for users by the University of Huddersfield, West Yorkshire, UK.

## **An overview of Web 3.0**

In 2006, John Markoff of the New York Times has suggested web 3.0 as third generation of the web (Suphakorn Tanakit, 2008). Accordingly, “Web 3.0 can be defined as a third phase in the evolution of the World Wide Web, based on the idea that the Internet “understands” the pieces of

information it stores and is able to make logical connections between them. This has led to the coining of expressions such as the Semantic Web, or the Intelligent Web” (Web 3.0, 2014). Furthermore, **Zeldman (2006)** state that Web 3.0 is defined “as the creation of high-quality web content and web services produced and gifted individuals using web 2.0 technologies as web enabling platforms”. In line with same to highlight the essence of Web 3.0 in the epoch of technological revolutions (**Hassanzadeh and Keyvanpour, 2011; Spivack, 2011; Nykanen, 2008; Suphakornthanakit, 2008; Yogesh, Michael, Amit, Suraj, Vishanth, n.d.**) put forward that Web 3.0 (acknowledged as “Semantic Web”) by making available the machine-readable content on the Web intends to trim down human efforts and decisions given to machines. Accordingly, Web 3.0 would emphasize the importance of machine-facilitated understanding of information by creating additional properties that would include natural language search, micro formats, machine learning, data mining, recommendation agents and artificial intelligence technologies. Consequently, this would endow with a more refined and beneficial experience to user (Strickland, 2009 as cited in **Myhill, Shoebridge & Snook, 2009**). Moreover, to elaborate the concept of Web 3.0 in a more effective manner **Noori (2008)** state, “It is a web where the concept of website or webpage disappears, where data is not owned but instead shared, where services show different views for the same web / the same data. Those services can be applications (like browsers, virtual worlds or anything else), devices or other, and have to be focused on context and personalization, and both will be reached by using vertical search”. Bing’s reference search is one instance of a Web 3.0 application.

## Key tools and services encompassing Web 3.0 technology

### *Micro blogging*

A micro blog differs from a traditional blog in that its content is typically smaller. Micro blogging is a broadcast medium that exists in the form of blogging. It “allow users to exchange small elements of content such as short sentences, individual images, or video links” (**Andreas and Micheal, 2011**). Micro blogging is posting brief and often frequent updates online. Unlike traditional blogs, which are often hosted on a custom website, micro blogs are typically published on social media sites like Twitter or Face book (**Micro blogging Definition, 2015**). Accordingly, it would help users to put forward comments related to various aspects of libraries and can help in exchange of opinions, thoughts, experience related to libraries. That will in turn help to improve existing collection and services in libraries as well as well help introducing new services to users.

### *Intelligent search engine*

One of the important tools of web3.0 is the innovation of intelligent search engines. These web search engines have been purposely developed for the key task of retrieving practical and pertinent information particularly in multimedia form from its users. Since, with the technological developments and ever increasing, Ocean of information in varied formats the need to efficiently deal with the enormous information available on the web-increased manifolds, and accordingly these advanced web search engines serve the purpose (Inamdar & Shinde, 2008 as cited in **Madhu, Govardhan & Rajinikanth, 2011**). Moreover, **Rajiv and Lal (2011)** observed that a Web 3.0 era of agent’s based-search engine could not only locate the keywords in user search, however can also construe the context of their request. Accordingly, it would return

appropriate results and recommends some more content allied to users search terms. An example of this sort of technology can be found on software like *Ojos Riya* photo sharing tool that allows tagging of images automatically via face recognition.

### ***3D-Wikis / Virtual 3D Encyclopaedia***

In contemporary, technologically advanced world, researchers & technocrats have been continuously working on new-fangled tasks related to ready reference tools like Wikis & encyclopaedias to bring an innovative dimension to these tools particularly, with the much-hyped innovative technology of 3D web. ***An example of this kind of technology can be found on software like Copernicus-3D Wikipedia.*** These would be able to endow with affluent & effective environment that engross every bit of media and animation, for learners, to have an enhanced impact on their learning & knowledge (Rajiv and Lal, 2011). This type of tool is particularly effective in research libraries where researchers experience with web can be made much more interesting and effective giving real like experience to rather lifeless objects and thus enabling users to find information in much more effective manner.

### ***iGoogle***

“iGoogle was formerly known as Google Personalized Home Page. This is Google's "portal" service, which allows you to create a custom page that displays the Google search engine and configurable Google Gadgets” (Karch, 2015) launched in 2005 (iGoogle, 2015). Nevertheless, in Nov 2013 it was soon discontinued because the company believed the need for it had eroded over time due to revolutionary transformation in web-based technology (What happened to iGoogle? Search Help, 2015). Yet, despite the fact, there are countless options available as an alternative to iGoogle for instance uStart, My Yahoo Net Vibes, Protopage (iGoogle: what are the best alternatives?, 2015).

These Web 3.0 tools along with other specialized tools can be effectively used by libraries to make enrich the experience of users with web by making it much more interacting media rather than static.

### ***Mobile Library Catalogue***

Rainie and Anderson (2008) state that as revealed by Pew Research Centre by 2020 the mobile device will be the key connection tool to the internet for most of the people in the world. In view of the fact that to increase the interaction of users with the library “Australian public libraries have developed an app provides standard search functions as well as barcode scanning capability, a social recommendation engine and New York Times best seller list cross-referencing. However, in view of impact of the technological advancements on libraries it is more prevalent in foreign countries, predominantly in university libraries, which are serving to a more tech-savvy and mobile-saturated audience” (Belling, Rhodes, Smith, Thomson & Thorn, n.d.)

Apart from these tools there are several other which includes Semantic social networks: *GroupMe!*, *Twine*; Semantic Web browsing: *Magpie*, *PowerMagpie*; Assuring portability: *DataPortability initiative* (Buraga, n.d.)

Besides, to provide an overview about the key variation between Web 2.0 and Web 3.0 (**Prasad, Manjula, Bapuji, 2013 ; UmeshNaik D Shivalingaiah, 2008**) attempted to highlight some the main difference which is presented below in a tabulated form

### Comparison between Web 2.0 and Web 3.0

	<i>Web 2.0 (Social Web)</i>	<i>Web 3.0 (Semantic Web)</i>
<b>Year of origin</b>	2000 – 2010	2010-2020
<b>Founder</b>	Tim O'Reilly	Tim Berners Lee
<b>Features</b>		
1)	Read Write Web	Read Write and Execute
2)	Billion of Users	Trillion of Users
3)	Connect People	Connect Knowledge
4)	Participation	Understanding Itself
5)	User Interaction	User Engagement
6)	Web Community	Web Semantic Web (for machines)
7)	Publish Content E.g. Flickr, YouTube	People Build Applications E.g. Facebook, Google Maps
8)	Wikis, Wikipedia	Semantic Wikis: dbpedia, SemperWiki, Platypus,
9)	Google Personalized App. drive, maps, Hakia	Semantic Search Engine: SWSE, Swoogle
10)	Two way web pages, based flash video, pod casts, shading, 2D portals	Wikis, 3D portals, Avtar representation, Interoperable profits, multi-user Personal publishing, virtual environment (MUVes)
11)	Community portals	Semantic Forums and community portals: SIOC, OpenLink, DataSpaces

## Conclusion

Contemporary epoch is an era of technological revolutions that has transformed each bit of society and in this regard, libraries are no exception to it. Even though, at present libraries have been constantly juggling between conventional and contemporary aspects of libraries in terms of collection and services as well trying to incorporate these transformations in their organizations. However, keeping pace with these technological transformations is the real need of hour in order

to fulfil the information needs of tech-savvy users, which require refined information in just a click. In this perspective therecentinnovations of technology in form of Web 2.0 and Web 3.0 tools has revolutionized the concept of information generation as well as dissemination. These tools yield effective results if incorporated judiciously by information professionals in their libraries. However, despite their significance their application in libraries is not still prevalent especially in developing countries as intricate by studies conducted by an array of researchers. In view of the fact, it becomes enormously imperative for libraries to incorporate these tools and services for making their information dissemination much more efficient and technologically advanced so as to serve the patron community in a best possible way. Besides, owing to their dynamic features that fit information needs of tech savvy users, tools like social networking sites, blogs, Skype casts and micro blogging seems to be efficient in facilitating real time scholarly communication that promotes fast and qualitative research and development.

## References

1. Anderson, P. (2007). What is Web 2.0? Ideas, technologies and implications for Education, *JISC Technology and Standards Watch*, 1-55. Retrieved from <http://webarchive.nationalarchives.gov.uk/20140702233839/http://www.jisc.ac.uk/media/documents/techwatch/tsw0701b.pdf>
2. Arch, X. (2007). Creating the academic library folksonomy. Put social tagging to work at your institution. *C&RL News*. 80-81. Retrieved from <http://crln.acrl.org/content/68/2/80.full.pdf>
3. Beaton, B. (2012). *New Technologies for Virtual Reference: A Look at Skype and Twitter* , 1-5. Retrieved from <http://www.lib.umich.edu/files/departments/SkypeTwitter%20112912.pdf>
4. Buraga, S. C. (2008). *Why Web 3.0?*. Iashington 2008. Retrieved from [www.purl.org/net/busaco](http://www.purl.org/net/busaco)
5. Belling, A., Rhodes, A., Smith, J., Thomson, S., & Thorn, B. (n.d.). Exploring Library 3.0 and Beyond. *2010-2011 Shared Leadership Program State Library of Victoria and Public Libraries Victoria Network*. 1-23. Retrieved from [http://www.libraries.vic.gov.au/downloads/20102011\\_Shared\\_Leadership\\_Program\\_Presentation\\_Day/\\_exploring\\_library\\_3.pdf](http://www.libraries.vic.gov.au/downloads/20102011_Shared_Leadership_Program_Presentation_Day/_exploring_library_3.pdf)
6. Catalogue. (2014). Search the catalogue. *Ann Arbor District Library*. Retrieved 21-12-2014 from <http://www.aadl.org/catalog>
7. Dora, M., & Maharana, B. (2008). A-Lib 2.0: New Avatar Academic Libraries with Web 2.0 Applications. *6th International CALIBER -2008*, Allahabad, February 28-29 & March 1, 469-476. Retrieved from [http://eprints.rclis.org/14123/1/A-Lib\\_2.0\\_Mallikarjun.pdf](http://eprints.rclis.org/14123/1/A-Lib_2.0_Mallikarjun.pdf)
8. Draper, L., & Turnage, M. (2008). Blogmania. *Internet Reference Services Quarterly*, 13(1), 15-55. doi:10.1300/j136v13n01\_02
9. Golder, Scott A., & Huberman, Bernardo A. 2005. The structure of collaborative tagging systems. Information Dynamics Lab. *HP Labs, Palo Alto, CA*. Retrieved from <http://arxiv.org/abs/cs.DL/0508082>
10. Gichora, F.G., & Kwanya, T. (2015). The impact of Web 2.0 tools on academic libraries in Kenya

11. Hassanzadeh, H., & Keyvanpour, M. (2011). A Machine Learning Based Analytical Framework for Semantic Annotation Requirements. *Ijwest*, 2(2), 27-38. doi:10.5121/ijwest.2011.2203
12. Huffman, K. (2006). Web2.0: beyond the concept: practical ways to implement RSS, podcast and wikis. *Education Libraries*, 29(1), 12-19.
13. Kataria, S., & Anbu, K, J, P. (2009). Applications of Web 2.0 in the Enhancement of Services and Resource in Academic Libraries: An Experiment, *ICAL 2009 – LIBRARY SERVICES*, 584-589. Retrieved from [http://crl.du.ac.in/ical09/papers/index\\_files/ical-98\\_130\\_287\\_1\\_RV.pdf](http://crl.du.ac.in/ical09/papers/index_files/ical-98_130_287_1_RV.pdf)
14. Khan, M. H. (2007). Use of ICT based resources and services in special libraries in Kerala. *Annals of Library and Information Studies*, 54, 23-31. Retrieved from <http://nopr.niscair.res.in/handle/123456789/3204>
15. Mohamed Hanif N (2009). Need for Web 2.0 Technology for the Libraries, *7th International CALIBER-2009, Puducherry*, February 25-27, 330-336. Retrieved from <http://www.inflibnet.ac.in/caliber2009/CaliberPDF/40.pdf>
16. King, D., & Brown, S. (2009). Emerging Trends, 2.0, and Libraries. *The Serials Librarian*, 56(1-4), 32-43. doi:10.1080/03615260802672452
17. Ma, L. F.H. (2011). Current Status and Future Prospects: A Survey of the Application of Web 2.0 in Hong Kong School Libraries, 199 — *Moving into the future - a new vision for libraries in Asia. 1-12* and Oceania — Asia and Oceania Section Retrieved from <http://conference.ifla.org/ifla77>
18. Madhu, G., Govardhan, A., & Rajinikanth, T. (2011). Intelligent Semantic Web Search Engines: A Brief Survey. *Ijwest*, 2(1), 34-42. doi:10.5121/ijwest.2011.2103
19. Madhusudhan, M., & Nagabhushanam, V. (2011). Web-based library services in university libraries in India: an analysis of librarians' perspective. *The Electronic Library*. 30 (5), 569-588. DOI 10.1108/02640471211275657
20. McAfee, A. (2006). Enterprise 2.0: The Dawn of Emergent Collaboration. *MIT Sloan Management review*. 47(3), 21-28. Retrieved from <http://www.inflibnet.ac.in/caliber2009/CaliberPDF/40.pdf>
21. Myhill, M., Shoebridge, M., & Snook, L. (2009). Virtual research environments – a Web 2.0 cookbook?. *Library Hi Tech*, 27(2), 228-238. doi:10.1108/07378830910968182
22. Maness, J, M. (2006). Library 2.0 Theory: Web 2.0 and Its Implications for Libraries, *Webology*, 3(2). Retrieved from <http://www.webology.org/2006/v3n2/a25.html>
23. Neal, D. (2007). Introduction Folksonomies and Image Tagging: Seeing the Future?. *Bulletin of the American Society for Information Science and Technology*, 1-11. Retrieved from [https://www.asis.org/Bulletin/Oct-07/Neal\\_OctNov07.pdf](https://www.asis.org/Bulletin/Oct-07/Neal_OctNov07.pdf)
24. Naik, U., & Shivalingaiah, D. (2008). Comparative Study of Web 1.0, Web 2.0 and Web 3.0. *6th International CALIBER -2008*, February 28-29 & March 1, 499-507. Retrieved from <http://ir.inflibnet.ac.in/bitstream/1944/1285/1/54.pdf>
25. Ndidiamaka, N. L. (2013). The Impact Of Information And Communication Technology (ICT) Compliant Librarians On Library Services Delivery In Academic Library: The Case Of National Open University Of Nigeria (Noun) Library. *The International Journal of Engineering and Science (IJES)*. 2(8). 37-43. Retrieved from <http://www.theijes.com/papers/v2-i8/Part.1/G0281037043.pdf>
26. Noruzi, Alireza (2006). Folksonomies: (Un) Controlled Vocabulary?. *Knowledge Organization*, 33 (4), 199-203. Retrieved from [http://eprints.rclis.org/10307/1/Folksonomy,\\_UnControlled\\_Vocabulary.pdf](http://eprints.rclis.org/10307/1/Folksonomy,_UnControlled_Vocabulary.pdf)

27. Nova, Spivack (2011), “*Web 3.0: The Third Generation Web is Coming*”, Retrieved from <http://lifeboat.com/ex/web.3.0>
28. O'Reilly, Tim (2005): *What is Web 2.0? Design Patterns and Business Models for the Next Generation of Software*. Retrieved from <http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html>
29. Ossi, Nykänen (2003), “Semantic Web: Definition”, Retrieved from <http://www.w3c.tut.fi/talks/2003/0331umediaon/slide6-0.htm>
30. Prasad Rajendra, 2Dr. B. Manjula, 3V.Bapuji A Novel Overview and Evolution of World Wide Web: Comparison from Web 1.0 to Web 3.0 1M. IJCST Vol. 4, Issue 1, Jan - March 2013. Retrieved from <http://www.ijcst.com/vol41/3/mrajendra.pdf>
31. Rajiv., & Lal, M. (2011). Web 3.0 in Education & Research. BIJIT - BVICAM's International Journal of Information Technology, 3(2). Retrieved from <http://bvicam.ac.in/bijit/downloads/pdf/issue6/02.pdf>
32. Rainie, L., & Anderson, J. (2008). *The Future of the Internet III. Pew Research Center's Internet & American Life Project*. Retrieved 4 March 2015, from <http://www.pewinternet.org/2008/12/14/the-future-of-the-internet-iii>
33. Rehman, A.U., & Shafique, F. (2011). Use of Web 2.0 and Its Implications for Libraries: Perceptions of Information Professionals in Pakistan. *Library Philosophy and Practice 2011*. Retrieved from <http://www.webpages.uidaho.edu/~mbolin/rehman-shafique.pdf>
34. Sahu, H. K., Pathak, S. K., & Singh, S. Nath. (2010). New and Innovative Library Services: Moving with WEB 2.0 / Library 2.0 Technology: A case study. *LISA VI, Feb 14-17, IUCAA, PUNE*. Retrieved from <http://www.iucaa.ernet.in/~archives/LISA-VI/Presentations/PDF/170210/HKSAHU-Paper-I LISA%20VI.pdf>
35. Stern, J. (n.d.). *Introduction to Web 2.0 Technologies*, 1-9. Retrieved from [http://www.wlac.edu/online/documents/Web\\_2.0%20v.02.pdf](http://www.wlac.edu/online/documents/Web_2.0%20v.02.pdf)
36. Suphakornthanakit, N. (2008). *Web 3.0*. Retrieved from <http://webuser.hs-furtwangen.de/~heindl/ebte-08ss-web-20-Suphakornthanakit.pdf>
37. Tripathi, M., & Kumar, S. (2010). Use of Web 2.0 tools in academic libraries: A reconnaissance of the international landscape. *The International Information & Library Review*, 42(3), 195-207. doi:10.1016/j.iilr.2010.07.005
38. *What happened to iGoogle? - Search Help*. (2015). Support. google.com, Retrieved 3 March 2015, from <https://support.google.com/websearch/answer/2664197?hl=en>
39. Web 3.0.(2014). Web 3.0 and Web 4.0. *The future of education technology*. Retrieved 28/02/2014 from <http://futureofeducationtechnology.blogspot.in/2014/11/web-30-web-40.html>
40. Zeldman, J. (2006). *Web 3.0. Alistapart.com*. Retrieved 3 March 2015, from <http://alistapart.com/article/web3point0>
41. Yogesh, D. K., Michael, W. D., Amit, M, Suraj, N., & Vishanth, W. (n.d.). *Understanding Advances in Web Technologies: Evolution from Web 2.0 to Web 3.0*. Retrieved from <http://is2.lse.ac.uk/asp/aspecis/20110261.pdf>

# Green Library: An emerging concept

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*The awareness regarding Green library is spreading slowly among library professionals. The paper aims to discuss the concept, benefits, how to make Green library, Green Building Rating System, several initiatives, role of Green librarian etc. The author aims to project the significance of adoption of Green innovation in the field of Library and Information Science.*

## Keywords

Carbon footprint, Green Building Rating System, Green House Effect, Sick Building Syndrome.

## Introduction

The Science and Technology is developing at enormous rate. Electronic media slowly engulfing paper media. Human civilization is becoming more mechanized and is moving away from nature and depleting the nature by various activities. The question arises regarding the sustainability of future. It is the right time the deep thinkers of society should seat together to resolve problems. Advancement of technology cannot be stopped; but can walk along with nature. In this noble thought process librarians can play great role enhancing the concept of Green library. The IT revolution has given rise to various dimensions in the new civilization; which has adversely affected the environment, society and economy. The unseen impact of all the activities is depleting the environment slowly. Education can play important role in addressing the present threat on environment and create a social movement ensuring protection, reduction, transformation through various activities and move towards sustainable development. Librarians can play an important role in the transformation from traditional libraries to Green libraries. To make dream project into reality; librarians can have to walk with the specialist like Architects, Civil engineers, Electrical engineers, naturalist and many more. An integrated coordination and collaboration is required within them.

## Sustainable development

The word sustainability has been derived from the Latin word “sustinere” which means capable of being maintained. Oxford University Press defined Sustainable development as “development that meets the needs of the present without compromising the ability of future generations to



meet their own needs”. Economy, environment and social community are the three interrelated components of Sustainable development.

There are many countries, but the world is a single entity. Hence we should work jointly towards achievement of sustainable development.

## Different models of Sustainable development

There are following models of sustainable development.

- **Three pillars of sustainable development:** This is widely accepted model. However if any one of these pillars be weak, then the model will become unsustainable one. This model may be represented in following two ways as shown below in the Fig. 1.

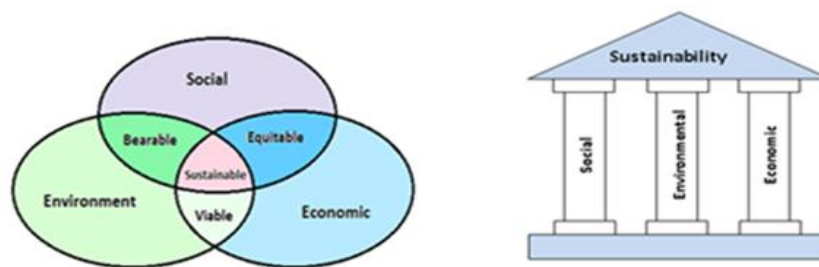


Fig.1: Three pillars of sustainable development

- **Bullseye Model:** This model tries to establish that, environment is the key factor; without which neither society nor economy exist. Alternatively it may be said that, if environment be destroyed, society as well as economy will be destroyed. This model has been shown below in Fig.5.
- **Mickey Mouse Model:** In the Mickey Mouse Model, two factors i.e., environmental and society and entirely dependent on economic aspects. Fig.3 below represents the Mickey Mouse Model.
- **Egg of sustainability:** It was designed by the International Union for the Conservation of Nature (IUCN) in 1994. This model resembles an egg. This model has two components – people and ecosystem. The yolk part represents people and the albumin part represents ecosystem. An egg is considered as good if both the yolk part and albumin part is good. Likewise, a society is sustainable if both ecosystem people is in good condition. This model has been shown below in Fig.4.
- **Nested Model:** Nested means on one object is stored inside another object. According to this model, Social and Economic spheres are found to be located within Environmental sphere. Environmental sphere cannot grow unlike the other two spheres. This model has been shown below in Fig.2.
- **Prism Model:** German Wuppertal Institute devised four dimensional of sustainability known as Prism Model of Sustainability. This model tries to focus Sustainable Development with the help of four components – economy, environment, society and institutions. The four sides of this model are –justice, democracy, access and eco-

efficiency. The two diagonals of this model are care and burden sharing. This model has been shown below in Fig.6.

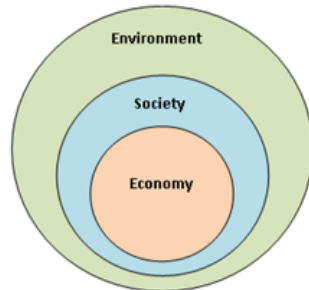


Fig.2: Nested Model

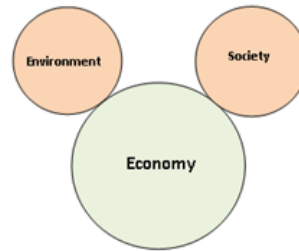


Fig.3: Mickey Mouse Model

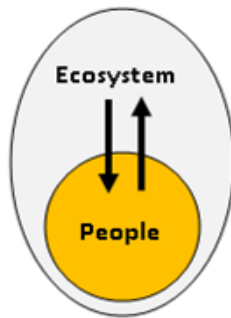


Fig.4: Egg of Sustainability Model

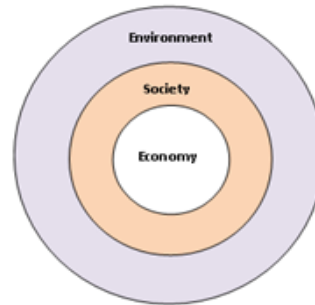


Fig 5: Bullseye Model

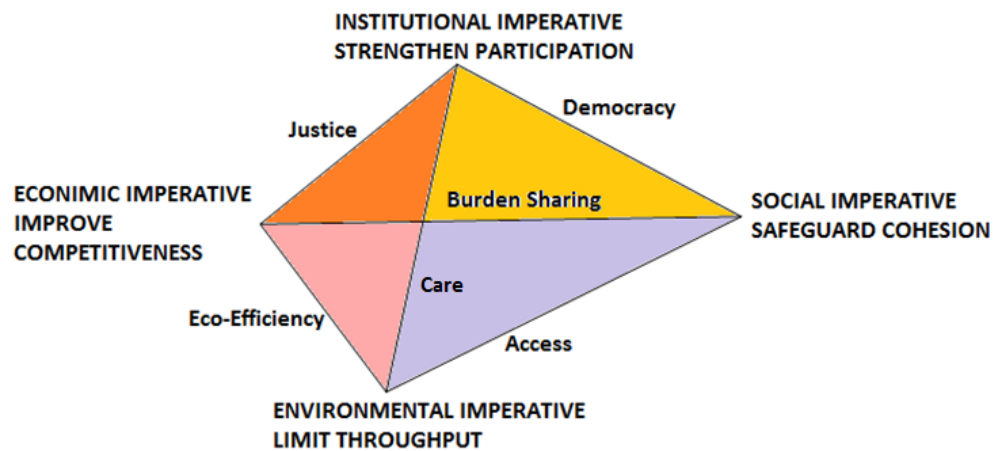


Figure 6. Prism Model

## Literature review

Discussions have been made in a nutshell about some relevant literatures. For this paper, the authors have consulted different literatures relating to Green Library. (Bhattacharya, 2017) focus on utilities of Green library in modern day. (Meher and Prabhoi, 2017) presented the concept of Green library in Indian context. (Peckenham, 2016), on his article “11 green building materials that are way better than concrete“ advocate to use materials like – bamboo, hempcrete, recycled plastic, wood mycelium, ferrock, ashcrete, timbercrete etc, alternative to concrete. (Safaa Nasser Hassan Al-Hussaini, 2016) disseminated knowledge relating different models of sustainable development. (Rawat and Agarwal, 2015) have explained nicely the concept of biodiversity. They have also explained the probable threats and conservation of biodiversity.

## Green Library – concept

The concept of Green began its journey in the former part of 1990s. A Green Library is constructed in such a fashion which tries to minimize all sorts of negative impacts. Environmental factors like humidity, fungus, moisture, dust, air pollution are actually responsible for the degradation of library materials. Sincere attempts are to be taken to control those environmental factors so that library materials can be protected for longer period of time. Different persons defined Green Library in different ways. However it manifests the ideas of environmental factors, renewable resources, vegetation, air quality, biodegradable products, conservation of resources (water, electricity), cost effectiveness etc. Librarians can take vital role to protect natural environment adopting Green Library concept. Green librarians should set up environment friendly policies which should be strictly followed. Green Library is the part of Green Building. Green Library is applicable to all kinds of library. In fact Green library is a multifaceted concept. It is comprised of Green building, Green program and services, Green information systems, Green operations and practices, etc.

People in a workplace or inhabitants of a building are found to suffer medically or feel uncomfortable due to Sick Building Syndrome. Physical (artificial light, temperature, sound, inadequate ventilation), Chemical (toxic chemical contaminants from indoor sources), Biological (microorganisms) and Psychological (stress) factors are responsible for occurring such situation. Adoption of Green concept is useful to diminish Sick Building Syndrome.

## Environmental issues

Various environmental changes which are taking place are either natural phenomena or induced by human being. People are cutting down trees in order to make wooden furniture, paper etc. Mining of fossil fuels resulting into depletion of natural resources. Global warming, Ozone layer depletion, loss of natural resources, biodiversity bring about all such things poses very serious problems to the quality of life on this planet.

- **Global Warming:** Global warming is being taking place because of Greenhouse effect. Greenhouse gases are mainly carbon dioxide, methane, nitrous oxide etc. Human beings are producing these gases due to their routine living activities. This type of gases makes a

blanket above the earth's crust. Consequently radiant energy arrives through the sunlight is not getting released resulting into increase in temperature of the world. Buildings are also responsible for emission of greenhouse gases. It is therefore highly essential to take adequate measures to diminish the emission of greenhouse gases in order to protect the planet. Health of human being can be protected to some extent through sustainable architecture. The amount of greenhouse gases (generally carbon dioxide) released to atmosphere due to human activity either domestically or commercially, is called carbon footprint. Various initiatives have been taken worldwide to reduce the carbon footprint for better living and also to save this planet.

- **Ozone layer depletion:** Ozone (O<sub>3</sub>) gas at the upper atmosphere protects living being against the harmful ultraviolet radiation coming from the sun. Ozone layer depletion takes place mainly because of Chlorofluorocarbons (CFCs) and other halogenated ozone depletion substances (ODS). This situation increase the amount of ultraviolet radiation causing – skin cancer, eye cataracts, disruption of immune system, genetic disorders, reduction of plant growth etc. Severe ozone depletion may cause a worse situation called Ozone Hole which is found to be very acute over South Pole (Antarctic region). CFC molecules are extremely stable and are comprised of chlorine, fluorine and carbon molecules. Countries round the globe should avoid using ozone depleting substances to protect the stratospheric ozone layer.
- **Loss of natural resources:** The depletion of natural resources is taking place very rapidly. The reasons for depletion is due to – overpopulation, excessive consumption and wastage of water, deforestation, mining, soil erosion, contamination of natural resources due to pollution etc. We should embrace the concept of sustainable development; otherwise problem will arise on human existence. Hence stress is to be given upon utilization of renewable energy resources.
- **Biodiversity:** The term biodiversity resulting due to combination of two words – biological and diversity. This term was coined by Walter G Rosen in 1986. Biodiversity considers life of animals, plants, microorganisms, genes etc. Biodiversity can be broadly classified into three groups, namely – Genetic diversity, Species diversity and Ecosystem diversity. Biodiversity conservation maintain ecosystem in a well balanced manner and keeps life healthy on earth. Ecosystem is disrupted due to deforestation, industrial farming, over hunting, over harvesting, environmental pollution. Biodiversity should be maintained at individual as well as Governmental level in order to prevent ourselves from dangers.
- **E-waste:** Due to exuberant growth of technology, relatively old electronic equipments are being replaced by new one resulting accumulation of huge electronic waste (e-waste) which are very harmful for human being as well for the environment. Government should take adequate measures for e-waste management.

## How to make Green Library

In order to make Green Library, one must have to consider several aspects namely –building structure, natural ventilation, heating, cooling, lighting, interior decorations. LED lights are very much environment friendly compared to traditional fluorescent light. Hence fluorescent light should be replaced by LED lights. Besides emphasis is to be given on several other points like use of biodegradable products, reduction of wastage of water and electricity. Stress is to be given to use renewable materials like wood, bamboo, linoleum. Landfill space is to be filled up with

minimum waste materials as far as possible. Green roof or living roof (with proper drainage system) may have manifold benefits namely – reduction of cost for cooling or air conditioning, prolongation of the life span of the roof etc. Library must have Green space which include – Green wall, Green tanks with hydroponic plantation, park with flowering and medicinal plants. Around the library big trees will be there; which will provide shades. All these ensure essential cooling that will compensate the heat liberated by AC machine, generators etc. Air purifying plants like – Dwarf Date Palm, Peace Lily, Spider Plant, Rubber plants, Areca palms, Ficus, Aloe Vera, Bamboo Palm, snake plants should be there within library. In fact NASA is using snake plants in their space project program

## **Benefits**

It having numerous benefits -

- Attracts patronage
- Prevail better health and hygiene
- Ensures quality living
- Maintain ecological balance of the earth
- Reduction of use of energy ( water and electricity)
- Reduction of maintenance cost
- Improves light, air and water quality
- Promotion of alternative energy source

## **Green Building Rating System**

A Green Building Rating System follows certain prerequisites and requirements in order to achieve certification. Various countries round the globe have developed their own Green Building Rating System. Some examples are as follows –

- Building Research Establishment Environmental Assessment Method (BREEAM) of UK in 1990.
- Leadership in Energy & Environmental Design (LEED) of USA in 1998.
- Green Globes of Canada in 2000.
- Comprehensive Assessment System for Environmental Efficiency (CASBEE) of Japan in 2004.
- Green Mark of Singapore in 2005
- Green Rating for Integrated Habitat Assessment (GRIHA) of India in 2006.

LEED projects are going on in more that hundred countries of the world. Both GRIHA and LEED-India are being operational at the national level. There are four levels of certificates for LEED, which are – Certified, Silver, Gold and platinum. The Energy Resource Institute (TERI), located at New Delhi, has taken the key role for the development of Green Building. TERI has developed GRIHA.

## Initiative

The Green Library movement began its journey in the early part of 1990s. However several high profile Green libraries were established in foreign countries in the very early part of this century. Some examples are –

- Seattle Central Library, (2004): This library received LEED Silver certification for its Green building.
- Children's Museum of Pittsburg (2004)
- My Tree House is very popular, which is located at the Central Public Library of Singapore. It is the first Green library for children of the world. It was officially launched on 31<sup>st</sup> May 2013.
- Minneapolis Public Library (2006): It is a Green library having three impressive Green roofs about 18500 square ft. which make the library very cool.

India is still at its infancy towards development of green library. TERI is the pioneer of Green building movement in India. The essence of Green library can be obtained within limited libraries in our country.

Some examples are as follows –

- Karnataka University Library, Dharward: The Karnataka University has started a project on Green library. Several benches are there under trees and students are reading library books in the open atmosphere
  - Mumbai University Library (1857): The library was set up with eco-friendly equipments.
  - Anna Centenary Library: This library is located in Kotturpuram, Chennai. This is one and only Green library in India. In fact the Anna Centenary Library is the first LEED Gold Rated Library Building in Asia.
  - Calcutta University Library: This library has started its journey towards Green destination.
- India has several Green buildings. Some of those are as follows -
- 'PanditDeenDayalUphadhayayUrjaBhawan' of ONGC located at New Delhi has been bestowed LEED India 'Platinum' by US Green Building Council (USGBC). Four more green buildings of ONGC are coming up at Delhi, Mumbai, Kolkata and Hyderabad.
  - Suzlon One Earth campus of Pune possesses Green building certified by LEED as well as GRIHA.
  - Rajiv Gandhi International Airport of Hyderabad also set up a benchmark for green building.
  - Infinity Benchmark situated at Salt Lake, Kolkata conferred Green Building certification by LEED.
  - Infosys Limited of Mysore has green building.

## IIT Kharagpur marching towards Green concept

Central Library, IIT Kharagpur began its journey in the year 1951. This library is not Green Library in true sense; but has started some Green activities. The floor area of this library is 8000 Sq. M. and the users enjoy natural sunlight through its wide window. The natural sunlight through roof top of the Annex Building saves electricity during day time. The Central Library

has given emphasis on purchasing E-books and E-journals. More than 120 computers have been installed to provide services to the users. Some kindles have been procured to develop the habit of E-book reading. Initiative has been taken to develop its own Institutional Digital Repository (IDR) for Ph.D and D.Sc Theses. Some air purifying plants have been kept at different corners of the Central Library. At the present moment there are more than 12,000 students, and students are not allowed to use motor vehicles. However the institute authority has introduced free bus service for the purpose of transportation. The institute having 45 Departments, Centres and Schools and the authority is maintaining lush green gardens within the campus. A research team of this institute has developed a bio-toilet which can recycle waste water and can generate electricity from waste. Movement sensors have been introduced in some places of the institute building in order to save electricity. Solar panels have been installed on the rooftops of several buildings including the Central Library building in order to reduce the monthly electricity bill 10-15%. Fluorescent lights have been replaced in places by LED lights. The entire campus is Wi-Fi enabled. Out of 5000 rooms of the hostels, 100 rooms come under smart electrification module which can be operated using smart phone app. Consequently students will be in a position to switch off electrical equipment of his/her room. Thus initiative has been taken to transform the college campus into smart one. Some scientists have successfully generated green electricity from waste onion skins. This institute has totally banned the use of plastic cups and plastic packets within the campus. The students of IIT Kharagpur celebrates eco-friendly smokeless Diwali in absolutely stunning manner. The students light up their hall of residences with thousands of diyas. The Institute has been promoting green activism within the campus by conserving and planting trees with deep roots (like Palash and Amaltas) which usually do not get uprooted during storms. Initiatives have been taken by the institute authority to offer various projects to the UG and PG students relating to sustainable development, environment and promotion of green movement. A cheaper, quicker and pollution-free technology has been developed by some researchers of IIT Kharagpur towards manufacturing of bio-fuels from - green leafy part or corn and sugarcane, waste part of paddy straw, bamboo, banana plant, pineapple, kassphool (kans grass) along with non-edible weeds. Carbon Clean Solution (CCS) of IIT Kharagpur enables to capture 90% of CO<sub>2</sub> gas emitted from factories. This institute is spending more than a crore for new innovations relating to Green technology solutions.

## Barriers for construction of Green Library

It can be explained using Ishikawa diagram or Cause-And-Effect Diagram. This concept was conceived by Prof. Kauro Ishikawa of Japan. Because of the structure of the diagram, it is also known as Fishbone diagram. Several reasons are there for constriction of Green library (effect) which may be explained from the point of view of – users, staff, infrastructure and policy (four causes). Apart from these several others causes may appear which may create negative impacts towards making a library Green.

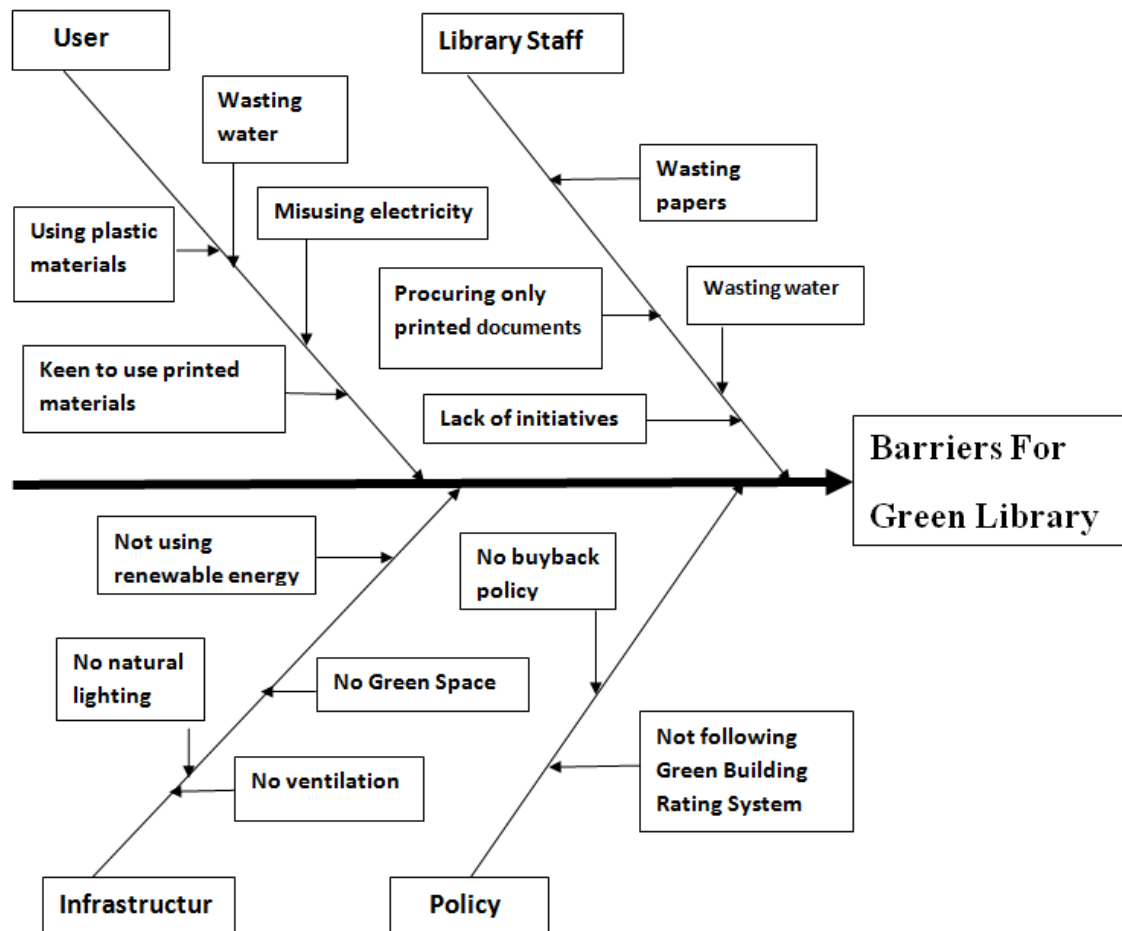
**Users:** Some users are wasting water, misusing electricity, using plastic materials (cup, bags), strong affinity to use book materials,

**Staff:** Wasting huge papers, wasting water, procuring only printed documents.

**Infrastructure:** No provision for natural ventilation and natural lighting within the library, not using renewable energy.

**Policy:** No buyback policy, not following Green Building Rating System.

The following Fishbone diagram (Fig.7) shows some barriers for Green Library



**Figure 7.** Fishbone diagram regarding barriers for Green Library

## Green Librarian

A Green librarian should undergo wide range of activities towards green library movement. Some of those are as follows –

- A Green team is to be formed
- Setting up a policy



- Giving stress on E collection (E-books, E-journals, Electronic Theses & Dissertations etc.) in lieu of paper documents.
- Frequent use of LCD monitors
- To organize brain storming session, open houses, seminars, conferences etc.
- To use biodegradable or environment friendly products avoiding the use of plastics or toxic elements.
- Make provision to use Photovoltaic Technology, Green roof.
- Use of Green building materials like bamboo, wood, cork, wool bricks, straw bales, hempcrete, timbercrete, recycled plastics, ferrock, – to diminish green house environmental impact.
- Making provision for natural lighting and ventilation
- Developing habit among library users for using stairs rather than lift or elevators (not for the people with special abilities).
- Reduction of paper consumption as far as possible
- Introduction of buyback policy in order to reduce the accumulation of electronic waste materials
- Carbon footprint of a library may be reduced using High Density Mobile Book Stack Shelves or Compactor machine. It will -
  - ❖ Require less floor space thereby require relatively small library building.
  - ❖ Reduce the construction cost of library building.
  - ❖ Reduce energy for heating, cooling and for the lighting purpose.

Various issues are there. However concrete decision may have to be taken under the leadership of Green librarian to take part actively towards Green library movements.

## Conclusion

Human beings knowingly or unknowingly are polluting the atmosphere. The Green colour of the world is depleting alarmingly. It is the duty of every citizen to keep this planet green. Adequate measures are to be taken to protect this world. IT based modernization cannot be restricted. At the same platform the concept of Green library is the demand of the era. In this perspective librarians can play vital role to strike a happy balance between advancement of Technology and establishment of Green Library. A library is a temple of learning. Landscape and Green architecture of a library will enable the reader to enjoy their reading for hours together. Several high level initiatives have been taken place in different corners of the world in countries like USA, Canada, Singapore etc. However Indian librarians have to gear up this blooming concept in a wider range following standardized Green Building Rating System. Green library buildings are more advantageous than traditional library building. Librarians of this dot com era should take initiatives to construct modern Green library building in order to maintain a balance between knowledge extraction and environment protection. Library conferences on Green library and interconnected topic like – going green, sustainable library, paperless society etc. are to be conducted with a positive intention to bring environmental awareness to library professionals. The post of Green librarian is to be created for the execution of the concept into reality. Libraries can be made Green through Green library movement which will save as an introspective measure to protect the planet from jeopardy.

## References

1. Andrew Michler. 2011. **Green-Roofed Minneapolis Central Library is a Civic Lesson on Eco Design.** <https://inhabitat.com/green-roofed-minneapolis-central-library-is-a-civic-lesson-on-eco-design/> (accessed on 10.07.2019)
2. Awaaz, IIT Kharagpur. 2016. <https://www.facebook.com/awaaziitkgp/posts/an-rti-filed-to-the-mhrd-has-revealed-that-the-annual-electric-bill-paid-by-iit-1209156405771379/> (accessed on 09.07.2019)
3. Belcham, Adrian. 2014. *Manual of Environmental Management*. London: Routledge
4. Bhattacharya, Anindya. 2017. **Green Library and its Utilities in Modern Day Library Service.** *Interenational Journal of Next Generation Library and Technologies*. Vol. 3(3). 1-10.
5. Blogspot .2011.**What is sustainable development?**
6. Dalziel,Lottie. 2018. **Air purifying plants: 20 best air cleaning plants.** <https://inhabitat.com/11-green-building-materials-that-are-way-better-than-concrete/> (accessed on 25.06.2019)
7. Emily Peckenhan. 2016. **11 green building materials that are way better than concrete.** <https://inhabitat.com/11-green-building-materials-that-are-way-better-than-concrete/> (accessed on 05.06.2019)
8. Global Gujrat News. 2019. IIT-Kharagpur Sanctions Rs.1.45 CroreFor Green Technology. <http://www.globalgujaratnews.in/article/iit-kharagpur-sanctions-rs-1-point-45-crore-for-green-technology/> (accessed on 04.07.2019)
9. **Green Library**. 2019. [https://en.wikipedia.org/wiki/Green\\_library](https://en.wikipedia.org/wiki/Green_library) (accessed on 24.06.2019)
- 10.Hassan ,Safaa N. 2018. **Sustainable Development.** [https://uomustansiriyah.edu.iq/media/lectures/5/5\\_2018\\_03\\_27!12\\_16\\_19\\_AM.pdf](https://uomustansiriyah.edu.iq/media/lectures/5/5_2018_03_27!12_16_19_AM.pdf) (accessed on 18.06.2019)
- 11.IITKGP Foundation. 2018. **Scientists at IIT Kharagpur Use Waste Onion Skins to Develop Green Electricity!** <https://www.iitkgpfoundation.org/article.html?nl=122>. (accessed on 15.07.2019)
- 12.Lucia Athens. 2007. **Design for Social Sustainability At Seattle’s Central Library.** *Journal of Green Building*.Vol. 2 (1): 1-21.
- 13.Molina, Claude et al.1989. **Seek Building Syndrome.** [http://www.inive.org/medias/ECA/ECA\\_Report4.pdf](http://www.inive.org/medias/ECA/ECA_Report4.pdf) (accessed on 25.08.2019)
- 14.MüjdeAltin, 2016. **Green Building Rating Systems in Sustainable Architecture.** pp.601-611
- 15.Oil and Natural Gas Corporation Limited. 2017. **PDDU UrjaBhawan receives LEED Platinum award from US Green Building Council.**
- 16.OzPolitic. 2006. **Environment, Society, economy.** <http://www.ozpolitic.com/articles/environment-society-economy.html> (accessed on 22.07.2019)
- 17.Peckenham, Emily. 2016. **11 green building materials that are way better than concrete** <https://inhabitat.com/11-green-building-materials-that-are-way-better-than-concrete/> (accessed on 15.06.2019)

18. Petra Hauke. 2018. **“Green Literacy” Professional Skills, Competencies and Goals of Managing the Green Library From a Hungarian Perspective.** [https://mke.info.hu/wp-content/uploads/2018/05/Green\\_Literacy\\_Budapest\\_02.pdf](https://mke.info.hu/wp-content/uploads/2018/05/Green_Literacy_Budapest_02.pdf) (accessed on 15.07.2019)
19. Puspanjali Meher, and Lambodara Parabhoi. 2017. **Green library: an overview, issues with special reference to indian libraries.** *International Journal of Science and Research Vol.7(2): 62-69.*
20. Quora. 2017. Which reaction is responsible for the ozone layer depletion? <https://www.quora.com/Which-reaction-is-responsible-for-the-ozone-layer-depletion> (accessed on 17.07.2019)
21. Rag, R L. 2016. **Introduction to Sustainable Engineering.** Delhi: PHI Learning.
22. Rawat, U S and Agarwal, N K. 2015. **Biodiversity: Concept, threats and conservation.** *Environment Conservation Journal* 16(3): 19-28.
23. Southwest Solutions Group. 2019. **Decrease Library Carbon Footprint with High Density Mobile Book Stack Shelves.** <https://www.southwestsolutions.com/library/decrease-library-carbon-footprint-with-high-density-mobile-book-stack-shelves> (accessed on 12.07.2019)
24. Srivastava, Vaibhav. 2017. **List of Ten Renowned Green Buildings in India.** <http://www.bullmenrealty.com/news/list-of-ten-renowned-green-buildings-india/> (accessed on 19.07.2019)
25. Takepart. 2016. **What is a carbon footprint?** <http://www.takepart.com/flashcards/what-is-a-carbon-footprint/index.html> (accessed on 29.06.2019)
26. **Why green roofs? Benefits?** 2019. <https://commons.bcit.ca/greenroof/faq/why-green-roofs-benefits/> (accessed on 25.06.2019)

# Building NextGen Discovery Service Using VuFind at Central Library

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## Abstract

Central Library IIT Kharagpur subscribes many electronic resources, and each e-resource database has its own search engine. Therefore, users need to visit different search engines web sites to get their required information, which is both time consuming as well as a laborious task. Central Library implemented central index using “VuFind” open-source software. To save the time of the users, the discovery services provide a single-window search interface. This study is accomplished by two processes (1) Implementation Process: Study of implementation of the discovery tools VuFind Portal and eSearch Portal (2) User Experience (UX) Analysis: wherein survey of the usability of various discovery tools are taken from the students. This survey is then analysed to understand the user need and experience (UX) of the various discovery services as provided by the digital library section of central library IIT Kharagpur. In today’s digital era, the new age discovery services focus on “Central Index” content search. Henceforth the two key benefits of these new-age discovery solutions are 1) they act as a single-window search interface for the library content and 2) they operate on web-scale.

“Central Index” is the latest technological development in the world of the digital library. Here the “central indexing server” indexes the metadata from varied platforms and varied collections. It allows library users to search across the vast range of local database, remote database, pre-harvested indexed contents. The central indexing server creates a unified, customized index for the institution's information e-resources. It also harvests metadata from both internal “library LMS” (Library Management Software), “IDR” (Institutional Digital Repository) as well as from external subscribed resources, to create a pre-indexed data service.

## Keywords

Discovery Solutions, Web-Scale Discovery Service, VuFind, Solr, Central Index, NextGen Catalogue, Metadata Search.

## Introduction

Web-Scale Discovery Services provides a single-window search interface to the central indexed metadata as well as the full-text documents. Central discovery solutions are changing the information-seeking behavior of our users. The information processing layer provides the search results in varied formats like relevancy rank results; date wise sorted results, subject-wise classified or document type classified, and others. It creates across-platform customized index of our institution's information e-resources. It is a powerful tool to access all the e-content from a single search box. The “*Information Search Process*” (ISP) as suggested by Carol Kuhlthau in 1991, is a six-stage process of the information-seeking behavior of library users. Carol (Kuhlthau, 1991) defined six cyclic stages of ISP; they are i) Initiation ii) Selection iii) Exploration iv) Formulation v) Collection and vi) Search closure.

Central library IIT Kharagpur has a rich collection of subscribed e-resources, physical books, open-access digital collections, aggregator's database, institutional digital repository contents of scanned documents of rare books, out of print books, faculty publications, Ph.D. theses, and other resources. Library VuFind portal provides URL of library e-resources from where all the users reach individual e-book database site and search their required information. However, Library website is not providing single-window search interface of all library e-resources; instead, it is displaying a list of e-resource with the URL link to access individual publisher portal. This noble thought had made us design and implement “VuFind” software for our Central library users. Author (Houser, 2009) explains VuFind is available for to download by anyone, use, modify, and distribute under the GPL open source license. Villanova University decided to develop its software and make it open source in the year 2010. VuFind uses the Yahoo! User Interface Library (YUI) framework

Our library “eSearch” portal designed and developed by the server team using PHP and MySQL. The MySQL database is having 26,000 journal titles of both ESS Consortium subscribed e-resources as well as libraries own subscribed e-resources (e-Journals, e-books, and e-database). At present, Library provides IP based access to 26,000+ full-text e-Journals and 1.6 lakh full-text e-books to the users.

## Literature Review

Hofmann & Wiermann (2014) discussed VuFind catalog as the next generation Social Online Public Access Catalogue (SOPAC). It has many features including the much sought after single search box for phrase search as well as it allows the library users to tag, rate, and review the holdings. Results returned along with “*did you mean*” and “*shows suggestions*” for term choices. In the year 2012, the library of the University of Music and Drama Leipzig (Germany) installed VuFind-based discovery system, called “MT-Katalog.” In this context, Hofmann discussed the use of the discovery solution and the various opportunities offered by music discovery. University also selected many external music resources and integrated with the “MT-Katalog” system. This helped in extending the search scope of the library users.

According to Rasmussen(2014) web-scale discovery solutions are a widespread phenomenon and used extensively in the university libraries around the world. Third party software solutions like Summon Serial, Biblio-Commonshave become very useful both for the library and its users. VuFind, on the other hand, offers a Solr based central indexing solution. VuFind's appearance is also customizable as similar to the library's website, providing users with a seamless transition from the library's home page to the catalog search box. Author further discusses that the single search box with auto-suggestions(Burchill & Rasmussen, 2014) and the ability to limit results after an initial search by format, language, author, subject area, or any other facet are useful to the information seekers.

“Cross-Platform” metadata ingestion, as explained by Ho, Kelley, & Garrison(2009), is the most crucial feature for the VuFindadministrators.The author Han, (2012)explains ‘facets’ as new dimension using which a user can explore the search results. Facetssuch as LC classification, subject, era, language, and author are very import for filtering the serach results. The future of library systems based on the open-source software's with the innovative new initiatives by the Open Library Environment (OLE) project and “The Future of Libraries is Open” FOLIO project.

## Problem Statement

Displaying the search result in a single-window search box is a requirement for the library users.Librarians are facing challenges in choosing appropriate information resources from varied sources, licensing them wherever necessary, and finally presenting this heterogeneous collected information in the library portal for users to use. The library portal provides hyper-link of Library subscribed e-resources like e-journals, e-books, and databases. However, the critical problem is the information display as the portal does not provide a single-window search interface for e-resources;instead, it displaysa long list hyperlinked to publisher portal. Therefore, a “google” like interface for the users is the need of the day.

***Problem Statement 1: Librarian's Point of View:***“Librarian need a solution to provide single search box on Physical book holdings, Library subscribed e-resources and the Open Access Contents available on the Internet.”

***Problem Statement 2: End Users's Point of View:***“Users need relevant information, social sharing, stylecitation for the research articles.”

## Objectives

Central Library IIT Kharagpur implements two web-scale discoveryplatforms for its users (1) VufindeBook search portal integrating other subscribed resources/contents present in the library. (1) eSearch Portal which is developed for listing all the subscribed journal and e-database information in one window.This study tries to evaluate the usefulness of these discovery tool from end users view point.

The objectives of this study are:

- To know the user experience of accessing the e-resources like e-journals, and e-databases in eSearch platform.
- To analyses the usage of VuFind platform and its benefits to the end-users.

## Hypothesis

- **H0:** Null Hypothesis: There no sinificant difference in the usage of VuFind software. Test the hypothesis for very few less than a hundred live installations in global forum.
- **H0:** Null Hypothesis: There is no significant difference in finding subject wise ebooks details on the VuFind ebook discovery portal.
- **H0:** Null Hypothesis: There is no significant difference in finding journal titles on eSearch portal.

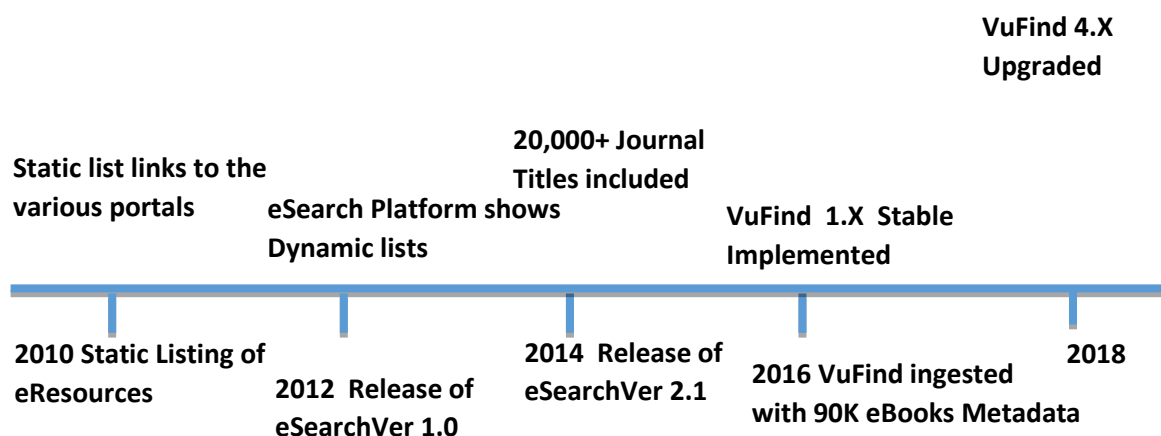
## Methodology

This study is done in two parts one is study of the platform and others is study of the user experiences. The methodology followed here is interviewing the IT support and competent authority who maintains does the data ingestion. For the tracking the user experience questioner method is followed. A survey of 50 students are made to understand the significance and usability of the platforms [Questioner Sample Annexure I].

**Study of Implementation of Discovery Tool:** Central Library IIT Kharapur implemented two platforms as mentioned above for the discovery electronic resources.

- **“eSearch” platform:** It is developed in PHP and MySQL by library server team.  
[URL: <http://www.library.iitkgp.ac.in/pages/eSearch2.1/>].
- **“VuFind” eBooks search platform:** It is implemented using the “VuFind” open source software.

[URL: <http://www.library.iitkgp.ac.in/vufind/Search/Results?type=AllFields>] VuFind, as mentioned in the wiki, is an “open-source library search engine that allows users to search and browse beyond the resources of a traditional Online public access catalog” (OPAC) [Source: <https://en.wikipedia.org/wiki/VuFind>]. **VuFind is developed by Villanova University, version 1.0 released in July 2010.** The bibliographic data of indexed documents imported from marc files. A Single Window is a one-stop portal for library users and listing of library e-Resources. It dramatically reduces the complexity, time, and costs involved in information access. Many countries are now focusing on a “Single Window” access portal, which is an essential instrument to increase the competitiveness of their research activities. The graphical timeline for the notable events in the developments of our current web-scale discovery platform, as shown in Figure 1.



**Figure 1.** Timeline Evolution of Discovery Platform at Central Library IIT Kharagpur

During the year 2010 all the library resources were listed in library portal as static list. Gradually, we have developed our eSearch portal which enlists all the e-resources and it is having some additional features like A-Z listing, journal title search and Boolean search window. This is very much helpful to our users. In the year 2016 VuFind open source software is used for displaying 90,000 ebooks bibliographic information. Presently we are having 1.40 lakh ebooks metadata in its central index.

### Item Metadata Ingestion

- **Metadata Ingestion Process in VuFind:** The SolrMarc tool comes packaged with VuFind (Katz & Nagy, 2013) for importing MARC records. Large scale metadata harvesting (Roy, Sutradhar, & Das, 2017) from DSpace repositories is done using OAI-PMH protocol. It is done by simply editing the oai.ini file present in the harvest subdirectory of VuFind installation folder. eBook marc records are ingested into the VuFind solr index [Ref Table 3].
- **Metadata Ingestion Process in eSearch:** The discovery platform is having separate admin portal which support bulk ingestion into the MySQL database. Journal bibliographic data like title, publisher, url link are the main fields which are stored in the database. The platform does not support OAI-PMH protocol in the present version. Henceforth it doesn't support harvesting. The table below shows the record details in both the platforms.

SI No	Publisher	Record Count	Remark	Library Discovery Platform
1	SpringerLink eBooks	140,605	Marc Ingestion	VuFind Platform
2	Taylor Francis eBooks	17,565	Marc Ingestion	VuFind Platform
3	Wiley eBooks	2,112	Marc Ingestion	VuFind Platform
4	Cambridge eBooks	119	Marc Ingestion	VuFind Platform
5	Journal Title List	26000	SQL Ingestion	eSearch Platform

**Table1 :** Item record counts in discovery platforms



## User Experience (UX) Analysis of Discovery Platform

This study considered 50 students at random who are using these tools. The questionier is distributed among them and the findings are then analysed. This survey questionier mainly focused on the user interface and content availability on the platforms. VuFind discovery tool supports tagging, facets, and other Catalog 2.0 features to enable users to “*search and browse*” through all the indexed bibliography.

## Data Analysis

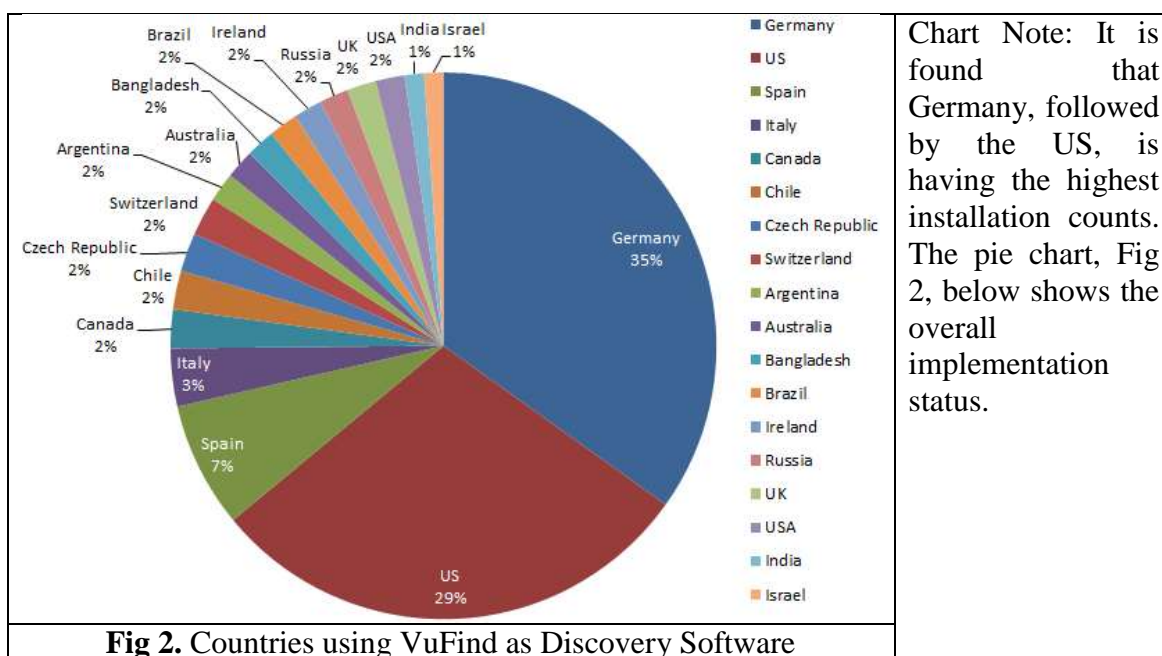
Vufinddiscovery software’s heart is the Lucene/Solr, which indexes the marc metadata in its central index, where aseSearch portal stores the metadata into MySQL database. This study found that library team have designed and developed the eSearch journal portal. All the journal subscription details are present in the database.

*First Hypothesis Test:*  $H_0$ : “There no significant difference in the usage of VuFind software. There is less than 100 live installations in whole world.” To prove the alternative hypothesis as true this study collected data of all libraries that have implemented VuFind software in whole world. Table below shows top 5 countries that are using VuFind software as a resource discovery tool.

Country	Registered Installation Count	Remark
Germany	61	The data collection is from the VuFind official registered portal link ( <a href="https://vufind.org/wiki/community:installations">https://vufind.org/wiki/community:installations</a> ). Then data exported in MS Access database to process and group by country wise.
US	51	
Spain	13	
Italy	6	
Canada	4	

**Table 2.** Top Five Countries using VuFind as Discovery Software

The study found there are more than 200 live installations present in various libraries through out whole world. So alternative hypothesis is true “*There is significant usage of VuFind software lobalforum*”. The pie chart below shows the usage of VuFind software in various countries.



**Chart 1.** Countries using VuFind as Discovery Software

*Second hypothesis test  $H_0$ :* we mentioned that “There is no significant difference in finding subject wise ebooks details on the VuFind ebook discovery portal”.

*Third hypothesis test  $H_0$ :* we mentioned that “There is no significant difference in finding journal titles on eSearch portal”

This study performed a survey among the digital library users from 26-Aug-2019 to 30-Aug-2019. Here we tried to understand the user experience (UX) regarding the discovery platforms by giving questionnaires. In the questionnaire it had been asked to the users regarding “Discovery Portal Usage and Features”.

Usability of the Platform (Sample Size: 50)			
SL No	Discovery Portal Features	Useful (Y)	Not Useful (N)
1	Usability of VuFind Discovery Portal	42	8
2	Usability of Esearch Discovery Portal	44	6

**Table 3.** User Experiences for using Discovery Platforms

**One-Sample Test**

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Useful	43.000	1	.015	43.00000	30.2938	55.7062
NotUseful	7.000	1	.090	7.00000	-5.7062	19.7062

**Table 4.** One-Sample Testfor using Discovery Platforms

Table 3 & 4 shows the users satisfaction level while accessing the platform. The one sample ‘T’ Test is generated using SPSS software. Henceforth the alternative hypothesis is correct that there is a significant difference in finding subject wise ebooks details on the VuFindebook discovery portal. Regarding descriptive statistics, the very least we should report, is the mean, standard deviation and N on which these are based. We may report the t-test results by writing “we found that, on average, most users mentioned that the platforms are useful to them; for Useful  $t(1) = 43$ ,  $p = .015$ . and NotUseful  $t(1)=7$ ,  $p=.090$ ”. We usually reject the null hypothesis if  $p < .05$  and accept the alternative hypothesis as true.

## Scope for further works

VuFind, BlackLight are some of the open source software which are used for discovery solution in many libraries. There are still many challenges affecting those creating and operating Discovery Services today. The main challenge for Discovery Services(Mutschler, 2014) is library staff participation. One may work further to meet the various challenges as mentioned below.

The challenges are mainly internal, such as:

- It is not just not enough to create the “Discovery Services” and expect that staff to work willingly for the bibliographic process. A successful relationship between library/Discovery Services staff and users like faculty, students is a must.
- Advocacy and advertisement are another aspect. Their must be oriental classes for the users, so that they should be able to use it easily. After all, without advocacy, the Discovery Services will not expand, therefore defeating its purpose.
- Collaboration with the other data providers like publishers is also needed. Effort to create collaboration with key stakeholders will bring the success of meeting the “Discovery Services” goal.
- Indexing 3D and Virtual Reality content in VuFind and displaying the content in proper format is also a need of the day.

## Conclusion

FOLIO “The Future of Libraries is Open” is the new diamention for the academic libraries. The library communities is collaborating and joining in partnership to innovate, develop a new open source and open access library service platform. Therefore the study found “*cross platform discovery services*” and open access collections are the future. It may be concluded that the “*Resource Discovery*” feature of VuFind’s as according to Roy, B. K., Biswas, S. C., Mukhopadhyay, P. (2018) includes facet formats like call number, topic, author, language, genre, era, and region are very useful. This study found the library users uses the discovery tool / platforms more often now a days. When search results are displayed, these facets are not shown as the part of the result sets but displayed as lists in the default right-side of the column. Each facet present in the right column list displays the number count of search results. The communication between the various open source software’s like koha, greenstone, evergreen, dspace, eprint , VuFind, BlackLight are the new technological developments, where many innovation yet to be established. The interoperability among the softwares and linked data harvesting process will create a whole new world for the library users where they will be able to find out their required document in no time and will truly establish the Ranganathan’s five laws.

## References

1. Burchill, M. K. ., & Rasmussen, N. (2014). Implementing VuFind: A Public Library Improves Electronic Search Quality and Saves Searcher Time. *Public Library Quarterly*, 33(1), 76–82. <https://doi.org/10.1080/01616846.2014.877718>
2. Roy, B. K., Biswas, S. C., Mukhopadhyay, P. (2018). Designing web-scale discovery systems using the VuFind open source software. *Library Hi Tech News*, Number 3 2018, 16-22. <https://doi.org/10.1108/LHTN-12-2017-0088>
3. Emmanuel, J. (2012). Usability of the VuFind Next-Generation Online Catalog. *Information Technology and Libraries*, 30(1), 44–52. <https://doi.org/10.6017/ital.v30i1.3044>
4. Han, M.-J. (2012). New Discovery Services and Library Bibliographic Control. *Library Trends*, 61(1), 162–172. <https://doi.org/10.1353/lib.2012.0025>
5. Ho, B., Kelley, K., & Garrison, S. (2009). Implementing VuFind as an alternative to Voyager’s WebVoyage interface. *Library Hi Tech*, 27(1), 82–92. <https://doi.org/10.1108/07378830910942946>
6. Hofmann, A., & Wiermann, B. (2014). Customizing Music Discovery Services: Experiences at the Hochschule für Musik und Theater, Leipzig. *Music Reference Services Quarterly*, 17(2), 61–75. <https://doi.org/10.1080/10588167.2014.904699>
7. Houser, J. (2009). The VuFind implementation at Villanova University. *Library Hi Tech*, 27(1), 93–105. <https://doi.org/10.1108/07378830910942955>

8. Kabir, A. M. F. (2003). Ranganathan: A Universal Librarian. *Journal of Educational Media & Library Sciences*, 40(4), 453–459. Retrieved from <https://libproxy.library.unt.edu:9443/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=llf&AN=502904957&site=ehost-live&scope=site%5Chttp://search.ebscohost.com/login.aspx?direct=true&db=llf&AN=502904957&site=ehost-live&scope=site>
9. Katz, D., & Nagy, A. (2013). VuFind: Solr Power in the Library. In *Library Automation and OPAC 2.0* (pp. 73–99). <https://doi.org/10.4018/978-1-4666-1912-8.ch004>
10. Kuhlthau, C. C. (1991). Inside the search process: Information seeking from the user's perspective. *Journal of the American Society for Information Science*. [https://doi.org/10.1002/\(SICI\)1097-4571\(199106\)42:5<361::AID-ASI6>3.0.CO;2-#](https://doi.org/10.1002/(SICI)1097-4571(199106)42:5<361::AID-ASI6>3.0.CO;2-#)
11. Mutschler, T. (2014). VuFind als Discovery-Tool für digitalisierte Kulturgüter. *ABI Technik*, 34(2), 66–74. <https://doi.org/10.1515/abitech-2014-0012>
12. Roy, S. G., Sutradhar, B., & Das, P. P. (2017). Large-scale Metadata Harvesting—Tools, Techniques and Challenges: A Case Study of National Digital Library (NDL). *World Digital Libraries: An International Journal*, 10(1), 1–10. <https://doi.org/10.18329/09757597/2017/10101>

# Implementation of DESIDOC Discovery Service: Powered by VuFind

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## **Abstract**

This paper describes about resource discovery and its importance in the libraries. OPAC which were significant surrogates of the document in the libraries are being replaced by resource discovery software. This study is aimed at investigating the problems in present retrieval platform of DESIDOC and its possible solution. The present paper also describes installation, customization and the procedure of implementing open source software, VuFind. Steps of integrating Vufind with KOHA, DSpace and OJS have also been mentioned. The study found that open source software like VuFind may be a good information retrieval tool in the special libraries for managing their resources and providing quick services to the users.

## **Keywords**

Resource discovery, VuFind, Information retrieval, Defence Science Library, DESIDOC Discovery Service.

## Introduction

Libraries play a very vital role in the research and development of the organization. Dr SR Ranganathan, Father of Library Science in India, was the first person who identified the role of libraries and librarians in India. He formulated five fundamental laws of library science in the field of librarianship in the year 1930. The fourth law specifies 'save the time of the users'. User play a prominent role in the growth and upliftment of a library. The feedback of users should be given utmost attention. The foremost thing is that the retrieval of information should be as quick as possible and users may feel satisfied. Users in need of information related to his R&D work should get his desired information within a fraction of seconds. This suggest that information retrieval software used by the libraries should be designed in such a way that it should retrieve the information lying locally in the library or to any place in the world without any hindrance. Information should flow from one place to another place with ease. To achieve this goal libraries across the globe put every efforts from 1970s till today to come out with a library automation software which can meet user expectations.

Earlier in the 1970s, traditional libraries were operated as analogue systems where knowledge resources e.g. books, reports, journals, standards, patents, conference proceeding etc were acquired and organized through classification, cataloguing and indexing by using tools like CC, DDC, UDC, AACR2 and thesaurus. Finally, these resources were made available to users via 3x5 inch catalogue cards. Later on with the development of the information technology and introduction of computers, LAN and WAN during 1980s libraries adopted Online Public Access Catalogs (OPAC).

With the invention of the internet in 1990s, web OPAC came into existence. Users were able to search remote data by using web OPAC. During this period, OPAC has been traditionally providing high quality information on printed documents and was treated as a sole information seeking gateway. But in spite of this, users were not satisfied with the platform (OPAC) offered by libraries. Now-a-days users expectation are very high, their behaviour have also changed. They live in highly interactive, networked environment. In present scenario users want self service, satisfaction and seamlessness. Users demand the services just like it is provided by Google and Google scholars with ease and quick delivery.

The same user also expects that libraries should develop similar type of search interface like Google which could serve their quality information needs through simple search. From 2006 onwards, libraries started to respond towards these issues and developed web resources discovery software. Some open source web based resource discovery tools can be listed e.g. Black Light, VuFind, Extensible Catalog, Franklin etc. Proprietary resource discovery tools are Encore, Primo, EBSCO discovery, Summon, World Cat, Bibliopole, Aqua Browser library etc.

Resource discovery service providers have started working in partnership with ILMS vendor's so as to re-index OPAC and other electronic resources into a single unified index (Heather Lea 2015).

## Need for Resource Discovery

Fifth law of library science says 'Library is a growing organism'. Special libraries devoted towards R&D activities subscribe to various types of information resources i.e. books, journals, magazines, reports, databases, proceedings, standards, patents etc. These resources may be available with the library in print form, e-resources, CD or online form. Handling and accessing these types of various knowledge resources available in different forms and formats have become a challenging task for most of the libraries. These resources must be integrated with one another and support the learning and research needs of users. To fulfill access needs of the users, libraries developed internal practices in standardized form for the management of these resources.

To meet the challenges, libraries took the help of various tools to serve their users e.g. MARC (Encoding standards), AACR2 (Representation of bibliographic data), RDA (Representation of bibliographic data for print as well as e-resources), DOI (Standards for linking), and Dublin core (For collection description), Z39.50 (Search and retrieve protocol in OPAC environment).

Before 2007, Online Public Access Catalog (OPAC) was the main tool for locating information in the libraries. Through OPAC, users were able to search and browse the collection of the library. Although OPAC provided quality search services to users, but most of the users were still unaware as how to search for the exact information. They always need the help of a librarian in searching the required information. Growing collection of e-resources in libraries now-a-days forced them to think and manage their resources differently. According to Emanuel, Jennifer (2011), users are no longer accustomed in using the library catalogs because they have moved to discovering materials online, libraries must adapt to new way of obtaining information and focus not on teaching users how to locate library materials, but give them the tools to discover on their own.

In view of these issues, libraries started to adapt a new way of searching information. Resource discovery tools are options among many open and proprietary tools to be adopted by the libraries for their user satisfaction.

With the growing number of local and online collections as well as multiplicity of interfaces, DESIDOC also felt the need for an open source resource discovery software for the benefit of the users with the following objectives:

- To integrate DESIDOC resources available on Single Window Services platform
- To provide users to browse and search through all library resources ( OPAC, repositories, databases, e- journals )
- To navigate and discover information in an easy way.
- To increase access to DESIDOC resources.
- To save the time of the DRDO user fraternity and enhance their satisfaction.
- To manage retrieval of all types of library resources according to expectations of the users



## Literature survey

To extract information from various types of resources there are many proprietary and open source e-discovery tools available. Defence Science Library (DSL) only reviewed the free and open access e-discovery tools eg. Backlight, eXtensible Catalog and Vufind. Literature published on discovery software as mentioned above during 2006 to 2018 in the form of articles and reports eg. (Sonawane, Chetan Sudhakar, 2017) and (Yang, Sharon Q and Wagner, Kurt, 2010) were accessed and studied. Book specially published on the topic titled 'E-discovery tools and applications in modern libraries' by deSmet, Egbert and Dhamdhare, Sangeeta (2016) was quite helpful in understanding the concept of discovery tools to carry out the study.

A comparative study on free and open source discovery tools by Md. MukhlesurRahman and Md. ZahidHossainShoeb (2016) observed that among three open source discovery tools VuFind possesses most number of features (11 out of 16) while eXtensible Catalogue 09 features and Blacklight 06 features respectively.

## Features of Resource Discovery

The introduction of resource discovery software in 2009-10 has revolutionized the environment of conventional library because it provides access to all types of library resources through a single search interface. Some of the features ([vufind.org.github.io/vufind/features.html](http://vufind.org.github.io/vufind/features.html)) of resource discovery software are:

- Communicate with Integrated Library Management Software (ILMS): Most important feature of resource discovery software is its ability to interact with library ILMS. It interactively communicates with ILS and displays the current availability status of the resource by place of location, issue status to patron, on order etc.
- Single search interface: It provokes Google like single search interface which provides access to all library resources e.g. OPAC, database, repositories etc.
- Open access: Resource discovery software like Vufind is available as open source which means libraries need not to pay any amount for the software.
- Easy customization: Since the software as mentioned above is available as OSS, library can easily modify and customize the interface as per needs of their organization.
- Faceted navigation: The results in discovery interface are displayed in groups as sets such as languages, dates, availability, formats, locations etc. Users give only simple keyword in the box and then refine the results by clicking on the various results facets. With this, users easily narrow down the result by filtering and get his pinpointed required resource.
- Content enrichment: Discovery interface enriches the content of the record by supporting features like QR codes, RSS, similar items, tagging, user's comments.
- Relevancy ranking: Resources relevant to the users are shown at the top according to its relevancy. More frequently circulated books indicate popularity and usefulness.
- Spell check: Discovery interface also displays 'Did you mean' a spell check mechanism whenever users type incorrect spelling.

- Internationalization: Discovery software can translate the results in users required language e.g. English, German, Chinese, Russian Hindi, Urdu, Bangla etc. This feature is displayed with the help of Unicode.
- Zotero compatibility: Users can save search results and tag in to Zotero.
- Simple keyword search box: Discovery interface provides simple keyword search box on every page with a link to advance search. This facilitates users to conduct search and navigate easily.
- Mobile compatibility: Resource discovery softwares are compatible with mobiles. User can access the library on their mobile phone 24x7.
- Social network integration: Discovery interface invites users to write a review on any item and share their opinions with others on social networking sites.

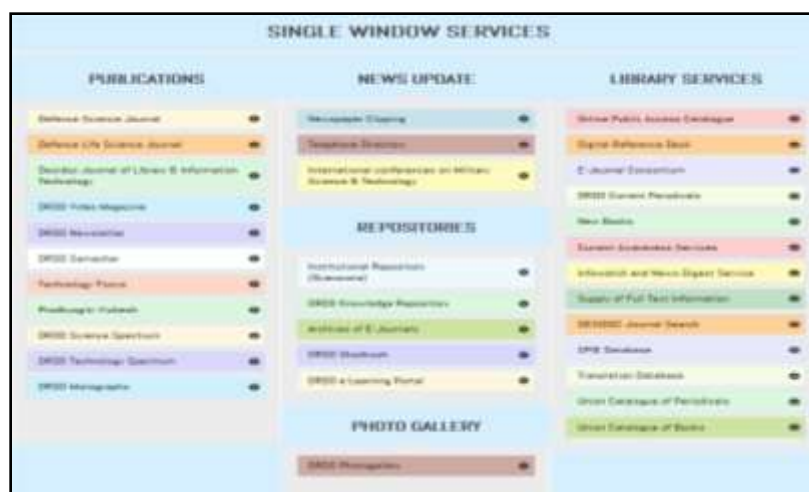
## **Defence Science Library (DSL)**

DESIDOC being the nodal agency of DRDO plays a pivotal role in information collection, retrieval and dissemination to the DRDO fraternity through Defence Science Library (DSL). The total collection of DSL is over 3 lakhs which includes books, reports, standards, journals, patents in print as well as digital form.

### **Retrieval Platform of DESIDOC Library**

DESIDOC is the central information centre of DRDO, which provides information to various DRDO laboratories through its information and knowledge based-services hosted on DRDO intranet by 24x7. Presently, there are more than 30 such services accessed by all DRDO units spread across the country. Fig 1 depicts the screenshot of the DESIDOC library-portal on DRDO intranet providing links to these services:

The useful knowledge and information for the users is scattered across these 30 web services. These web-services were developed on different platforms in due course of time, caused varied user experiences and also difficulty in maintaining and hosting due to the diverse nature of their backend and frontend programming languages. Therefore, for ease of usability and knowledge-discovery, enhanced search features and to ensure easy maintenance of these services, an open source digital library software was used in DESIDOC and most of these services were migrated on the DSpace platform.

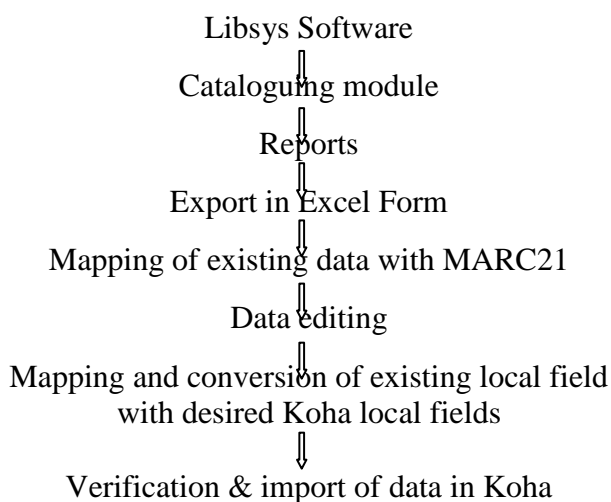


**Figure 1.** Single Window Services of DESIDOC

## Data Migration

DSL is more concerned towards providing a better state of the art services to DRDO community. The huge increase in the cost of proprietary software and its maintenance forced DSL to adopt open source integrated library management software like Koha. From 2019, DSL implemented Koha. This shifting from proprietary software (Libsys) to open source software (Koha) by DSL necessitated data migration.

Data migration requires a lot of planning, technical skills and experience. It involves many repetitive works and verification of converted data in the desired format several times. Although data migration is a tedious process, nevertheless it gives opportunities to the library for its data refinement and editing of data before migrating to a new system. It gives clear picture about existing data and errors as well. Data migration process does not involve only understanding the current system in which data lies, but it is also required to study the system which has been planned to adopt eg. Koha. For exporting data from present Libsys module, the DSL follows the following steps:



Before importing final data into Koha web OPAC fields like Koha item types eg. Books, conference proceeding, CD-ROM, reports, microform, standards were added in the respective records. Since these resources are located in various floors of DSL, their respective shelving location were added in the records.

The entire record (approximately 2.50 lakhs) held by Defence Science Library in the form of books, e-books, technical reports, microfiche reports, hindi books, standards, patents, conference proceedings, CD-ROM etc. were successfully migrated from Libsys to Koha web OPAC.

### **Discovery Software Deployment at DESIDOC**

Defence Science Library has a huge collection of printed books, S&T journals, standards, patents, conference proceeding, technical reports etc. These collections are available in print, CD, database, e-resource or online form and have grown vastly. To manage the enormous information content and provide it systematically to users was a big challenge for DSL. In the first phase, DESIDOC tried to bridge the gap by implementing federated searching over single window services. But this was not enough to satisfy the users, because federated search system has many issues. Database connectors are not always available & it requires monitoring and maintenance. On many occasions time out occurs and users get frustrated.

Due to these reasons DSL reviewed the retrieval mechanism of Single Window Services available on DRDO intranet and decided to introduce and implement open source resource discovery tool, VuFind, which is free and open source software. VuFind, is developed by Villanova University, USA with the aim to provide integrated search facilities to all of the library resources in a single interface (<https://vufind.org>) on its website. It is also mentioned that it is a open source library search engine that allows users to search and browse beyond the resources of a traditional OPAC.

### **VuFind Software Components**

Most of the resource discovery software follows LAMP architecture. Installing and setting up VuFind involves a lot of additional software's which includes the following:

**Linux:** VuFind run in a lot of environment but Linux is the preferred operating system.

**Apache Web Server:** Apache web server is required so that its web pages are visible to the users who want to access.

**MySQL:** MySQL is a relational database management system (RDBMS) that collects VuFind's local application database for incorporating social metadata. It is generally used for user tagging and comments.

**PHP Programming Language:** VuFind is written in PHP language. Web server Apache uses PHP to turn VuFind's code into web pages customized to answer user requests.

**Search Engine:** Apart from LAMP architecture as mentioned above, VuFind use powerful Solr search engine. Solr is the popular, blazing fast, open source search platform. Solr search feature includes full text search, hit highlighting, faceted search, real time indexing, dynamic clustering, database integration and rich document handling.

## Installation and Customization of VuFind

Once the hardware and software requirements have been met (Ref: doi 10.5260/chara.16.2.46) an installation process begins that establishes the proper permissions and environment variables for VuFind to communicate with Apache and MySQL. Complete steps for installation and customization are as follows:

Install Linux operating system.

Update the system:

```
$sudo apt-get update
```

```
$sudo apt-get dist-update
```

After installing patches, you should reboot your system so that everything can take effect:

```
$shutdown -r now
```

Install Apache HTTP Server

Install the Apache web server. This will facilitate communication between Vufind and web browsers.

```
$apt-get -y install apache2
```

```
$a2enmod rewrite
```

```
$/etc/init.d/apache2 force-reload
```

Install MySql

```
$apt-get-yinstallmysql-server
```

Install following PHP modules

```
$apt-get-yinstall libapache2-mod-php php-mbstringphp-pear php-devphp-gdphp-intlphp-jsonphp-ldapphp-mysqlphp-xml php-soap php-curl
```

Install Java JDK

```
$apt-get-yinstall default-jdk
```

Download VuFind

```
$cd /tmp
```

```
$wgethttps://github.com/vufind- org/vufind/releases/download/v5.1.1/
vufind-5.1.1.tar.gz
$tar xzv f vufind-5.1.1.tar.gz
$mv vufind-5.1.1 /usr/local/vufind
```

### Install VuFind

```
$cd/usr/local/vufind
$phpinstall.php
```

You should also set some permission to allow Apache to write configuration and cache files to disk:

```
$sudochown-Rwww-data:www-data/usr/local/vufind/local/cache
$sudochown-Rwww-data:www-data/usr/local/vufind/local/config
```

If you plan to use VuFind's command line tools, you also need a separate cache for that:

```
$mkdir/usr/local/vufind/local/cache/cli
$chmod777/usr/local/vufind/local/cache/cli
```

### Link VuFind to Apache

```
$ln-s/usr/local/vufind/local/httpd-vufind.conf/etc/apache2/conf-enabled/vufind.conf
```

Apache needs to be restarted so the changes can take effect:

```
$/etc/init.d/apache2 reload
```

### Setup Environment Variables

```
$sh-c'echo export JAVA_HOME=\"/usr/lib/jvm/default-java\" >
/etc/profile.d/vufind.sh'
$sh-c'echo export VUFIND_HOME=\"/usr/local/vufind\" >> /etc/profile.d/vufind.sh'
#sh-c'echo export VUFIND_LOCAL_DIR=\"/usr/local/vufind/local\" >>
/etc/profile.d/vufind.sh'
```

After creating the file, you must load it manually for the changes to take effect without forcing you to log out and back in again:

```
$source/etc/profile.d/vufind.sh
```

### Final Configuration

```
Start Solr
$cd/usr/local/vufind/
```

```
./solr.sh start
```

Configure VuFind

Open a web browser, and browse to this URL:

<http://your-server-name/vufind/Install/Home>

Home page of VuFind, was customized to fit the DESIDOC requirements. Front page was reflected as 'DESIDOC Discovery Service' along with logo. The config.ini file was configured to display the narrow search options.

## Integration of Koha, DSpace and OJS

VuFind prefer standard metadata and OAI/PMH compatibility for harvesting. For as periodic harvesting of metadata from Koha to VuFind discovery index, OAI/PMH is the preferred method. The first logical step of integrating VuFind with any ILMS (here Koha) is to enable Koha OAI/PMH compliance (Roy, Bijan Kumar 2018). The other steps to follow are mentioned below:

### *Index DSpace with Vufind*

DSpace was integrated with VuFind with following steps:

**server.xml is modified** for DSpace Tomcat instance in the **Host** block:

```
<Context path="/oai" docBase="/path_to_dspace/webapps/oai" debug="0"
  Reloadable="true" cachingAllowed="false"
  allowLinking="true" />
```

**dspace.conf** config file is modified for DSpace instance:

```
...
harvest.includerestricted.oai = true
harvester.autoStart = true
...
```

Modify **\$VUFIND\_LOCAL\_DIR/harvest/oai.ini**

```
[DSpace]
url=http://dspaceserveriporname/oai/request
metadataPrefix=oai_dc
idSearch[]="/^oai: dspaceserveriporname:/"
idReplace[]="ir-"
idSearch[]="/\//"
idReplace[]="-"
injectDate="datestamp"
injectId="identifier"
dateGranularity=auto
harvestedIdLog=harvest.log
```

Run

```
cd $VUFIND_HOME/harvest
php harvest_oai.php
./batch-import-xsl.shdspace.properties
```

### ***Index Koha with Vufind:***

Koha was integrated with VuFind with following steps:

Make the changes in marcllocal.propertiesfile

```
#collection = "collection"
institution = "DESIDOC"
#building = "Library A"
id = 999c, first
```

To import data of koha into vufind run below command:

```
./import-marc.sh location of .marc file
```

change the \$VUFIND\_LOCAL\_DIR/config/vufind/config.ini file to have

```
[Catalog]
driver = "Koha"
```

Change your Koha.ini file

```
[Catalog]
host      = serveriporname
port      = 3306
username  = usernamemysql
password  = passwordmysql
database  = koha_database
url       = http://kohaserveriporname/
```

### ***Index OJS with Vufind:***

OJS system was integrated with Vufind with the following steps:

Enable OAI-PMH in OJS config file

\$VUFIND\_LOCAL\_DIR/harvest/oai.ini

```
[DSpace]
url=http://ojsserveriporname/oai/request
metadataPrefix=oai_dc
idSearch[]="/^oai: ojsserveriporname:/"
idReplace[]="ojs-"
idSearch[]="/\//"
idReplace[]="-"
```



```
injectDate="datestamp"  
injectId="identifier"
```

## DESIDOC Discovery Service

DSL recognized the way to cope up with huge amount of information by implementing 'DESIDOC Discovery Service (DDS)' on DRDO Intranet that supports real time searching and provides up to date information on varied knowledge field.

DESIDOC Discovery Service comprise of a preassembled index that covers all library resources, the single search box having advanced search features to limit, sort and refine searches, navigation and lastly a display of consolidated search results.

This service is among such technological achievements in the DESIDOC which meets the retrieval demands of user in very quick and efficient way. Some of the important features of this DESIDOC Discovery service are as follows:

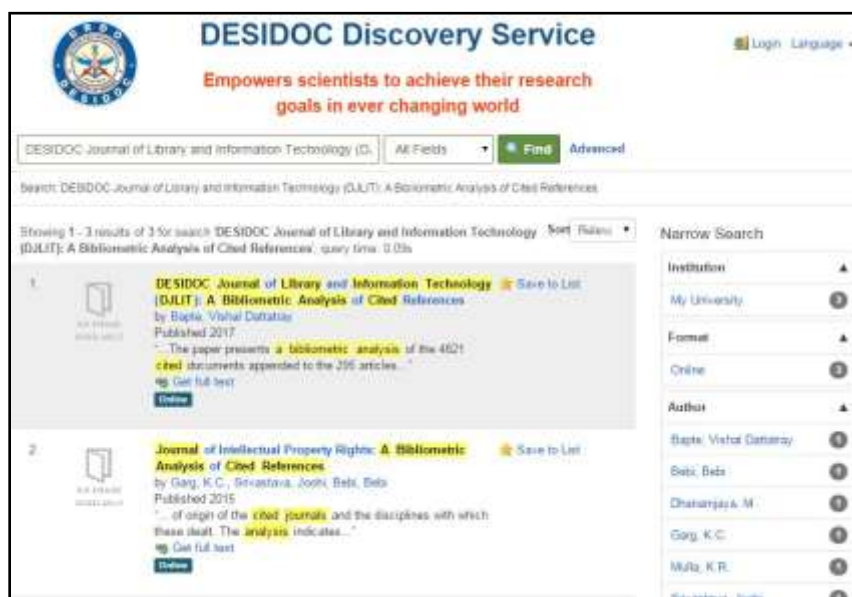
- One point search
- Faceted search result
- 'More like this 'resource suggestion
- Save search result
- Browse for resource
- Citation management
- Persistent URLs
- Language compatible

The home page of DDS as shown in Fig 2 includes single search box having search options, browse by language, format etc.



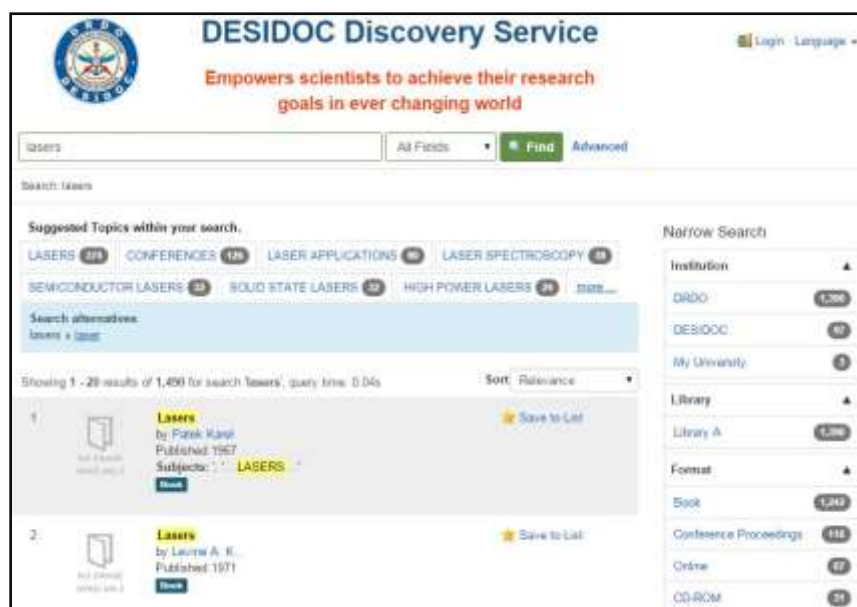
**Figure 2.** Home page of DESIDOC Discovery service

The most compelling feature for users in this service is its narrowing facets. Narrowing facets means user can explore the results of a simple search as shown in Fig 3 and 4. When a search result is displayed, these facets are displayed as lists in the default right column. Each item in the list displays with the number of search results associated with it.



**Figure 3.** Full-text search

User can also explore full text search through this service as shown in above figure.



**Figure 4.** Simple Keyword Search Example

DSL has rich collection of Hindi books and foreign language books. Records of Hindi book and foreign language book displayed are shown in fig 5 and fig 6 respectively. At the individual record displayed level, there is a similar item feature. Similar items are selected based on call number and some number of characters from the title.



Figure 5. Example of a Hindi book record



Figure 6. Example of a Russian book record

Citation styles can be found by clicking 'Cite this' at the individual record display as shown in Fig 7. This discovery interface supports three citation styles like APA, MLA and Chicago. The researcher can easily manage their citation for bibliographic citation as a reference to a book, article, webpage or other published items.

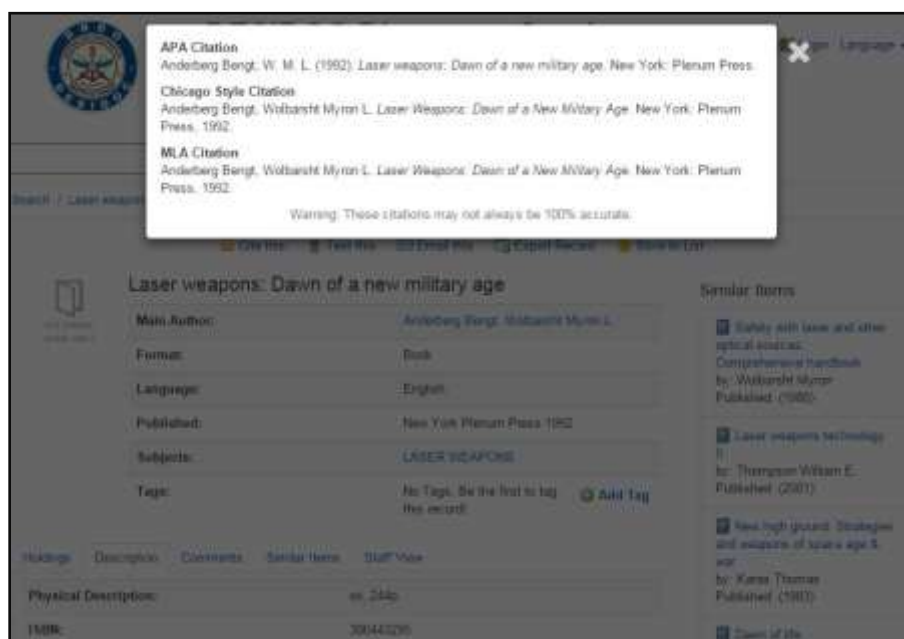


Figure 7. Citation Style

## Conclusion

Defence Science Library was facing a growing number of complex local and online resources. These multifaceted complex types of resources caused varied user experiences and also difficulty in maintaining and hosting due to the diverse nature of their backend and front-end programming languages. Also this multiplicity of interfaces and disjointed approach of information makes it very difficult for users in retrieving their desired information. Therefore, for ease of usability DSL investigated solutions to overcome this disjointed approach and decided to adopt VuFind for DRDO community and made this software customized as 'DESIDOC Discovery service'. One of the most powerful features of this discovery service is the ability to meet DRDO user's expectations of a single search interface supported by a robust and wide ranging search system. Implementation of DESIDOC Discovery service was a big challenge and required a holistic approach to address many potential problems along with the process of configuration and customization. Integration of VuFind with Koha and Dspace at the initial stage of configuration leads to several problems. Difficulty was also faced during display of records in VuFind. Some fields were not properly displayed during search. For all these types of problems, DSL contacted Demian Katz of Villanova University, USA through email. He gave valuable inputs and suggestions through email by which all the problems were solved and implemented in phases.

In the process of implementation, through many challenges were faced, nevertheless, DESIDOC was able to successfully test and implement VuFind as 'DESIDOC Discovery Service' for the benefit of the DRDO user community.

## References

1. VuFind (2018) Retrieved from <http://vufind-org.github.io/vufind/>
2. VuFind feature (2018). Retrieved from <http://vufind-org.github.io/vufind/features.html>
3. Roy, Bijan Kumar, Biswas, Subal Chandra and Mukhopadhyay, Parthasarathi (2018). Designing web-scale discovery systems using the VuFind open source software. Library Hi Tech News, No.3, pp 16-22.
4. Vufind: A nextgen overlay (2014): doi:10.5260/chara.16.2.46
5. Emanuel, Jennifer. Usability of the Vufind next generation online catalog. Information Technology and Libraries, March 2011, pp.44-52.
6. Heather Lea, Moulaison, Kroeger Angela and Corrado Edward M. What's driving discovery systems? The case for standards, IFLA WLIC 2015, Cape Town, 2015. <http://library.ifla.org/1300/1/166-moulaison.pdf>
7. de Smet, Egbert and Dhamdhare, Sangeeta. E- Discovery tools and application in modern libraries. Information Science Reference, USA, 400p.
8. Rahman, Md. Mukhlesur and Shoeb, Md. Zahid Hossain. Embracing e-resource discovery technique using open source software. In de Smet, Egbert and Dhamdhare, Sangeeta. E- Discovery tools and application in modern libraries. Information Science Reference, 2016, pp 138-167
9. Sonawane, Chetan Sudhakar (2017). Library discovery system: An integrated approach to resource discovery. Informatics Studies, Vol 4, Issue 3, pp 27-38
10. Yang, Sharon Q and Wagner, Kurt. Evaluating and comparing discovery tools: how close are we towards next generation catalog? Library Hi Tech, vol. 28, no. 4, 2010, pp 690-708



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# Scientific Publications and Digital Marketing: Desidoc's Perspective

**Dipti Arora**

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## Abstract

“Change is the only constant in life”, i.e., pacing and evolving with time is the only way to survive. With evolution of Internet and Information & Communication Technology (ICT) revolutionary changes happened in every walk of life. Marketing could not remain untouched with it. Internet revolution gave it new means to reach to buyers. Nowadays when we even casually look for any product, even a book, at any of the online retailer site, the product and also its related merchandise are displayed instantly on the search engine. Besides showing so many options of the retailers who are selling the product, the sites also give the reviews about the product by the certified customers, which gives the buyers extra option to whether to buy or not buy the product. This paper presents various aspects of digital marketing, how it evolved and what are the latest trends and ways to use digital marketing. The paper also presents digital marketing of scientific publications at Defence Scientific Information and Documentation Centre (DESIDOC). The paper concludes that digital marketing could be a game changer in popularisation and sale of scientific publications.

## Keywords

Internet, e-commerce, Digital marketing, online marketing, online retailing, marketing trends, DESIDOC, digitization

## Introduction

No other technology in the 20th century has changed the social life of mankind than Internet. Conceived by the Advanced Research Projects Agency (ARPA) of the U.S. government in 1969 and called the ARPANet, for interconnecting academic and military networks in the 1980, it entirely changed the way of traditional communication giving birth to new services like email, instant messaging, Internet forums, Internet telephony, Internet television, online music, digital newspapers, and video streaming websites, digital newspapers, and a whole generation of individual publishers. Internet also led the emergence of new forms of communication platforms resulting in emergence of social networking sites leading to more personal interactions. By the 1980s, computers became common and came from offices to home. Increase in use of computers led to increase in more and more digital platforms affecting our daily life and needs. The Internet also enabled and accelerated new forms of personal interactions and gave marketers opportunity to advertise and sell their products through digital platforms.

India does not remain unaffected with the digital revolution. The report 'Digital India-- Technology to Transform a Connection Nation' by McKinsey Global Institute said the country is one of the largest and fastest-growing markets for digital consumers, with 560 million internet subscribers in 2018, second only to China. According to an estimate of Internet and Mobile Association of India (IAMAI), around 451 million monthly active Internet users would be there in the country at end of financial year 2019! This shows Internet has actually revolutionised all aspects of Indian societies as well. In India, the users of Internet is not limited to only youngsters but every age people are now using it not only for their daily chores but also for entertainment and usability. Internet revolution has given birth to many e-commerce firms in India also. Not only big MNCs or big Indian companies, but even small companies in the country are now using digital platforms for promoting their products.

## Literature Review

Various studies have been carried out earlier in respect of marketing and digital marketing. Kamal<sup>1</sup> in his paper studied some trends of digital marketing. He studied utilisation from digital marketing in digital era and domains, which need incorporation of digital marketing. He reflected such scenario as customer side and system side strategy. Bala and Verma<sup>2</sup> in their study did critical review of digital marketing. They made their study based on recent literature and what is happening in the business world. They concluded that digital marketing brought radical change in business or sale of any product. Out of various trends of digital marketing, they studied the impact of some of the preferred websites of users. Rathre, Pant and Sharma<sup>3</sup> studied emerging trends of digital marketing. They categorised some of the effective ways of digital marketing and their changing trends. They also studied factors that effect the digital marketing. They concluded that digital marketing is cost-effective and is having a great commercial impact on sale and marketing of any product.

## Digital Marketing: The Evolution

The history and evolution of digital marketing date back to 1980s when an advertising company Soft Ad Group incorporated some advertising campaigns in the soft form with the help of digitalization of advertisement. They made a promotional attempt and used Reader Reply Cards found in magazines and in return received floppy disks, which consist of multimedia content. A new concept was born that involved using soft media for campaigning and promoting products. This further gave rise to term digital marketing. Launch of social media sites Facebook in February 2004, Gmail in April 2004, and Twitter in March 2006 captured the marketing as well. Marketers started using these sites also for promotion of the products. An eMarketer 2019 Global Ecommerce Forecast says that the global ecommerce market will rise more than 20% in 2019, despite mounting economic uncertainty and declining consumer spending growth around the world<sup>4</sup>.

With second largest Internet users in world, India has also seen tremendous rise in ecommerce. According to market research agency Kantar, India's internet users are expected to register double digit growth to reach 627 million in 2019, driven by rapid internet growth in rural areas, IMRB Wednesday said. In its ICUBE 2018 report that tracks digital adoption and usage trends in India, it noted that the number of internet users in India has registered an annual growth of 18 percent and is estimated at 566 million as of December 2018, a 40 percent overall internet penetration. The potential of digital marketing in the country, therefore, bound to raise manifold. In a report dated October 5, 2019, The Economics Times reported that the combined gross sale of the Amazon & Flipkart in their recently 3rganized sale is estimated at \$3.5-3.7 bn, a jump of 33% YoY<sup>5</sup>.

## **How to do Digital Marketing?**

Companies, big or small, have now realized the importance of using digital media to promote their business and products. Social media sites are acting as catalyst for such digital marketing campaigns. There are number of ways where digital media can be used for marketing and promoting. Different ways to use digital medium to popularize marketing are:

### ***Search Engine Optimization***

Although accessibility, speed and navigation are three factors that affect the search results, but Google also updates its algorithms continually and optimize the relevancy of the results. Choosing the right keywords and less-jargons may help your website tweaked and appear in top results. However, other technicalities like content and query matching, indexing, spidering also affect top search results. Still investing in search engine optimization (SEO) get beneficial and cost-effective as many times google naturally or organically boosts websites to appear in top results.

### ***Search Engine Advertising***

This is one of such paid marketing effort where advertisements displayed while search is ON. It includes search retargeting, paid social advertising and display advertising. Google offers several models for such marketing, like, pay-per-click, Cost-per-click or Cost-per-thousand impressions. Google AdWords on Google and Bing Ads on Yahoo are most popular these days.

### ***Customised Content Marketing***

Digital marketing has changed the traditional adage from customer is king to content is king. Using the best and creative ways of developing the content may actually help and boost the marketing and it is coming out as one of the trending way of digital marketing. Wisely choosing the format of content, i.e., articles, blogs, forums, white papers, case studies, banners, podcasts, news, updates, etc. has become is as important as deciding any of the way of digital marketing. Contents also aid in filtering of results at any of the search engine. Google has also made

changes to its algorithms like, Panda, Hummingbird, or Penguin, but for the strategy customized content it is actually the basic factor while choosing the top results for search engine.

### ***Social Media Marketing***

Social media are the place where most of the people spend their on-screen time on internet. Facebook, Twitter, Instagrams, LinkedIn has become preferred and bookmarks for the internet user. This has opened opportunities and led to substantial growth for digital marketing as well. Putting Luring advertisement on social media sites may divert the attention of the customers to any of the company's website. It also involves constant engagement of the customers. Besides putting such static advertisements on social media websites, now companies are also making small videos and animation for branding and driving sales.

### ***Mobile Marketing***

Customised digital marketing is what led to mobile marketing. The display size of the mobile is much smaller as compared to desktop or PC. So, customizing the advertisement so as to appear in single screen at the display of the mobile user is what mobile marketing is. It stratifies that user may not have to scroll the page else he/she will lose the interest and the effort may go futile. So mobile marketing is one of the customized forms of digital marketing but used widely and happening to give best results as branding and advertising.

### ***Digital Display Marketing***

Although digital display is a part of search engine marketing as it involves same efforts. Using digital displays, like, images, text, banner, video ads, etc. for advertising or promoting the product. This is trending these days as using artificial intelligence algorithms, search engines sense and judge the choices of user and hence display the ads of his/her interests only.

### ***Remarketing***

Remarketing takes the aid of cookies technology to help understand the choices of customers. Intriguing customers with reminders or advertisements using any of the techniques, like digital display or social media fascinate target customer to revisit the product website. This is one of the preferred strategies as used by mega online sellers, like Amazon and Flipkart. Remarketing and Retargeting involves several other approaches as follows:

#### ***Viral Marketing***

Boosting and spreading some unique content exponentially and to make it viral is viral marketing. Be it negative viral or positive viral, but it involve high creativity and also the format chosen for spreading also effect this digital marketing strategy.

### E-mail Marketing

This is one of the sophisticated trends of digital marketing for reaching to the potential customers. Using effective mailing software, one can quarantine spending habits and likes and dislikes of the customers and connect to the potential customers. Although it is not easy as it sometimes affixed with spamming and protocols and policies are needed to be followed to adapt this digital marketing strategy.

### Interactive Marketing

This tool of digital marketing followed the strategy of staying in touch with the customer using any of the interactive option on your website. Sometimes widgets and opt-in features or also feedback and tracking user behavior affect the sale and promotion of the products.

### **Online Public Relations**

Importance of using PR in marketing was well-understood years back and is equally applicable for digital marketing as well. It says, not to lose any customer for any of the reason. However, as far as PR is concerned, digital marketing has the advantage that it offers the quick communication.

### **Web Analytics**

Web Analytics is a crucial facet of digital marketing. It involves collecting, collating, understanding and analyzing the data and henceforth planning, reporting and predicting the web activities. It gives the analyses and perspective to enhance the sale. Some of the currently used Web Analytics tools are Google Analytics, Spring Metrics, Woopra, Clicky, Mint and Chartbeat.

## **Digital Marketing: Desidoc Perspective**

Defence Scientific Information and Documentation Centre (DESIDOC), a Delhi-based central information resource of the DRDO, is engaged in providing S&T information through its scientific publications, library, multimedia and printing resources, to the DRDO HQ and its various laboratories all over the India. The Centre has kept pace with changing ICTs and has been reaching out to DRDO scientific community with the user-based information<sup>6</sup>.

DESIDOC brings out many international peer reviewed primary and secondary publications for the benefit of R&D community. Some of the publications being brought out by the Centre are: Defence Science Journal (DSJ), Defence Life Science Journal (DLSJ), DESIDOC Journal of Library and Information Technology (DJLIT), DRDO Science Spectrum, DRDO Technology Spectrum, Technology Focus, DRDO Newsletter, monographs, Coffee Table Books, etc. Scholarly research journals of DESIDOC are being abstracted by the international abstracting agencies like Cambridge Scientific Abstracts, Chemical Abstracts, Elsevier databases (EMbase, Compendex, Geobase, EMbiology, Elsevier Biobase, Fluidex, World Textiles, Scopus), Scimago Journal Ranking, Indian Science Abstracts, International Aerospace Abstracts, ProQuest, Google

Scholar, DOAJ, Indian Science Citation Index, Omnifile Full-text Mega, Omnifile Full-text Select, and NTIS database (World News Connection), Ulrichs International Periodical Directory, Web of Science, LISA, LISTA, EBSCO Abstracts/Full-text, Library Literature and Information Science Index/Full-text, The Informed Librarian Online, DOAJ, Open J-Gate, Indian Science Abstracts, Indian Citation Index, Full text Sources Online, WorldCat, Proquest, and OCLC, etc. The Centre is also engaged in providing scientific communication through design and development of web-based knowledge repositories; digital data storage and retrieval; e-publishing and e-library. It also provides IT-enabled services to DRDO's scientific community through Internet and through its Intranet DRDO Rapid Online Network (DRONA). The centre has kept pace with the technological innovation in the field of information technology and has adapted the latest technologies to serve members of the scientific community engaged in research in India and abroad. The Centre employs various means to disseminate and market its priced.

## **Distribution of Desidoc Publications**

### ***DRDO Newsletter and Technology Focus***

Both, DRDO Newsletter and Technology Focus<sup>7</sup> are available in print, PDF and other formats like flipbook and e-book. PDF is an established format. Flipbook and e-book besides being re-flowable are also device independent. Some of the salient features of flipbook and e-book version of DRDO Newsletter and Technology Focus are:

- Customised for offline reading
- Supports all smart devices features (reflow, zoom, brightness/contrast, night reading, font type, font size, scroll view, theme, bookmark, etc.)
- Table of contents
- Picture, graphics, text exactly like printed book
- Searching
- Feel and look of the book
- Online and Offline reading
- Thumbnail, full screen mode
- Printable, FTP sharing
- Page scroll bar, Hyperlinking of elements
- Background music insertion, etc.

### ***Other DESIDOC Publications***

Other DESIDOC publications, viz., DSJ, DLSJ, DJLIT, and monographs are being marketed using conventional methods using pamphlets, attending book fairs, seminars, workshops, and important scientific events like Indian Science Congress, giving discounts to booksellers, and by profiling prospective readers.

### ***Digital Marketing at DESIDOC***

As an organizational effectiveness strategy, DESIDOC aims to drive marketing growth by focusing sale efforts. Sale of publications through online book sale platforms is the next logical step. Online sites give a greater reach to the prospective buyers not only in India but abroad also. There are a number of online bookstore like Bookdepository, BetterWorldBooks., AbeBooks, Amazon, Powell's Books, Thrift Books, Alibris, etc. which can drive the sales of the books being brought out by the Centre.

## **Conclusion**

Digital marketing has changed the traditional way of marketing. The more and more consumers are looking up to buy things up in Internet. It gives buyers freedom, flexibility and choice of shopping at one place at the time of his/her choice. India has a large number of prospective buyers, the youngsters who are hooked up to Internet and who extensively surf e-commerce sites to purchase things. Digital marketing of DESIDOC publications may prove a game changer in the sale of scientific publications.

## **References**

1. Yusuf Kamal, Study of Trend in Digital Marketing and Evolution of Digital Marketing Strategies, International Journal of Engineering Science and Computing, May 2016, DOI 10.4010/2016.1298 (accessed 24 September 2019)
2. MadhuBala and Deepak Verma, International Journal of Management, IT & Engineering, Vol. 8 Issue 10, October 2018, [https://www.academia.edu/37632966/A\\_Critical\\_Review\\_of\\_Digital\\_Marketing](https://www.academia.edu/37632966/A_Critical_Review_of_Digital_Marketing) (accessed 24 September 2019)
3. Dr. Amit Singh Rathore, Mr.Mohit Pant and Mr.Chetan Sharma, Emerging Trends In Digital Marketing in India, International Conference on Innovative Research in Science, Technology and Management, 2017, <http://data.conferenceworld.in/MIMT/P107-115.pdf> (accessed 25 September 2019)
4. Emarketer, <https://www.emarketer.com/content/global-ecommerce-2019> (accessed 25 September 2019)
5. Economic Times, [//economictimes.indiatimes.com/articleshow/71449679.cms?utm\\_source=contentofinterest&utm\\_medium=text&utm\\_campaign=cppst](https://economictimes.indiatimes.com/articleshow/71449679.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst), (accessed 22 September 2019)
6. Defence Scientific Information and Documentation Centre (DESIDOC), Delhi-110 054, <https://www.drdo.gov.in/drdo/labs1/DESIDOC/English/indexnew.jsp?pg=homepage.jsp> (accessed 15 September 2019)
7. Technology Focus, <https://www.drdo.gov.in/drdo/English/index.jsp?pg=techfocus1.jsp> (accessed 15 September 2019)

# Development of Human Resource Management System in DESIDOC

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## **Abstract**

This paper covers the aspect of Human Resource Development and development of Human Resource Management System (HRMS), its need and benefit to R&D organisation. The paper elaborates on the requirement and importance of HRMS in Defence Scientific Information and Documentation Centre (DESIDOC) and discusses the development of HRMS for the organisation and its benefits to the management and employees of DESIDOC.

## **Introduction**

Human resource development (HRD) is the integrated use of training, organization, and career development efforts to improve individual, group, and organizational effectiveness. The HRD develops the key competencies that enable individuals in organizations to perform current and future jobs through planned learning activities.<sup>1</sup>

The HRD is very important for the organization, employees, and also society. HRD's roles include the development of organisation's employees and prepare them to take responsibilities, take part in the change taking place in the organisation, initiate change and also implement the programs that will improve the quality of products and services of the organisation.



The HRD helps in improving the ability, skills, knowledge, and other talents of employees. The success of an organisation depends on the performance of its employees. To increase the productivity and profitability, the organisation has to increase in skills development, performance, achieving employee potential and fulfilling their needs so that they can help in achieving organisation's goal.

## **DESIDOC and Requirement of HRD System**

“DESIDOC conducts user education programmes in the area of IT, communication, technical writing and LIS for personnel of DRDO labs/estts to update their knowledge and working skills. It also invites the scientists and managers of middle and senior levels from other departments/organisations like CSIR, ICMR, ICAR and PSUs to impart training”<sup>2</sup>. DESIDOC also conducts short-term training programmes under the Continuing Education Programme (CEP) of DRDO labs/estts at DESIDOC. It also deutes officers and staff for various training courses and workshops organised by DRDO labs/estts and other institutions.

### ***HR Development Programmes of DESIDOC***

Any form of education or training that adds knowledge or skills to employees is human resource development. The development of employees can be done in various forms such as online training, academic education, trainings imparted by faculty/instructors, online training, self education, employees' meetings, etc.

The development of the employees of DESIDOC is being done in many ways such as:

- Organising relevant lectures for the employees- This is considered very important as the employees learn the latest developments in their areas of work and improve their processes.
- Employees Explaining processes to colleagues- If one employee imparts knowledge of his area of work to enhance their knowledge, the HRD is happening. It promotes sharing of knowledge among the employees.
- Organising technical meetings of the groups-These meetings are organised to have technical discussions by the group. It increases the collaboration and team effectiveness.
- Organising meetings of cross-functional groups- These meetings are organised to have discussions by cross-functional groups working on projects covering different aspects. It helps the employees to understand other group's work culture, functioning, etc., and helps in creating cooperative and collaborative environment and increases the productivity of organisation.

- Imparts knowledge about its resources (print and online) at various Continuing Education Programme (CEP) courses<sup>2</sup>.
- Deputing DESIDOC officers/staff for courses/workshops/conferences, etc., for short-term courses- Employees gain new knowledge by participating in workshops, seminars, etc.<sup>2</sup>
- DESIDOC conducts special training courses with collaboration of other institutions (of similar nature) to improve knowledge of its employees<sup>2</sup>
- Regular interaction is done with the many Institutes such as IISc; IITs, CSIR Labs, University of Roorkee, etc., for project collaboration which help the employees to share as well as gain knowledge.<sup>2</sup>
- Encouraging employees to share their knowledge- with others via writing papers, books, articles, etc.
- Providing platforms for accessing and sharing knowledge of organisation-The organisation establish knowledge management systems, institutional repositories, etc., for sharing of knowledge by employees and which help in not only current scenario of knowledge development but also is useful for organisation in future also.

### ***Need of Establishing the HRM System***

Since a large no. of employees are being imparted training in various areas by attending various courses and are also participating in conferences/seminars, etc., it was highly required to have a system that will aid the management to identify the training needs of the employees and act as a tool for decision making regarding the responsibilities to be assigned to employees.

During Performance Appraisal which is a systematic evaluation of employees regarding their performance of work done and determining potential for development, it is mandatory to describe what training/courses an employee has take in a year and also the areas in which he/she requires further training. So the system will also help the individual to have that information.

It is mandatory for each employee to fill in a proforma in which he/she has to list details of his/her attended courses in last three years. It is a very useful tool for the individual for that purpose. Also the management can decide upon the course suitability for the individual such as if there is requirement of advance course/basic course in field also.

With these general needs, the system was to be developed with the following specific requirements:

- To analyse the overall training needs of the employees of the organisation
- To develop a decision making tool for the management regarding the responsibilities to be assigned to employees
- To give a view of the trainings acquired by each employee and for decision/recommendation for further trainings
- Serve as a statistical tool to understand how many employees were imparted training and which areas have been covered
- To analyse the potential areas in which trainings can be imparted

## Designing and Implementation of System

It was decided that system should have details of each employee of DESIDOC. The fields covered would be as follows:

- Cadre:** There are different cadres employees in DESIDOC such as DRDS, DRDC, Admin, Finance, Stores Asst, etc. They require different skills and knowledge in different areas. Through the system it should be possible to analyse the areas in which training has been imparted and where is some requirement left.
- Financial Year:** The system will record the year in which the training/courses were attended by the employee which will give a comprehensive view regarding theno. of courses attended by the employee.
- Name:** This field inputs the individual's name in the system.
- Designation:** Each employee has a designation in the organisation. The system can help in analysing which specific courses are meant for and are attended by the employees of a specific designation. It shows the training needs of specific designation employees.
- Type:** This field inputs the type of course attended by the employee, say conference, workshop, continuing education programme, etc.
- Prog Detail:** This field covers the name of course, dates, duration and place where the course was conducted.
- Sort by:** The field helps in searching among the fields to give reports.

## Implementation of System

The system has been designed and implemented successfully with the previously discussed feature. The system has been named 'DESIDOC HRMS'. Figure 1 shows a screen shot of the field covered in DESIDOC HRMS System.



**Figure 1.**Screen shot of Field covered in DESIDOC HRMS System.

### Search and Retrieving Results

The system is supported by a powerful search mechanism which helps the management and employees to get HR related desired information. The system can be searched and used with following options:

- *By Name*--The system has the facility to search with the name of employee. Figure 2 shows the search of the system by name and Fig. 3 shows the search results of the employee which details about what courses are attended by individual.



**Figure 2.**Screen Shot of Specific name Search.



**Figure 3.** Search result for individual employee

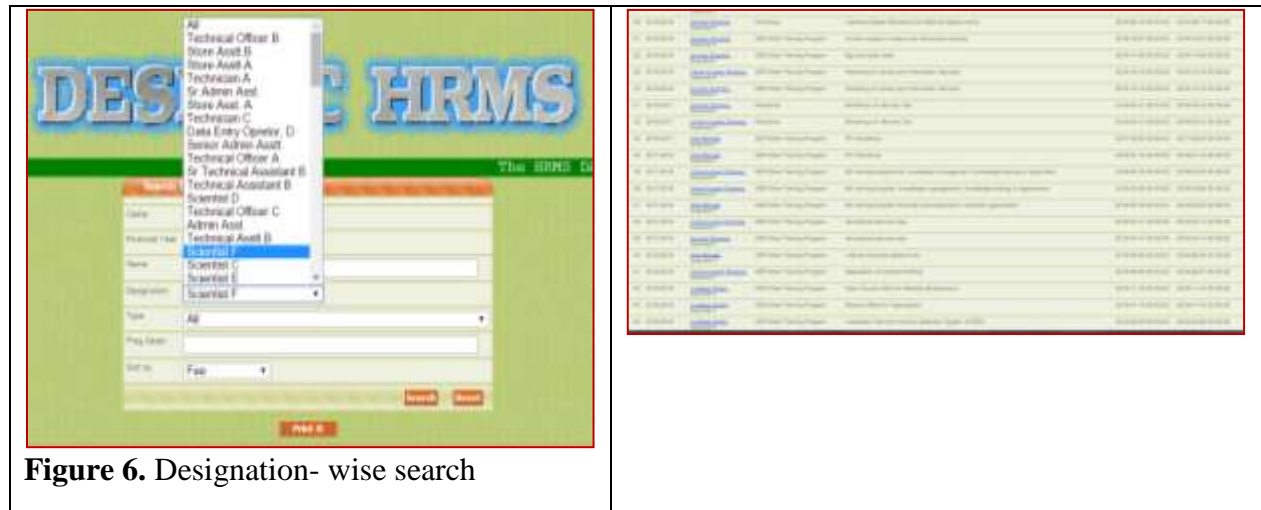
- *Year wise*- Through this search it can be deduced that how many employees were given training and in which areas. It also shows the courses/trainings attended by the individual employee in a year (Fig. 4). In case an employee has not attended any programme, then preference can be given to him/her to attend relevant course. It can also be known that in a particular on which subjects the training was imparted. It is also an important tool to understand the trends taking place over the years.



- **Cadre-wise Search-** The management can determine how many employees of each cadre have been imparted training and which areas have been covered. It helps to depute the work to the employee who has got the training in that area. It also helps to know which new areas can be covered. Figure 5 shows the cadre-wise search option of the HRMS system.



- **Designation-wise Search-** In an organisation, employees with different designations are entrusted with different responsibilities. There are specific courses designed for specific designations. So with designation-wise search (Fig. 6), the management can determine how many employees of that designation have been imparted particular training and those who have not been deputed may be sent for training.



**Figure 6.** Designation- wise search

- *Event-wise Search*-Attending conferences help in interaction with researchers working in similar areas. The system can be searched by events also (Fig. 7), such as, by conference, workshop, etc. It helps the organisation to know who have attended what conference/workshops, etc., and how many employees were deputed to the conference. The organisation utilises this knowledge to promote collaboration and cooperation in knowledge generation.



**Figure 7.** Event-wise search option of HRMS System

#### ➤ *Payments*

It is also important for the organisation regarding how much amount is being sanctioned and payments are being made and hence budget being spent on different trainings. Figure 8 shows the Payment option of the system. This helps to maintain the current budget and also to predict the future requirement for the budget.

The screenshot shows a table with 15 columns: S.No., Name of the Employee, Designation, Program, Date of Training, Duration, Amount, Status, and Remarks. The table lists various training programs such as 'ICDL Other Training Program', 'IC Conference on Open Special Libraries', 'Training of Patrons on Plan', 'Computer Hardware Tg. Programme', 'Professional Priority Rights', 'Refugee Survival of Officers', 'Cyber Security & Stress Handling', 'Defence Technology & Security in India', and 'Reaching to Patrons: A Case Study of DESIDOC Outreach Programmes'. The 'Status' column indicates 'Approved' for most entries, with some marked as 'Pending' or 'Not Approved'.

S.No.	Name of the Employee	Designation	Program	Date of Training	Duration	Amount	Status	Remarks
1186	Dr. S. S. S. S.	ICDL Other Training Program	IC Conference on Open Special Libraries	2019-02-16 00:00:00	2019-02-16 00:00:00	0000	Approved	
1187	Dr. S. S. S. S.	ICDL Other Training Program	IC Conference on Open Special Libraries	2019-02-16 00:00:00	2019-02-16 00:00:00	0000	Approved	
1188	Dr. S. S. S. S.	ICDL Other Training Program	IC Conference on Open Special Libraries	2019-02-16 00:00:00	2019-02-16 00:00:00	0000	Approved	
1189	Dr. S. S. S. S.	ICDL Other Training Program	IC Conference on Open Special Libraries	2019-02-16 00:00:00	2019-02-16 00:00:00	0000	Approved	
1190	Dr. S. S. S. S.	ICDL Other Training Program	IC Conference on Open Special Libraries	2019-02-16 00:00:00	2019-02-16 00:00:00	0000	Approved	
1191	Dr. S. S. S. S.	ICDL Other Training Program	IC Conference on Open Special Libraries	2019-02-16 00:00:00	2019-02-16 00:00:00	0000	Approved	
1192	Dr. S. S. S. S.	ICDL Other Training Program	IC Conference on Open Special Libraries	2019-02-16 00:00:00	2019-02-16 00:00:00	0000	Approved	
1193	Dr. S. S. S. S.	ICDL Other Training Program	IC Conference on Open Special Libraries	2019-02-16 00:00:00	2019-02-16 00:00:00	0000	Approved	
1194	Dr. S. S. S. S.	ICDL Other Training Program	IC Conference on Open Special Libraries	2019-02-16 00:00:00	2019-02-16 00:00:00	0000	Approved	
1195	Dr. S. S. S. S.	ICDL Other Training Program	IC Conference on Open Special Libraries	2019-02-16 00:00:00	2019-02-16 00:00:00	0000	Approved	
1196	Dr. S. S. S. S.	ICDL Other Training Program	IC Conference on Open Special Libraries	2019-02-16 00:00:00	2019-02-16 00:00:00	0000	Approved	
1197	Dr. S. S. S. S.	ICDL Other Training Program	IC Conference on Open Special Libraries	2019-02-16 00:00:00	2019-02-16 00:00:00	0000	Approved	
1198	Dr. S. S. S. S.	ICDL Other Training Program	IC Conference on Open Special Libraries	2019-02-16 00:00:00	2019-02-16 00:00:00	0000	Approved	
1199	Dr. S. S. S. S.	ICDL Other Training Program	IC Conference on Open Special Libraries	2019-02-16 00:00:00	2019-02-16 00:00:00	0000	Approved	
1200	Dr. S. S. S. S.	ICDL Other Training Program	IC Conference on Open Special Libraries	2019-02-16 00:00:00	2019-02-16 00:00:00	0000	Approved	

**Figure 8.** Search results for Payment for Course as a budget tool

## Conclusions

The HRMS is a very effective tool for the management and employees to know about the details of courses attended and take informed decisions. It helps in identifying courses and improving skills, knowledge attitude and abilities to achieve the organisational goals. It helps in designing the suitable courses for the employees for future also.

## References

1. What is human resources development (HRD)? <http://hrssolutions.com/human-resources-development-hrd/>
2. AlkaBansal, Sumati Sharma, SK Jindal. Reaching to Patrons: A Case Study of DESIDOC Outreach Programmes. Paper presented at 9th Convention PLANNER-2014 Dibrugarh University, 25-27 September 2014. [ir.inflibnet.ac.in](http://ir.inflibnet.ac.in).





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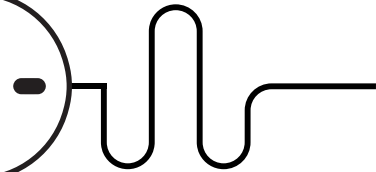
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# Factors Affecting Knowledge Sharing Practices in Public and Private Universities

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## Abstract

**Purpose:**The primary aim of this study is to examine and illustrate the patterns of Knowledge Sharing (KS) among undergraduate students in one Public and Private University.

**Methodology:**This is a quantitative study. In order to examine the Knowledge Sharing (KS) patterns, a structured questionnaire was developed and disseminated to the students of Dhaka University (DU), that is the top public university in Bangladesh and East West University (EWU) that is one of the prominent private universities in Bangladesh. This study included different parameters such as demographics, purpose, frequency, preferred channel, benefits, governing factors, barriers, and motivators for Knowledge Sharing.

**Findings:**The data was collected from 300 undergraduate students from EWU and DU. The findings show that the basic objectives of sharing knowledge were to enhance understanding of the concepts discussed in the class and to build relationships with classmates. For the purpose of assignments, presentations, and quizzes more knowledge sharing occurred within the group members with other groups. The major obstacles to knowledge sharing were the lack of time, lack of sharing culture, lack of technological support and inadequate depth in relationships. This paper suggests certain measures to inspire knowledge sharing among students.

**Research limitations:**The paper serves more as a descriptive think about the knowledge sharing patterns instead of a co-relational study to find the relationship among variables.

**Practical implications:** The findings suggest that group activities should be preplanned and structured in all educational modules to empower sharing among students. Academics are expected to play an important role to inspire their students in collaborative learning to among students. The administrative authority of universities can promote knowledge sharing by understanding the boundaries and motivators of KS.

**Originality:**This paper is among one of the first attempts to compare the knowledge sharing patterns of undergraduate students between a private and public university in Bangladesh.

## Keywords

Bangladesh, Undergraduates Students, Knowledge Sharing Patterns, Private universities, Public universities.

## Introduction

Knowledge sharing is an activity through which knowledge, information, skills, and expertise are exchanged among people, friends, families, communities, or organizations. Connelly and Kelowna (2003) defined knowledge sharing as a set of behaviors that involve the exchange of information among the members of an organization. With the growing emphasis on collaborative learning, nowadays Knowledge sharing among the undergraduate students both public and private universities are increasing. Using Facebook, Slide share, Google+, LinkedIn, and many other social networking sites the students share their knowledge for preparing a class note, gathering class lecture, participating online classes and so on. The aim of this study is to show a comparison between the pattern of Knowledge sharing among the undergraduate students of Dhaka University and East West University.

## Literature review

Numerous studies have been done on the topic of Knowledge Sharing Pattern of Undergraduate students, this is one of the significant issues for the past few years among the scholars all over the world (Islam, Nowrin and Mostofa, 2017; Wei et al., 2012; Roknuzzaman, 2012; Yaghi et al., 2011; Parekh, 2009; Yuen and Majid, 2007; Chen and Huang, 2009; Behnke, 2006; Rafaeli and Ravid, 2003; Lagerstrom and Andersson, 2003; Walker, 2002).

Universities in Bangladesh are mainly categorized into three different types: Public (government owned and subsidized), Private (private sector owned universities), and International (operated and funded by international organizations such as the Organisation of Islamic Cooperation). Bangladeshi universities are affiliated with the University Grants Commission (UGC). According to the University Grand Commission (UGC), at present Bangladesh has 44 Public and 104 Private Universities. Due to the high demand for enrolment to private universities in Bangladesh, the curriculum of the degrees is structured in a way which involves the students in various assignments (individual/group), Presentation, Quizzes as part of their coursework. For doing these kinds of activities student both Public and Private Universities are involved in Knowledge Sharing.

Mostofa (2015) state that the universities and KS largely emphasize on the matter that the operating atmosphere of the universities is totally different from different Institutes in numerous ways that and also the image of various aspects resulting out of information management (KM) and KS. This study disclosed that initial overall advantages from the first stage of KS among feminine students of Khulna University in Bangladesh were encouraging. The findings of that study also showed that the present culture of KS and factors of KS, don't rely on technology alone. Additionally, to that, that academic qualification is closely connected with the needs of KS.

Islam, Nowrin, and Mostofa (2017) noted that the majority of the students share their information for self-complacency. The study further showed that ks will facilitate to resolve their problems, though some of them assume otherwise. It is clearly shown from the study that the majority of the respondents use social networks for sharing knowledge and the percentage of only a few students share information through community discussions. This study found that

the students mainly share knowledge on a totally different topic from the academic discussions. The present analysis found that to find out from one another is one of the prime motivators of KS. It's appalling that in the age of knowledge Technology (IT), the most important portion of the respondents uses IT hugely occasionally throughout information sharing. The study additionally recognized that poor sharing of data within the organization is that the major problems to share information with others.

Roknuzzaman (2012) in his study found that the users of the Dhaka university library possessed a positive perception and perspective towards the idea of knowledge sharing. They shared numerous knowledge connected to their study, current problems, together with social, political and cultural affairs.

When cohesiveness is present, students tend to be more willing to work together, communicate with one another frequently, solve tasks together, coordinate their tasks through knowledge sharing from all team members (Kratzer et al., 2006). The results suggest that students need to develop group cohesiveness to improve knowledge sharing potential and team performance.

According to the findings of Yaghi et al. (2011), assured that knowledge sharing among students was a significant learning activity that benefited both the sharer and recipient.

Wei et al (2012) state that since universities are growing institutions with the goals to achieve a similar set of results, especially in this competitive environment. The differences mainly occur in the Scope and mode of exchange of knowledge between students.

According to Behnke (2006) Knowledge sharing refers to share explicit or tacit Knowledge, information, ideas, experiences or even skills from one individual to another. For this activity, it is necessary that the student or group of students interact with each other, whether through face-to-face or non-physical means. Focused mainly given to encourage students to overcome the tendency of accumulating knowledge and suggests that what higher education Institutions can do to promote the exchange of knowledge. Some studies have emphasized the benefits of knowledge exchange, for example, Parekh (2009) has pointed out some of the advantages of exchange of knowledge, how to avoid reinventing research, reducing redundant work, reduce the cost of inventions and accelerate knowledge creation with the help of experts and people of experience.

In another study, Liebowitz (2008) revealed that the existing trend of the organization ought to be appreciated and accommodated for each initiated KM plan. The specific characteristic of sharing of information has been mentioned by many commentators in their range of analysis articles. However, a comparatively little number of researches are performed within the field of knowledge sharing itself and different effective factors of knowledge sharing. This text intends to form a contribution towards creating a clear understanding of KS in offering day's Universities from student's purpose of view and discussing touching factors of KS.

A study on the perception of students about the exchange of knowledge was carried out by Nemati et al. (2002) who discovered that students share their explicit knowledge most of the time, which It will be expressed using written procedures, quantifiable data, and mathematical calculations.

Considering a lengthy volume of study on knowledge sharing pattern founds that the works are mainly done on undergraduates within a university, the comparison between undergraduates and postgraduates whether Public or Private universities. So this comparative study on Knowledge Sharing Patterns of Public University (Dhaka) and Private University (East West) undergraduates is one of the first attempts in Bangladesh.

## **Objectives of the study**

- To determine the comparison of Knowledge Sharing pattern between DU and EWU.
- To identify the faculty wise positivity and negativity towards KS.
- To determine the most preferred social networking sites among the students.
- Identify the academic purposes of KS.
- Identify the advantages and disadvantages of sharing knowledge.

## **Methodology**

### ***Sampling***

The targeted respondents of this study comprised of undergraduate students of East West University (Private) and Dhaka University (Public) in Bangladesh. This study attempts to compare the knowledge sharing patterns between these two universities. Online questionnaires were sat to 417 respondents from DU and EWU, among them 300 valid questionnaires were collected randomly from the students through social networking sites (SNSs). About 193 questionnaires were returned from EWU and 107 from DU.

### ***Questionnaire***

The attributes of questionnaires were included Different parameters such as demographics, purpose, frequency, preferred channel, benefits, governing factors, barriers, and motivators for Knowledge Sharing. The questionnaire consists of 17 questions. The first 5 questions are designed to collect the respondents' demographic information. They include the name of the institutions, year of study, faculty, education, age, and gender. The questions from 6 to 16 designed to collect the students' general attitude towards knowledge sharing, preferred sources for study-related tasks, types of knowledge shared, types of channels preferred, and difficulties of sharing knowledge. The last question (17) designed to collect individuals' opinions and suggestions in knowledge sharing.

**Table I.** Respondent's Profile

<b>Profile Characteristics</b>	<b>Number</b>	<b>%</b>
<b>1 .Type of institution</b>		
EWU	193	64.33
DU	107	35.67
<b>2. Level of education</b>		
<b>EWU</b>		
Year 1	32	16.6
Year 2	46	23.8
Year 3	60	31.1
Year 4	55	28.5
<b>DU</b>		
Year 1	9	8.4
Year 2	18	16.8
Year 3	56	52.3
Year 4	24	22.4
<b>3. Bachelor</b>		
<b>EWU</b>		
Business and economics	71	36.8
Science and Engineering	58	30.1
Liberal arts and social	64	33.2
<b>DU</b>		
Business and economics	43	40.6
Science and Engineering	27	25.5
Liberal arts and social	36	34
<b>4. Age</b>		
<b>EWU</b>		
18-21	64	35.2
22-25	109	56.5
26-20	16	8.3
<b>DU</b>		
18-21	44	41.1
22-25	61	57
26-20	2	1.9
<b>5. Gender</b>		
<b>EWU</b>		
Male	87	45.1
Female	106	54.9
<b>DU</b>		
Male	47	43.3
Female	59	55.7

## Results

### *Demographic profiles of respondents*

Although the study uses the convenience sampling method, the respondents' demographic characteristics are somewhat spread which we believe as a result of the random selection of respondents. As shown in Table I, the female made up the majority of the students sampled. The majority of the responses come from students of East West University (Private). Undergraduate students of Business and economics made up the largest percentage of respondents. Most of the students sampled are currently in year 3, followed by those in year 4. Years 1 and 2 students only comprised of 40.4 percent from EWU and 25.2 percent from DU of the total respondents.

### *The general attitude towards knowledge sharing*

The students were asked to indicate their general attitudes towards knowledge sharing. The students from both public (DU) and private (EWU) university agree that it is very important to share knowledge with others, and they should willingly share knowledge not to gather high scores in the examination but to enrich their academic skills by sharing knowledge. Table II shows the results. However, private university students indicated a significantly higher degree of agreement on these six statements compared to public university students. When asked to indicate opinion about sharing increases knowledge, Knowledge sharing is a must in an academic environment, sharing knowledge makes one innovative in terms of ideas, knowledge should share spontaneously. students from both public and private express that these are obvious to gather new experience. It is interesting to note that the public and private university students show similar disagreements to the statement that knowledge sharing should be avoided.

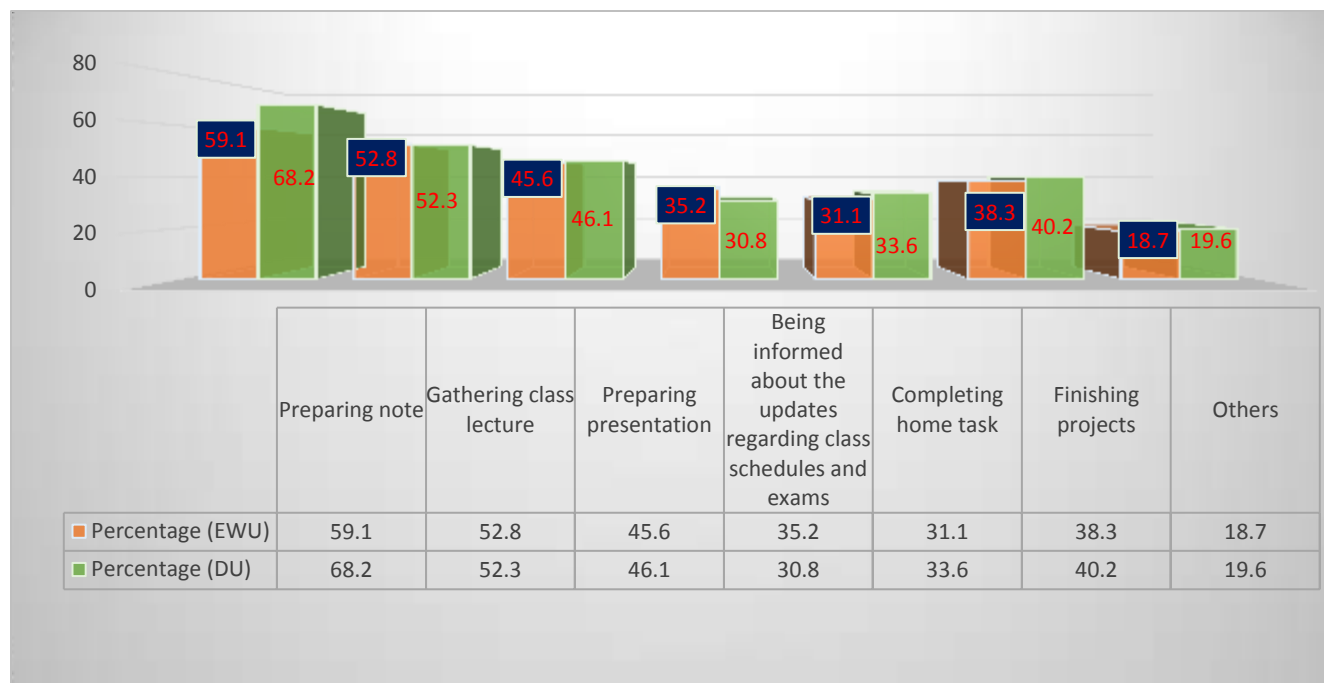
**Table II.** The general attitude towards Knowledge Sharing

Statements	Number of respondent		Percentage	
	EWU	DU	EWU	DU
Sharing increases knowledge.	109	81	56.50	75.70
Knowledge sharing is a must in an academic environment.	93	56	48.20	52.30
Sharing knowledge makes one innovative in terms of ideas.	87	50	45.20	46.70
Knowledge sharing shouldn't be done with classmates from your competition.	59	17	30.60	15.90
Sharing your knowledge can make others copy your ideas.	59	20	30.60	18.70
Students should share their knowledge spontaneously.	63	47	32.60	43.90



### ***Perceived frequency of knowledge sharing for study-related tasks***

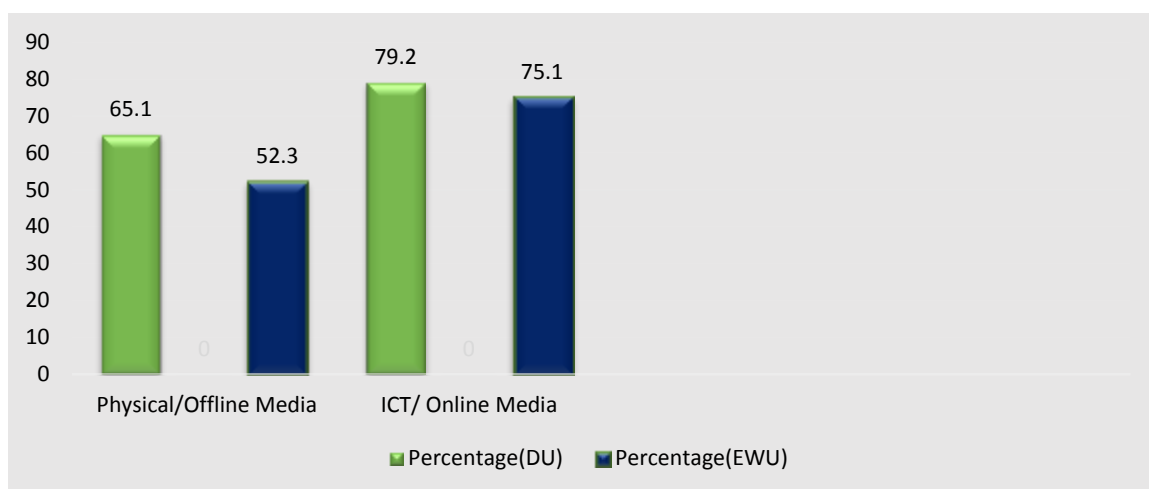
As shown in Figure III, students from both the public and private university demonstrate similar patterns of knowledge sharing at the time of preparing a note, gathering class lecture, preparing a presentation, collecting information about class lectures and schedules, completing home tasks, finishing projects, and others. Table III reveals that private university students tend to indicate a significantly higher knowledge sharing behavior in presentation, class lectures and projects.



**Figure III.** Perceived frequency of knowledge sharing for study related tasks

### ***Preferred media for Knowledge Sharing***

As indicated in Figure IV, both private and public university students score significantly high in using Physical/Offline and ICT/Online media. As a Physical/Offline media, the public university students mostly prefer face to face communication when they share information with individuals and groups of people. However, channels such as e-mail, telephone, and online message boards are seldom used as an ICT/Online media by the students of both types of universities.



**Figure IV.** Preferred media for Knowledge Sharing

### ***Preferred Social Networking Sites (SNSs) for Knowledge Sharing***

Nowadays knowledge sharing through facebook, messenger, WhatsApp is a popular trend both in Public and Private University. Because the students believe that using SNSs are more convenient than the traditional media because knowledge transfer through the Internet saves and helps in decision making easily. SNSs are an efficient way to reach people without any hindrance. As indicated in Table II, private university students score significantly higher in using SNSs compared to public university students. However, channels such as e-mail, telephone, and online message boards are seldom used by the students of both types of universities.

Social Networking Sites (SNSs)	Number of Respondents		Percentage	
	EWU	DU	EWU	DU
Facebook	128	80	66.3	75.5
Slide Share	110	48	57	45.3
Academia	78	28	40.4	26.4
Research Gate	62	10	32.1	9.4
YouTube	46	18	23.8	17.0
WhatsApp	70	29	36.3	27.4
Messenger	80	62	41.5	58.5
Others	34	20	17.6	18.9

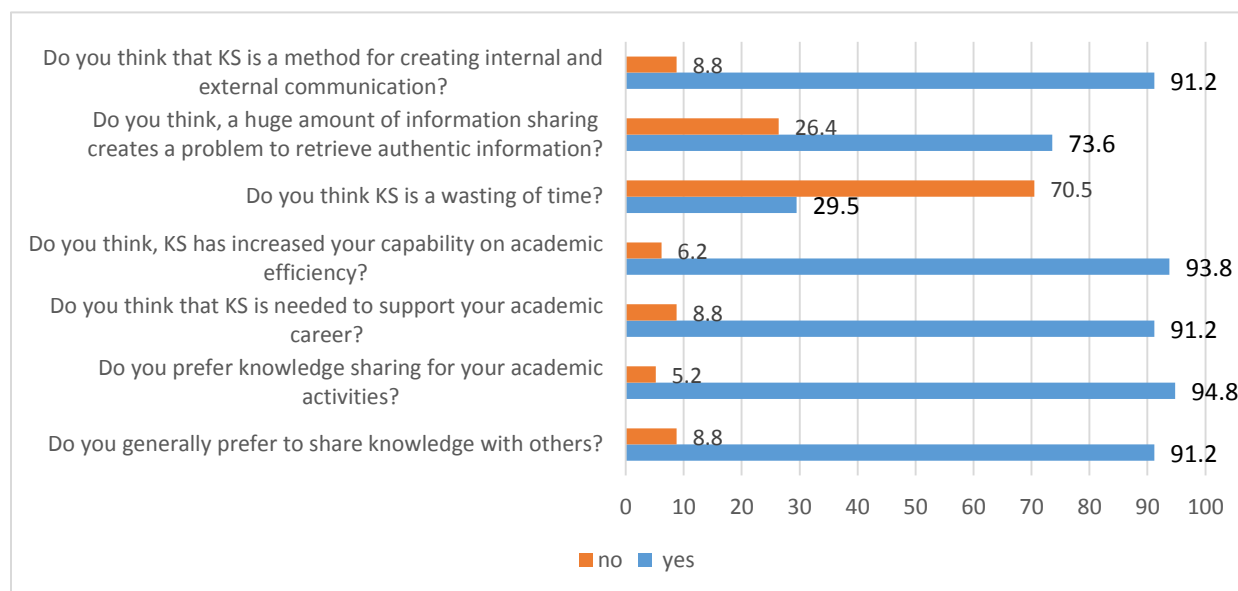
**Table II.** Preferred Social Networking Sites (SNSs) for Knowledge Sharing

### ***Perception of knowledge sharing***

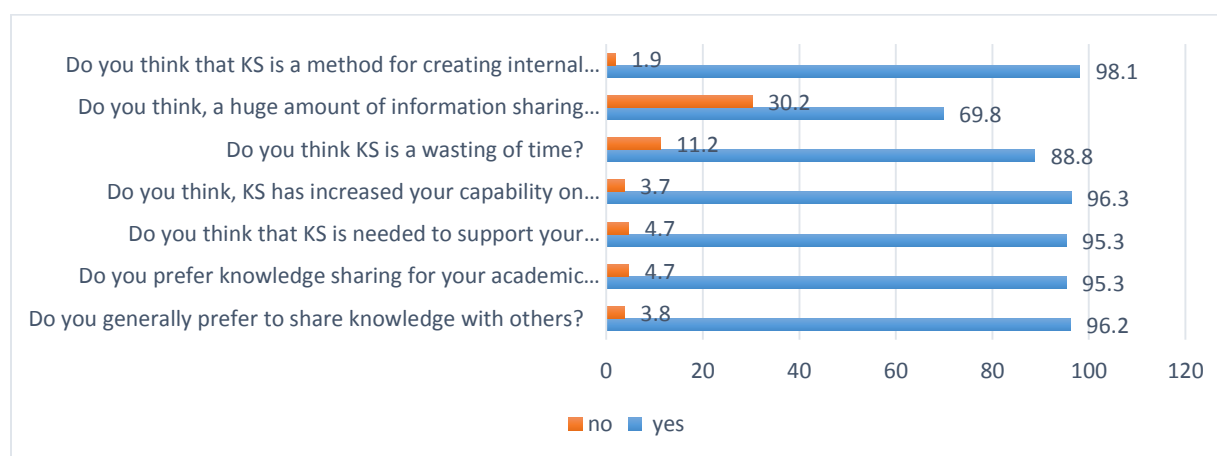
The students both East West University and Dhaka University were asked to indicate their perception in knowledge sharing. There were numerous questions including Do you generally prefer to share knowledge with others, Do you prefer knowledge sharing for your academic

activities, Do you think that KS is needed to support your academic career, Do you think KS has increased your capability on academic efficiency, Do you think KS is a wasting of time, Do you think, a huge amount of information sharing creates a problem to retrieve authentic information, Do you think that KS is a method for creating internal and external communication. The percentages are shown in figure V and VI.

### ***Perception of knowledge sharing (EWU)***



**Figure-V. Perception of knowledge sharing (DU)**



**Figure-VI**

**Figure V & VI. Perception of knowledge sharing EWU & DU**

## Discussion and Conclusion

This study has contributed to knowledge in several aspects. Above all, it has bridged the gap on the scarcity of research in examining knowledge sharing behaviors and patterns among students of public and private universities adopting a comprehensive research model.

Consistent with the findings of Yuen and Majid (2007), the students in this study particularly recognize the importance of sharing knowledge with their peers. According to the findings of Yaghi et al. (2011), assured that knowledge sharing among students was a significant learning activity that benefited both the sharer and recipient. Further, since students in the private university (EWU) are devoted to consulting their lecturers or tutors for study-related tasks, the study found support in the academic's role in promoting knowledge sharing activities, especially among the private universities. The findings are significantly correlated with the motivators for knowledge sharing. It is therefore not surprising when the students feel that sharing is an act of caring for their peers rather than sharing knowledge can make a copy of anyone's idea. Despite the fact that the findings favor the private universities, it is interesting to note that both public and private university students show strong disagreement to the statement that knowledge sharing should be avoided and that they do not view knowledge sharing as a type of plagiarism.

Private university students tend to indicate a significantly higher knowledge sharing intention at the time of preparing presentation, class lectures and projects. As Hussain et al. (2011) put it, students in private universities are likely to form discussion groups in order to reshape their knowledge about a particular subject. Group cohesiveness, a dynamic process reflected in the tendency for a group to stick together, is, in fact, important to influence knowledge sharing and performance of groups (Huang, 2009). When cohesiveness is present, students tend to be more willing to work together, communicate with one another frequently, solve tasks together, coordinate their tasks through knowledge sharing from all team members (Kratzer et al., 2006). The results suggest that students need to develop group cohesiveness to improve knowledge sharing potential and team performance.

Private and Public university students both score significantly high in using Physical/Offline and ICT/Online media. This may indicate that the bond between the private university students is stronger where a lot of face-to-face interactions occur in the course of their academic pursuit. The findings imply that knowledge sharing through human interaction is still prevalent, and that technology is just an enabler. This notion has been confirmed by some KM studies (Cheng et al., 2009; Chong et al., 2011).

Nowadays knowledge sharing through facebook, messenger, WhatsApp is a popular trend both in Public and Private University. Because the students believe that using SNSs are more convenient than the traditional media because knowledge transfer through the Internet saves time and helps in decision making easily. SNSs are an efficient way to reach people without any hindrance. It is interesting to note that the public university students are not lagging behind in using Facebook, Messenger Youtube compared to the private university students as a tool of sharing their knowledge.

To indicate the perception of knowledge sharing the students both East West University and Dhaka University were asked numerous questions including Do you generally prefer to share

knowledge with others, Do you prefer knowledge sharing for your academic activities, Do you think that KS is needed to support your academic career, Do you think KS has increased your capability on academic efficiency, Do you think KS is a wasting of time, Do you think, a huge amount of information sharing creates a problem to retrieve authentic information, Do you think that KS is a method for creating internal and external communication. In figure V and VI, it indicates that most of the students both East West University (Private) and Dhaka University (Public) provide their positive answer in the above questions. It is very interesting to note that when the amount of sharing information is huge then it sometimes creates problem to retrieve exact information but the students said that when the amount of information is increased then it will be more helpful to gather more knowledge.

## References

1. Behnke, T. (2006). Share your fruit: ten practical approaches to combat knowledge hoarding. Paper presented at *Eastern Academy of Management 43rd Annual Meeting: Management, Scholarship, Teaching: Learning in the 21st Century*, Saratoga Springs, New York, NY, 10-13 May.
2. Chen, C. and Huang, J. (2009). Strategic human resource practices and innovation performance — The mediating role of knowledge management capacity. *Journal of Business Research*, 62(1), pp.104-114.
3. Chin Wei, C., Siong Choy, C., Geok Chew, G. and Yee Yen, Y. (2012). Knowledge sharing patterns of undergraduate students. *Library Review*, 61(5), pp.327-344.
4. Connelly, C. and Kelloway, E. (2003). Predictors of employees' perceptions of knowledge sharing cultures. *Leadership & Organization Development Journal*, 24(5/6), pp.294-301.
5. Huang, C. (2009). Knowledge sharing and group cohesiveness on performance: An empirical study of technology R&D teams in Taiwan. *Technovation*, 29(11), pp.786-797.
6. Hussain, S., Anwar, S. and Majoka, M.I. (2011). Effect of peer group activity-based learning on students' academic achievement in physics at secondary level. *International Journal of Academic Research*, 3(1), pp. 941-4.
7. Islam, S., Nowrin, S. and Mostofa, S. (2017). Knowledge Sharing Pattern Among the Arts Faculty Students of Dhaka University: A Survey. *DESIDOC Journal of Library & Information Technology*, 37(4), p.243.
8. Jer Yuen, T. and ShaheenMajid, M. (2007). Knowledge-sharing patterns of undergraduate students in Singapore. *Library Review*, 56(6), pp.485-494.
9. Kratzer, J., Leenders, R. and Van Engelen, J. (2006). Managing creative team performance in virtual environments: an empirical study in 44 R&D teams. *Technovation*, 26(1), pp.42-49.
10. Lagerström, K. and Andersson, M. (2003). Creating and sharing knowledge within a transnational team—the development of a global business system. *Journal of World Business*, 38(2), pp.84-95.
11. Liebowitz, J. (2008). 'Think of others' in knowledge management: making culture work for you. *Knowledge Management Research & Practice*, 6(1), pp.47-51.

12. Mostofa, S.K.M. (2015). The culture of knowledge sharing among students: A study of Khulna University. *The Arts Faculty J*, 6(8), pp.125-45.
13. Nemati, H., Steiger, D., Iyer, L. and Herschel, R. (2002). Knowledge warehouse: an architectural integration of knowledge management, decision support, artificial intelligence and data warehousing. *Decision Support Systems*, 33(2), pp.143-161.
14. Parekh, R.A. (2009). Knowledge sharing: collaboration between universities and industrial organizations. in Mitra, J. (Ed.), *Globalizing Academic Libraries: Vision 2020:Pre-conference Volume:The International Conference on Academic Libraries*, University of Delhi, Delhi, pp. 146-51.
15. Rafaeli, S. and Ravid, G. (2003). Information sharing as enabler for the virtual team: an experimental approach to assessing the role of electronic mail in disintermediation. *Information Systems Journal*, 13(2), pp.191-206.
16. Roknuzzaman, M. (2012). Knowledge sharing pattern among users of Dhaka University library. *Dhaka University Studies*, 69(1), pp.39-56.
17. Walker, J. (2019). *Research, knowledge sharing, and you. (Perspectives)*. [online] Go.galegroup.com. Available at: <https://go.galegroup.com/ps/anonymous?id=GALE%7CA90624980&sid=googleScholar&v=2.1&it=r&linkaccess=abs&issn=01998986&p=AONE&sw=w> [Accessed 16 April 2019].
18. Yaghi, K., Barakat, S., Alfawaer, Z.M., Shkokani, M. and Nassuora, A. (2011). knowledge sharing degree among the undergraduate students: a case study at applied science private university. *international journal of academic research*, 3(1).

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# **Segmentation and quantification of solar PV losses using data-driven algorithms to help better design and operational monitoring**

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## **Abstract**

In the current scenario of increasing demand for solar Photo-voltaic (PV) systems, the need to predict their feasibility and monitor performance is more than ever. Although PV systems are known for their reliability, they are not above the damaging effects of their surroundings. Various lossy phenomena affect overall plant performance. In this paper, several of such losses, namely thermal, soiling, module degradation and inverter clipping, are discussed. Algorithms to evaluate these losses are proposed which are data-driven and empirical in nature. This is done as an effort to leverage the analytical capabilities provided by the plant data. The paper also compares the estimated losses with those obtained using the PVsyst simulation. As the latter is an independent industrial standard, it helps in understanding the ground reality of PV performance and insights for better operational monitoring.

These insights are of immense business value and are aimed at optimizing performance and thereby revenue.

## **Keywords**

Photo-voltaic, Data-driven, Estimation, Plant performance, Internet of things

## Introduction

PV systems are a predominant means of harnessing solar energy. They are cheaper than most means of renewable energy along with low periodic maintenance. They are also highly durable and easily scalable. Hence, there is a rapid demand for them worldwide. The major bottleneck to widespread installation of solar PV systems is their high dependence on surrounding weather. Even a sporadic event such as passing cloud cover can drastically drop the resulting generation. This brings the need to conduct feasibility & performance analysis of such projects. Simulation using energy modelling tools is the most widely used course of action. S.M. Maleki et al [1] and N.M. Kumar et al [2] establish the context of the discussion henceforth and are to be used for reference. Since any decrease in PV generation can result in considerable financial penalties, it is important to predict the possible generation. Apart from incident irradiation, major parameters of interest in estimating generation are PV losses. There are several types of losses each with its varying degree of complexity. Factors like module temperature, ambient temperature, communication loss, grid unavailability, soiling, design flaws etc., contribute to overall generation loss. N.M. Kumar et al [2] is a study to understand various PV losses using simulations of the energy modelling tool PVsyst.

The first aspect of studying the lossy physics of a PV module is attributed to its operating temperature. Irradiation is incident energy and when the module absorbs it, only a portion of the captured energy is harnessed into electric power. The remainder has a side effect of increasing the material's temperature. The module temperature rises as the incident irradiation and the amount of time it falls increase. As temperature rises, material efficiency decreases which further aggravates the module operation and so on. T. Dierauf et al [3] and R. Bohra [4] elucidate the requisite concepts regarding thermal loss and emphasize its contribution in a fuller understanding of PV losses.

Soiling of the solar modules is another lossy phenomenon with a significant effect on its performance. The amount and rate of soiling is highly dependent on the plant surroundings. Soiling rate is defined as the loss in generation due to soiling as a percentage of the generation which would have been with clean modules. M.G. Deceglie et al [5] puts forward the case of estimating soiling rates using the advantage of plant data. It also presents the necessary motivation towards pursuing such numerical models to better monitor PV systems.

The above types of generation loss have more to do with the surroundings than the material properties itself. But module degradation is majorly attributed to its electrical characteristics. It explains the inherent nature of the material to result in decreased performance over time even in the most standardized operation conditions. Regardless of the weather and geographic influence, module degradation poses a great financial risk. Therefore, its proper understanding is not just a research interest but also of fiscal responsibility. A. Ndiaye et al [6] deals with standardization of various measures relating to module degradation and does a great review of the technicalities. M. Malvoni et al

[7] studies degradation estimates in a grid connected PV system. Since the dataset for this study is based on grid-connected rooftop PV as well, it serves the purpose of establishing a reference and helps in drawing parallels.

Inverter clipping is more of a design optimization result rather than a lossy phenomenon. It nevertheless results in a saturated generation in the wake of high enough irradiation. In simple terms, if the DC power injected by the module array into the inverter is higher than its rated DC capacity then its AC output flattens and results in clipped generation. Various design constraints such as loading ratio, inverter capacity, inverter cost, plant capacity and project cost determine whether clipping is acceptable in a PV system and its extent.

This paper is organized as follows. Section 2 explains the methodology of estimating each of the aforementioned losses. Section 3 discusses the obtained results. It also compares the estimates with PVsyst simulation results to understand variations. Apart from these, there is a discussion on the limitations of the model. Section 4 summarizes the content and gives concluding remarks.

## Methodology

### Input dataset

As part of the asset management, all the solar PV components have sensors whose measures are sent to the servers on a real-time basis. This is incorporated into the analytics portal which is used for operations and monitoring.

time	Irradiation	Module_ temperature	DG_active power	Active_ power	Inverter 1_ active_power	Inverter 2_ active_power
2019-06-02 08:25:00+05:30	171.1188683	44	0	42.89	10.18	9.29
2019-06-02 08:30:00+05:30	396.9559794	43.6	0	101	23.28	21.32
2019-06-02 08:35:00+05:30	414.863768	44	0	106.64	24.16	20.95
2019-06-02 08:40:00+05:30	430.7818022	45.3	0	108.91	25.56	23.31
2019-06-02 08:45:00+05:30	452.6690994	46.4	0	114.59	26.91	24.5
2019-06-02 08:50:00+05:30	462.6178708	46.7	0	118.65	27.74	25.33
2019-06-02 08:55:00+05:30	486.4949222	47.2	0	124.11	0.08	0.49
2019-06-02 09:00:00+05:30	502.4129564	47.7	0	126.67	30.04	27.25

The above snippet is the sample data showing readings from the plant components. It is a time-series data with a temporal resolution of 5 minutes. This table is only intended to introduce the scope of sensor measurements possible in a PV system. The actual data and its list of parameters is dependent on plant capacity and design. For the reference dataset, a grid-connected solar rooftop PV plant in India was studied and its loss parameters were estimated. The plant components are discussed in the prologue of the results section.

### Performance Ratio (PR)

This is the standard measure of a PV system performance. It is the ratio of actual plant efficiency and theoretical efficiency.

**pltcap** is henceforth used to denote DC plant capacity (in KW).

$$PR (\%) = \frac{\text{AC energy generated (KWh)}}{\text{Irradiation (KWh/m}^2\text{) * pltcap (KW)}} * 100$$

## Temperature Corrected PR and Thermal loss

It is generally observed that PR has significant seasonal variation. PR tends to have higher values in winter which can be mistaken for better performance of the plant and the inverse happens in summer. It is quite possible that the PV system was neither overperforming in winter nor underperforming in summer. Instead, this spurious variation is due to the adverse effect of module temperature on module efficiency. Therefore, PR is corrected for the changes in module temperature. S. Pandey et al [8] is a technical briefing paper in an effort to understand the variations in temperature corrections with respect to Indian operating conditions. It presents the concept of temperature coefficient and studies thermal loss. This section takes a similar path and takes a step forward in actually using the temperature coefficient to calculate what would have been the generation prior to the loss. Standard temperature condition (STC) is defined at 25°C and is considered as the reference.

### Procedure:

- Given the AC active power and module temperature, STC corrected active power is calculated.

$$\text{Power}_{\text{stc}}(\text{KW}) = \frac{\text{Active power (KW)}}{[1 + \mu * (T_{\text{mod}} - 25)]}$$

$\text{Power}_{\text{stc}}$  : Temperature corrected output AC power

$\mu$  : temperature coefficient (°C/°C)

$T_{\text{mod}}$  : module temperature

- **Power<sub>stc</sub>** is an instantaneous value and is therefore calculated for each timestamp. Summation of  $\text{Power}_{\text{stc}}$  over the day will give the temperature corrected daily generation **Energy<sub>stc</sub>**.

$$\text{Energy (KWh)} = \frac{5 \text{ (min)}}{60 \text{ (min)}} * \sum_{\text{all-day}} \text{Active Power (KW)}$$

$$\text{Energy}_{\text{stc}}(\text{KWh}) = \frac{5 \text{ (min)}}{60 \text{ (min)}} * \sum_{\text{all-day}} \text{Power}_{\text{stc}}(\text{KW})$$

- Having the irradiation data as well, temperature corrected PR i.e.,  $\text{PR}_{\text{stc}}$  is calculated.

$$\text{Irradiation (KWh/m}^2\text{)} = \frac{5 \text{ (min)}}{60 \text{ (min)} * 1000} * \sum_{\text{all-day}} \text{Irradiance (W/m}^2\text{)}$$

$$\text{PR}_{\text{stc}}(\%) = \frac{\text{Energy}_{\text{stc}}(\text{KWh})}{\text{Irradiation (KWh/m}^2\text{)} * \text{pltcap (KW)}} * 100$$

$$\text{Thermal loss (\%)} = \frac{\text{Energy}_{\text{stc}}(\text{KWh}) - \text{Energy}(\text{KWh})}{\text{Energy}_{\text{stc}}(\text{KWh})} * 100$$

## Module soiling loss

Since the data captures only the generation post soiling, the ideal generation has to be estimated using actual generation data. Majority of existing approaches involve employing a comparison analysis between dirty and clean modules to quantify generation difference. This conventional method, while useful in benchmarking, proves to be a cumbersome effort in dealing with large-scale PV plants. This section presents a novel method of estimating the soiling rates which uses a data-driven approach.

### Assumptions

- The trend in  $PR_{stc}$  is generally assumed to be that of a periodically linear one with a negative slope and having a sharp rise at a cleaning event.
- The cleaning event is not always feasible to be an instantaneous (single day) and can stretch depending on the plant capacity. In such cases, the effect of cleaning in PR trend isn't one of a sharp rise but that of a gradual yet considerable increase.

### Proposed algorithm

- Within a month, the maximum of  $PR_{stc}$  (refer temperature corrected PR part) is assumed to be representative of a cleaning event. Let it be **Max. $PR_{stc}$** .
- The local minimum of  $PR_{stc}$  in the left neighbourhood of the maximum is considered as the dirtiest the modules have been. Let it be **Min. $PR_{stc}$** .
- The aggregate loss in PR is then calculated as the difference between the above two and is normalized by ACC (average cleaning cycle in days) to get averaged daily PR loss defined as  $\Delta PR$  (%/day).

$$\Delta PR \text{ (\%/day)} = \frac{\text{Max. } PR_{stc} \text{ (\%)} - \text{Min. } PR_{stc} \text{ (\%)}}{ACC \text{ (days)}}$$

- Daily generation loss (KWh) is then calculated using  $\Delta PR$  (%/day), irradiation and  $pltcap$ .
- This daily loss is summed over the cleaning cycle period to get total generation loss (in KWh) due to soiling.

$\Delta Gen_S$  (KWh) : rise in generation due to cleaning

$\Delta Energy_S$  (KWh) : total generation loss due to soiling between consecutive cleanings

$$\Delta Gen_S \text{ (KWh)} = \frac{\Delta PR \text{ (\%/day)} * ACC \text{ (days)} * Irradiation \text{ (KWh/m}^2\text{)} * pltcap \text{ (KW)}}{100}$$

$$\Delta Energy_S \text{ (KWh)} = (1/2) * \Delta Gen_S \text{ (KWh)}$$

- Ideal generation is the sum of the actual generation ( $\text{Energy}_{\text{stc}}$ ) and the total loss ( $\Delta\text{Energy}_S$ ).
- Soiling rate is then the total loss as a percentage of the ideal generation.

$$\text{Soiling loss (\%)} = \frac{\Delta\text{Energy}_S}{(\text{Energy}_{\text{stc}} + \Delta\text{Energy}_S)} * 100$$

The motivation behind using  $\text{PR}_{\text{stc}}$  instead of PR is to calculate soiling loss independent of thermal loss.  $\text{PR}_{\text{stc}}$  represents an idealized notion of generation excluding the loss due to module temperature. Hence, the logic is to estimate the soiling loss using the pre-loss generation and it is rational to assume that this approach better captures the actual figures. As stated in the assumptions, the nature of the cleaning event is not temporally visible in majority cases since the data is from industrial-sized PV plants. Also, the inclusion of such a variable in the estimation model can ruin accuracy along with adding complexity. Hence,  $\text{PR}_{\text{stc}}$  was used to quantify the cleaning action as well.

### Inverter clipping loss

Consider a plant ‘P’ with N inverters as below.  $\text{INV}_i$  denotes ith inverter henceforth.  $\text{INV}_i$  has  $\text{DCcap}_i$  (input DC capacity) &  $\text{ACcap}_i$  (Output AC capacity) for  $i = 1$  to N

- For  $\forall \text{INV}_i$ , do the following for every date D.

identify the time period ‘ $T_D$ ’ such that  $T_D = \{\text{all times when Irradiance (W/m}^2) \in [400,900]\}$

This set of data is considered to give the best plant performance and is used to get a reference PR for the day.

$\text{INV}_i \text{ gen}^D$  : daily generation of  $\text{INV}_i$  at optimal performance

$\text{Irr}^D$  : irradiation at the time of optimal performance

$\text{INV}_i \text{ PR}^D$  : daily PR of  $\text{INV}_i$  at optimal performance

$$\text{INV}_i \text{ gen}^D \text{ (in KWh)} = (\sum_{T_D} \text{Active power}_i) / 12$$

$$\text{Irr}^D \text{ (in KWh/m}^2) = (\sum_{T_D} \text{Irr}_X) / 12000$$

$$\text{INV}_i \text{ PR}^D \text{ (\%)} = \frac{\text{INV}_i \text{ gen}^D * 100}{\text{Irr}^D * \text{DCcap}_i}$$

Where  $\text{INV}_i \text{ PR}^D$  is considered as the reference PR of that day for calculating what would have been the unclipped generation from  $\text{INV}_i$ . We filter the data for possible clipping scenario as follows.

identify the set of time period ‘ $T_C$ ’ such that

$T_C = \{\text{all times } T_X \text{ with Active power} \geq (0.98 * ACcap_i) \cap \text{Irradiance} (W/m^2) > 900\}$  Active power<sub>ix</sub> : output AC power (KW) of INV<sub>i</sub> at time  $T_X$

Irr<sub>X</sub> : Irradiance (KW/m<sup>2</sup>) at time  $T_X$

$$INV_i \Delta gen^D \text{ (in KWh)} = \frac{5 \text{ (min)}}{60 \text{ (min)}} * \sum_{T_X \in T_C} \left( \left[ \frac{INV_i PR^D}{100} * Irr_X * DCcap_i \right] - \text{Active power}_{ix} \right)$$
  
 $\left[ \frac{INV_i PR^D}{100} * Irr_X * DCcap_i \right]$  denotes what would have been the unclipped active power at ‘ $T_X$ ’ with the reference PR whereas (Active power<sub>ix</sub>) is the actual inverter output power which is clipped.

Here,  $INV_i \Delta gen^D$  is the generation loss due to clipping of INV<sub>i</sub> on date ‘D’. Summation of all such days in a month-wise & yearly fashion as below (for month ‘M’ and year ‘Y’)

$$INV_i \text{ Monthly clipping loss} := INV_i \Delta gen^{M,Y} \text{ (in KWh)} = \sum_{(\forall D \in M) \cap (\forall D \in Y)} INV_i \Delta gen^D$$

$$INV_i \text{ Yearly clipping loss} := INV_i \Delta gen^Y \text{ (in KWh)} = \sum_{\forall M \in Y} INV_i \Delta gen^{M,Y}$$

- These monthly/ yearly losses are summed over all INV<sub>i</sub> to get total clipping loss in KWh.
- This is then expressed as a percentage of Energystc (refer thermal loss part).

## Module degradation

PV solar ’s performance decreases over time due to weather and operating condition. The degradation of the module is one of the key markers for actual photovoltaic performance assessment. Module degradation assessment is also necessary for predicting plant’s performance in upcoming year, this is required for preventive maintenance of modules and calculating the lifetime of PV plants. This paper calculates over the year module degradation with respect to previous year and compares simulated standard data (PV Syst) with actual on-site data of the plant.

Proposed algorithm

Consider a plant ‘P’ of capacity N inverters with the required data for the years {Y<sub>i</sub> for i = 1 to K}

INV<sub>j</sub> has DCcap<sub>j</sub> (input DC capacity) & ACcap<sub>j</sub> (Output AC capacity) for j = 1 to N (refer previous subsections for common nomenclature used henceforth)

- Select the month with the best clean data & minimal inconsistency-related issues across all Y<sub>i</sub>. Let it be ‘M’.
- For every date D of month M, year Y<sub>i</sub>, identify the set of time period ‘ $T_D$ ’ such that

**TD** = {all times  $T_X$  such that all  $INV_j$  are working  $\cap$  Irradiance ( $W/m^2$ )  $\in [400,900] \cap T_{mod} > 25^\circ C$ }

➤ Calculate the temperature corrected active power at each  $T_X$  for each  $INV_j$  as follows.

$INV_j$  Active power $^{Y_i}_X$ : active power of  $INV_j$  at time  $T_X$  in year  $Y_i$

$INV_j$  powerstc $^{Y_i}_X$ : temperature corrected active power of  $INV_j$  at time  $T_X$  in year  $Y_i$

Total powerstc $^{Y_i}_X$ : total temperature corrected active power at time  $T_X$  in year  $Y_i$

$$INV_j \text{ powerstc}_X^{Y_i} \text{ (in KW)} = \frac{INV_j \text{ Active power}_X^{Y_i}}{[1 + \mu * (T_{mod} - 25)]}$$

$$\text{Total powerstc}_X^{Y_i} \text{ (in KW)} = \sum_{j=1 \text{ to } N} INV_j \text{ powerstc}_X^{Y_i}$$

➤ Aggregation of STC corrected active power gives individual daily generation of each inverter. Daily irradiation is also calculated by summation of irradiance over the course of each day.

$INV_j$  Energystc $^{D,Y_i}$ : temperature corrected generation of  $INV_j$  on date 'D' in year  $Y_i$

Total Energystc $^{D,Y_i}$ : total temperature corrected generation on date 'D' in year  $Y_i$

$Irr^{D,Y_i}$ : total irradiation ( $KWh/m^2$ ) on date 'D' in year  $Y_i$

$$INV_j \text{ Energystc}^{D,Y_i} \text{ (in KWh)} = \frac{(\sum_{T_X \in T_D} INV_j \text{ powerstc}_X^{Y_i})}{12}$$

$$\text{Total Energystc}^{D,Y_i} \text{ (in KWh)} = \sum_{j=1 \text{ to } N} INV_j \text{ Energystc}^{D,Y_i}$$

$$Irr^{D,Y_i} \text{ (in KWh}/m^2) = \frac{\sum_{T_X} Irr_X}{12000}$$

➤ Using the above calculations, PRstc is calculated for each  $INV_j$  and overall (plant level) PRstc as per the above sections (refer PR and temperature corrected PR parts above) and denoted as below.



$INV_j PR_{stc}^{D,Y_i}$  : PRstc of  $INV_j$  on date  $D$  of year  $Y_i$

Plant  $PR_{stc}^{D,Y_i}$  : overall PRstc of the plant on date  $D$  of year  $Y_i$

- Having the daily values of PRstc for inverter-level as well as the plant-level of all years, the next step is to divide the month into 3 windows and identify the days with maximum overall PRstc within each window. We have considered the windows to have a maximum of 10 days.
- Let the windows be  $W_Z$  for  $Z = 1,2,3$  such that  $\sum_{Z=1,2,3} W_Z = M$
- Calculate the average of the 3 maxima to get the reference PRstc for each year  $Y_i$  denoted by  $PR_{REF}^{Y_i}$ . Similarly, such yearly PRstc values are calculated for each inverter as  $INV_j PR_{REF}^{Y_i}$ .

$$PR_{REF}^{Y_i} (\%) = average(\{ \max_Z (Plant PR_{stc}^{D,Y_i}) \mid Z = 1,2,3 \})$$

$$INV_j PR_{REF}^{Y_i} (\%) = average(\{ \max_Z (INV_j PR_{stc}^{D,Y_i}) \mid Z = 1,2,3 \})$$

- Module degradation between consecutive years  $Y_i$  and  $Y_{i+1}$  is the difference between  $PR_{REF}$  values for the respective years.

$$Plant - level degradation (\%) \equiv \Delta PR_{REF} (\%) = PR_{REF}^{Y_{i+1}} - PR_{REF}^{Y_i}$$

$$INV_j - level degradation (\%) \equiv \Delta INV_j PR_{REF} (\%) = INV_j PR_{REF}^{Y_{i+1}} - INV_j PR_{REF}^{Y_i}$$

## Results & discussion

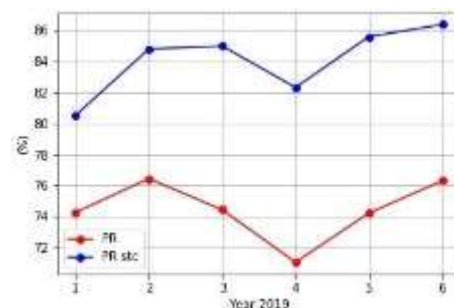
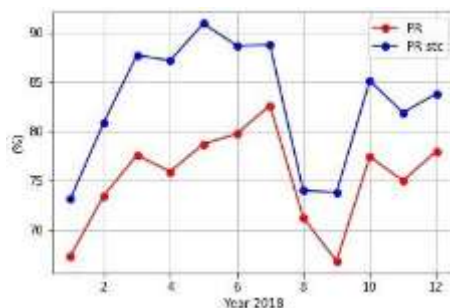
Grid-connected rooftop PV Plant at Moosapet, Hyderabad, Telangana, India is used for the study Plant DC capacity = 511 KW.

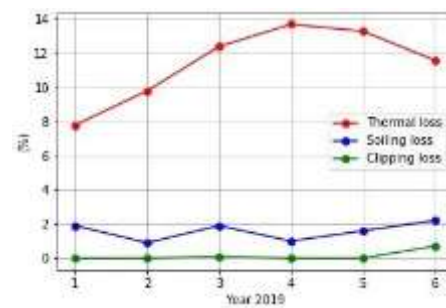
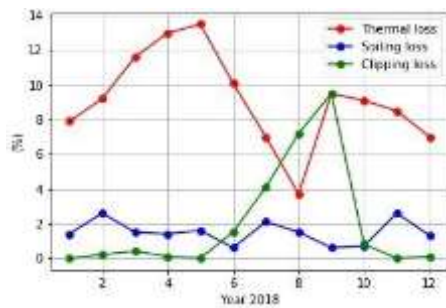
1 CMP3 irradiation sensor and 1 PT-1000 module temperature sensor.

7 SMA inverters each of rated DC capacity of 78 KWp and design AC capacity of 60 KW. 1 Schneider energy meter model EM6400

The plant data from January 2018 to June 2019 has been used for the study.

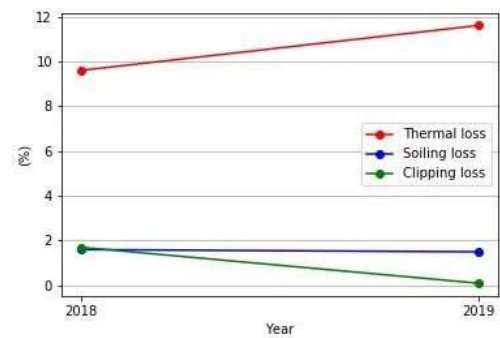
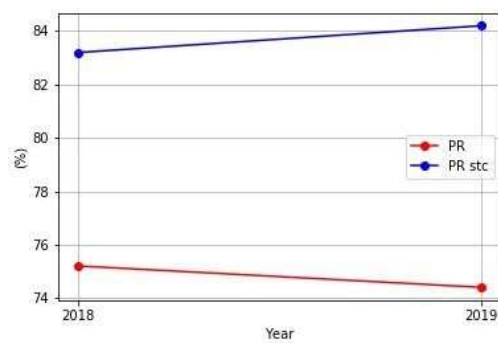
### Monthly plots





year	month	thermal loss(%)	soiling loss(%)	inv clip loss(%)	Plant PR (%)	Plant PRstc (%)
2018	1	7.9	1.4	0.0	67.3	73.1
2018	2	9.2	2.6	0.2	73.4	80.8
2018	3	11.6	1.5	0.4	77.5	87.7
2018	4	13.0	1.4	0.1	75.9	87.2
2018	5	13.5	1.6	0.0	78.7	90.9
2018	6	10.1	0.6	1.5	79.7	88.7
2018	7	7.0	2.1	4.1	82.6	88.8
2018	8	3.7	1.5	7.2	71.2	73.9
2018	9	9.5	0.6	9.5	66.8	73.8
2018	10	9.1	0.7	0.8	77.4	85.1
2018	11	8.5	2.6	0.0	74.9	81.9
2018	12	7.0	1.3	0.1	77.9	83.8
2019	1	7.8	1.9	0.0	74.3	80.5
2019	2	9.8	0.9	0.0	76.5	84.8
2019	3	12.4	1.9	0.1	74.4	85.0
2019	4	13.7	1.0	0.0	71.1	82.3
2019	5	13.3	1.6	0.0	74.2	85.6
2019	6	11.6	2.2	0.7	76.3	86.4

## Yearly plots



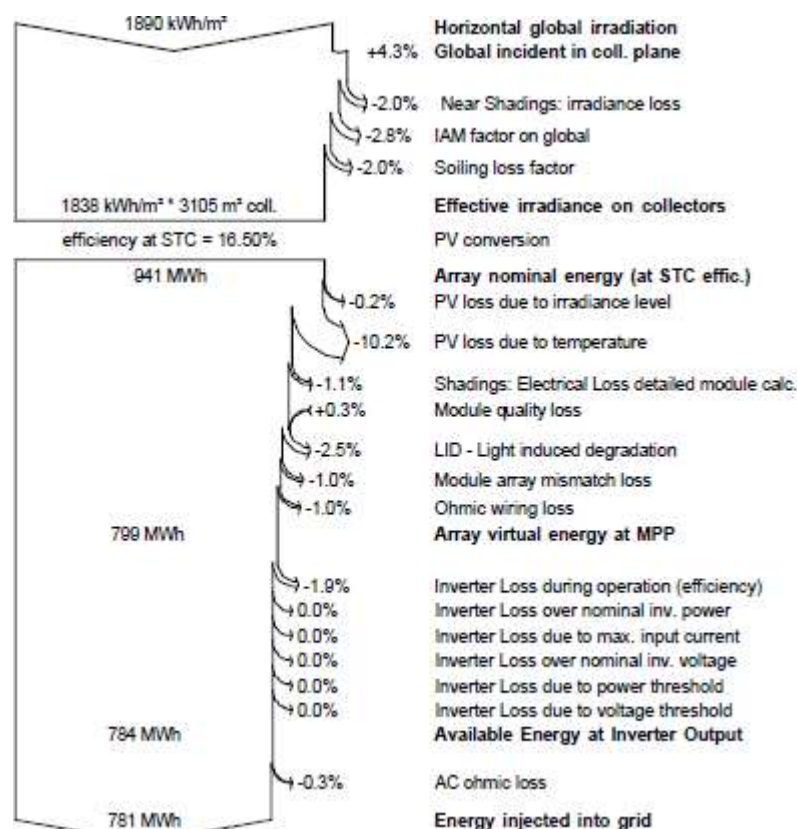
year	thermal loss(%)	soiling loss(%)	inv clip loss(%)	Plant PR (%)	Plant PRstc (%)
2018	9.6	1.6	1.7	75.2	83.2
2019	11.6	1.5	0.1	74.4	84.2

### Yearly Module degradation

previous year	current year	average Inverter degradation (%)	Plant level degradation (%)
2018	2019	-1.03	-1.05

### PVsyst simulation

The below snapshot is from the simulation report using PVsyst v6.68 for the same plant. The 'soiling loss factor' refers to the loss due to module soiling and is shown to be 2%. 'PV loss due to temperature' refers to the thermal loss which was estimated above. It is shown to be 10.2% in this simulation. The total value of inverter loss is taken here to be 1.9% and this includes various losses shown below. LID (light induced degradation) which is an important contribution to overall module degradation is shown here to be 2.5%.



## Discussion

- The need for precise calculation of thermal loss is clearly illustrated in the above results where PR and PR<sub>stc</sub> are shown. The seasonal variation in PR is evident whereas PR<sub>stc</sub> is a more tolerant measure to understand plant performance.
- The monthly variation in various losses calculated above gives thee necessary insights to understand the plant environment and thereby help in preventive maintenance.
- Such losses can be monitoring to understand the plant limitations in terms of generation and thereby help the financial and business side of the operations in adjusting the revenue models.
- Large-scale reproduction of the proposed models on various sites pan India has the potential to map the generation capability with respect to Indian geography of future PV systems.

## Conclusion

Solar PV is such a technology which has been enjoying increasing demand and this market scenario is quite favourable for innovation in energy research. This paper hopes to not only introduce the context of PV losses but also tries to engage the motivation to adopt data-driven and empirical methodologies to understand modern systems. This approach is better in the sense that it only gets better at prediction as time goes by and there is more data. Industrial research such as the above work in critical analysis of PV systems not only helps identify possible limitations but also suggest room for improvement. Since energy generation and project cost are key towards maximizing revenue, these estimation models aimed at predicting PV losses are to be deemed indispensable. As with any estimation, there is no one unique way of hitting the bull's eye that is to know the exact value. The algorithms proposed above are very much dependent on the quality and quantity of data. However, the comparison between losses estimated using plant data and standard simulation using energy modelling can act as feedback towards improving the design and maintenance of such PV systems.

## Acknowledgement

This opportunity is to thank our managers Ankur Gupta, Vinayak Singh and Kranthi Tej for their overall guidance and nuanced domain expertise. Naresh Kumar and Oves Khan are part of our team's full-stack developers and their help in proper and timely data acquisition is very much appreciated. The PVsyst simulation reports for the respective plants were performed by the design team to be used by the operations team.

## References

1. S.M. Maleki, H. Hizam, C. Gomes. Estimation of Hourly, Daily and Monthly Global Solar Radiation on Inclined Surfaces: Models Re-Visited, *Energies*, Volume 10, issue 1, 10.3390/en10010134.
2. N.M. Kumar, R.P. Gupta, M. Mathew, A. Jayakumar, N.K. Singh. Performance, energy loss, and degradation prediction of roof integrated crystalline solar PV system installed in Northern India, *Case studies in Thermal Engineering*, Vol.13, 100409.

3. T. Dierauf, A. Growitz, S. Kurtz, J.L.B Cruz, E. Riley, C. Hansen. Weather-corrected performance ratio, National Renewable Energy Laboratory Technical report, NREL/TP-5200-57991.
4. R. Bohra. Performance analysis of 1MW SPV plant; Temperature corrected PR, energetica India, Sept-Oct'14.
5. M.G. Deceglie, M. Muller, S. Kurtz. A scalable method for extracting soiling rates from PV production data, 43<sup>rd</sup> IEEE Photovoltaic Specialists Conference.
6. A Ndiaye, C.M.F. Kebe, A. Charki, V. Sambou, P.A. Ndiaye. Photovoltaic platform for investigating PV module degradation, International conference on technologies and materials for renewable energy, environment and sustainability, Energy Procedia 74 (2015) 1370-1380
7. M. Malvoni, M.G.D Giorgi, P.M. Congedo. Study of degradation of grid connected photovoltaic system, Conference of Italian thermal machines engineering association, Energy procedia 126 (201709) 644-650.
8. S. Pandey, R. Dhuriya, G. Mishra, R. Mhatre. Study on measurement of temperature coefficient of different types of PV modules in outdoor operating conditions in India, PV Tech Power Volume 16, Sept'18

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# **Estimation of monthly Global Horizontal Irradiation pan India using spatial interpolation and comparing its deviations from standard dataset**

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## **Abstract**

In the current scenario of increasing demand for solar photovoltaic (PV) systems, the need to predict their feasibility and performance is more than ever. Irradiance of a geographical location almost exclusively determines the generation possible via solar. Hence, accurate irradiance data is required to assess the value of solar PV systems. Emphasizing such need, this paper presents a method of estimating global horizontal irradiance (GHI) using the two dimensional (2-D) spatial interpolation technique. The proposed model is geo-agnostic and can estimate irradiance depending on the geographical range of the input data. This paper also compares the model predictions with a standard irradiation dataset in the industry. This comparison helps in getting insights regarding the spatio-temporal trends in recent times.

## **Keywords**

Global horizontal irradiance, spatial interpolation, kriging, estimation, Data-driven

## **Introduction**

PV systems are a predominant means of harnessing solar energy. They are cheaper than most means of renewable energy along with low periodic maintenance. They are also highly durable and easily scalable. Hence, there is a rapid demand for them worldwide. Since any decrease in PV generation can result in considerable financial penalties, it is important to predict the possible generation. Solar irradiance is a key factor used in yield assessment. Generation has an almost linear dependence on input irradiance. Thus, the estimation of irradiance is an important exercise for PV asset management. Solar irradiance is measured in various ways each with a different notion of incident radiation. S.M. Maleki et al [1] familiarizes with the requisite concepts. It dives deep into the formulation of such concepts and elucidates the mechanics of changing irradiance with time. D.Young et al [2] and D.Palmer et al [3] discuss the current methodologies used by the industrial as well as research communities not only to define the scope of the engineering challenges but also solving them. These provide a fairly lucid picture of the system and establish the context to understand the motivation behind this study and helps better appreciate the research work presented.

Spatial interpolation is a well known and effective technique in modelling distributions and parameters which are dependent on geography. Ryu, JS., et al [4] emphasizes the challenges of geostatistics and explains how interpolation techniques such as inverse distance weighted functions, kriging, etc., can be leveraged for accurate estimation. B. Bacchi et al [5] even presents the case of explaining the complexity of numerical weather prediction models. It circumvents the issue of weather prediction by employing spatial correlation techniques to explain rainfall trends. D. Perez-Astudillo et al [6] is a study which is similar to the one in this paper. It attempts to map GHI trends all over Qatar only using the weather station data. However, this paper goes a step further and performs interpolation pan India producing gap-filled estimates at every grid coordinates spaced 10 Kilometer (Km) apart i.e.,  $0.1^\circ$  latitude/longitude difference.

This paper is organized as follows. Section 2 explains the methodology behind the estimation model. Section 3 discusses the obtained results and their accuracy. It also compares the deviations between the standard dataset and the model predictions. Section 4 summarizes the content and gives concluding remarks.

## Methodology

Most of the PV projects are installed at an orientation(s) as per either design optimization or client-side requirements or both. Thus, irradiation sensor data are the measurements of Global Tilted Irradiance (GTI) in respective sites. In terms of plant monitoring, GTI makes more practical sense as it captures the incident irradiance on the tilted modules. But discerning inherent trends from such GTI data alone is complex as it majorly depends on the tilt and azimuth. GHI trends are also known to be more gradual and continually smoother than those of GTI. Hence, the idea is to transform GTI to GHI which will eliminate the model's dependence on sensor orientation. This reduces the model complexity and simultaneously increases the accuracy of GHI estimates. Thus, we have used a transform domain approach to achieve the aim of predicting irradiance more accurately as summed up below. GTI data is firstly transformed into GHI data using the corresponding transposition factor (TF). The model is then built using the geographical parameters and input GHI values. The output essentially identifies spatial trends in GHI and uses them to produce GHI estimates pan India. This resulting GHI estimates can be transformed back to respective GTI using the inverse of TF.

## Training dataset

As part of asset management, solar PV plants have irradiation sensors whose measures are sent to the servers on a real-time basis. This is incorporated into the analytics portal which is used for operations and monitoring. Thus, the data is organized for each plant with its geographical parameters (latitude and longitude) along with GTI measured by on-ground sensors. T-factors corresponding to each sensor orientation are also known which are used to obtain GHI values.



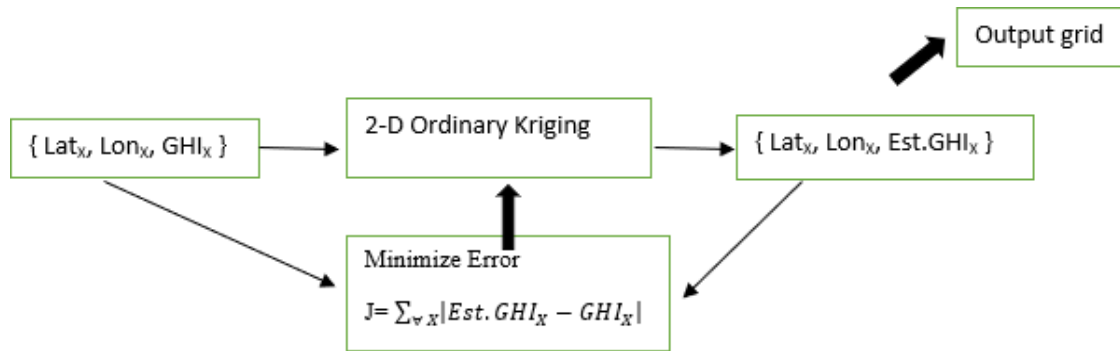
Latitude	Longitude	Month	monthly GTI	T-Factor	monthly GHI
28.100	77.000	08/2019	156.81	1.013	154.83
28.521	77.472	08/2019	132.36	1.001	132.28
24.553	73.732	08/2019	108.18	0.999	108.26
27.569	75.144	08/2019	160.40	1.013	158.34
31.020	76.450	08/2019	156.75	0.999	156.95
12.918	77.695	08/2019	124.02	0.998	124.26

The above snippet is the sample training data showing ground sensor readings from the mentioned coordinates. The number of rows in the training set (number of sensors) varies depending on the month and year in question. This is because the source of data for this study is from the commissioned PV systems across India. The training data for August 2019 has more than 130 sensors across India.

Formulate a training dataset with the parameters **{Latitude, Longitude, Monthly GHI, Month}**.

- Use the 2-D spatial interpolation modules of Pykrige python library to perform gap-filling. Refer to the official Pykrige documentation [7] to understand the various modules of the library.
- Define a reasonable range and resolution of the geographical grid to perform interpolation so that inherent trends can be conspicuous.
- The optimization problem is defined as minimizing total absolute error of estimation (J) with respect to the kriging variogram parameters.
- Output dataset is of the same format as that of input one except that the former has GHI estimates for all co-ordinates within the grid.
- The feedback from the error minimization block is performed until we obtain the minima of J.

### Flowchart of data flow



The results shown henceforth for August 2019 have been obtained using **2-D Ordinary kriging** in the geographical range corresponding to India (+**5.6 to +37.4 latitudes** and +**67.8 to +97.6 longitudes**) with a **0.1 grid resolution (10Km X 10Km)**.

The nomenclature below is defined to aid visual understanding in the results section and maintain uniformity.

**Lat** (+degrees) : latitudes defining the geographical grid (rounded to 1 decimal place)

**Lon** (+degrees) : longitudes defining the geographical grid (rounded to 1 decimal place)

**Est.GHI** (KWh/m<sup>2</sup>) : estimated GHI for [Lat, Lon] coordinates from the model

**Ref.GHI** (KWh/m<sup>2</sup>) : reference GHI (standard dataset) at respective coordinates

**Est-Ref dev** (%) : percentage deviation of estimated GHI form reference GHI

**Latitude** (+degrees) : latitudes of the training dataset

**Longitude** (+degrees) : longitudes of the training dataset

**Act.GHI** (KWh/m<sup>2</sup>) : measured GHI at respective coordinates

**Est-Act dev** (%) : percentage deviation of estimated GHI form measured GHI

## Results

### Sample output - August 2019

Lat	Lon	Est.GHI	Month
23.6	68	128.96	8/2019
23.5	68.1	128.71	8/2019
23.6	68.1	128.94	8/2019
23.7	68.1	129.07	8/2019
23.8	68.1	129.25	8/2019
23.9	68.1	129.48	8/2019
23.5	68.2	128.64	8/2019
23.6	68.2	128.87	8/2019
23.7	68.2	129.07	8/2019
23.8	68.2	129.19	8/2019
23.9	68.2	129.35	8/2019
24	68.2	129.51	8/2019

### Irradiation heat map - August 2019



### Average daily GHI (KWh/m<sup>2</sup>)



### Sample Training error - August 2019

Latitude	Longitude	Act.GHI	Lat	Lon	Est.GHI	Est-Act dev (%)
31.59	74.962	149.48	31.6	75	150.71	0.82
27.218	78.092	134.12	27.2	78.1	133.88	-0.18
25.135	75.856	114.36	25.1	75.9	113.94	-0.37
17.332	78.724	142.22	17.3	78.7	142.2	-0.01
31.634	74.835	143.07	31.6	74.8	143.58	0.36
13.02	80.182	155.83	13	80.2	150.11	-3.67
12.874	80.138	151.85	12.9	80.1	153.75	1.25
12.818	77.53	123.99	12.8	77.5	122.85	-0.92
11.046	76.899	130.4	11	76.9	131.43	0.79
12.918	77.695	124.26	12.9	77.7	126.62	1.9
28.499	77.397	136.23	28.5	77.4	135.82	-0.3
28.155	76.878	148.54	28.2	76.9	150.73	1.48

### Error statistics:

Mean training error ( $\mu T$ ) = -0.032%

Standard deviation of error ( $\sigma T$ ) = 1.926%

## Comparison between model estimates and standard dataset

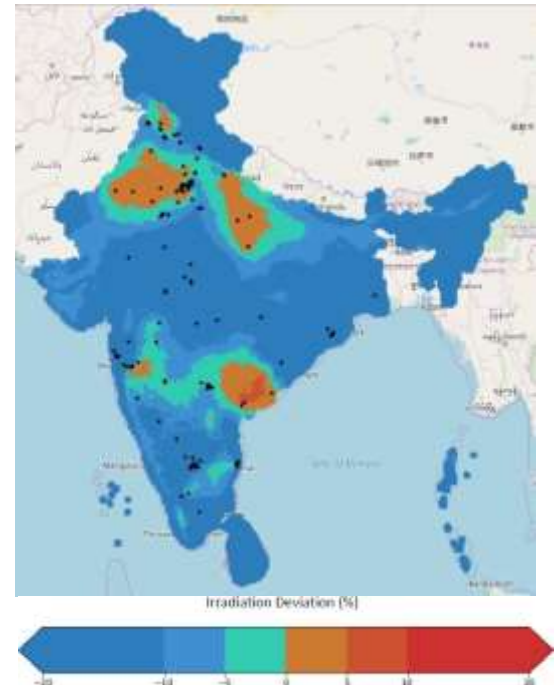
Irradiation deviation (%) - August 2019

lat	lon	Est.GHI	Ref.GHI	Est-Refdev(%)
31.6	75	150.71	158.01	-4.62
25.1	75.9	113.94	140.28	-18.78
29	77.7	141.71	147.67	-4.03
16.3	80.5	143.24	141.49	1.23
30.2	75.1	170.21	164.55	3.44
31	75.8	146.31	157.22	-6.94
28.4	77	149	148.99	0.01
28.5	77.1	144.81	148.49	-2.48
20.3	85.8	111.87	137.73	-18.77
19.1	73.1	96.14	127.62	-24.67
28.9	79.4	154	152.15	1.22
26.9	76.1	136.73	147.03	-7.01
18.5	73.9	134.68	133.21	1.11

Mean (Est-Ref dev) =  $\mu_d$  = -8.76%

Standard deviation (Est- Ref dev) =  $\sigma_d$  = 9.67%

Irradiation deviation (%) heat map – August 2019



## Discussion

- The black dots on the heat maps denote the locations of the irradiance sensors. Their considerable spread across India can be observed. This helps in learning majority spatial GHI trends if not all.
- The irradiation heat map for August 2019 is in line with actual weather data reported by Indian weather agencies. For instance, the trend of excessive rainfall reported in central India this august closely correlates that which is shown as considerably lower irradiation in the region.
- The model optimizes its variogram parameters by achieving the minima of total absolute error (%) which is evident in the mentioned statistics of training error.
- The standard dataset has been obtained from a reputed industrial vendor whose data points are a combination of long-term averaged values and satellite imagery. This is used as a reference to understand temporal GHI trends.
- As shown above, reference GHI considerably deviates from ground reality. In the sample results for August 2019, there is negative mean deviation and considerable standard deviation in the error distribution. This verifies the increasingly severe trend of monsoon pan India this August and the consequent irradiation shortfall.
- The major bottleneck in improving estimation accuracy is the quality and quantity of training data. Having a greater geographical spread of sensors and the ability to capture accurate measurements, the model's capability to predict GHI trends can be better appreciated.

## Conclusion

As part of our study, the increasing predominance of solar PV as a renewable source of energy is discussed. This has focused the attention on the need to have quality irradiation data. The above research has been as an endeavour to use a data-driven approach to solve the issue at hand. Hopefully, this work can showcase the power of using data-intensive techniques such as the one above to solve the many challenges in the energy industry especially those in solar. The model is built using irradiation sensor data pan India and used an effective spatial interpolation technique, kriging, to produce the gap-filled estimates. The statistical measures of estimate error are also mentioned which show impressive accuracy. Heat maps for respective months have also been produced for better visualization of GHI trends. An independent standard dataset is also compared with the estimates to better understand the temporal GHI trends with respect to long-term averaged values. The assessment of this work's potential is for the industrial community to ascertain as this can have various use cases of immense business value.

## Acknowledgement

This opportunity is to thank my managers Ankur Gupta, Vinayak Singh and Kranthi Tej for their overall guidance and nuanced domain expertise. Naresh Kumar and Oves Khan are part of our team's full-stack developers and their help in proper and timely data acquisition is very much appreciated. Pooja has been a helping hand in enhancing my understanding at every stage of the project and for that, I thank her. The standard dataset is used by the design team for benchmarking PV performance and has been obtained from a reputed data services vendor.

## References

1. S.M. Maleki, H.Hizam, C.Gomes. Estimation of Hourly, Daily and Monthly Global Solar Radiation on Inclined Surfaces: Models Re-Visited, *Energies*, Volume 10, issue 1, <https://doi.org/10.3390/en10010134>
2. D.Young, A.Nobre, R. Baker, T. Reindl. Large-area irradiance mapping, *PV-Tech Power* Volume 1
3. D.Palmer, I.Cole, T.Betts, R.Gottscalg. Interpolating and Estimating Horizontal Diffuse Solar Irradiation to Provide UK-Wide Coverage: Selection of the Best Performing Models, *Energies*, Volume 10, issue 2, <https://doi.org/10.3390/en10020181>
4. Ryu, JS., Kim, MS., Cha, KJ. et al. Kriging interpolation methods in geostatistics and DACE model, *KSME International Journal* (2002) 16: 619. <https://doi.org/10.1007/BF03184811>
5. B. Bacchi, N.T. Kottegoda. Identification and calibration of spatial correlation patterns of rainfall, *Journal of hydrology*, Volume 165, February 1995, [https://doi.org/10.1016/0022-1694\(94\)02590-8](https://doi.org/10.1016/0022-1694(94)02590-8)
6. D. Perez-Astudillo, D. Bachour. Variability of measured Global Horizontal Irradiation throughout Qatar, *Solar Energy*, Volume 119, September 2015, <https://doi.org/10.1016/j.solener.2015.06.045>
7. Pykrige documentation, release 1.4.1, Jan 15, 2019, <https://pykrige.readthedocs.io/en/latest/overview.html>



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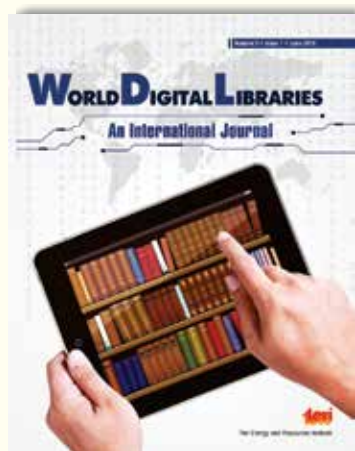
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