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Digital Technology in Action: Journey from Print to Electronic Resources

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The paper discusses the role of digital technology in the daily lives of people while enumerating various digital devices of the digital age. It traces the history of application of digitisation in libraries beginning with CD-ROM technology to present era of online environment. The authors share their personal experiences in introducing and implementation of digitisation in libraries with suggestions and recommendations, giving snapshots and examples of digital services so generated. They conclude that copyright issues are the main impediments in digitisation which needs amendments in copyright laws in view of the present network and digital environment in compliance to call of the knowledge society for free flow of information.

1 Introduction

Digital technology has revolutionised and transformed the present-day society. Our daily living has been influenced by digital technology. Most of the world population uses one or the other digital technology or devices during their daily working hours. Internet and mobile technology has the greatest impact on modern living. Anyone without mobile phone/smartphones in hand seems unusual and an exception. The new generation cannot even imagine that there was a society without laptops and mobile phones. Dependence on digital technology is so great that everyone of us

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would always like to be on-line. Handheld devices like smartphones, wristband, smart watches can do most of our daily work (Lupton, 2015: 9). *Life is Digital: Back it Up*. This statement appeared as an advertisement for selling digital protection products (Lupton, 2015: 1). Digital technology like any other material culture artifacts are becoming a constitutive part of what makes us human (Miller and Horst, 2012). All our actions are digitally mediated (Lupton, 2015: 3). Digital technology has obliterated the space and institutions. It was estimated that there were 738 million people using on-line services during 2000 which increased to 3.2 billion in 2015 (Davidson, 2015). Mobile users in Asia are estimated to be 3 billion using basic features (Schmidt and Cohen, 2013: 14). According to the report of the Internet and Mobile Association of India (IAMAI) mobile Internet users increased from 238 million in June 2014 to 306 million at the end of December 2015 and was expected to reach 370 million users by June 2016 (*Indian Express*, February 4, 2016). Users of digital technology in one or the other forms are multiplying at a terrific speed. Even the rural Indian population is becoming digital dependent and there is significantly an increase in the use of technology over the years. The rural population of India uses this technology for entertainment, social networking, communication, shopping and online ticketing with the percentages of 52, 39, 37, 1 and 4 respectively (IAMAI-IMRB). Launching of the Digital India project by the Government of India on July 2, 2015 will have a direct impact on the rural population of India providing every village of India with the requisite infrastructure facilities of high speed Internet connectivity.

How can libraries which are the main beneficiary of digital technology remain unaffected? In fact, there has been maximum impact of every new technology on librarianship. Digital technology has gone beyond institutions overcoming geographical boundaries with availability and accessibility all the time. It has transformed embodied space in the digital age (Farman, 2012). Life is digital as most of the routine work is performed through digital devices. It is difficult to enumerate digital devices in action. It will not be an exaggeration if we say that there is hardly any action which cannot be done by digital technology. Now digital technology does not need any intermediaries and dependence. Digital data becomes globally available without any time lag and assistance. The expectation of present-day library users is to get all their resources in a single click from anywhere anytime in their favourite devices without visiting libraries. Smartphones and tablet computers are small enough to carry with us at all times (Lupton, 2015: 1) making things most easy and convenient to use and do.

Rightly said that life is digital and all of us are forced to support and back it. This was a glimpse of the role of digital technology in our daily lives. Now let me discuss briefly the role of this technology in librarianship and know how it has shaped the profession over the years.

2 My Story with Digitisation in Practice

I shall limit my paper to discuss applications of digital technology in libraries which I have experimented as a professional since the 1980s to date. Most of the young professionals present here might not have worked with old digital technology, might not have seen a room-sized computer transformed [now] into an omnipresent and endlessly multifaceted outlet for human energy and expression (Schmidt and Cohen, 2013). Professionals of my generation have been fortunate to see the profession changing fast which had been without any such significant developments before the 1980s except some research works on semi-manual indexing systems and some developments in the field of classification and cataloguing. However, the impact of Ranganathan's contributions was visible all over, waiting for the applications of technology for the fulfilment of messages contained in Ranganathan's five laws. Technology came as if summoned by Ranganathan's laws. Ranganathan's five laws are as valid today and will be tomorrow as applied to digital libraries (Wallace, 2004). As soon as technology started entering the field of librarianship, its scenario began changing with challenges and opportunities to the professionals.

2.1 Advent of CD-ROM

The advent of the CD-ROM database has brought a new era of computerisation to libraries (Christine, 1996). This digital technology came with enhanced storing and searching abilities bringing users and E-contents much closer. I started working with PC XT and AT during the late 1980s with a limited storage capacity which has now increased from MB to GB, TB, EB and PB to store data in million gigabytes. This background brought us to the present digital age in which people get all the information instantaneously meeting most of their information needs. Physical spaces and distances have been bridged to zero. It was the late 1980s when international databases started coming in CD-ROM with storing capacity of about 700 MB. Its size was 4.72" equivalent to 1500 floppy discs which could store 200,000 typed single spaced pages (Herbert, 1983). It was a significant breakthrough in digital storage and retrieval. Bibliographical control which was an impossible task earlier could collect retrospective data published during the last 5 years or so. *Chemical and Biological*

Abstracts, ERIC Database started appearing in CD-ROM. I being in the Horticultural & Forestry University purchased *CAB Abstracts* (Now CABI Abstracts), *Hort-CD, AGRIS, AGRICOLA* Databases and some other databases on Forestry. Dictionaries, Encyclopedia, Books in Print, Dissertation Abstracts also appeared in CD-ROM. Earlier CDs were popular for storing music and videos only. CD-ROM digital technology made research easier for academicians and students. It became much more convenient and time saving for the researchers to browse and download the published material. The indexing and abstracting services became quite popular within a short time to the satisfaction of the faculty and the students. It is important to note that some senior faculty members observed that it is not so good to simplify literature search so easily and conveniently which used to take a lot of time earlier. Searching for literature manually, visiting various libraries and sources also had its own advantages. Nonetheless, the advent of CD-ROM technology was an important event for archival purposes highly useful for retrospective search. Librarians and users were happy to use this technology and it was out of common imagination that this technology is going to be replaced so soon. This was the first digital technology, I could implement at the beginning of the 1990s.

2.2 Current Awareness Service

The availability of bibliographical databases with abstracts was well received and during that time nobody could think that full-text would be ever be available as today. The only limitation with this technology was the time lag which was only good for retrospective search. The need for availability of current information in digital format was felt. Thanks to the contribution of Eugene Garfield who introduced *current contents on diskette* in all the four disciplines as was available in print format. This was a weekly service that began coming up initially in 5.25" discs followed by 3.25" and finally in CD-ROM and online. I started subscribing to this service in diskettes and discontinued the printed version. This was the second eventful development in the history of digital sources for me. We used to receive these diskettes through the foreign post office, New Delhi. In the beginning, the post office used to intercept and withhold the arrival of these diskettes, treating them as custom items. It took time to convince the authorities that these are as good as any other reading material and should not involve custom duty. I had to seek clarification from the Ministry and UGC to get exemption from custom duty on these products. I started subscribing to this service in the field of *Agricultural, Biology and Environmental Sciences* which was launched by ISI during 1989. In 1991,

this service appeared with abstracts which was earlier without abstracts called *CC On Diskette with Abstracts*. It had additional features of Keyword Plus and application of Boolean logic features for advanced search (Garfield, 1991). These diskette had all the facilities of searching including generating profile-based services.

Since standalone systems were not sufficient so the CD-NET station came into use to search many CDs together. Libraries also began establishing their local area network to extend this service within the campus. Simultaneously, I started in-house computerised services with compilation of online catalogue using CDS/ISIS software.

2.3 Repackaging of Information

Having experimented with CD-ROM services and Current Content on diskettes, I thought of repackaging information from international databases. The project was planned to collect bibliographical records with abstracts on '*Post-harvest Technology*' and '*Biotechnology*' during 1995-96. The scope of these projects were limited to literature generated in SAARC countries. Literature available in different sources were downloaded and entered in CDS/ISIS software (Chandel and Kamal, 1997). After proper subject indexing and providing all possible access points, the publications in hard copies were also brought out along with computerised databases. This could be done as copyright issues in respect of bibliographical records which were not involved so rigidly as today in case of records with full-text. The computerised databases so created were working effectively and received well by the users. After some years, the databases remained unused which were stored in CDs as backup. When we wanted to update these databases and add new records, but data was not retrievable due to change in the DOS version. The copy of the earlier version of the operating system was not available through any source. So the entire data in the electronic version was lost. The lesson learnt was that digitisation or computerisation works seem fascinating but also issues a warning that data so archived may be lost due to change in hardware and software if not updated and migrated timely. In case of hard copies there is no danger of their disappearance as digital resources. Hard copies are beyond such danger and has this advantage over the E-version.

2.4 Internet Age

Much like an industrial revolution, the Internet revolution changed the life of people, how they live, work, shop and socialise (Agrawal and Mazumdar, 2015). Personal computers appeared late during the 1980s and

World Wide Web (WWW) was invented in 1989 but came into use in 1994 (Lupton, 2015: 2). Indian Universities started Internet use during the 1990s with dialup connection, followed by broadband now with Wi-Fi connectivity, may further go to Li-Fi technology based upon light wave in place of radio technology which may make Internet connectivity much faster (Yuvaraj, 2016) and more common everywhere. This is further going to change with some new innovations in ICT with their applications in libraries. Today all functions of Internet are available in smartphones and there is a complete shift from desktop to handheld and wearable devices which can be worn on the body such as self-tracking, wristbands or headbands used to collect biometrics data (Lupton, 2015: 9). Internet that initially started with mail services with low speed has reached such a stage today that most of the activities of daily life are performed by Internet. So far as digitisation in action is concerned, Internet is the backbone. This is the Internet which makes the resources globally available.

The landscape of librarianship started changing since the late 1980s. Changes became faster and faster over the years. The scenario of the 21st century is quite different where people live more in the virtual world. Communication devices in various forms and formats started entering the society and communication and connectivity became more effective and useful. Today, we have billions of people getting connected through Internet, reshaping and changing our traditional functioning. Internet gave a significant boost to digital technology. More and more print material started getting converted into E-content with global accessibility and availability. Any material as soon as it gets digitised becomes instantaneously global. In hard copy the material may have seemed obscure but when digitised it becomes a core resource (Hirtle, 2002). The vision of paperless society which Lancaster gave us during the 1970s started entering our conscious level after a decade or so.

3 My Experience with Digitisation

North Eastern Hill University (NEHU), Shillong got a project on digitisation proposed by our Department of Library & Information Science under '*University with Potential for Excellence*' (UPE). I was appointed as a Chairman of this project with its management committee to look after all the projects sanctioned under UPE including the present one. The challenges before me were the following which others might have also experienced who had initiated such projects:

1. Establishment of digital lab with required hardware and software

2. Manpower planning
3. What to digitise?
4. Customisation of software if required
5. Consultancy if required, and many more.

Establishing a digital lab with server, scanners, computers, software, work stations and other equipment was quite a challenging job which needs professional as well as technical knowledge to plan and implement the project. There are many considerations to be taken into account. Planning has to be done in view of the project in hand with future vision. This was an experience of how to bring digitisation into action.

Having established the lab, the obvious question was what to digitise first as there were many options at hand. Developing Institutional Repository was already in mind which had many problems associated with it likely to confront us at a later stage. It looks quite easy and relevant too to digitise your own resources first then to digitise other documents according to the priority. Some of us might have taken the hurried decision to launch digitisation of resources which don't fall under copyright restrictions, which may not be that important from the users' perspectives. The usability of the resources is the main consideration and that too by your own patrons which is likely to differ from one institution to another. The resources so digitised must be more useful to your own institutional users. Outside users should be the second priority. Norman (1988) had emphasised in his book *Design of Everyday Thing* that our products and services should be user-centred. Ranganathan's whole philosophy is also user-centred. Every institution needs to make an assessment based upon actual data before launching such projects on digitisation. My choice was to take up the following areas:

- i) Administrative documents which includes all meetings, ordinance, statutes, etc.
- ii) MPhil and PhD theses (this was before Inlibnet launched the project or might be at the planning stage).
- iii) All issues of NEHU Journals (University publications)
- iv) Publications of NEHU faculty (Institutional scholarships)
- v) Literature on North-Eastern States (Local history).

3.1 Process of Digitisation

The actual process begins with the selection of print material to be digitised followed by creation of records (metadata) in a particular software which has to be designed in view of the requirement of input and output. Change in the structure of software if required should be done right at the beginning. Changes in any form even in the policies may create many problems at a later stage. This has to be done in view of the types of material likely to be indexed; such as theses, meetings, periodical articles, chapters in a book along with the book itself, audio or video CDs, etc. It would be good if different worksheets are designed for different major types of material to be considered for digitisation. Customisation if required should be done to the minimum adopting international standards so that interoperability is possible without many problems likely to come up at a later stage.

Then comes scanning and data entry work. Your scanner(s) should be able to scan all types of proposed documents of all sizes to be digitised. We may need two scanners (document and book scanner) with reasonable speed and resolution along with other important features. Accuracy and content analysis are the backbone for retrieval which has to be taken into account at description level during data input. Who will assign the keywords? The data entry operator or someone else who has the subject background? Arrangement of the PDF file should be such that it is easier to find and append the right file. These processes seem to be easy but are not so easy for better output.

3.2 Accepting, Editing and Approving

Before records are archived, it should be ensured that every record is checked and edited by senior professionals. What becomes global should be correct and authentic.

In NEHU, I made the departments as *community* and publications of each department as *collection* using DSpace, thinking that all resources belonging to the department are put together and arranged at one place. If someone is interested to browse his own contribution, he can click on his own collection rather than going to search options. It also becomes easier to get the records verified by the authors themselves with this arrangement. The demonstration of this order was given to the faculty members to know their reaction about this classificatory arrangement.



This was as per approach of the faculty members who were the main users. Hence, the convenience of the users was taken into account for formation of community and collection. The list of communities with subject index is given below:

Community	No. of Records	Subject Index	No. of Entries
Administrative Documents	2812	Meghalaya	291
Central Library	2297	Assam	243
Department of Anthropology	189	North East	195
Department of Biochemistry	262	Botany	182
Department of Botany	455	Geography	157
Department of Chemistry	500	Arunachal Pradesh	129
Department of Economics	233	Manipur	120
Department of English	84	Chemistry	116
Department of Environmental Science	163	North-East India	110
Department of Physics	251	North-East India	109
Department of Zoology	320		
NEHU Journal	123		
Theses and Dissertations Digitised	1118		

Another repository developed at Sikkim University has a different structure. The snapshots are given below for reference:

Communities in DSpace

Choose a community to browse its collections.

ADMINISTRATIVE DOCUMENTS	120
AUDIO/VIDEO COLLECTION	14
E-RESOURCES	0
FACULTY PUBLICATIONS	347
JOURNALS	679
 LIST OF E BOOKS	59
M PHIL DISSERTATIONS	75
 OPEN ACCESS RESOURCES	128

3.3 Current Contents of Journals

In view of the low usage of the journals being subscribed, we thought of digitising the contents pages of all issues of journals and archive them in a digital repository keeping in view their present and future use. Under each department, their journals were listed with a link to their respective contents pages. This arrangement has the advantage for the faculty members to know their list of journals being subscribed and can also refer to the contents pages of each issue. Mere listing of these contents pages

was not enough unless proper indexing of each article is done. The only option was to make this community with full-text searching facility so that every title of the article with the author is searchable. We wanted only this community and collection with this facility not disturbing the other communities where searching was based upon controlled vocabulary. The snapshot of the specimen is given below:

Issue Date	Title
2016	Foreign Affairs V. 95 (1) 2016
2016	International Relations V. 30 (1-2) 2016
2016	International Organization V. 70 (1-2) 2016
2016	International Politics V. 53 (1-4) 2016
2016	International Journal V. 71 (1-2) 2016
2016	<u>International Political Science Abstract V. 66 (1-2) 2016</u>
2016	International Affairs V. 92 (1-3) 2016
2016	Ethics and International Affairs V.30 (1-2) 2016
2016	European Journal of International Relations V.22 (1-2) 2016
2016	British Journal of Politics and International Relations V.18 (1-2) 2016
2016	Daedalus (Winter, Spring 2016)

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This also takes the user to the acquisition records being done in Koha software. The journals which are being subscribed online, will take the user to the publisher's website to download the text. This was an innovative service which we have introduced for present and future use with availability of their hard copies in the library without any issue of copyright for producing photocopy or scanned copies to the users.

3.4 Digitisation of Contents Pages of Books

As done in the case of journals, we thought of digitisation of contents pages of books too with the facility of free text search of these pages. We had experienced over the years that assigning subject headings/ keywords is a difficult professional job which needs subject as well as professional competence which most of the libraries don't have. Standard tools being used may not fulfil the requirement. If survey of the catalogues are done, we may find that most of the subject headings/ keywords are not sought which have taken a lot of time of the professionals. In such a situation, we thought of indexing the contents pages of books as part of the online catalogue. While browsing the catalogue, it ensures the users the relevance of the book which a simple catalogue entry may not give. This is more useful in case of an edited volume having different chapters by different authors which remain undescribed and unsought in our catalogue. This is being done in the Koha environment. Though scanned pages require cropping and editing for better presentation in the catalogue entry is time consuming but ultimately is going to be cost effective from the users' point of view. Some of the contents pages of the books are also available to download and from online catalogues of other libraries. We thought that providing multiple access points with authors' vocabulary will be more useful to the users and limit assigning subject headings/keywords to broad categories only. The specimen of the entry is given below:

Poverty impact analysis :

- **Published by:** Asian Development Bank (Mandaluyong City, Metro Manila, Philippines)
- **Description:** xxxiii, 412 p. 23 cm
- **MARC Preview:** Show

- **ISBN:**
 - 9715616283
 - 9789715616287
- **Subjects:**
 - Poverty -- Research
- **Copyright:** 2007
- **Lists that include this title:**

Holdings Descriptions Acquisition details Images

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3.5 Repackaging of Open Access Resources

We have planned enriching our E-resources by selecting relevant open access resources and adding them to our repository. Also we are developing a digital database on *Himalayan Studies* which will be useful to the region and also to our neighbouring countries. This will cover already digitally born resources and creation from printed resources into digital.

4 Conclusion

These were some of the experiments made with digitisation in action. The main hurdle and obstruction in digitisation is copyright restrictions. Institutional Repository cannot be developed unless copyright restrictions are relaxed. Getting pre-print copies from the faculty members as suggested by some authors seems to be impractical. Taking permission from the publishers to host institutional publications in the institutional repository may work which may fall under on fair use. The request to the publishers can be initiated either from the authors or the institutions. Publishers may oblige in lieu of the subscription of some of the journals by the institution. The paradox is that authors write the scientific papers at the cost of their own institutions and their own intellectual efforts, get them published without getting any economic benefit for their work. The beneficiaries are the publishers, not the society and the community as expected in the present knowledge society. Even when authors themselves need to download their own publications they are asked to pay for the same or shall have to request the publisher to oblige them by sending their own copy of publication. In fact publications of institutions should be covered under public funded projects as institutions are directly or indirectly supporting their research and publications. Due to copyright restrictions, the projects of building IRs could not succeed. This control over the flow of information and social interaction is crucial to the society (Maxwell and McCain, 1997: 156-57). Authors further recommend free use of copyrighted works by the students. China has rightly amended their copyright law under which authors enjoy the exclusive right to transmit their works through information networks (Feng, 2002). The Indian copyright law enacted during the pre-digital age does not take the knowledge society into consideration, hence is not compatible with the present digital environment. If the maximum material falls under copyright restriction then the question is what to digitise, the remaining material outside the copyright may not be useful and cost effective. The initiative taken by Google to digitise the whole collection of five important American academic libraries was a significant step, though Google had to fight a

legal case to resolve the issue. Another initiative was taken by Harvard University not to publish with the publishers as a protest against high subscription of journals and resolve to archive their contributions in their own repository. In view of all these issues relating to digitisation, a balance needs to be struck, protecting the interests of all stakeholders – publishers, authors and the users, finally the knowledge society.

We also observe that more and more works are coming into digital format, some priced and some as open source. Publishers' E-books packages are not affordable to all libraries, subscription of journals are equally costly. Repackaging from open sources though useful, needs efforts and time. Professionals have to pursue their work in the field of digitisation in view of the needs and aspirations of present-day information users. Libraries have to deal with both printed as well as digital resources which have multiplied professional responsibilities. Creation, organisation, maintenance and preservation of digital resources are more complex than printed ones which requires more competence and IT skill. Challenges are many with more opportunities to use technology to improve and enhance services.

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