CHAPTER I
INTRODUCTION

1.1. Background

The invention of paper in 105 AD in China by Cai Lun and printing machine in 15th Century in Europe, were the initial factors that changed the status and fate of the libraries worldwide. Since then libraries have seen the technology growth in all their aspects, i.e., collection, process and services. Collection-wise it has grown over the time from clay tablets, to papyrus rolls, to paper, and now to electronic documents. Even the process of preparation of library records have changed from hand written records using ink pen, to type writers and now to computers. Further, services of a librarian have changed from guardian of documents, to circulator of documents, to information provider and now he is regarded as knowledge manager. The technological changes have been affecting almost every type of library including public, academic and special. A computer with the Internet access has become a very basic necessity of any type of library.

The major changes for libraries came in 1876 when several developments took place together. These developments were the publication of 1st edition of Dewey Decimal Classification, creation of Cutter’s Rules for Dictionary Catalogue, and formation of American Library Association; since then a series of developments and new innovations were noticed in the field of library and information science. Williams (2002) notices the introduction of technology to automate library functions entered in the libraries with the use of punch cards for the library circulation and acquisition during 1930s extending to 1960s.
1.2. **Genesis of library automation**

It was World War II that staged the development of libraries throughout the globe. Libraries had huge collection gaps created by World War II (Rayward, 2002). The libraries, after the World War II, were under huge pressure of acquisition and quick technical processing of it. The existing library technologies were proving inadequate and incapable to bear this pressure. During this time library professionals got attracted towards the new emerging technologies that could boost up the work. But the libraries at that time were not able to manage immediate transition towards implementation of new technologies. Rayward observes the situation as;

> When existing library technologies began to break down under economic, social and bibliographical pressures emerging in the late 1950s and early 1960s and library began seeking relief in automation, the introduction of automation involved profound misunderstanding between librarians and early systems developers about the nature of the professional knowledge and tradition of librarianship on one hand and of the capabilities of the new technology and what was required for implementation on the other. (Rayward, 2002, p. 6).

However, various projects on Library automation were initiated around the world. According to a survey carried out by Library Automation Research and Consulting (LARC), there were about 2,000 library automation projects in all types of libraries by 1968 and another 20,000 library automation projects were underway in the world by 1973 (Patrinostro, 1974).

American and British libraries began experiments with computers in 1950s and 1960s that quickly spread to other countries of Europe. No innovation or development, according to Rayward (2002), in the field of library profession, after that, was simple or straightforward. Every development had gone through extensive literature studies and efforts of library and technical professionals.
Bush (1945) may be the first scientist to thing about an Integrated Library Management Software. In his article "As we may think" he talked about a device that can control circulation, cataloguing and indexing of the books of a library. He observed:

A library of a million volumes could be compressed into one end of a desk. If the human race has produced since the invention of movable type a total record, in the form of magazines, newspapers, books, tracts, advertising blurbs, correspondence, having a volume corresponding to a billion books, the whole affair, assembled and compressed, could be huddled off in a moving van. Mere compression, of course, is not enough; one needs not only to make and store a record but also be able to consult it, and this aspect of the matter comes later. Even the modern great library is not generally consulted; it is nibbled at by a few. (Bush, 1945, p. 2).

And later in the same he suggests:

Consider a future device for individual use, which is a sort of mechanized private file and library. It needs a name, and, to coin one at random, "memex" will do. A memex is a device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory. (Bush, 1945, p. 6)

His concept of ‘memex’ had straight away shown a way for ‘hypertext research’ of Ted Nelson. Ideas of Bush realized firstly in Massachusetts Institute of Technology (MIT) in the form of COMIT which was developed by Victor Yngve and others in 1957 (Yngve, 1958). COMIT was a programming language to manage linguistic computation that enabled a programmer to retrieve a particular string of information. After this, a series of innovations for the automation were taken place. The librarians moved towards new vision and ideas for the use of technologies for the advancement of library systems. This move led to an explosion of the experiments for computerization of library functions during 1960s and 70s.

It was the third generation of computer applications which marked a significant invention by Jack Kilby of Texas Instruments in 1958. The invention was integrated circuit. It replaced transistors of second generation and it was able to pack a huge number of transistors into a single chip of silicon. By the end of this generation instead of punched cards, librarians and other technical professionals interacted with third generation computer, through keyboards
and monitor and interfaced with operating system (ITL Education Solutions Limited, 2006). The development of computers during 1958 guided Hans Peter Luhn of IBM to generate a computer based keyword index for the articles appearing in Chemical Abstracts. This keyword index known as Keyword in Context (KWIC) was found very comfortable for the computers as it was inexpensive and presented several access points (Cornog, 1983).

In 1960s another instance of computer use for cataloguing appeared when Library of Congress used Machine Readable Catalogue (MARC) for the production of standard computerized cataloguing cards. Technologies in this area flourished rapidly to take the developments from MARC to MARC II by the end of 1968. The MARC was designed with the help of ‘fields’ and ‘tags’ consisting of three digit numbers from 001 to 999 for each bibliographic details of the document. Allocating bibliographic details to these tags is called ‘tagging’, i.e., Title, Author, Publisher, ISBN No. and so on. MARC II became well known among libraries in the US resulting in NISO (National Information Standards Organisation) accepting it as a standard format for bibliographic records in 1973 (Wedgeworth, 1993). 1960s also marked the establishment of Ohio College Library Centre1 (OCLC) in 1967. With the help of OCLC, University of Ohio became the first university of the world to do online cataloguing as early in 1971 (OCLC, 2010; Jorden, 2006). Membership of OCLC in its initial years was open for only academic libraries especially college libraries but with an amendment in OCLC Articles of Incorporation on May 17, 1972 non-academic libraries were also permitted to join OCLC (Grosch, 1995). This step of OCLC opened the door to widening the new-born OCLC online system towards cooperative agreements with many regional library networks outside Ohio; by 1975, OCLC had grown up with over 500 participating

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1Now Online Computer Library Center
libraries. The number further extended to above 2000 academic, research, public and special libraries by the end of 1970s.

On the other hand MARC Project boomed up and spread a revolution of computerized library cataloguing in the US followed by the development of national MARC projects by the various national agencies in countries worldwide. UK MARC in the UK and similar projects in several countries mushroomed and by 1986, about 19 countries reported existence of national MARC service and another 25 were in progress (Wedgeworth, 1993). However, it was still not clear that how exchange of bibliographical data could cross the national boundaries. Later initiatives from IFLA (International Federation of Library Associations and Institutions) to develop UNIMARC (Universal Machine Readable Catalogue) made it possible to share standardized bibliographic data globally.

1.3. ARPANET, Internet and Emergence of Online Databases

In 1959 engineers of the US Department of Defence, came together and formed Advanced Research Project Agency (ARPA). The objective of this team was to develop a network that can be used for peer to peer communication in Department of Defence. Department of Defence did not approve the use of this approach, but this research of ARPA provided a strong basis for the Internet. After failing to get its project get approved at Department of Defence, ARPA Connected computers of four Universities of the US, i.e., University of California at Los Angeles, the University of California at Santa Barbara, Stanford Research Institute, and the University of Utah to form ARPANET in 1969. By 1971 the number raised to 13 Nodes with 30 different university sites funded by the ARPA (Cerf, 1993). Within next two years the Global Networks become a reality when University College of London and Royal Radar Establishment, Norway connected to ARPANET (Crotec, 2000, Kirstein, 1988, Zakon, 2010; Baldauf & Stair, 2009). University of California later used this network to
develop an Online Public Access Catalogue named Melvyl\(^2\). The subsequent development of a number of protocols, i.e., TCP/IP, FTP, Gopher, Telnet, etc. and many other networks such as CSNET\(^3\), MILNET\(^4\), BITNET\(^5\), and EDUCOM led to the birth of the Internet.

Development in networks also realized the dream of Michael Hart to provide books free of cost to the public when he started a project in 1971 known as Project Gutenberg. Project Gutenberg has the credit of being world’s ‘1st virtual library’\(^6\) and online full text database of books. Success of Project Gutenberg, invention of microcomputers and storage devices, and unprecedented growth of the Internet provided a new way of information dissemination through online databases. DIALOG was the most popular commercial database to search reference and bibliographical information for scientific and technical information.

1.4. Evolution of Digital Divide

Research in automation of library functions was marked mainly in four countries, i.e., United States of America, United Kingdom, Australia and Canada. A few universities and institutions played pioneering role in library automation. In the US it was University of

\(^2\)Melvyl was started in University of California as a library automation system for circulation in 1977. It was available online in 1980.

\(^3\)Computer and Science Network, a huge data communication network for institutions doing research network in computer applications.

\(^4\)Military Network, a network came into existence due to split of ARPANET in 1983. This network was used for unclassified military production applications.

\(^5\)Because It's Time Network, managed by Educom. It was mainly spread into universities in many countries. It was invented in 1981.

\(^6\)A comprehensive account of Project Gutenberg is given by Marie Lebert in her article, *Project Gutenberg, from 1971 to 2005*, at http://www.etudes-franceises.net/dossiers/gutenberg_eng.htm
California, Library of Congress, Ohio State University, and Online Computer Library Centre (Tedd, 1994; Rayward, 2002), University of Newcastle and University of Bath in UK (Line, 2006), University of Guelph and University of Waterloo in Canada (Tedd, 1994) and University of Adelaide in Australia (Tedd, 1994). Later similar research extended to few more universities of these countries. The early automation systems include University of California’s Melvyl, Geac’s ADVANCE, Dynix and BLCMP’s BLS, IME’s TINlib, Ohio State University’s Library Computer System.

The continuous developments in library computerisation led the libraries of developed countries far ahead to that of libraries in Asia, Africa, Latin America and many other developing and under developed countries. The term ‘Digital Divide’ became prominent in 1990s when the differences between the various fields, i.e., education, commerce and Industry of the countries with IT power and without IT power was clearly visible. The libraries were not exempted from this.

The term digital divide may be “perceived to be the gap between those people who have access to the latest information and communications technologies and those who cannot” (Murelli, 2002). According to Pippa Norris (2001, p. 2) the digital divide is understood to be the difference between “Those who do and those who do not, use the panoply of digital resources to engage, mobilize, and participate in public life.”

The digital divide was observed largely in three aspects; first, availability of technology; second, availability to finance to acquire the technology and third, availability of skills to make use of the technology. After the birth of the Internet, its growth was limited for the first 20 years but as soon as World Wide Web came into existence in 1989 and web browsers were developed, it became a boom and developed rapidly.
On the one side where computerization of libraries was started in developed countries, i.e., USA, UK, Australia, Canada, France, Germany, etc. in 1950s and 60s, the other developing and under developed countries could apply these technologies only after 1980s. India reported use of computers in libraries in 1965 in INSDOC, and Bangladesh in 1996. In Africa, Nigerian special libraries initiated the implementation of technologies and played the pioneering role for computerisation of libraries.

1.5. Development of Open Source Software and Open Access Resources

In 1985 UNESCO developed a software called CDS/ISIS (Computerized Documentation System - Integrated Set for Information Systems) to develop in-house databases of local collection. It was distributed free of cost to the libraries worldwide. Since then libraries in developing and under developed countries started their interest in automating library functions. CDS/ISIS was primarily an information storage and retrieval system used for storing and retrieving bibliographical details of library resources.

In 1985 Richard Stallman established Free Software Foundation (FSF) with an objective to promote universal freedom to create, distribute and modify computer software applications. Additionally it was established to generate and use funds for GNU project (A project that marked the beginning of free software movement), started by Stallman in 1983. The head office of FSF is in Massachusetts, USA.

The philosophy of GNU project and FSF was not only to provide free access to software but to provide software in such a manner in which users can run the software, access the source code, modify the source code for its improvement and redistribute it to others. The authors of the software applied General Public License (GPL) to their software. A major success came to GNU Project in 1991 when it, with the help of Linus Torvalds, could develop completely
free software for operating system known as Linux. Since then a number of initiatives have been taken towards the development of free software. Today we can find free software for any operating system as well as for any purpose. The field of library and information science is no exception.

In 1998, Eric S. Raymond and Bruce Perens formed Open Source Initiative (OSI) with a hope to remove the ambiguity of the individuals who perceived “free software” as anti-commercial. The aim of OSI was to bring software business into open source in which they could get remarkable success. The concept of Open Source Software is explained in details in Chapter 5.


As far as open access is concerned, free access to literature was all along there even in ancient times when there were no legal restrictions in having access to literature. But with the invention in printing technologies, price factor started to be involved in accessing knowledge. Slowly and gradually, accessibility to available literature, especially research literature, turned costly to costlier. With the establishment of Educational Research Information Centre (ERIC) in 1966 one may see the development of open access movement though the
footmarks of open access were felt so early when a number of inventors did not patent their inventions and kept them under public domain, i.e., open access.

With the growth of the Internet and World Wide Web the distance between the countries across the world became narrower. The concept of resource sharing is realized in true sense. In last few years most of the countries of the world could afford access to computers and other information technology. The cost of the Internet and Computers has reduced to such an extent that any library can easily adopt it with minimum finance. Additionally, increase in ICT education and professional trainings by software vendors have reduced the skills barriers to operate the modern software. However, on the other hand these developments also increased the perception in people that these technologies are going to result in differences in development opportunities to people, and that a gap will be developed between those who can access these technologies and those who cannot. This is due to the financial constraints which is still a concern for libraries to acquire costly software and online databases to provide high-tech services to their users.

1.6. Statement of the Problem

A continuous salient role of ICT in libraries is an indisputable reality. A number of articles over several decennia have emphasized the technological transformation in libraries. Information services are strengthened due to advancement in Internet, e-resources and computer software. Almost all library functions, i.e., acquisition, processing, maintenance and dissemination have been affected by technological changes. In this way one can say that the penetration of ICT in the profession of library and information science is deep rooting. It can be easily seen that the ICT based ‘automated libraries’ are also growing with ‘traditional libraries’. At the same time several problems are also arising due to the widening gap between the traditional libraries and modern ICT based libraries. Once, Florence Nightingale,
pioneer of modern nursing, said that “The progressive world is necessarily divided into two classes — those who take the best of what there is and enjoy it — those who wish for something better and try to create it” (Wikiquote, 2009). In the preview of this quote of Nightingale, the whole universe is divided into two divisions. Earth as Land and Water, human beings as men and women, morals as right and wrong and the society again is divided into two categories, i.e., Capitalist and Non-Capitalist. In this way libraries are also divided into two divisions, i.e., rich and poor, in other words libraries which can afford new technologies and libraries which cannot afford such technologies. This division has given birth to the concepts of ‘Techno-capitalism’ and ‘Digital divide’ which are getting very important and assert a debatable place among library professionals. Earlier every library had been providing almost similar services with the limited available resources. The major difference that could be found between these libraries was regarding their collections only. But in the technological era this difference is touching quality of service also. Organisations with a healthy budget provide attractive services with the help of new emerging library management software, digital library software, e-content management software, client server technologies and online literature/databases to their users in their libraries. All these software and databases are very costly, so the organisations with poor economic condition cannot afford it and still carry on with traditional circulation services that lead to a big gap between these libraries and modern IT based libraries. Use of ICT is directly affecting the popularity of the libraries especially public and academic libraries in developing countries like India. It may not require a great research to evaluate the differences in quality of public libraries between libraries of developing and that of developed nations. Lack of ICT results into insufficient services to the users, hence the library professionals of these libraries feel backward in comparison to the others. This technological difference has given rise to this new concept of ‘Digital divide’. This term is widely used in describing the difference between
libraries which have and which do not have access to the Info-technologies either due to technical expertise or financial resources. However the latter is the major cause in the present arena.

However, it is only present technology that can provide a solution to this problem. In this world where capitalists are leading, there is a small segment that does not believe in the capitalistic view and are following Marxist ideology. They believe that an opportunity to grow should be available to all regardless of their status, caste, creed, colour etc. These groups believe in open access and open source and they are awakening the world about open source and open access.

If we refer the research articles published on these topics we find number of such writings. But most of these deal with one or two software or a few databases which are available in the public domain. However, there is a lack of literature discussing in full the open source movement and open access movement from a librarian’s point of view. This study attempts to fill in this information gap.

Thus, this research titled ‘Open source software and open access resources for enhancing library services: An exploratory study’ will study open source software and open access resources available on the Web. This research is an effort to change the mind of those who believe that Internet based services can be available only to the affluent libraries. This proposed research work will be an intervention between the modern ICT based libraries, and the traditional libraries which are lagging behind due to financial condition or due to the lack of information about the open source software and open access resources.

1.7. Research questions

The present study would attempt to answer the following questions.
• How open source software movement originated, developed and succeeded?
• How many important open source software projects are there for libraries?
• Which open source software would be the best for library automation?
• Which open source software would be the best for development of a digital library?
• How open access movement started and developed and has impacted the library and information services?
• Are there enough English language open access e-Journals from various subjects to enrich a library’s collection?

1.8. Objectives of the study

The objectives of this study are:

• To analyse the Open Source Software Movement from its birth to present status from a librarian’s point of view.
• To analyse the features of open source software for library automation and development of a digital library.
• To construct a model of optimum open source software for a library
• To analyse the Open Access Movement, its development and its impact on Library and Information Services.
• To identify and collect various English language Open Access e-Journals from different subjects.

1.9. Significance of the study

This research would help the libraries with no finance or with limited financial resources. Libraries that are not able to buy expensive commercial library management software, digitization software and scholarly databases, through this study, would become aware of the
open source software and open access literature that can be helpful to get their work done without huge financial resources. Additionally, this research will help them to come out of the dilemma of selection of a proper Integra:ed Library Management Software (ILMS) and other open source software out of a number of available open source software. The exemplary database of English language scholarly journals, which is provided in Appendix A of this research report, will strengthen any type of library in respect of its digital collection.

Many libraries in developing countries like India do not have sufficient resources to deliver modern Information Technology (IT) based services as effectively as delivered by those in developed countries. This inequality threatens the fundamental laws of library science. In fact it is not possible to minimise and remove the inequalities and get modern sophisticated technology for all libraries but with the help of open source software and open access resources. The present research addresses this issue head-on.

1.10. Scope of the Study

The scope of this study is delimited to open source software and open access resources. This study is a descriptive study that does not collect the data through any questionnaire or interview. The study carries out descriptive analysis of open access movement and open source movement. Moreover, the software which are freely available on the Internet but are not open source do not come under the purview of this study. In this study, no attempt is made to evaluate any open source software through primary sources of data collection. However, secondary sources of information are used to assess the open source software. The study also aims to draw an optimum model of open source software for libraries that they can use successfully and rely on.
1.11. Limitation of the Study

In the present study the researcher could not touch Web 2.0 tools that are freely available on the Internet due to their volatile nature and complexities. In addition to that, in listing open access journals, researcher has used only English language open access journals, however, open access journals in a number of languages are available.

1.12. Structure of the research report

The present work is planned under 8 chapters, which are briefly discussed below.

Chapter 1: Introduction

This chapter briefly discusses the introduction of computer applications in libraries. The researcher has tried to emboss the level of struggle in implementing technologies into the libraries. Additionally this chapter defines the statement of the problem. Objectives of the study are also stated in this chapter. The significance, scope and limitations of the study has been mentioned and the plan of study report has been formulated.

Chapter 2: Related Literature: An overview

To understand the problem and critical aspect of the subject a number of studies and research literature are needed to be referred. Hence this chapter on related literature is one of the very important chapters of the study. This chapter includes an overview of the work done on open access and open source since the beginning of the concept.

Chapter 3: Research Design and Methods Used in the Study

This chapter describes the research design used in the present study. Moreover, the methods used for the present study has been explained in detail.

Chapter 4: Open Source Movement: An Analysis
This chapter discusses the open source software movement. This movement was started as a general movement and entered in the field of library and information science in late 1990s. It faced many dissenting voices and doubts of its success in library fields as people in library and information science were not computer experts and may not programme the codes for library software. However, the time proved such doubts as wrong. This chapter discusses this story that revolutionised the information services in libraries.

Chapter 5: Open Source Software for Libraries

This chapter deals with the technical features of the prominent open source software for libraries. Researcher has selected software from various categories such as library management software, digital library software, etc. which are used extensively in libraries. This chapter also presents evaluation of software based on the existing studies.

Chapter 6: Optimum Open Source Software for a Library: A Model

This chapter fulfils the last objective of the study. The researcher has identified and explained an optimum open source software model for a library. This model is suggested keeping in mind the libraries of India that are having inadequate finances and technical expertise. The researcher has also given the reasons and justifications for suggesting this particular model.

Chapter 7: Open Access Movement: An Analysis

This chapter deals with the concept of open access in detail from the librarian’s point of view. This chapter fulfils the first objective of the study. This chapter enunciates the analytical chronology of the open access movement under various headings. The researcher has found that the open access movement has been put forward as a strong opposition to subscription based scholarly journals and is very helpful to the libraries to deliver excellent information services to the users.
Chapter 8: Conclusions and Suggestions

This chapter presents and highlights the conclusions emerging from the findings derived from the analysis in previous chapters. On the basis of derived conclusions researcher has drawn some suggestions to make the open access movement and open source movement more powerful and effective in the coming years.

References


