CHAPTER – 3
INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

3.1 Introduction
We are in the information age. Our society is moving through a ‘cyber’ culture. Twenty first century has emerged as an existing period of transition and a change. It has become the potent force in transforming social, economic and political environment globally. Presently we are living in ICT world. Today ICT world is concerned with creating sharing and using information electronic / digital form. The right information available to the right person at the right is the aim of the modern libraries. Information and Communication Technology has almost converted the world into a global village. The revolution in the IT sector is influencing the information industry also. Libraries are also changing to meet the demand put on them. The new generation whose demand for information is never met and is always demanding that traditional libraries should be developed as a well equipped and interconnected as ICT-based libraries.

The impact of ICT is enormous and global in its magnitude, pervasiveness and usefulness because of its most distinguishing features of dramatic decrease in cost, size and tremendous increase in processing speed, storage and communication capabilities. ICT has profound effect on the progress and development of human civilization. The tools used in ICT include computer programs, databases, communication networks, analysis and design methods programming languages, artificial intelligence, knowledge bases, etc. ICT has long standing influence in almost all areas of human activity.

3.2 Definition ICT
According to Mahaptra and Ramesh
ICT, as “Information Communication Technology is the result of the technological convergence of existing single isolated technologies viz, computer technology, communication technology, information processing, publishing technology etc.”

3.3 Characteristics of ICT
There are many special characteristics of ICT application. Some special characteristics are as follows:
Effectiveness:
- Most interactive
- Fewer errors
- Customized
- Personalized
- Achievable
- Transparent
- Searchable
- Acceptable

Efficiency:
- Faster
- Cheaper
- Fewer steps
- Lower costs
- Less people
- Less paper work

Innovation:
- New product
- New technologies

3.4 Need of ICT

The emerging trends of Information Communication Technology (ICT) and its application explore the opportunity to make more efficient the functions and services of Libraries. This paradigm changes have not only specified new exploratory and innovations thoughts of managing the functions and services of Libraries but also create a unprecedented challenging environment for professionals and information officers to fulfill the astounding information desire of users and also to manage the unimaginable exploration of electronic information. Electronic Information becoming a challenging issue for information professionals and practitioner because most of the Libraries are now moving towards automation or the partial/complete digitization without giving due consideration to the post technology deployment, services and other management issue. ICT in Libraries have made easier production; storage, access and easy dissemination of electronic information. Consequently, the user is becoming more demanding in terms of availability of specific, measurable, accurate and timely information. The Libraries
have found it very difficult to acquire, arrange, process and disseminate information in traditional ways. So, Librarians are compelled to plan, organize and communicate the huge information communication technologies. Electronic information resources are available in static physical forms such as CD-ROMS, floppies or in a fluid form like the Internet Technology has made it possible to collate information from various source points and package it to be accessible from a single source point, while delivering it to the user. Changed concept of a library is mixed – media library. For this, libraries need to be equipped with multimedia technological aids to elicit code, store, retrieve and disseminate information.

3.5 Functions and benefits of ICT based library system

Traditionally, computers in libraries have been used and in most cases are still being used to automate the following functions.

- Acquisition and budget;
- Cataloguing and short loans;
- Circulation;
- Serial control (Periodicals);
- Provision of access to online catalogue.

Since the 1950s, use of ICT in libraries has basically gone through four stages, corresponding to the major reasons of automating.

- Improving the efficiency of internal operations.
- Improving access to local library resources.
- Providing access to resources outside the library.
- Interoperability of information systems

ICT is used in various fields of library activities. Some of the areas where new technologies can perfectly be used are as follows:

A. Acquisition:
- Acquisition/ Accession list;
- Order file/report

B. Serial management:
• Serial check-in/out and claiming;
• Union/holding list.

C. Cataloguing/Classification:
• Catalogue card/label production;
• Retrospective conversion;
• On-line catalogue.

D. Circulation:
• Issuing;
• Inter library loan;
• Reservations;
• Over dues.

E. Audio Visual Management:
• AV acquisition/cataloging.

F. Management:
• Accounting/budgeting;
• Word processing/mailing;
• Scheduling/planning;
• Statistics/report.

G. Information storage/retrieval:
• Database construction;
• Online database searching;
• Downloading/uploading;
• Indexing and abstracting.

H. Reference/information services:
• Bibliographic listings;
• Library instructions;
• Public access/computer literacy.

3.6 Impact of ICT

3.6.1 Impact of ICT on Library and Information Services
Libraries are experiencing a significant impact of Information Technology (IT) on information processing, sources and services. Rapid technologies developments enabled libraries not only to improve the quality of existing services but also of offer a wide range of new services to users. Today, Libraries have wide range of opportunities and variety of challenges offered by the rapid development and wide application of Information Communication Technology (ICT). ICT has become integral part of all library operations and information services. This movement of using ICT in libraries has dramatically changed the ways by which data acquisition, processing and access has been carried out and the libraries have provided information services. As this technology provides librarians with new choices, new opportunities and new challenges, there has been a phenomenal progress in use of ICT applications in library operations and information services in the developed countries of world. ICT usage in Indian Libraries has also gained considerable momentum in recent years, which is going to increase at much faster rate in future.

### 3.6.2 Impact of ICT on Society
Developments in ICT have brought about the merger of the computing, information, Communications, entertainment, and mass media industries thereby providing a means of exchanging information anytime, anywhere in the digital format used by computers. This technological convergence has brought about an enormous impact on the way we live, work, think and play. These changes are quite prevalent in our everyday lives such as the use of e-mail and cellular phones at home and in the workplace and also linked to all facets of society: business, education, military, recreation, transportation, communication, scientific exploration, knowledge management, etc.

### 3.6.3 Impact of ICT to Change the Scenario of Academic/College Libraries
ICT has changed the nature of academic/college libraries. A variety of terms such as hybrid, digital and virtual library are used to refer to the academic library. A digital library can be defined as a “Managed collection of information with associated services where the information is stored in digital format and accessible over a network”. The virtual library has been defined as “Remote access to the content and services of libraries and other information resources, combining an on-site collection of current heavily used materials both print and in electronic form with an electronic network which provides access to and deliver from external world wide library and commercial
information and Knowledge sources. Hybrid libraries are libraries that provide access to both electronic resources and paper based resources”. From the definitions it is clear that most of today’s academic/college libraries fall in hybrid category. The internet has made information access and retrieval both simple and complex. Information retrieval systems are being designed to suit the need of end users and therefore try to simplify the process. Simultaneously however the user is overwhelmed with so much information resources and choices that the process become complex.

3.6.4 Impact of ICT on the Library / Information Centers
- ICT made information creation in digital format possible.
- ICT made online access and file transfer possible
- ICT made networking and sharing of information resources possible.

The shift from print to digital information has a high impact on libraries, information centers and other institutions directly involved in processing information. This shift is generally attributed to the merging of computing, telecommunications technologies and other industries. Computers have permeated society because of their ability to perform high volume error-free repetitive tasks at speeds much faster than human beings, while recent and emerging developments in the area of computing; telecommunications, networking and resource sharing made access to information anytime, anywhere possible.

3.6.5 Impact of Digital Information Materials on Libraries
- Digital information can be sent in multiple copies simultaneously over information networks in fractions of a minute or even of a second. There is no need for users with PCs attached to the network to physically go to the library. They can access information via their PCs.
- Digital information can be cut/copied and pasted from one document into another
- Digital information may be free or cheaper than print equivalents
- Digital information often modifies librarians’ roles in various ways.

3.6.6 Impact of ICT on Collection Management
In this age of information explosion electronic resources has made collection management a very complex and challenging task. There is budgetary constraint, numerous formats, ever changing user needs. Collection management implies
involvement in tasks such as analysis of needs, negotiation of contracts and evaluation of resources.

**Electronic resources**

ICT has fundamentally changed academic/college library collections. Forever gone is the era when academic library’s physical collection determined its stature. In the modern networked technological era the emphasis is shifted from ownership of physical resources to access to electronic resources that are globally accessible.

**E-Journals**

The e-journal can be defined as a version of the traditional print or paper based journal which is disseminated electronically in some form or other directly to the user. Since it’s inception in 1665 the printed journal remained the primary vehicle for communication among academics and researchers but there had been major increases in the cost of journal subscription during the last decades. Between 1986 and 1996 the average increase per journal subscription had been 147%. The advent of the internet transformed publishing radically made it possible to publish cheaply. Internet also made access universally available.

**E-Books**

E-Books are essentially published books and reference materials that were digitized and are distributed electronically. From library point of view e-books are cost saving in terms of shelving, binding, circulation, overdue notices and management of fines. Other advantages are on-line availability, key word searching capability, etc.

### 3.6.7 Impact on Users

Academic/College library staff has a good understanding of the tremendous value of printed and electronic resources available to students at academic libraries. Users do not necessarily the insight. New generation library users have a preference for electronic resources rather than print resources. They want

- All resources should be available in full text and printable
- The library service should be fast and easily accessible
- 24 × 7 hours availability of library services
  All library transaction should be online

**Effects of these developments on the user community**

- Increases the level of technology literacy
- Increases demand for better and faster access to information
• Aggravates discrepancies between the information rich and information poor.
Exposed to different applications of technology in their life, users nowadays are more
adept at its use and are expecting to have access to it in their times of need. In libraries,
users that are knowledgeable in using computers and the Internet for their research
demand nothing less than a computer with Internet access. However, this may not be
true and not applicable to those who have no access to such technologies due to
financial difficulties. Thus, two different kinds of users have emerged that libraries
must cater for: the "haves" and "have-nots". Ideally a balance must be maintained in
providing services for both groups so that all users will have equal access to
information. This can be effectively done through the use of powerful and appropriate
technologies.

3.7 Benefits of Using ICT in Libraries
The benefits of using ICT in Libraries / Library and Information Centers may be
consolidated as:
• Improved efficiency of library operations,
• Improved quality of existing services,
• Introduced new services,
• Improved Collection Development,
• Improved accuracy and control,
• Increased ability to share resources,
• Improved image,
• Improved management information,
• Eliminate duplication of efforts,
• Rapid and effective communication,
• Perform tasks not possible by the manual system,
• Improved uniformity and standardization,
• Improved users satisfaction,
• Facilitate effective utilization of funds, and
• Facilitate to market library services.
3.8 Use of ICT Tools

The emergence of the information revolution as championed by information and communication technology (ICT) has enabled libraries to devise viable strategies for improved service delivery (Igwe, 2010). Library uses various technologies to provide information to its users. Followings are the some of the ICT tools which are basically used for different communication purposes:

Communication Technology: Email is the most effective way of formal communication; it is the best system to exchange the messages and information in electronic format. Revolutionary changes have been seen in communication, because different types of information such as personal message, letter, article, computer programming files, pictures, sound, etc. are being possible to send or receive from any corner of the world within some fraction of second. At present, this is the most useful tool for different types of communication (personal, official communication, etc.). This tool can be used to provide the required information at the right time. At present, Libraries are using this live tool to serve the library users; through this, renewal or return (check-in) of library materials is basically asked. It can also be considered as a medium for faster information.

Voice mail is the new and innovative emergence of mail technology. We can also say it as an alternative to email technology. It helps to send the mail immediately through the voice.

Telephone is used for personal contact of the users. Generally, users ask their queries regarding the resources and availability of the reading room. Even, they use the telephone for advance booking of carrels for reading and research purpose.

Fax (short for facsimile and sometimes called telescoping) is described by Rouse (2006) as “the telephonic transmission of scanned-in printed material (text or images), usually to a telephone number associated with a printer or other output device. The original document is scanned with a fax machine, which treats the contents (text or images) as a single fixed graphic image converting it into a bitmap. In this digital form, the information is transmitted as electrical signals through the telephone system. The receiving fax machine reconverts the coded image and prints a paper copy of the document”. This technology helps us for providing Various services, such as to send official letter, communicate with the vendors, etc.
**Videoconferencing** (or video conference) is explained as a “means to conduct a conference between two or more participants at different sites by using computer networks to transmit audio and video data. For example, a point-to-point (two-person) video conferencing system works much like a video telephone. Each participant has a video camera, microphone, and speakers mounted on his or her computer. As the two participants speak to one another, their voices are carried over the network and delivered to the other's speakers, and whatever images appear in front of the video camera appear in a window on the other participant’s monitor (Beal, n.d.)”. This tool is used for various purposes of the library activities, such as to conduct user orientation for students available at remote places. Basically, when students are out of the campus and they study in other universities under the student exchange programme, that time, it is essential to use this technology to guide them about the use of resources.

**Internet**: This is the most important component of ICT. It is basically a network of networks that performs the connectivity among the computers. Internet provides the medium for communication using different online tools.

**Remote Control Technology**: Remote control provides a platform to work with a remotely located computer system. It is a great development in the field of technology. By using this technology, one can easily implement any kind of services sitting far away from the destination. This ICT is generally used for remote control, online meeting, desktop sharing, web conference and file transfer from one computer to others. One example of remote control software is Team Viewer.

**RemoteXs Technology**: Eclat Engineering Pvt. Ltd. (n.d.) defined Remote Xs as a “single-window Platform to access all subscribed e-resources anytime anywhere. It has an ability to provide secure access to scattered e-Resources of the institution, bringing them under one umbrella, along with subscribed e-Journals, eBooks, and all other e-Content. This technology has empowered institutions in systematically imbibing research values among faculty and students and take right steps in creating a knowledge-base of their own”. This technology is very much helpful, where students are outside the campus and wanted to use their institution’s resources for research and learning.

**Social Media**: Social media like Facebook, Twitter, Blogs, etc. have become the central focus for quickest information dissemination. Most of the libraries are using these social media for the promotion or marketing of their e-resources. Basically,
Blogs are used to disseminate short communication of library, whereas Face book has become most useful ICT tool for every kind of information dissemination. Now, face book live plays a very significant role for telecast the current ongoing programme

**Library Security:** The technology has a great contribution in the security of library through computer after having been civilized various technological processes. It can provide great security for the reading material of the library. This security arrangement is provided by applying RFID technique.

**RFID Technology:** New technology has changed the way of library transaction (check-in and check-out). Libraries are providing ICT-based library services to increase the possible ways of fast and user-friendly services. One of the best inventions of technology for library is the ‘Radio Frequency Identification’ (RFID). Nowadays, libraries are adopting RFID technology to provide enriched and efficient library services. This technology achieves the fourth law of library science, (i.e. ‘save the time of the users’) by providing quick and effective services (Ranganathan, 1931).

**Closed-Circuit Television (CCTV):** CCTV stands for Closed Circuit Television and also known as video surveillance (Kumar & Swenson, 2015). This technology plays an important role in the library management. Through the help of CCTV librarian can supervise the whole activities of libraries. It helps to look after the staffs as well as the users.

**Quick Response (QR) Code Technology:** Walsh (2009) has discussed as “QR codes can be used to encode various sorts of data when used for mobiles, most typically text; uniform resource locators (URLs); phone numbers (prompting your phone to call the number); text message and number (prompting your phone to text the number); and contact details (vcard). The QR readers most reliably work with the text and URL options, particularly as some of the providers of the software also provide hosting services. In hosted solutions, QR codes generated through their software link to a re-direction link on their site, providing data on traffic from a particular code to their customers”. Xu (2014) has described the method as “generating a single QR Code is simple. There are many free QR Code generators available online, such as Kaywa, Qrstuff, Goqr, Qurify, Delivr and Invx. Google offers two convenient tools to create an individual QR Code. Google URL Shortener allows one to shorten a long URL, and at the same time, it generates an accompanying QR Code for the shortened link. The accompanying QR Code can be downloaded by simply adding .qr at the end of the shortened link. Another tool is Google Chrome QR
Code extension, which enables a user to create a QR Code while visiting a Web site. Many online QR Code tools, like Qrstuff, allow batch creating QR Codes, but they usually require users to pay subscription fee. QR code is very simple to use; at present days, it is indispensable to use for quick retrieval of library materials.

**Digital Library:** The base of digital library is computer and computer network because the reading material cannot be processed in the digital material without the computer and even no published books can be modified to digital form. In digital libraries the entire reading material like PDF, HTML, Audio, video, and services etc. also depend on computer and network.

**Archiving, Preservation and Digital Repository:** It is a very difficult task in the libraries to preserve and archive manuscripts and ancient write ups and make those secure for future use. This work is being carried out with the help of computer, scanners and storage device, with the help of computer published writes ups can be modified to digital form and then can be stored in the form of computer hard disk and other media like CDROM, DVD etc.

Digital Repository software goals to provide a managed environment to store and retrieve digital objects, such as documents, images, audio/video clippings and their metadata. Repository software usually includes tools to allow curators and users to exploit the stored objects and their metadata. Variety kind of digital repositories are being created today to serve the different communities information needs. To create a digital repository one needs digital repository software (Sastry & Reddy, 2010). There is much software to build digital repositories like Dspace, Eprints, Greenstone, etc. Dspace is much popular among the institutional repository software because of its simple workflow and consistency. It provides a best platform to archive the digital content. User community can be benefited using the institutional repository for research and learning.

**Resource Sharing:** ICT can be used for resource sharing among libraries and information centers. It provides a great prospect for sharing both the human and material resources of a library with others library. The role of technology is very much significant for cooperative acquisition, cooperative processing (cataloguing and classification), exchange of information materials (e-resources), joint publication, networking, joint training of personnel, interchange of staff for seminars, and workshops (Igwe, 2010).
Use of Library Automation Software: Library automation is the excellent way of reducing the human involvement for library services. The aims of the current automation technology are to provide maximum services in minimum time and lowest cost. Library automation is the application of ICTs to library operations and services. Much library automation software are available for library operation such as Libsys, Koha, SLIM21, etc. The functions of the software are to automate the library systems which cover acquisition, cataloguing, circulation, serials management, stock verification, etc. ICT is used in various library housekeeping operations as well as for different library activities and services. The details uses of ICTs are as follows:

**Acquisition:** With the help of web, acquisition work has become very much simplified. Order placing, duplication checking, price checking etc. are done very effectively using ICT technique. Receiving suggestions or demands and placing the order for purchasing library materials have become easy through the online. As publishers and vendors are available through the website, such as Amazon, Flip kart, Infibeam, etc. the quantity of workload has reduced and due to this the time can be saved and make it applicable to the other services. Invoices can be downloaded from the Websites that make service faster and avoids postal delay. E-mail helps in sending reminders to the publishers, vendors and even to the borrowers of the books (Antherjanam & Sheeja, 2008).

**Cataloguing:** There has always been awareness among librarians that without cataloguing and classification, the goal of making materials and information resources available would have been difficult. The advent and use of ICT has made it possible for remote libraries to access the huge databases of big libraries in developed countries for the purpose of adopting or adapting their bibliographic data for their own library use; and indeed the online catalogues have transformed the landscape of cataloguing and classification (Adeleke & Olorunsola, 2010). With the help of Internet and different web-sources, the cataloguing and classification work has been stress-free. The organization like Library of Congress has made the work possible to classify or catalogue a resources in the minimal time. The LC online catalogue is a database of records representing the vast collection of materials held by the Library of Congress. The online catalogue provides cross-references, notes and circulation status, as well as information about library materials still in the acquisition stage. LC catalogue records’ information of different resources (books, serials, manuscripts, cartographic materials, computer files, sound recordings, music, etc.) are publicly available and it can be
easily used for importing or copying data. All the functions of cataloguing have become possible through the use of library automation software. Importing bibliographic records from trusted online sites such as ‘OCLC World Cat’, ‘Trove - National Library of Australia’ have reduced a huge amount of time for cataloguing. Importing metadata through MARC format has made easy to the process of cataloguing and makes it available as soon as possible to the users. Resources such as book, microfiche, audio, videocassettes, CDs, pamphlets, and theses etc. are catalogued through importing bibliographic records; required fields are edited manually as per the library requirement. Automation software gives update to the user about the progress of the library materials. After the processing of books or any requested materials, the automatic reminder is sent to the users about the availability of books.

**Classification:** With the technological development, the classification work has been possible through online tool. There are many online catalogue records available from where one can get the whole bibliographic record of the library resources. Along with the record, we can also get the classification number in the catalogue record. British Library catalogue, Trove-National Library of Australia’s catalogue, Library of Congress’s online catalogue can be used to search the catalogue record and data can be copied for own catalogue preparation. These libraries provide classification details in their catalogue record, but there are also some online resources where library resources/materials can be classified. OCLC classify, LOC classification web and Web Dewey are the examples of online classification tools.

**Serial Control:** Serials or periodicals are the backbone of the library. Automated serials management gives quickest information access about the particular resources. Below mentioned tasks can be accomplished through the software for serial control: Current holdings status, Tracing missing *volume and issue*, Preparation of budget for periodical subscription, Preparation of periodicals list and its verification, Online Letters to publishers, vendors, etc., Processing of online electronic magazines and receiving copies of the periodicals, Preparation of New arrivals.

**Circulation:** The use of electronic gadgets such as computer, barcode scanner and the library management software helps to perform circulation routine operations in an easiest and quickest way. After the invention of barcode technology, library transaction has become faster. Nowadays, for any type of communication we depends on the internet, email, telephone, etc. These technologies are also used in the library for the
day to day activities of the circulation. Basically, the following duties are performed in the circulation by using ICT: Issue, returns, overdue reminder, Renewal, Reservation of books/documents, Membership registration, User guides, Daily check-in and check-out statistics.

**Stock-taking/Verification:** The use of the computer in stock verification is the most important. The verification of the stock is carried out with the storage of library through the database in the computer. Stock available in the library is scanned through RFID reader/barcode scanner and data are collected. These collected data are compared with the available data in automation software. In this way, how many books have lost we can find out.

### 3.9 ICT and Library Services

The following library services can be rendered using information and communication technology (ICT):

- **On-Line Public Access Catalogue (OPAC):** ICT has revolutionized the practice of cataloguing in the library. Using OPAC users can see the holdings of the library collections. It reduces the cost of maintaining a library catalogue. It also eliminates pen and paperwork, along with it helps in the preparation of union-catalogue. OPAC is the easiest way to get the information of collection, weekly new arrivals and other recent addition to the libraries.

- **Reference/ ILL Service:** By using computer and internet technology, the reference service has become very simple. Various types of information resources like the encyclopedia, directories, dictionaries, databases, online library catalogues, maps, biographies, patents and online information resources are available on the internet which can be used to provide required information to the users.

In the reference section, queries are answered through the telephone. For ready reference service, library staff uses Internet and E-mail facility. The computer has provided a great promptness to reference section. The role of technology in reference services are as follows:

- Library staffs fulfill the demands of the users through various electronic resources like database, library catalogue database, directories etc.

- In reference service, services are also provided to the users regarding information available on the internet after getting delivered through the computer.
• **Reprographic Service:** Reprographic technology is used for the reproduction of the documents. Using technology, the photocopy and the reproduction of the documents has become very easy and accessible. In this technology, printed documents are converted into digital form, and then photocopy is prepared. For the same, computer scanner and software is required. This service is provided to library users for photocopy of some pages of books, journal articles or other materials.

• **Selective Dissemination of Information (SDI) Services:** Hensley (1963) stated “SDI involves the use of the computer to select from a flow of new documents, those of interest to each of a number of users. This process may be thought of as the inverse of information retrieval. In information retrieval, a user precipitates a search of a file of documents. In SDI a document precipitates the search of a standing file of user interests”. Through the computer, the profile and document of user are prepared and aligned. As per the need of the users or area of interest, various online databases, electronic resources and other materials are viewed and selected; finally required information is sent to library users.

• **Document Delivery Service:** It is difficult for the library to procure every type of resources published across the globe because of financial constraints. So, the exchange of library resources such as books, journals, etc. Among the libraries are very much essential. To overcome these problems computer and the internet have got a great contribution in DDS. Through this medium first document are converted into digital form after that these can be received at any place by users through electronic mail. Besides, the storage reading material like electronic periodicals, documents etc. can be disseminated to users on demand.

• **Bibliographic Service:** Through the computer, bibliographic services have become convenient. Nowadays, libraries and publishers are providing bibliographic service to the library users. Bibliographic software such as Endnote, RefWorks, Zotero and Mendely are very much helpful to compile the list of references for the research work.

• **Translation Service:** Mechanical translation is carried out with the help of ICT. For this purpose, various online tools like Bablefish translator and Google translator can be used to make translation from foreign languages to English and vice-versa.
- **Database Search Guide:** At present, databases have become the central focus for exploration of varieties of the research problem. Researchers are using databases hugely for their research work. Searching and retrieving the online resources or data from the database has become very easy in the ICT environment. Generally, libraries provide the database searching guidance through the library website. The search guidance helps to researchers and faculties for their research and learning.

- **Library Networks:** Library networking is meant to promote and facilitate sharing of the resources available within a group of libraries in order to provide maximum information to users, lower operational costs and also make optimum use of national resources. They have grown mostly during the last thirty years in different geographical environments in order to cater to the specific needs of users, in the United States; there has been a proliferation of them. Library networks in other countries are also growing; Several models have emerged that provide specific services. Numerous library networks have been in place, and are still in existence, throughout the world. Networks can be divided into two categories. Infrastructural networks, which provide the hardware, software and protocols for the flow of information. I-NET, NICNET, ERNET and INDONET are example of this category.

Application networks which are set up by or for a specific community or for serving well-defined end users. Networks like Online Computer Library Center (OCLC), Information and Library Network Centre (INFLIBNET), Developing Library Network (DELNET), Calcutta Library Network (CALIBNET), Bombay Library Network (BONET), Ahmedabad Library Network (ADINET) and Madras (Chennai) Library Network (MALIBNET) are example of this category.

- **Library Consortium:** The term consortia have been defined as “cooperative arrangement among groups or institutions or libraries”. A library consortium is a formal association of libraries not under the same institutional control, but usually restricted to a geographical area, number of libraries, type of materials, or subject interest established to develop resource sharing among members. Electronics publishing and telecommunication have enable library consortia to expand both in number and functions over the last decade. Objective of library consortia is to reduced the cost of information, time saving, improved resource sharing, better terms and conditions of licenses, and more professional services to users.
Library consortia vary in their type, goals, structure, membership, and funding Library. Consortium development is rooted in the history of library cooperative efforts and is now also driven by the need to provide remote users with licensed access to electronic resources. Though there have been many cooperative efforts for resource sharing among the libraries of India in the last two decades, it is hard to find one successful program that could be used as a benchmark to replicate in other libraries. The information environment today is very much conducive enough to tackle the problems faced earlier. With the advent of the Internet and World Wide within the organization, but other institutions that participate in the consortia program.

Shared subscription to electronic resources is the main activity of a library consortium and it can be a viable solution in order to increase the access to electronic resources across institutions at a lower cost. Shared subscription means a strategic planning thought which number of institutions having more or less the same information needs and requirements for fostering the library and information services to their readers agreeing to participate in a collective and collaborative efforts to subscribe electronic information resources for their mutual benefits. The committee of Experts on Consortia-based Subscription to Electronic Resources foe Technical Education System in India listed the following benefits:

- Consortia-based subscription to electronic resources would increase the access base more e-journals at substantially lower cost.
- The consortia-based subscription provides rational utilization of funds. A little more pays a lot.
- It provides Qualitative Resources Sharing and effective Document Delivery Services.
- It avoids price plus models and pay up-front products not for R & D.
- Since the subscribed resources would be accessible online in electronic format, the beneficiary instructions would have less pressure on space requirements for storing and managing print-based library resources. Moreover, all problems associated with print media such as their wear and tear, location, shelving, binding, organizing, etc. would not be an issue for electronic resources.
- It increases user base access from desktop of users.
- It provides electronic contents licensing for providing accesses to Bibliographic database, e-journals, full text reports, conference proceedings etc.
- It facilities Inter Library Lending and Document Delivery.

**Internet Technology and Services**

Internet is the world wide, publicity accessible network of interconnected computer networks that transmit data by packet switching using the Standard Internet Protocol (IP) The growth of Internet has been global & continuous and it is growing at a rapid pace. In 1991 and in the Internet was in the reach of only 73 countries, 100 countries accessed it in 1993 and in 1995 it reached 148 countries. At present with a base of about 608 million subscribers, it is expected to reach 20 millions by the turn of century. The Internet, which is now well developed, provides unprecedented opportunities for storage, retrieval and dissemination of information. Internet provides access to the most diversified source of information hosted by individual and various organizations worldwide on a vast network of servers.

The Internet is an exciting and intellectually stimulating social medium of communication and information. It provides an unprecedented source of access to the world and its peoples, resources and cultures. Electronic mail (E-mail) is one of the most commonly used applications on the Internet. E-mail supposed to be the most vital reason for the popularity of the Internet. Just in seconds, messages get their destination in the ever-safest manner. File Transfer Protocol (FTP) application is used to transfer files from the host computer to the local computer or vice versa. Telnet is an Internet programme to invoke host. World Wide Web (WWW) is a navigational system that allows users to find and view multimedia information stored in computer files across the Internet, and to move from one destination to another just by clicking on “hyperlinks”.

The Internet has become an indispensable resource for libraries worldwide to enhance the collection, improve services and operations. Internet has made easy access to information sources / documents like books, journals, electronic publications, etc. The Internet can be successfully utilized for providing reference service because various primary and secondary sources of information are available online. Libraries can use Internet to communicate with publishers, booksellers and vendors. Through the Internet a librarian can also use Newsgroups for getting information. Through the Internet a
librarian can access the resources of other libraries. It is also possible to browse the entire collection of a library through Web OPAC and can make a request for a document through e-mail.

3.10 Emerging Technologies

3.10.1 Wireless Technology

Over the last several years, wireless technologies have progressed and achieved success in various fields like healthcare, education, manufacturing, etc. Wireless technology has been around libraries for some years. But now only the libraries have realized its benefits for information services and library management activities. A number of libraries in western countries are using this technology. Wireless technology is very fast, reliable and highly flexible. Its major benefit is the immediate access to digital resources. It enables users to simply and easily connect a wide range of computing and telecommunications devices without the need a buy, carry, or connect cables. It uses a variety of devices such as laptop and notebook computer, tables, and personal digital assistants (PDAs), e-mail-only devices, handheld computers, etc. Wireless technology allows users to access the Internet without the constraints of cables, data lines, phone jacks, or even walls. Wireless data-translation protocols allow disparate devices to use the information from all sources effectively.

3.10.2 Bluetooth

Bluetooth is an industrial specification for wireless personal area networks (PANs). Bluetooth provides a way to connect and exchange information between devices such as mobile phones, laptops, PCs, printers, digital cameras, and video game consoles over a secure, globally unlicensed short-range radio frequency. The Bluetooth specifications are developed and licensed by the Bluetooth Special Interest Group. Bluetooth is a radio standard and communications protocol primarily designed for low power consumption, with a short range (power-class-dependent: 1 metre, 10 metre, 100 meters) based on low-cost transceiver microchips in each device. Bluetooth lets these devices communicate with each other when they are in range. The devices use a radio communications system, so they do not have to be in line of sight of each other, and can even be in other rooms, as long as the received transmission is powerful enough. Bluetooth is in a variety of new products such as phones, printers, modems, and headsets. Bluetooth is acceptable for situations when two or more devices are in proximity to each other and don’t require high bandwidth. Bluetooth is most commonly
used with phones and handheld computing devices, either using a Bluetooth headset or transferring files from phones / PDAs to computers. Bluetooth also simplified the discovery and setup of services. Wi-Fi is more analogous to the traditional Ethernet network and requires configuration to set up shared resources, transmit files, set up audio links (for example, headsets and hands-free devices), whereas Bluetooth devices advertise all services they actually provide; this makes the utility of the service that much more accessible, without the need to worry about network addresses.

3.10.3 Wireless Networking in Libraries and Information Centers

Wireless networking help users to access digital information without connecting physically and system administrators can set up or extend networks without installing wires. Mobility is the most attractive feature of wireless networking. It is more flexible than wired networking. It provides all the functionality of wired networking, without the physical constraints of the wire. Wireless networking can be used to access the library network, library resources and Internet without plug in by wires and cables. Wireless networking will allow users with devices like laptops, notebooks, PDAs, tablet PCs, etc. to move freely in the library while remaining connected to the library network. Wireless networking is an excellent solution for libraries with historic buildings or older buildings where the installation of wired networking is either impossible or very expensive. Libraries can be saved from the constant wiring and rewiring by installing wireless networks. Libraries can get lot of space by wireless networking. Installation wireless network is very easy because there are no wires. Wireless network components can be set up anywhere in the library. Wireless networking makes it easy to move computers and other devices without the need to reconfigure the network. Following are the benefits of wireless networking in libraries:

(a) A library wireless network provides access to multiple computers, databases, the internet and library OPAC throughout the library or outside the library.

(b) It provides faster access to information for library users, resulting in better service and improved user satisfaction. Location independent access for network administrations for easier on-site-trouble-shooting and support.

(c) Using laptop computers library users can access electronic media and also be physically near whatever printed material they went.

(d) Sharing of peripherals, files, multimedia resources and databases are easier.

(e) Improved database access.
(f) Simplified network configuration.

(g) Wireless networking permits quick connectivity to the network.

3.10.4 Mobile Technology

Mobile technologies provide wide coverage to access information from networks. There are several mobile technologies. Here are some of the most used mobile technologies.

3.10.5 Wireless Application Protocols (WAP)

Wireless Application Protocol or WAP is an open international standard applications that use wireless communications. Its principal application is to enable access to the Internet from a mobile phone or PDA. A WAP browser is to provide all of the basic services of a computer based web browser but simplified to operate within the restrictions of a mobile phone. WAP is now the protocol used for the majority of the world’s mobile internet sites. Known as WAP sites. In order to display the information on the screen of mobile devices, websites should be written in specially designed. Wireless Markup Language (WML). WML is a markup language developed for mobile devices. It is based on Extensible Markup Language (XML) and created to address the display, bandwidth and memory limitation of mobile and wireless devices. WML supports text and images and manages navigational command execution. Websites written in Hypertext Markup Language (HTML) contents to wireless devices. WAP technology can be used to send information to users mobile devices. It can used to provide reference services for specific information.

3.10.6 General Packet Radio Service (GPRS)

The General Packet Radio Service is a service that allows phones to be used for sending and receiving data over an Internet Protocol based network. GPRS enables wireless access to Internet, enabling users to access E-mail and other Internet applications using mobile phones. As in Internet, GPRS data is also handled as a series of ‘Packets’ that can be routed over several paths through the network. GPRS enables any service that is used over the Internet like File Transfer Protocol (FTP), web browsing, chat, E-mail, and telnet. It allows information to be transmitted more quickly and efficiently and facilitates instant connections where by information can be sent or received immediately as the need arises. To use GPRS, users need a mobile phone or terminal that supports GPRS and a subscription to a mobile receives GPRS information using the mobile devices.
3.10.7 Universal Mobile Telecommunications System (UMTS)

Universal Mobile Telecommunications System uses ATM based switching network architecture. UMTS aims to provide services for mobile and fixed subscribers by common call processing procedures. It will provide at least 144 kbps for full mobility, 384 kbps for limited and 2048 mbps for low mobility applications. It can deliver low-cost, high capacity mobile communications offering data rates upto 2 Mbits/sec with global roaming and other advanced capabilities. UMTS can deliver pictures, graphics, video communications and other wide-band information as well as voice and data. It will extend the capability of mobile technologies by providing increased capacity, data capability and a far greater range of services using an innovative radio access scheme and an enhanced network.

3.9.8 Artificial Intelligence (AI)

Artificial Intelligence is the science and engineering of making intelligent machines, especially intelligent computer programs. It is concerned with the study and creation of computer systems that exhibit some form of intelligence system that learn new concepts and tasks, systems that can reason and draw useful conclusions about the world around us, systems that can understand a natural language or perceive and comprehend a visual scene, and systems that perform other types of feats that require human types of intelligence. It is a branch science, which deals with helping machines, finds solutions to complex problems in a more human-like fashion. This generally involves borrowing, characteristics from human intelligence, and applying them as algorithms in a computer friendly way. It is an interdisciplinary field making use of concepts form various fields like Cybernetics, Information theory, Psychology, Linguistics, Logic etc. It can to stimulate human behavior and for Computer Aided Instruction, Expert Systems, Robotics and for Natural Language Processing (NLP). It can also use for Intelligent Retrieval from databases. The application of Artificial Intelligence to information and library work is relatively recent and has been mostly in the expert systems field. Natural language processing can use to search relevant information from databases, indexing and to reduce language barrier. In information retrieval process the user can easy his information requirement in natural language making the searching more easy and fruitful. This allows users to state complex query statement without knowing the complex retrieval languages.
3.10.9 Expert Systems

Expert Systems are meant to solve real problems, which normally would require a specialized human expert. Building an expert system first involves extracting the relevant knowledge from the human expert. Such knowledge’s is often heuristic in nature. Expert Systems have been used to solve a wide range of problems in domains such as medicine, mathematics, engineering, geology, computer science, business, law, defense, education, etc. Many activities in the provision in the provision of library and information services involve expertise, and thus provide applications where expert systems techniques and technology promise to improve performance. An analysis of the literature on the applications of expert systems in LIS fields the following application areas:

(a) Intelligent interfaces, in particular interfaces for online information retrieval systems
(b) Subject analysis and representation, including classification, indexing and abstracting services.
(c) Information storage and retrieval systems in general.
(d) Reference and referral systems.
(e) Collection Development.

3.10.10 Smart Card

A smart card, chip card, or integrated circuit card (ICC), is defined as any pocket sized card with embedded integrated circuits which can process information. This implies that it can receive input which is processed- by way of the ICC applications and delivered as on output. There are two broad categories of ICCs. Memory cards contain only non-volatile memory storage components, and perhaps some specific security logic. Microprocessor cards contain volatile memory and microprocessor components. This technology will have applications in identification, authentication, access control, healthcare, finance administration, etc. Application of smart card in library delivers increased efficiency by providing a means of regularly updating the library’s inventory and maintaining an accurate control of borrowing records.

3.10.11 Bar-Code Technology

Bar code technology is being used in library and businesses for the past 30 years to minimize data entry, speed processes and reduce costs. Most books, journals as well as
other costumer products in the market carry black and white thin and think strips called barcodes. Barcodes technology offers a mechanism that can be used identification, location and tracking of items that are bar coded.

Barcode is not a new technology; it was introduced in 1940 although it was first applied commercially in 1960’s as a method for tracking rail cars. Since then, it has been used extensively in customer industry, material handling, industries and libraries. A bar code is a machine readable code consisting of a series of bars and spaces printed in defined rations. Bar code symbologies are essentially alphabets in which different widths of bars and spaces are combined and ultimately, form a message.

Because there are many ways to arrange these bars and spaces, numerous symbologies are possible. Common linear symbologies include UPC/EAN, Interleaved 2 of 5 (I of 5), Codabar, Code 39 and Code 128. While each symbology is in some way unique, the composition of a complete message (bar code) is regardless of the symbology used. Barcode by itself is not a system but is an identification tool that enables accurate reading of data for sophisticated management systems. Use of barcode increasing accuracy in data collection, saves time and brings about the efficiency in library activities.

Bar code technology is being used in libraries all over the world especially for circulation of books as well as for several other functions including location control or book tracking, stock verification, receipt of issues of journals, cross checking of documents issued from the library, etc.

3.10.12 RFID Technology

Radio-frequency identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. An RFID tag is an object that can be attached to or incorporated into a product, animal, or person for the purpose of identification using radio waves. Chip-based RFID tags contain silicon chips and antennas. Passive tags require no internal power source, whereas active tags require a power source.

3.10.13 RFID in Libraries

Among the many uses of RFID technologies is its deployment in libraries. This technology has slowly begun to replace the traditional barcodes on library items (books, CDs, DVDs, etc.). However, the RFID tag can contain identifying information, such as
a book’s title or material type, without having to be pointed to separate database. The information is read by an RFID reader’s which replaces the standard barcode reader commonly found at a library’s circulation desk. The RFID tag found on library materials can also act as a security device, taking the place of the more traditional electromagnetic security strip.

RFID was first proposed in the late 1990s as a technology that would enhance workflow in the library setting. Roockefeller University in New York may have been the first academic library in the United States to utilize this technology. Whereas Farmington Community Library may have been the first public institution, both of which begun using RFID in 1999. Worldwide, the United States utilized RFID in libraries more. It is estimated that over 30 million library items worldwide now contain RFID tags.

RFID has many applications in libraries that can be beneficial, particularly for circulation staff. Since RFID tags can be read through an item. There is no need to open a book cover or DVD case to scan an item. This would help alleviate injuries such as repetitive strain injury that can over many years. Since RFID can also be read while an item is in motion, using RFID readers to check-in- returned items while on a conveyor belt reduces staff time. Furthermore, inventories could be done on a whole shelf of materials within seconds, without a book ever having to be taken off the shelf.

However, this technology remains cost prohibitive for many smaller libraries, and the conversion time has been estimated at 11 months for an average size library. With RFID taking a large burden off staff, it has also been shown to produce a threat to staff that their job duties have been replaced by technology. In fact, library budgets are reduced for personnel and increased for infrastructure, making it necessary for libraries to add automation to makeup for the reduced staff size.

A concern surrounding RFID in libraries that has received considerable publicity is the issue of privacy. Because RFID can in theory be scanned and read from over 350 feet in distance, and because RFID utilize an assortment of frequencies, there is a legitimate source. However, advocates of RFID use in library will point out that library RFID tags do not contain any patron information, and that the tags used in the majority of libraries use a frequency only readable from approximately ten feet. There is much yet to be written and discussed on the issue of privacy and RFID, but it is clear that vendors need to be aware of this issue and develop improved technologies for secure RFID transactions.
3.10.14 Digitization

Digitization is the process converting the content of physical media (e.g., periodical articles, books, manuscripts, cards, photographs, etc.) into digital format. A digital image, in turn, is composed of a set of pixels (picture elements), arranged according to a pre-defined ratio of columns and rows. An images document file can be managed as a regular computer file and can be retrieved, printed and modified using appropriate software. In most library applications, digitization normally results in documents that are accessible from the web site of a library and thus, on the Internet. Optical scanners and digital cameras are used to digitize images by translating them into bit maps. It is also possible to digitize sound, video, graphics, animations, etc. Further, textual images can be OCR'ed so as to make its contents searchable.

Digitization is not an in itself. It is the process that creates a digital image from an analogue image. Selection criteria, particularly those which reflect user needs are of paramount importance. Therefore, the principles that are applicable in traditional collections development are applicable when materials are being selected for digitization. However, there are several other considerations related of technical, legal, policy, and resources that become important in a digitization project.

Several digital library projects are concerned with providing digital access to materials that already exists with traditional libraries in printed media. Digitization of printed material is practically the only reasonable solution for institutions such as libraries for converting existing paper collection (legacy documents) without having access to the original data in computer processible formats.

3.11 References


