Chapter 2

Library Automation and Networking — Survey of Relevant Literature
This chapter highlights the important concepts and components of automation and networking relevant to libraries based on literature survey. This chapter is divided into four sections, namely, A. Library automation and networking – current situation, B. Information systems and networks for library services – current situation, C. Internet, and D. Libraries in electronic information environment.

Section A: Library automation and networking – current situation

2.A.1. Introduction

Change is a constant feature of life. The notable difference between current changes and changes in the past are the speed with which they take place at present and the greater awareness of this fact by the affected. It is the availability of relevant and up-to-date information that contributes to the quality and speed of development in the present day information society. Therefore, change is felt more strongly in the processes involving information handling. Libraries which are centres of information have to get adjusted to the changes causing different and more sophisticated demands for information; by equipping themselves with the tools and techniques of information technology.

2.A.2. College libraries - the existing situation

College libraries cannot be immune from the alternations in structure coming about because of the direct impact of technology on library operations and the educational environment. It is the libraries that collect, store and transmit up-to-date information to teachers, students, of all subjects and those engaged in research. Hence all expert bodies on higher education all over the world have pointed out that higher education needs to change its patterns, provision, and the services it delivers, more rapidly than ever before.
2.A.3. Information and education

Availability and utilization of up-to-date information on topics dealt with in college in teaching and learning is essential to maintain the quality and relevance of college education. The college library which has to collect, organize, retrieve and disseminate information is a complex system in the teaching environment. Our college libraries are yet unable to satisfactorily solve the fundamental problems associated with the provision of information support required for the teaching-learning process in higher education. In a study carried out recently the problems of our college libraries were listed as: 1. lack of a good library policy 2. high rate of unplanned growth 3. irrelevant collections 4. poor organization of materials 5. high cost of collection and storage 6. unqualified staff 7. inefficient retrieval systems 8. diversion or unscientific use of funds, etc.

Further, it is an accepted fact that transfer and utilization of information is an inseparable part of modern teaching-learning process. But our college libraries lack reliability in giving teachers and students the information support they require. The teaching learning method followed is also obsolete, for which information services are not essential beyond a mere lending of textbooks. This is also a major factor contributing to the under-functioning of libraries. Despite the wide spread awareness of the need for efficient library and information services to maintain the quality of education, and the awareness of the tools and techniques of information technology available for developing library and information services with minimum financial commitment, libraries remain still the most disregarded division in colleges.

Today, the college libraries have a large quantum of reading material, a major portion of which is totally irrelevant or obsolete expressing the poor performance of the existing system in identifying and acquiring materials, which users need. Manpower is mainly meant for clerical or physical labour in libraries, which are built
on a tradition of mere custodianship. Hence a vitalization of library services requires a total reorganization of the system retaining whatever is useful in the existing system and discarding what is unwanted, as a first step. Whatever the cost, a new foundation is to be laid with all care and quality to build and bear a strong and efficient structure. This has to be done as speedily as possible taking care that there is no undue expenditure. So we have to check how far and in what aspects the new information technology can be used by colleges to build a good library system that enables improved utilization of information by teachers and students.

2.A.4. College libraries – information technology

Information technology has revolutionized the methods of recording knowledge, keeping records, indexing documents, and information, communication. The new technologies compete not only with the traditional technologies but also with one another. Further, the new technologies can choose to attempt to emulate the existing means of functioning or to offer completely new means of operation. Technologies, however, that go beyond emulation of the traditional approaches offer some of the most exciting prospects and most difficult challenges.

Application of information technology gives rise to the application of computers and telecommunications for traditional operations in a library system. Therefore, this study examines the following concepts relating to the application of information technology:

1. Library automation,
2. On-line access to information,
3. Library network.
2.A.4.1. Library automation

a. Automation-concept and definition:

The term automation was first introduced by D.S. Harder in 1936, who was then with general motor company in United States. He defined it initially as “The automatic handling of parts between progressive production processes”. This definition was modified and revised in 1956 by London Goodman thus: “Automation is the technology of automatic working in which the handling method, the processes and the design of processed material are integrated to utilize as is economically justifiable of mechanization of thought and effort in order to achieve an automatic and in some cases a self-regulating chain of process”. ¹

Today the scope of automation is so vast that it includes mechanization of various processes and their operation as well as the use of machines, equipments, tools, all sort of mechanical devices, automatic machines, electronic equipment and also systems.

Automation includes the following:

- Implementation of processes by automation means;
- The theory, art, or technique of making a process more automatic;
- Investigation, design, development, and application of methods of rendering processes automatic, self-moving or self-controlling;
- Conversion of a procedure, a process or equipment to automatic operations.

The Encyclopedia Britannica defines the term 'Automation' as an automatic system of working, the difference between automation and mechanization, a related term, being mainly one of degree”. ²

b. Library automation-concept and definition:

The present day information society which has to be more responsive to the needs of potential users, libraries, information and documentation centres, therefore must offer a higher level of information service taking into consideration the
information seeking behaviour of the users rather than adjusting with the existing system. The ability to retrieve, analyze, compare and combine, manipulate and communicate is a process that is far more important than mere access to information for the potential users. Therefore, sharing resources and information is the prime slogan of the present day library environment, as the acquisition of books and journals has become very expensive, and financial resources and their allocations are diminishing very fast.

Owing to knowledge explosion, society is deluged with multifaceted and multidimensional information to such an extent that not only storage of information has become a challenge, but the organization of the huge mass of information has also become unwieldy. The gravity of the situation can be gauged from the fact that, according to an estimate, more than five thousand pages are being printed every minute in the world. It is impossible for the traditionally managed libraries to bring these to the notice of users. The reason for this lapse is that the library staff does not have time to select the respective documents, index them, and get these typed for onward transmission to the respective user or all users. By the time the staff complete accessioning / entering and technical processing of a particular batch of documents, the second batch arrives, and no time is left for use by all the users. Computers can solve these problems, because once, at the acquisition or recording stage, information about the documents is fed into the computer, with simple commands it generates and produces a printed copy of the list of additions including the SDI for each user by computerized matching the user profile with documents profile. It is difficult for a library to organize this flood of information manually.

Library automation aims at processing the operations, which are of a routine and repetitive nature, and cover mainly such common functions as acquisition,
serials control, cataloguing and circulation. No doubt, library automation extends beyond these functions in retrieving information stored in the library.

Library automation means "Application of computers and other technology to library operations and services". ³

According to Data Communications Dictionary, library automation is "The application of machines, especially computers but including other devices such as microfilm and photo copying machines, to improve library services by increasing the quality and quantity of the work performed by the library staff. Some automation, as in circulation control systems, increases the amount of work accomplished per man hour; other kinds of automation, as in the on-line retrieval services, greatly increase the capabilities of library in meeting user demands". ⁴

c. Library automation - a brief history:

The University of Texas was perhaps the first to use punched cards in 1936 for circulation control and further, for serial control in the mid-1940's. In 1942, the Montclair public library in New Jersey installed two specially designed book-charging machines for recording individual transactions automatically on punched cards. The Library of Congress used unit record machines for the production of catalogues for the first time in 1950. Until the 1950s, mechanization in libraries was primarily achieved by using only unit record machines.

The developments of library automation in the second era during the 1960s are listed below:

> The MEDLARS Project-a project to mechanize the handling of medical literature at the National Library of Medicine, USA.

> The pioneering work on serial control by the Southern Illinois University of California at San Diego.
The development of a circulation system by the Southern Illinois University at Carbondale.

Ontario New Universities library project of the University of Toronto in 1963 (the project was aimed at producing computerized book catalogues for five new university libraries in Ontario).

Initiation of the project MARC by the Library of Congress to provide a format for cataloguing data that can be:
- Computer readable,
- Accepted as a national standard, and
- Used on different computers.

The first report on library automation entitled 'Automation and the Library of Congress', was published in 1963.

The next era of library automation began in the late 1960s, with the success of the INTREX (Information Transfer Experimental) and the MARC projects. During this era, on-line, real-time interactive computer systems were introduced in the library and information field.

On-line systems were implemented at the MIT under its technical information project. In 1967, both the OCLC (Ohio College Library Center) and BALLOTS (Bibliographic Automation of Large Library Operations using a time sharing system) became operative. In the early 1970s on-line systems were in operation in several libraries in America. The Bell-Telephone Laboratories and Eastern Illinois University had on-line serial control system, and the Washington State University had on-line acquisition system.

d. Need for library automation:

The following factors emphasise the need for library automation:
Explosion of knowledge resulting in numerous specializations and flow of almost non-stop information;

Inability of users to explore through conventional methods literature and information of interest, which are unlimited;

Wastage of a lot of precious time of the staff in handling routine and repetitive library operations;

Impossibility of a single library to acquire and make available worldwide published material;

In addition to the above, as the reading habits of readers are also undergoing changes greatly, multimedia sources are fast becoming important;

Acquisition and preservation of new formats of reading materials are gaining ground in libraries. They are creating newer problems, which the libraries had not faced earlier.

The cost of paper documents, both monographs and serials, has been increasing abnormally. This has become a hurdle in the acquisition of documents in libraries. Cheaper materials which will last longer should be the medium for carrying human messages.

Elimination of human error, while performing routine library works.

Improved information retrieval through automated search techniques, such as key-work and/or Boolean searches;

Excellent control over circulation
- easy access to information regarding who borrowed what and when
- facility to answer at the desk all users' queries regarding availability of books,
- easy operations of charging, discharging, renewal, recall, reservation, computation of fines, etc.
- notification to users, library staff, etc.
- summary statistics
- faster cataloguing, and instant access to new cataloguing records.

e. Benefits of library automation:

The benefits of library automation can be summarised as follows:

- To improve control over collection;
- To have effective control over the entire operation;
- To improve the existing services (from the viewpoint of quality, user friendliness, regularity etc.) as well as to introduce new services;
- To share the resources effectively with other libraries in a given region;
- To avoid duplication of work;
- To use the services of the existing staff more effectively;\(^8\)
- To link the system with other existing systems;
- To use funds economically;

Ian Lovecy has spelt out the two aims of library automation in the UK as "Cost-cutting, in terms particularly of members and grades of staff, and the improvement of the visible services to readers. If that sounds cynical, there is nevertheless a good deal of truth in it, automation of cataloging provides both elements (records can be bought in by fewer, less-qualified staff, and an OPAC can give readers better access than before); and automated circulation clearly not only affects readers directly but can also reduce the time spent by staff filing slips. In acquisitions, the benefit to users is indirect and main benefits would be to library staff".\(^9\)
2.A.4.2. Online access to information

a. Concept:

Rapid developments and advances in telecommunication technology, especially with the introduction of communication satellites, new services such as telex, teletext, facsimile, etc., have brought different countries closer through information transfer. Thus, telecommunications have helped libraries to have online access to information.

Literally the term "Online" means that the user is in contact with the computer through the same direct linkage either by a direct line or over the telephone network. It also means the state of being in direct, immediate communication (online-to) with the database one wishes to interrogate and with the computer on which this database is loaded.

Online is a combination of three technologies: computer, information and communication. It has emerged as a cost-effective solution to the problems posed by information explosion, problems in organized storage for efficient retrieval and transfer / dissemination of information. Today, the online information system has become a well-established channel for information handling. It is a new technique and tool that can be exploited and used to provide new and improved services to the information seeking community.

Online information access emphasises the need for database technology. Therefore database technology has gathered rapid momentum in the field of computer and information science. This technology is a boon to libraries and information centres in collecting, retrieving, and dissemination of information.

There are mainly four components in an online system:

- Database producers that create computer-readable files;
Online vendors (also called search services) that make the files accessible on large computers for searching by many people simultaneously;

Libraries and information centres that search vendor's files on behalf of end users, and

End users who request and receive information.¹⁰

b. Definitions:

According to Suresh Basandra¹¹, online processing means "Direct communication with the computer and an uninterrupted flow of input data with special hardware devices. Online processing is used when delay in handling data is undesirable".

The phrase 'online searching' is "The process of directly interrogating computer systems to resolve particular requests for information. The research is usually conducted by means of a keyboard and screen, that communicate with a computer system, possibly remote, which contains files of data. The search process is dynamic and interactive. The results are made available almost immediately to the searcher who can then, according to the usefulness or otherwise of the information retrieved, refine the original request and continue the interaction until the best result possible is obtained. Some searches may take a few minutes; others may last half an hour or more. Some may request for one precise piece of information, which others may seek a lot of relevant information or might need to browse through the stored data."¹²

c. History:

Online information retrieval systems were pioneered in the United States by two companies, the System Development Corporation (SDC), and the Lockheed Space and Missile Corporation, now called DIALOG Information Services Inc. The first nationwide experimental network was introduced in 1965 under a series of
grants from the ARPA (Advanced Research Projects Agency), as US Governmental research agency.

The MEDLINE (Medical Analysis and Retrieval Service online) service was developed in the year 1963.

Lockheed's online retrieval activity commenced in 1964 with experimental work on their DIALOG system. This started as a self-financed research project, and the development continued under a US governmental research contract as the NASA/RECON system (US National Aeronautics and Space Administration/Remote Console). In 1967, it launched the ORBIT (On-line Retrieval of Bibliographical Information Time-shared) online service system.

The Europe Space Agency / Space Development Service (ESA/SDS) established the RECON system at Barnastadt in 1968. The Deutsches Institutes for Medizinische Documentation and Information (DIMDI) were started as online search service, initially via a special telecommunications network (DIMDINET) to medical databases, such as the MEDLINE in the early 1970s. Telesystem -- QUESTEL is a French on-line search service, which started to operate during the 1970s. Mead Data Central (MDC) is a part of the American Mead Corporation, which was started in 1973. Dow Jones and Company Inc., set up its Dow Jones News/Retrieval (DJNR) information service for American stock brokers in 1974. The Japan Information Center of Science and Technology (JICST) Japan Online Information System (JOIS) was set up in 1976.

The British library online information facility called BLAISE (British Library Automated Information Service) was introduced in April 1977. In 1982 the BLAISE divided its series into BLAISE-Link, a link with the US national library of medicine, for searching biomedical and related databases, and BLAISE-Line, which continues
to offer non-medical databases. Text line / News line / Data line online business search services were set up in 1980 by the British firm, Finsbury data services.

The EURONET/DIANE (Durent Information Access for Europe) service, the planning of which commenced in 1971, finally became operational in 1980. Data-star was set up by Radio swisse, Switzerland in 1980.

The PFDS (Pergamon Financial Data Services) is a Britain-based online service started in the year 1988 and aims to provide information services to the European business community.

The European Commission Host Organisation (ECHO), was set up in 1980 by the Commission of the European Communities (CEC) to contribute actively, encourage and support the use of online information in Europe.¹⁴

d. Advantages of online access:

▶ Computer searches are likely to be more accurate than manual searches;
▶ Online searches permit browsing;
▶ The online system usually has the capability of displaying its own controlled vocabulary;
▶ Access to database makes the search for information more wide and exhaustive. Online search often offers more access points than the corresponding pointed index;
▶ In multi-disciplinary research areas, on-line searches offer a special advantage by bringing together several subjects and up-to-date information;¹⁵
▶ The whole database can be accessed in a single operation;
▶ It is helpful for a user with a complex multi-topic search;
▶ It can retrieve information on topics, which are not included in subject indexes;
An online search produces an individualized bibliography designed for a specific query;

An online search provides citations that are more current than those found manually; 16

It has the ability to offer multiple products or services (e.g. printed indexes, SDI retrospective search) from a single intellectual input;

It has the ability to produce a database in machine readable form, on magnetic tape, that can be easily duplicated and sent to other information centres, thus facilitating the development of networks and other cooperative ventures;

2.A.4.3. Library network

a. Network – concept:

A network is a collection of computers which can communicate with each other, usually over a cable, which can also be radio or infrared based. The original idea was to share expensive equipment, for example, instead of having a printer on every desk, which is idle most of the time, so that there could be one to operate in the centre of the office used by every one.

An interconnected collection of autonomous computers is called ‘computer network’. Two computers are said to be interconnected if they are able to exchange information, the connection need via a copper wire, fiber optics, microwaves, and communication satellites.

b. Network – definitions:

According to Schmeber, network is “A communication that support many users” 17

26
Stevens\textsuperscript{18} defined a network "As a formal organization of three or more autonomous organizations interconnected to achieve their common purpose through the joint use of communication and computer technology.

Purser\textsuperscript{19} defines network as physical network, which is said to consist of all internal switching nodes, their inter-connecting links and the leading to external connected devices. The external devices themselves computer and terminals collectively referred to as Data Terminal Equipment (DTE).

Frezza\textsuperscript{20} defines networking as "A formal organization among libraries for cooperation and sharing of resources, in which the group as a whole is organized into sub groups with the exception that most of the needs of a library will be satisfied within the subgroups of which it is a member".

c. Library network-concept:

Owing to knowledge explosion and the consequent flood of information, no library today, however big, can dream of becoming self-sufficient. Information is being produced at such great speed and in such bulk that even the biggest libraries are not in a position to procure all of it. The goal of self-sufficiency has therefore become unrealistic and impracticable. It is for this reason that some one has wisely suggested that the slogan, "No library can stand alone" should be adopted as the 'sixth law' of library science. Therefore, cooperation and sharing of resources among libraries is very essential for effective library service.

The main goals of resource sharing are, to have

\begin{itemize}
\item Increased access to information and services at existing cost; and,
\item Access to existing information and services at less cost.
\end{itemize}

Earlier resources were shared through library cooperation by inter-library loan with the help of union catalogues and union directory of periodicals. Nowadays generally library resource sharing is achieved in two ways.
by telecommunication network;
> by databases in optical media.

Library resources are shared through automation and networking with the use of telecommunication technology.\textsuperscript{21}

d. Library network – definitions:

The UNISIST defined information network as “A set of interrelated information systems associated with communication facilities which are cooperating through more or less formal agreements, in order to jointly implement information handling operation, with a view to pooling their sources and better services to the user”. Basically information network is “A mixture of computer and communication technology where distributed processing on intelligent machines in different locations cooperate by means of networks.”\textsuperscript{22}

Miller\textsuperscript{23} defines library network as “A cooperative system established by libraries and information centers which are brought together by common subject, geographic proximity to share information resources, human resources, equipment and all other elements essential for providing effective information service”.

Generally a network is developed when a group of libraries / information centres decide to exchange information through computer application. It can be defined as a set of inter-related information systems associated with communication facilities, which are cooperating through more or less formal implement information handling operations with a view to pooling their resources and to offer better services to the users. A library Network is a collective or cooperative activity linking members/users to the computer resources by means of telecommunication connections.

In the words of Neelamegan\textsuperscript{24}, information network is “An arrangement to link information resources and information seekers/users such that the latter can
obtain the information they need or seek from the information resources. The basic objective is the sharing of information resources among the participating entities and, with digital networks, also enabling computer mediated communication, web publishing and provision of other information services by and among the participating entities at an affordable cost.

e. Need and purpose of library network:

According to Manoharan and Nagarajan the purpose of library network is:

- To evolve a national network, inter-connecting various libraries and information centres in the country and to improve capability of information handling;
- To provide reliable access to document collection of libraries by creating online union catalogues;
- To provide document delivery service by centres and to optimize information resource utilization;
- To implement computerization of operations and services in the libraries and information centres, following a uniform standard;
- To enable users scattered in rural areas, irrespective of location and distance, to have access to academic information;
- To develop a database of academic information and to maintain electronic communication of information for delivering academic information.

Bhatt and Arom listed the following factors necessitated libraries and information centres to go for library network.

- Information explosion: Post-War proliferation of scientific literature caused by expansion of scientific research and technology resulted in such a flood of scattered information that scientists were not in a position to scan regularly and consistently all publications that might contain information
which would interest them. The rate of growth of information triggered off after the war is still continuing and is faster than ever.

- Increased workload: The increase in the number of documents being published has made it very difficult for libraries to keep alert to new sources of information. Commonly, this increased workload may have to be borne with the existing or decreasing staff.

- Economic necessity: The subscription rates of periodicals are increasing continuously. In contrast, budget allocations to the libraries, especially in the developing countries, are generally frozen at a given level. Most of the libraries work on meager financial resources. In India, the financial crisis has further been aggravated due to the sharp devaluation of the rupee against foreign currency, and because of the heavy financial cuts imposed on all government-funded bodies.

- Multi-disciplinary research: Multi-disciplinary research has become an integrated feature of modern scientific enterprise, which is a natural reflection of the complexities, scale and cost of modern investigations. More and more scientific research is being attempted with intra-and inter-laboratory, intra-and inter-institutional and even international collaborations, requiring inputs on different aspects of various subjects. Thus, even special libraries dealing with research in specific disciplines cannot afford to acquire everything that their users might require. Resource sharing, using modern information technologies seems to be the only solution to this problem.

- Availability of online and CD-based databases: With the advent of computer and communication technology, it is now possible to log in to an online host and conduct an online search in an interactive mode via a microcomputer
even from a remote location. The use of communication technology for information retrieval activities gained momentum with the creation of several large databases made available online for shared use through vendors like DIALOG, Datastar, etc. A number of bibliographic databases are now increasingly appearing on compact discs (CD-ROM). Online databases can be used only through communication networks.

f. Academic information useful to colleges through library network:

Academic information is much wider and diverse and is quite different from scientific information. The different types of academic information available through library networks for colleges are:

- List of educational institutions at local, state, national and international level;
- Courses offered in educational institutions;
- Notifications about admissions to colleges and universities;
- List of centres with addresses which provide information services, guidance and counseling services;
- Scholarships available at different levels of education;
- Educational loans for higher education;
- Reservation of seats in different courses of study;
- Provision of book grants and study materials;
- Concessions on tuition fees, examination fees and travels;
- Career opportunities in India and abroad, selection procedures and qualifications required;
- Schemes of coaching for competitive examination for getting job and for different admission tests;
- Information about academic research and development.27
g. Library network services:

The following are some of the information services, which can be provided through library networks:

- **OPAC (Online Public Access Catalogues) services:** The machine-readable catalogue-OPAC of library can be made available through internal web or LAN.

- **Online circulation transaction:** In order to provide timely information about status of every document, the output file generated for daily transactions is published on web. This enables the user to watch the status of the document from his/her work place and to reserve the particular document, if required, through networking service.

- **Current Awareness Service (CAS):** List of the latest additions of books, journals, the CD-ROMs and other documents to the library can be displayed virtually on the LAN/WAN for the user’s attention.

- **Selective Dissemination of Information (SDI):** User’s e-mail requests may be collected and matched against the latest documents and the matched ones can be sent back to the required user, which is possible only through networks.

- **CD-ROM network service:** The CD-ROM is one of the best optical information storage systems of electronic publishing, which has influenced very much library and information science all over the world because of its durability, capability to hold large volumes of data, compatibility and affordability.

- **E-mail service:** E-mail is the lifeblood of network-based information service, the Internet in particular. It is as useful a form of communication as the telephone.
Bulletin board service: A bulletin board is a public discussion area where people can post messages, without sending them to anyone’s email address, and can be viewed by anyone who enters the area.

Indexing and abstracting service: For the benefit of research scholars and the teaching community indexing and abstracting services for the latest electronic texts and journals may be provided through network.

Content page service: Content page service of electronic publishing as well as important R and D oriented books and journals can be provided through web.

Internet service: The internet is a boon to the user group. It is a worldwide web of interconnected university, business and science networks and is a network of computer networks. It is made up of three types: little Local Area Networks (LANs), citywide Metropolitan Area Networks (MANs) and huge Wide Area Networks (WANs) connecting computers of organisations all over the world. These networks are hooked together with everything from regular dial-up phone line to high speed dedicated based lines, satellites. The three basic Internet applications or functions are electronic mail, remote logon and the file transfer. The internet has two main uses; one is person-to-person communication and the other finding information.  

Section B: Information systems and networks for library services – current situation

Information technology has enriched the services of information system and networks extending maximum information service to all types of libraries in the world. Hence the important national and international information systems and networks established for purpose of information collection, preservation,
distribution, and exchange around the world are presented briefly in the following pages.

2.B.1 In India

2.B.1.a INSDOC (Indian National Scientific Documentation Centre):

The INSDOC is the first national documentation centre in the field of science and technology established in 1952 under the aegis of the CSIR by the government of India with technical assistance from the UNESCO. It occupies the same position in India as the VINITI in the former USSR.

The INSDOC's main objectives are: (1) To receive and retain all scientific periodicals required in India; (2) To inform scientist engineers of articles which may be of value to them by issuing monthly bulletin of abstracts; (3) To answer specific queries for information available at the centre; (4) To supply photocopies of translation of articles required by laboratories or individual workers; (5) To be a national depository for reports of the specific work of the nation, both published and unpublished; (6) To be a channel through which the scientific work of the nation is made known and available to the rest of the world.

The services of INSDOC are: (1) It acts as national resource centre in the country. (2) It procures at least one copy of every worthwhile scientific publication within the country. (3) It provides access to information covering a wide range of subjects dealing with science and technology by compiling bibliographies on demand. (4) It provides translation services enabling scientists have access to works published in non-English languages. (5) It acts as a national centre for the International Serial Data System (ISDS) and it is responsible for registering the serials published in the country. (6) It publishes a few important journals namely (i) Indian Science Abstracts (semi monthly), (ii) National Index of Translations (monthly), (iii) Annals of Library Science and Documentation (quarterly), (iv)
Contents of the List of Soviet Scientific Periodicals (monthly), (v) Russian Scientific and Technical Publications – An Accession list (bi-monthly). (7) It provides access to such leading databases as the CA search (Chemical Abstracts search), the COMPENDEX (Computerized Engineering Index) and the INSPEC (Information Service for Physics, Electrotechnology and Control). (8) It conducts both short-term and long-term training courses in documentation sciences. (9) It publishes information tools on different areas of science and technology. (10) It also makes linkage with national, regional and international agencies including the NISSAT, DSIR, DESIDOC, IARI, VINITI, UNESCO, FID etc.. (11) It participates as the nodal point in the SAARC documentation system.

2.B.1.b. DESIDOC (Defence Scientific Information and Documentation Centre):

DESIDOC is a highly specialized information centre in the field of defence studies in India. When it was established in 1958 it was known as ‘Scientific Information Bureau’ (SIB) intended to provide indexing of current literature and translation services to defence scientists working on various projects. Later on in 1967, when it was reorganised and its functions were streamlined its name was changed to DESIDOC.

The basic objectives of DESIDOC are: (1) To provide information to the units at the headquarters, the laboratories / establishment of the DRDO and other agencies of the ministry of defence. (2) To coordinate scientific information programmes in the DRDO. (3) To develop a data bank. (4) To provide consultancy services to the TICs and other defence organizations. (5) To organize training programmes. (6) To provide translation services. (7) To provide reprographic services and. (8) To publish scientific and technical journals of the DRDO including books and monographs.
The basic services of DESIDOC are the following: (1) It provides fully computerized information services comprising scanning, indexing, abstracting, preparation of input sheets, data entry into computer, database creation and development, database searching, current awareness services etc. (2) It provides translation facilities for some of the major languages i.e. Russian, German, French and Japanese. (3) It conducts in-house training programme for to enable them keep abreast of the latest developments in information science. (4) Its publications are: (i) Defense Science Journal (quarterly), (ii) Popular Science and Technology (half-yearly), (iii) DESIDOC Bulletin (bi-monthly), (iv) DRDO Newsletter (monthly), (v) Science Abstracts from foreign languages journals (quarterly). (5) It keeps a close linkage with other organizations. It is an institutional member of the ILA, IASLIC, GILA, SIS, MCT, FID, ASLIB, ASIS etc.

2.B.1.c. NASSDOC (National Social Science Documentation Centre):

The NASSDOC is an apex body in the field of social science information in India, established in 1970, under the aegis of the Indian Council of Social Science Research located at Delhi.

The objectives of NASSDOC are: (1) To provide information to scholars about the material available in the field of social science and other allied areas. (2) To assist research institutions in creating documentation and bibliographical services. (3) To maintain linkages with other documentation and information centres. (4) To bridge the gap between professionals and information technology.

The services of NASSDOC are: (1) Building up reference materials and works on research methodology, collecting (a) unpublished doctoral theses approved by Indian universities and foreign theses on India, (b) research reports of the projects undertaken by the ICSSR and other social science research institutions assisted by the ICSSR, (c) working papers presented at the ICSSR funded seminars and
conferences, and (d) periodicals of research standards in social sciences. (2) Providing bibliographical information about Indian publications in social sciences to international documentation agencies. (3) Providing select bibliographies on request. (4) Awarding study grants for working at libraries of their interest in India. (5) Conducting professional training courses under continuing education programme. (6) Processing project proposals involving financial assistance to documentation and bibliographical projects for consideration by the ICSSR committee on documentation services and research information. (7) Entering into agreements with national and international organizations for mutual exchange of publications, and (8) Promoting the sales of ICSSR publications.

2.B.1.d. SENDOC (Small Enterprises National Documentation Centre):

The SENDOC is a highly specialised information centre in the field of small enterprises in India. It was established in 1971 under the aegis of the National Institute of Small Industries Training (SIET), Hyderabad. The SENDOC undertakes information activities as an integral component of the SIET, which aims at promoting major areas such as small industry development, management, extension and information for development.

The SENDOC's objectives are: (1) To collect and store information, data and documentation useful for the technological and managerial advancement of small industries. (2) To disseminate information to persons or organizations engaged in activities relating to small-scale industries development, and (3) To act as national centre for coordinating and collaborating with the information activities of other national institutions and effecting liaison with similar centres in other countries.

The services of SENDOC are the following: (1) It acts as a clearing house of information in the field of small enterprises in India, (2) It identifies, collects and
organizes information on various aspects of small industry development such as management, production, personnel, finance, marketing, technology including chemical engineering techniques and skills; machinery equipment, government and institutional programmes and policies, statistical data regarding types of industries, capacity production, export, employment, capital investment etc. (3) It maintains a highly specialized library with comprehensive collection of books, periodicals, trade literature, technical notes, reports, newspaper clippings, unpublished literature etc., covering a wide field of industry, technology, management and other behavioural sciences. (4) It provides comprehensive documentation services and responsive documentation service which are organized in anticipation of the needs of clientele by bringing out the SEDONC bulletin, the SEDONC chronicle, appropriate documentation bulletin, the SDI, Status of Technology reports (ST), Economic Survey reports (ES), the SEDONC library and information bulletin etc. (5) It provides consultancy services in building up necessary infrastructure, organizing documentation services, designing information system and conducting training programmes at different levels in any other organizations, libraries, documentation and information centres. (6) It organizes training programmes also. It has been conducting regularly a training course on 'information storage and retrieval system'. (7) It brings out a number of publications such as the SEDONC chronicle (a fortnightly bulletin), the SEDONC bulletin (monthly), Appropriate Technology Documentation Bulletin (4-bimonthly) etc. It has also brought out various publication such as the SEDONC survey series, index to product profiles at the SEDONC, directory of raw-materials and manufactures and manufacturing equipment, directory of training courses offered by different institutions, polytechnics etc. in different trades/industries, directory of entrepreneurship development training and research institutions in India.
2.B.1.e. NISSAT (National Information System for Scientific and Technology):

The NISSAT is a decentralized distributed information network launched by the department of science and technology, Government of India. Though its planning began in 1975, it came into operation only in July 1977. It is an important and unique information network, which involves active participation of different information centres across the nation.

The objectives of NISSAT are: To develop a mechanism to transform various information systems and services into an effective network under an overall coordinating agency. It aims at fulfilling two types of objectives, broad and specific.

a. The broad objectives include: (1) Optimum utilization of the existing information services and systems and the development of new ones. (2) Promotion of national and international cooperation and liaison for exchange of information. (3) Provision of support and active encouragement for the development of facilities for education and training in information science and technology and in communication to provide qualified manpower for the implementation of the national science information policy. (4) Support and actively participate in research, development and innovation in information science and communication to enhance both the efficiency of information services and the quality of the information provided by these services, and (5) Support and promote research, development and innovation in information technology.

b. The specific objectives are: (1) Information resource development such as: (i) Allocation of responsibility to institutions for building strong collections in specialized subjects; (ii) Ensuring that there is in the country at least one accessible copy of every worthwhile scientific publication for use by specialists, policy makers, etc.; (iii) Establishment of data bank for scientific, technical environmental and socio-economic data; (iv) Establishment of regional depositories for information
about specialists and experts in different subjects who may serve as successful sources of information and as consultants. (2) Identification of information users: (i) Identification of the present and potential users of science and management information; (ii) Creation of information consciousness among science, technology, industrial and business and management personnel. (3) Providing information service: (i) Establishment of a national lending library service; (ii) Establishment of a national referral centre; (iii) Provision of translation facilities in various languages; (iv) Provision of adequate reprography facilities and promotion of the use of reprography copies; (v) Provision of adequate computer facilities for information access and retrievals; (vi) Establishment of subject oriented national information grids with adequate communication facilities; (vii) Cooperation with other national and international organizations engaged in information and technology or related type of services; (viii) Developing necessary tools, techniques and services adequate to meet users information needs and demands as these change from time to time. (4) Manpower development: (i) Building up expertise and making provision for education and training for adequate number of professional personnel of different categories in information science, reprography and translation; (ii) Supporting projects in information science; (iii) Supporting research programmes in information science; (iv) Supporting conferences, symposia, seminars, workshops etc.,

The services of NISSAT are: (1) Infrastructure Development: It promotes and develops necessary infrastructure by establishing information centres such as sectoral, regional, and others in priority areas of specialized disciplines of science and technology, textiles, energy, transportation, aeronautics, small-scale industry, health and nutrition, natural resources and power and allied subjects. (2) Manpower Development: The NISSAT organizes a number of short-term courses at different places on information science and technology including reprography,
telecommunications, computer, indexing, storage techniques etc. (3) Document Collection: It provides financial support to different sectoral centres in their collection building so that they may be able to render their services on a national scale. (4) Equipment Acquisition: It makes efforts to equip the sectoral centres with modern and sophisticated technologies at every operational point such as storage, dissemination of information, processing of texts, microform preparation and other computing services. (5) Seminars and Workshops: The NISSAT holds seminars and workshops regularly at various intervals. It has conducted Indo-US joint seminars besides a number of other workshops at different places in India. (6) International Cooperation: Bilateral co-operation is another area where the NISSAT has made a headway. The Indo-US joint commission on science and technology identified many areas of bilateral co-operation between India and the USA. The NISSAT has made a number of agreements with countries like the USSR, France, etc. (7) Publications: The NISSAT has undertaken a publication programme also. It started the NISSAT newsletter (quarterly) in 1979 highlighting the state-of-art in information science and technology.

2.B.1.f. BARC (Bhabha Atomic Research Centre):

The BARC is a prestigious research organization in the field of nuclear sciences in India. It was known as the atomic energy establishment when it was established on Jan 29, 1957. But in 1967 it was renamed as Bhabha Atomic Research Centre (BARC). Its primary objective is to promote research and development of atomic energy for peaceful purposes. It has other objectives. It not only generates information but also performs a number of activities such as identification, collection, organization and dissemination of information covering a wide range of subjects including nuclear chemistry, nuclear desalination, radio metallurgy, radio
biology, agro-industrial complex, nuclear ship propulsion, hospital physics, radiation protection etc.

The services of BARC are: (1) It maintains one of the richest collections of information on nuclear sciences in the world. (2) It acts as the national inputting centre for the INIS involving a number of activities such as scanning, selecting, categorizing, indexing, abstracting and preparing machine-readable input in the standardized format of all scientific documents published in India falling within the scope of nuclear science and technology. (3) It renders Current Awareness Service (CAS) by bringing out “Current awareness service on reactors” and “Nuclear neutron physics” and “Nuclear information bulletin” since 1971. (4) It maintains a “Translation unit”. (5) It has linkage with the international agencies connected with International Nuclear Information System (INIS).

2.B.1.g. ENVIS (Environmental Information System):

The Environmental Information System (ENVIS) was set up by the Ministry of Environment and Forests, Government of India, in December 1982. It has been functioning since then and providing environmental information to decision-makers, policy-planners, scientists, engineers, research workers and the public all over the country.

The objectives of ENVIS are: (1) To build up a responsible dissemination centre in environmental science and engineering. (2) To gear up modern technologies of acquisition, processing, storage, retrieval and dissemination of information of environmental nature. (3) To support and promote research, development and innovation in environment information technology. (4) To provide national environment information service, relevant to present needs and capable of development to meet the future needs of the users, originators, processors and disseminators of information. (5) To build up storage, retrieval and dissemination
capabilities with the ultimate objectives of disseminating information speedily to users. (6) To promote national and international cooperation and liaison for exchange of environment related information. (7) To promote exchange of information amongst the developing countries.

The services of ENVIS are: (1) Documentation services: The ENVIS also looks after the various activities undertaken by departmental libraries, which act as a documents repository of the ENVIS network. (2) The query / answer service: The ENVIS as the national focal point of INFOTERRA (An international referral system for sources of information / UNEP (United Nations Environment Programme) and as regional service centre of INFOTERRA responds to various queries from the INFOTERRA users and those from South Asian sub-region countries by providing substantive information in the form of bibliographies, reprints / reports etc. (3) Liaison with other information systems: The ENVIS maintains a close liaison with other National Information Systems on Science and Technology (NISSAT), Biotechnology Information System (BTIS), etc, for exchanging environmental information and to avoid duplication of efforts in concerned fields concerned; 4. Press clipping service: The ENVIS focal point brings out / prepares its press clipping service by scanning all environment related information from the national dailies and magazines. About 30 newspapers and 10 magazines are scanned regularly and more than 500 clippings related to environment are documented every month as a secondary information base for quick and easy retrieval. (5) Abstracting service: Abstracts of various research papers / articles are compiled in the quarterly journal, the Paryavaran Abstracts. The abstracts are arranged under 12 major categories like air pollution, water pollution, noise pollution, environmental management, ecology, health and toxicology, environmental legislation, forestry, wildlife etc. For precise retrieval of information, subject key words index is also given at the end of
each issue. (6) Coordination with the ENVIS centres: The ENVIS focal point coordinates, monitors and reviews the activity of ENVIS centres to ensure effective functioning of the ENVIS network. Attempts are also being made by the focal point to ensure constant inflow of information from the ENVIS centres, so that a central repository of environmental information on various subject areas is developed / updated for easy and quick retrieval and dissemination. The focal point is also responsible for identifying priority areas and potential institutions for setting up new ENVIS centres.

2.B.1.h. NICNET:

Government of India established the National Informatics Centre (NIC) at New Delhi in 1975 along with its regional centres at Pune, Bhubaneswar and Hyderabad. The NIC established the NICNET in 1977. It is a satellite-based information network, which ensures a systematic protocol for information exchange among various department / ministries of state and central governments and other organizations. The purpose of setting up the NICNET is to collect, compile, store, process, and disseminate information to various departments / ministries and organizations of Government of India which is highly useful for decision making and planning, to achieve efficiency and productivity in the various sectors of the government.

The objectives of NICNET are: (1) To design, develop and implement, advanced computer based system. (2) To promote adoption of computer-based data management techniques. (3) To generate specialized manpower to work more effectively in the field of informatics. (4) To develop inter-city networks and connect them in such a way that it can work as a distributed governmental information system.
The services of NICNET are: (1) The ICMR-NIC centre: It is located at the national information centre, providing services to users in India the MEDLINE and POPLINE databases since April 1988. (2) The NIC also has developed a computerised online patent information system based on bibliographic data available from the International Patent Documentation Centre (INPADOC), Vienna. (3) Doormatics services: doordarshan and the NIC have together launched a telematics project called INTEXT. (4) Dial for data services: From 1989 onwards the NICNET has been offering dial for data service which is accessible from public booths with 1 billion bytes of information in this system called GISNIC (General Information System Terminals of NIC) and with another 150 million bytes being added every month. This service is now spreading to cities, towns including about hundred coin-operated public booths. (5) NIC’s election information services: From 1989 onwards the NICNET is offering this service for two lok sabha elections; 6. NCRMS: the NIC also has developed a standardized distributed database for hazard management called Natural Calamities Relief Management System (NCRMS).

2.B.1.i. INDONET:

The INDONET is the first commercial computer-based network engineered by Computer Maintenance Corporation Ltd. (CMC). It is the first public data processing network in India. It was a step towards revolutionizing data processing in India. The INDONET aims to provide facility for distributed data processing on an all India basis to large organizations in the network using of the CMC computers for their data processing operations. 31

The objectives of INDONET are: The main objective of the INDONET is the establishment of a network of computer centres accessible to remote parts of the country so as to deliver the benefits of information resources management to a wider cross section of users in the country. The other objectives of the project are: (1)
Providing remote access computing facilities for the development and export of software, specialized application packages in the areas of engineering design, management services, energy and computer networking, etc. (2) To help in the export of software. (3) To have a distributed data processing system, so that local queries are answered after scanning locally available databases and global queries are routed to their destinations and answered after the response is received. (4) To process large amount of scientific and industrial data centrally and effectively. (5) To facilitate access to remote user terminals. (6) To maintain common interest databases like stock exchange and foreign currency conversion rates centrally. (7) To help to promote key computer-related technologies like database management programming techniques, computer graphics. (8) To connect through international gateways to SPRINTNET (earlier telnet) and TYMNET communication networks of the USA.

The services of INDONET are: (1) Distributed data processing facility. (2) Computer service bureau consultancy. (3) Promotion of advanced networking technologies. (4) Providing computer power to users across the country. (5) Public database service. (6) Software export.

2.B.1.j. ERNET (Education and Research in Computer Network):

Project ERNET was initiated as a result of identification of computer networking as a thrust area by the Department of Electronics (DOE) New Delhi, during the seventh plan period (1985-90). The ERNET was launched in November 1986 by the DOE during the same plan. It is a computer network intended for the academic and research community with the initial participation from eight leading academic and research institutions including the Department of Electronics.\[32\]

The objectives of ERNET are: (1) To enhance national capabilities in the areas of design, development, research, education and training in state-of-art concepts of computer networking and related emerging technologies. (2) To
progressively set up a nationwide network for the academic and research community. (3) To carry out education, continuing education, training and consultancy programmes to generate control manpower needed by industry and users in this field.

The services of ERNET are: (1) Electronic mail. (2) File transfer; (3) Remote login. (4) Mailing lists, new groups and bulletin boards. (5) Bibliographic database access. (6) Information retrieval tools (Gopher, WAIS, WWLS). (7) Audio and video plus conferencing.

2.B.I.k. DELNET:

In February 1989 the NISSAT commissioned the CMC Ltd. to conduct a feasibility study of networking the libraries in Delhi. This was completed in 1990. The DELNET was conceived for the networking of about 30 libraries in Delhi in its first phase. Registered as a society in June 1992, it has its headquarters at the India international centre, New Delhi.

The objectives of DELNET are: (1) To promote the sharing of resources among the libraries in Delhi by developing, the DELNET which will collect, store, and disseminate information through computerized services to the clientele. (2) To undertake scientific research in the area of information science and technology, for which, the DELNET will create new systems in the field, apply the results of research and publish them. (3) To offer technical assistance to the participating libraries in collecting, storing, sharing and disseminating information. (4) To coordinate efforts for suitable collection development and reduce unnecessary duplication whenever possible. (5) To provide help in establishing referral research centres, maintain a central on-line union catalogue of books, serials and non-book materials of the entire member libraries. (6) To promote delivery of documents manually or electronically. (7) To develop specialized bibliographic database of books, serials and non-book materials. (8) To develop databases of projects,
specialists and institutions. (9) To possess and maintain electronic and mechanical equipments for speedy communication of information and delivery of electronic mail, and (10) To coordinate with other regional, national and international networks and libraries for exchange of information and documents.

The services of DELNET: With the launching of the DELNET e-mail on 19th March 1991, Delhi attained the distinction of being the first metropolitan centre to establish an electronic link among libraries, marking the beginning of resource sharing venture. The e-mail facility enables libraries to promote library mailing, inter-library requests, distribution of questionnaires, activisation of professional contracts and demonstration of file transfer with a view to eventually connecting the DELNET to national and international databases and networks.

It also offers the following services to member libraries: (1) Acquisition and fund accounting. (2) Serials control. (3) Books and journals maintenance. (4) Circulation. (5) User service (6) Calculation and maintenance of bibliographic database (7) Inter-library user services; (8) Document copy and transfer facilities. (9) Access to national and international databases. (10) Union catalogue. (11) Current awareness and the SDI. (12) Authority data. (13) Subject profiles. (14) Abstracts etc.

2.B.1. CALIBNET (CALCUTTA LIBRARY NETWORK):

The CALIBNET was inaugurated on 21 September 1993, with a mandate to facilitate the provision of broad information services in the country. The Calcutta Library Network (CALIBNET) is one of metropolitan library networks in India.

The CALIBNET adopts two routes to realize its objectives: (1) The network route with a library automation and networking using its own application software MAITRAYER. (2) The e-mail route to provide member libraries with, (i) Online access to information available through internet, the DIALOG / knight-rider, and
the CD-ROM resources through the ERL, (ii) Online access to various databases within the network, (iii) Full-text documents through the British library document supply centre, the ASTINFO, the UNCOVER and other agencies, (iv) Electronic-mail facility for easy interactions (v) Centralized bibliographic support for name and subject authority control, and (vi) Training and consultancy.

The services of CALIBNET are: (1) To significantly improve resource utilization and service levels to patrons at the individual libraries by providing automation facilities for all house-keeping functions and user services such as, (i) Acquisition and fund accounting (ii) Serials control (iii) Cataloguing (iv) Circulation (v) User services. (2) To operationally enhance resource sharing by providing individual libraries and their access to composite databases through, (i) Union catalogue, (ii) Partial STIS databases, (iii) Current awareness and the SDI, (iv) Subject profiles. (3) To provide efficient and reliable means of, (i) Inter-library user services, (ii) Document copy and transfer facilities, (iii) Access to national and international STIS databases. (4) At the individual level, the end-users of its services are, (i) Scientists, engineers, technologists, scholars and researchers, (ii) R and D personnel, (iii) Industrial entrepreneurs, (iv) University professors and other academicians, (v) Consultants and specialists, (vi) Official functionaries and executives, and (vii) Practitioners of science, engineering and technology, medical science, information and library science, humanities, social sciences and management.

2.8.1.m. INFLIBNET:

The Information and Library Network (INFLIBNET) programme was started by the University Grants Commission (UGC) in April 1991. It is a major programme towards the modernization of libraries and information services in the country, using computer and communication technologies. The INFLIBNET will include participants from colleges, universities, R and D institutes of higher learning,
information centres, institute of national importance and Document Resource Centres (DRCs).

The objectives of INFLIBNET are: (1) To evolve a national network of libraries and information centre in the country and to improve information handling capability. (2) To provide reliable access to document collection through online union catalogue of monographs, serials and non-book materials. (3) To provide better access to worthwhile bibliographic information sources, with citations and abstracts, such as articles in periodicals, conference papers, reprints, technical reports, standards and specifications, patents and monographs, through indigenously created databases of the sectoral information centres of the NISSAT and the UGC information centres and by establishing gateways for online accessing of international databases held by international information methods and centres. (4) To provide document delivery service by establishing resource centres around libraries having a rich collection of documents. (5) To optimize information resource utilization through shared cataloguing, inter-library loan service, catalogue production, collection development and avoiding duplication in acquisition to the extent possible. (6) To computerize operations of libraries and information centres in the country following a uniform standard. (7) To facilitate communication among scientists, engineers, researchers, social scientists, academicians, faculties and students through electronic mail, bulletin board, file transfer etc. (8) To enable readers, irrespective of distance and location, to have access information regarding books, monographs, serials and other reading materials, through new communication technologies. (9) To encourage cooperation among libraries, documentation centres so that pooled resources can augment weaker resource centres, and. (10) To evolve standards and uniform guidelines in techniques, methods, procedures, hardware, software and services and promote their adoption.
The services of INFLIBNET are the following: (1) Catalogue board services: (i) Shared cataloguing of books, serials and non-book materials, (ii) Union catalogue of books serials and non-book materials, (iii) Online catalogue access for shared cataloguing and location identification, (iv) Catalogue production in card, book, magnetic tape / floppy, CD-ROM form, book processing and preparation. (2) Database services: (i) Bibliographic database services, (ii) Retrospective searches, SDI, current awareness services, (iii) Databases of non-bibliographic information such as ongoing and completed projects, institutions and specialists. (3) Document supply services: (i) Interlibrary loan request processing, (ii) Document delivery (Fax/Non-Fax). (4) Collection development: (i) Acquisition and assistance in selection and procurement. (5) Communication based services: (i) Electronic mail, (ii) Transfer / receive messages, (iii) Bulletin board view / update bulletin board, (iv) Academic communication through electronic mail, bulletin board, file transfer, computer / audio / videoconference etc.

2.B.1.n. I-NET:

The I-NET, formally known as VIKRAM, is a bearer network for fast, reliable, flexible and cost effective transport of information. The I-NET is a packet switched public data network established by the Department of Telecommunications, Government of India.  

This network offers facilities for interlinking terminals and computers through packet switches located in important cities, and subscribers of this network can make international data calls to other networks abroad. This facility is provided through the gateway packet switching system of VSNL at Bombay. Subscribers can also get connected to subscribers of the remote area business message network of the Department of Telecommunications. Some emerging systems that depend on data switching capabilities of the I-NET are: (1) Corporate data / message system. (2)
Electronics payment systems / electronic fund transfer systems. (3) Maintaining systems e.g., environment, traffic. (4) Electronic mail.

The services of I-NET are: (1) Interactive data communication. (2) Connection to international gateway – GPSS, through Bombay node; 3. Connection to remote area business message network. The following facilities are available to customers: (i) Fast select, (ii) Closed User Group (CUG) facility, (iii) Reverse charging, (iv) Permanent virtual circuit.

In addition to the above, the following networks are also established for specific purposes by independent departments in the country. They are:

1. **BTISNET (Biotechnology Information System Network):** It is a specialized science and technology network set up by the Department of Biotechnology, Government of India.

2. **SAILNET (Steel Authority India Limited Network):** Steel Authority of India has set up a data communication system located in different SAIL factories in different places through micro earth stations located at the SAIL headquarters.

3. **RABMN (Remote Area Business Message Network):** During the early 1991, the DOT commissioned the Remote Area Business Network.

4. **OILCOMNET:** It is a multi-model, multi-terminal computing and communication network, and has been installed to support, enhance and improve the telecommunication and computing infrastructure of the oil industry.

5. **RAILNET:** At present the Indian railway, which is the biggest public sector enterprise in the country has two computer networks. One is the CRIS (Computerized Reservation Information System) and the other is FOIS (Freight Operation Information System).

6. **IAN (Indian Airlines Network):** At present Indian Airlines have the largest and midwest proprietary network, which connects over 700 terminals all over India.
It connects different sperry mainframe computers located in Delhi, Bombay, Calcutta, and Chennai through microwave links. The network was commissioned in 1986.

7. SBI NET: The message-switching network of the SBI operates in parallel with its voice network but on a much smaller scale. The network topologies have 6 nodal points and 60 terminals located at 14 centres. The nodal switches receive, store and then transmit data in the system. It is also planned to have a link with international centres (SWIFT) on the SBI overseas office links through a VSNL gateway through this network, in order to speed up customer remittances and other financial messages between the SBI foreign offices and its Indian branches.

2.B.2. Outside India:

2.B.2.a. FID (Federation International Documentation):

The FID is one of important non-governmental agencies (NGOs) in the field of documentation and information sciences. Its origin can be traced back to the establishment of the Institute International de Bibliographie (IIB) in 1885 by two eminent social scientists, Henri La Fountaine (1854-1943) and Paul Otlet (1869-1944). Later on in 1931 the name of IIB was changed to Institute International de Documentation (IID) and in 1938 to the Federation International de Documentation (FID).

The main objectives of the FID are to promote, through international cooperation research in and development of information science and documentation, which includes, inter alia, the organization, storage, retrieval, dissemination and evaluation of information, however recorded, in the fields of science, technology, social sciences, the arts and humanities.

The service of the FID: The activities of the FID are carried on through a number of committees constituted for these purposes. However, in the light of their
functioning, the overall services of the FID can be summed up as follows: (1) It provides an active forum for fundamental questions of general classification theory and the nature and scope of information. It promotes, sponsors and engages in research in the field of indexing. It has also taken up the responsibility of the operation and supervision of the Universal Decimal Classification, its revision and further development. (2) It promotes documentation activities especially in the developing countries, brings out a bibliographical index of publications on information terminology, surveys and makes analysis of terminologies pertaining to information and documentation. It also brings out a journal "Linguistic in Documentation—Current Abstracts". (3) The FID has taken up a certain mechanization programme, which includes standards for bibliographic data interchange, the application of hardware and software in mechanized information systems and telecommunications facilities. (4) The FID interacts with other international organizations such as the UNESCO, FAO, ILO, IAEA, UNIDO, CMEA, ICSU, ICA, WMO, ISC, ICOM, UIS, etc.

2.B.2.b. INIS (International Nuclear Information System):

The International Nuclear Information System is a leading information system on the peaceful uses of nuclear energy, which began to operate under the aegis of the international atomic energy, Vienna in 1970 in collaboration with its member states. The idea of the INIS was conceived in 1965 when the IAEA decided to foster the exchange of nuclear information amongst its member organizations / institutions.

The objectives of INIS are: 1. Its main objective is to encourage the exchange among its members of information relating to the nature and peaceful uses of atomic energy and also, to serve as an intermediary among them for this purpose, (2) It aims at international control of the literature of nuclear science on maximum
decentralization, consistent with reasonable efficiency. (3) To maximize the transfer of information, it aims to have some central control and administration. (4) The INIS has the major responsibility to make all the literature of the nuclear sciences available to all of its members so as to supplement the present bilateral arrangements.

The services of INIS are: The INIS as a cooperative computer based decentralized bibliographic information system, aims at catering to the increasing needs of the member countries in procuring, processing and providing nuclear information for peaceful purposes. It also performs the following services: (1) It provides most effective methods of information handling in different languages on nuclear science. (2) It assists in improving the national infrastructure in the member countries. (3) It makes comprehensive coverage of nuclear information literature. (4) It helps in sharing the cost of data collection and processing equitably between large and small producers and users of the literature. (5) It publishes the INIS auto index—a bibliographic reference journal, (6) It provides online access, machine-readable data for distribution and printed products as output. (7) It has an extensive system of liaison officers in member states who are responsible for submission of appropriate output to the system and also offer the INIS services the their respective countries. (8) It makes the provision of appropriate guidelines for database design and standardizes data collection.

2.B.2.c. DEVSIS (Development Science Information system):

The DEVSIS was launched in 1974 by the International Development Research Centre (IDRC).

The objectives of DEVSIS are: To provide improved access to economic and social information for individuals and institutions and others involved in developmental activities. It has been planned to act as a global decentralized
mission-oriented information network of national and regional centres using a
standard methodology to feed in information and providing services to users,
together with an international centre for constituting the common DATABASE,
maintaining the system and training staff for the participating centres. It is regarded
as a sectoral application of the UNISIST programme with which it maintains close
links. It includes information pertaining to areas like agriculture, industry, transport,
education, social welfare, and public health education. Each item of information is
classified not by subjects but is covered under the following major headings: (1)
Facts, trends and analyses; (2) Prescription for decision making; (3) Official policies,
plans and programmes; (4) Development action and operational experience; and (5)
Consequences and evaluation.

The services of DEVSIS are: (1) It provides access to development
information at the global level, (2) It facilitates information both conventional and
non-conventional on all aspects of economic and social development. (3) It
maintains two databases, a bibliographic database using the ISIS format and software
with in-depth subject indexes of the documents, and a referral database containing
the description of information and data source on economic and social development.
(4) It acts as a sectoral application of the UNISIST programmes. (5) It publishes
DEVINDEX-A bulletin of the printed output and DEVPROFILE—a file of sources.

2.B.2.d. OCLC (On-line Computer Library Centre):

The online computer library centre is the largest computer and
telecommunication network of libraries and information centres in the world. It is
also the world's largest database of bibliographic records and location information
known as the OCLC online catalogue. The OCLC was a regional cooperative
network in the state of Ohio, USA, known as Ohio college library centres, aiming to
serve 54 colleges and universities in the state of Ohio. Its name was changed to the
OCLC (Online Computer Library Centre) when it expanded from a regional cooperative network to a national network in the country.

The objectives of the OCLC are: (1) To increase the share and availability of library resources among its members. (2) To perform certain computerized functions.

The services of the OCLC are: (1) It provides access to the huge collection of information sources across national boundaries. (2) It maintains the world's largest database of bibliographic records consisting of 18 million unique records in eight formats: books, serials, sound recording, audio visual media, scores, maps, archives and manuscripts, and machine-readable data files. (3) Its online union catalogues hold different libraries materials through out the world. (4) Its databases cover more than 3000 languages. However, the English language constitutes 68.9 percent of the databases. (5) It facilitates inter-library cooperation both within and across national boundaries. (6) Its online system helps libraries to share the wisdom of catalogues. (7) It brings economy in terms of time and cost. (8) It not only catalogues the current titles but also makes retrospective conversion of previous catalogued titles into machine-readable form. (9) It offers an internship programme to international libraries enabling them to gain experienced at the OCLC for a minimum of three months. (10) It maintains a research and development division, established in 1974, to undertake mission-oriented research. At present the OCLC's research division conducts research through six established programme areas: distributed processing, electronic document delivery, human computer interaction, improved access techniques, microcomputer applications and online catalogues. (11) It participates in several on-going national-level programmers including the CONSER (Conversion of Serials), the ARL (Association of Research Libraries), the NFAIS (National Federation of Abstracting and Indexing services project) etc.
Thus, the OCLC has emerged as one of the important networks to meet the challenge of information explosion through on-line computer system, high-speed telecommunication, and other automation devices and acts as an integrating agency for linking knowledge and users at the global level.

2. B. 2. e. BLAISE (British Library Automated Information Service):

The BLAISE became operational in early 1977 and has established itself as one of the world’s largest services. Using a combination of on-line and off-line computer processing techniques, the BLAISE has two major functions: (1) The provision of an automated information retrieval service. (2) The facilitation of library housekeeping from catalogue production through to inter-library loans.

With regard to 1, files at present accessible include those available from: the US National Library of Medicine (MEDLINE, SDILINE, CHEMLINE, etc.), the US National Cancer Institute (CANCERLIT, etc.), the British library (UKMARC, Audio visual materials, Conference proceeding index, British education index), and the Library of congress (LCMARC)

The services of BLAISE are: Until 1982, all of its services were made available on an IBM computer at Harlow. The MARC files and other files of British origin remain on this UK computer to form the BLAISE-LINE services but a new BLAISE-LINK service provides direct access to the US National Library of Medicine. This makes additional data bases, such as the NAF (Name Authority File), POPLINE (Population Information Online) and the SERLINE (Serials Online), available.

Regarding cataloguing services, an integral part of the BLAISE called the LOCAS (Local Cataloguing Services,) was introduced in 1974. It offers a complete cataloguing service from data preparation to catalogue output for those libraries, which want to take advantage of a centralized system. Other services, less
comprehensive than the LOCAS, which are available from the British library include the following: (1) The Selective Record Service. (2) The exchange Tape Service (3) Microprocessor systems.

2.B.2.f. MEDLARS (Medical Literature Analysis and Retrieval System):

The MEDLARS is one of most publicised computer based bibliographical retrieval and information system operated by the National Library of Medicine (NLM). USA. Its origin can be traced from 1979 when an office of the surgeon general was established, among at organizing and coordinating the various activities of medical organizational under an authority in U.S.A. It started publishing the indexing journal “Index Medicus” on its own in 1980. Since then ‘Index Medicus’ has been considered the world’s largest indexing service in the field of medical sciences. In this way the MEDLARS came into existence in 1964. In 1970, an online service namely MEDLINE was introduced by the NLM and it became operational in December 1971. International use of the MEDLINE has been organized in different countries including Scandinavia, Canada, France, and U.K. etc.

The objectives of MEDLINE are: It acts as an important system in the field of medical sciences at the global level. It aims at providing information to any one who is seeking information on any area of medical sciences, by providing index abstracts of leading articles, and bibliographical services on demand in anticipation.

The MEDLARS offers a variety of services: It has the unique ability to offer information services to a wide ranging international biomedical scientific and professional community which has acclaimed ‘Index Medicus’ as one of the finest indexing services produced by the MEDLARS. MEDLINE is another important service came into operation in 1971 with access via the TYMNET Network. It has been offering a number of services since 1975 such as: (1) SDLINE -- Access to
2. B. Z. g. AGRIS (International Information System for the Agricultural Sciences):

The AGRIS is a computerized information system designed on the pattern similar to the INIS model, which began its operation in 1975 under the aegis of the Food and Agricultural Organization (FAO).

The AGRIS was conceived in accordance with the FAO constitution which laid down that “The organization shall collect” analyse, interpret and disseminate information relating to nutrition, food and agriculture, food, forestry, fisheries and rural development.

The services of AGRIS are: (1) It maintains computerized databases for storing and retrieving large amounts of information using the CD-ROM. It collects bibliographic references to materials, which may be either conventional journal articles, books or non-conventional samities called gray literature, e.g., theses, reports etc., not available through normal commercial channels. The AGRIS database is mentioned at the computer centre of the International Atomic Energy Agency (IAEA) for online access. (2) It processes agricultural information received from the participating countries and other regional centres. (3) It provides AGRIS-SDI service. The subscribers of this service (usually scientists, administrators, extension workers etc.) receive regular computer produced references to the literature within their field of interest. Many countries such as Brazil, India, Poland,
Bulgaria, Yugoslavia, the Netherlands, Spain, New Zealand have started their known AGRIS-SDI services. (4) It assists the member countries in developing their national information system in the field of agricultural sciences. For instance countries like Germany, USA, India and the Caribbean countries have developed their own information system as input centres to the AGRIS. (5) It impacts in-service training. (6) It holds seminars and symposiums for the participating countries. (7) It provides on-line communication to its database. (8) It allows retrospective searches through the entire database. (9) It publishes 'Agrindex' - the AGRIS monthly bibliography issued in English, French and Spanish versions.

2.B.2.b. POPIN (International Population Information Systems):

The POPIN is a decentralized network for promoting information activities in the field of population and allied matters under the aegis of the population division of the Department of International Economic and Social Affairs, UN secretariat. Its genesis can be traced back to 1973 when the United Nations Population Commission recognized the need for the establishment of an international information system on population.

The main objectives of the POPIN are as follows: (1) To identify and establish better ways to facilitate the flow of population information among the members institutions through the development of common goals. (2) To share the knowledge of the activities of network members. (3) To ensure the compatibility of the system and services. (4) To formulate working arrangement operations to develop and strengthen the information flow. (5) To solicit the support from government for the smooth functioning of the network.

2.B.2.i. UTLAS (University of Toronto Library Automation System):

The UTLAS is a bibliographic utility, which has been supplying computer-based systems, services, and products in both English and French since 1973. More
recently, it has won clients in countries outside Canada, including the United States and Japan. The on-line user network includes some 200 institutions and members of consortia. More than 600 individual libraries receive products and services from the system.

Using the Catalogue Support System of UTLAS (CATSS), libraries derive, edit or input catalogue data to create individually structured files. The database now contains well over 10 million records, and includes files from the Library of Congress, the national libraries of Canada, France and the UK, and the US National Library of Medicine.

From 1978, the CATSS has been an offering authority control facility to enable clients to create and maintain authorized forms of names, uniform titles and subject headings. An acquisition and serials control system has been designed to be completely integrated with the CATSS. A REFCATSS module offers public library staff an on-line retrieval system designed to meet a variety of information needs, including inter-library loan searches and customized bibliographies.

2.B.2.j. RLIN (Research Libraries Information Network):

The United States led the world in networking. It appears that there has been a settling down in the growth of the number of utilities, OCLC, RLIN and the WLN (Washington Library Network) having been the only one on the US scene for sometime.

The RLIN concentrates more on research libraries, whereas the WLN is concerned with all types of libraries, confining its growth to the northwest region. However, the WLN is closely linked to the RLIN.

One of the consortium's most powerful drawing cards is the Research Libraries Information Network (RLIN), which can provide members with an on-line catalogue of their own holding as well as that of the AACR 2 support, up and
running subsystem for acquisitions and interlibrary loan, and patron access to on-line catalogues.

In early 1978 the RLG (Research Libraries Group) announced its intention to utilize the BALLOTS system, (Bibliographic Automation of Large Library Operations using a Time sharing System), which was based in Stanford University in California. It is an online combining some of the features of the OCLC, some of Lockheed/SDC and some of the features not available on either of the other two systems. The BALLOTS have a subject's capability; in 1979, RLG aligned itself with the regionally successful WLN and agreed to share databases and jointly develop products and services.

The advantages of the RLIN are: (1) The great speed with which databases can be searched, (2) The user does not necessarily need to be within the physical confines of a library environment as the computer terminals provide the facility of remote access if the user has a telephone. (3) The work is shared. Participating libraries contribute records to centralized databases. The cost is shared as the work is done by an individual organization and users of the service pay for access to the resultant data.

2.B.2.k. EURONET:

The EURONET is a data network, which was inaugurated in 1979 by the telecommunication authorities of the member countries of the European Economic Community. It is used to provide users in those countries with access to the information system DIANE (Direct Information Access Network in Europe).

The information available through the network is aimed at researchers, engineers, scientists, managers, economists, the legal and medical professions. The subject coverage is correspondingly broad, embracing bibliographical data in these areas (publication, documents etc.) reference and handbook material (catalogues,
directories, statistics case-law etc.), patents, compilations, from lists of research projects in Britain to lists of national defaulters in Italy. The data are held on the computers of various participating organizations, which originally compiled the data banks for their own use, or as a freestanding service. The network essentially acts as a publishing medium for these organizations.

The EURONET-DIANE is a private network. That is, users need to subscribe to the service, and the number of users is strictly limited. Users are assumed by the system to be able to formulate and carry out their own searches, while on-line to one of the participating databases.

2.B.2.1. AGLINET (Agricultural Libraries Network):

The AGLINET is a cooperative library network in the field of agriculture. It aims at promoting mutual and national exploitation of agricultural library resources for the benefit of the world's agricultural development through systematic collaboration among agricultural libraries. The basic convention on the AGLINET was signed in 1974.

The network consists of a chain of major agricultural libraries in each region or country of the world supported by the international centre, FAO's David Lubin Memorial Library, at the FAO's head quarters in Rome.

The objectives of AGLINET are: (1) Mutual and rational use of library resources, not only for the benefit of members of our constituencies but also in support of other libraries within the country/region through efficient delivery of primary documents, especially unique material unavailable elsewhere, by means of inter-library loan provision of reproductions (papers, micro frame or any other means), as well as bibliographic information, and (2) Realization of comprehensive resource coverage with appropriate regional and subject specialization.
The services of AGLINET are: (1) Providing upon request, inter-library loan service, including reproduction and bibliographic information within the scope of each participating centre to other AGLINET centres of all categories primary, subject and international. (2) Forwarding major bibliographic tools published by each participant to all other centres whenever possible. (3) Notifying the international centre of changes that affect service operation of the AGLINET system e.g., the liaison officer, service facilities and cautions etc.

In addition to the above, there are the following international networks which are functioning as communication networks:

1. NELINET (New England Library Network): It was established in 1966 and its membership is open to academic, state, public and other libraries. It has a computer centre for handling telecommunication with the OCLC and performs other network tasks.

2. WLN (Washington Library Network): It is a small network operated by the Washington state library. Its computerized bibliographic database was established in the year 1972 with the cooperation of Washington libraries. The online system was started through this network in 1975.

3. SCANNET (Scientific Information and Documentation Network): This network was set up by the Scandinavian Council for Applied Research and it became operational in 1976 with nodes in Copenhagen, Gutenberg, Helsinki, Oslo and Stockholm.

4. TYMNET: It is a network operated by Tymshare Inc. (USA). It was established in 1977 and is at present the world’s largest data carrying network.

5. JANET (Joint Academic Network): The joint academic network was inaugurated in 1984. It is a distributed over a wide area network in the United Kingdom, which was originally planned to interlink institutions of higher learning.
and research organizations to enable researchers to share computing and communication resource. Of late, the services offered by the JANET also include library and information oriented services. The JANET is a private x.25 packet switched network.

6. KICNET (Kansas Interlibrary Communications Network): KICNET is private electronic mail WAN, administrated by the Kansas State Library. The programme started in October 1989 and by the end of the year, there were 77 participating libraries in the network programme. The KICNET participants range from high school libraries in small towns, academic and community college libraries to university libraries etc.

7. APINMAP (Asia and Pacific Information Network on Medicinal and Aromatic Plants): It is a new network set up in Bangkok in the year 1985.

8. MLNCO (Metropolitan Libraries Network of Central Oklahoma): The MLNCO was established in 1987, is a multi-type library network in the USA.

9. GULFNET: The GULFNET, the first computer based network in the Muslim world, was established in May 1985. Its objective is to facilitate exchange of information among the scientists and researchers of the Gulf region. Saudi Arabia and Kuwait universities and research centres are linked together to form this network.

Section C: Internet

2.C.1. Concept

The Internet is a network of networks spread worldwide. It is a conglomeration of smaller networks and other connected machines spanning the entire globe. Each country has at least one backbone network that operates at a very high speed and carries bulk of the traffic. Other networks connect to that backbone.
2.C.2. Historical development

The Internet got started in 1969 when the United States government funded an experiment known as the Advanced Research Projects Agency Network (ARPANET) for research in electronic communication. In the 1970s the ARPA developed a set of the decade, and centres all over the world were connected to this network. During the 1980s the ARPA Net joined the MIL net (the Military Network) and some other networks, and the Internet was born. Thus, the Internet is a network of networks. There is no commercial enterprise supporting the Internet effort.

2.C.3. Internet services

The following are the various services available on the Internet:

- Remote login (Telnet): The Telnet is the main Internet protocol for logging connection with a remote machine. It is a utility, which will allow the user to log on to another system, and gives him an opportunity to be on one, computer system and work on another, which may be thousands of miles away.

- Moving files (FTP): File Transfer Protocol (FTP) is the primary method of transferring files over the Internet.

- Finding files (Archie): This system enables locating files on the anonymous FTP servers on the Internet. It is actually a collection of servers on the Internet; each of these servers is responsible for keeping track of file locations in several different anonymous FTP sites.

- Electronic mail (E-mail): E-mail facilitates exchange of messages across computers.

- Mailing lists (lists serve): A mailing list is maintained on a list server, a special computer hosting such facility.
Network news (Usenet): The Usenet is a set of machines that exchange articles with one or more universally recognized tasks called news groups.

Bulletin Board System (BBS): There are thousands of bulletin boards on various subjects. Normally they are of local interest to some geographical area. Subscribers reach the bulletin boards via telephone lines.

Finding some one (who is): There is no single unified Internet dictionary. The main ‘who is’ database is maintained by the Network Information Center (NIC). The ‘Who is’ command will let you search a database of every registered domain. Postmasters of web sites primarily use it.

Finger: The Finger command gives information about each user who is currently logged in with reference to a specific machine of the Internet. If you want specific information about a person, finger command has the capability to give more information about a user on Internet host; this helps to find the complete e-mail address or the telephone number of the person.

Tunneling through the Net (Gopher): Gopher represents the first generation of attempts to replace the ‘where’ with the ‘what’ in cyberspace. It is a way of accessing what you want without having to know where it is. This is like browsing the remote library card catalogue and automatically getting the wanted material.

Veronica: It is a search tool that allows one to quickly scan Gopher space for particular files and directories. It is so programmed that one can access through Gopher.

World Wide Web (WWW): In the recent past, the World Wide Web or www has completely reshaped the Internet. It is allowing the users to experience sights and sound in an innovative style of navigation by introducing graphical user interfaces to facilitate access to the Internet. The tools for
locating relevant information mentioned earlier like gopher, telnet, ftp etc., are being merged and are becoming accessible through a single common interface, with the overwhelming popularity of the World Wide Web.

- Mosaic: A web browser like the Mosaic brings the way Internet is used into a new era. It provides an easy way to reach audio, video, text and graphics.

- WAIS (Wide Area Information System): It was developed by a company called thinking machines. It allows users to search indexed text on a number of servers. With the WAIS, one uses a computer to search in natural language among all the servers and indexed documents.

The internal Internet provides two types of services, known as (a) Intranet service (b) Extranet service.

2.C.3.a. Intranet:

Intranet means an internal Internet that utilizes, Internet technologies, TCP/IP technology and browsing technology, within an organization. Internet refers to a web model of network infrastructure that is run completely on the inside of a private network. The mode of transmission through which the activities take place is similar to that of browsing the World Wide Web.

Benefits of intranets are:

(1) Increased information efficiency; (2) Low technological implementation;
(3) Ease of use; (4) Financial gains.

The term “Intranet” has evolved to describe the use of Internet technologies within an organization for enhancing connectivity and communications.

2.C.3.b. Extranet:

Extranet can be defined as “Collaborative network that uses the Internet technology to link businesses with their suppliers, customers, or other business
partners that share common goals. An extranet can be viewed as part of a company's intranet that is made accessible to other companies.33

The infrastructure, where specific trading partners forming part of the extended enterprise are given selective access to the organization's Internet, is known as an "Extranet" providing entry to corporate information via an extract introduce security issues requiring action to be taken to restrict unauthorized access to specific applications and information, using some or all the following measures.

1. System passwords 2. Router filtering
3. Challenge / response authentication 4. Firewall techniques

The primary motivation to implement intranets is to improve the flow and timely access to information within an organization as well as to facilitate collaborative working on corporate projects. Internet technologies offer cost-wise savings over competing alternatives as well as reduce the training time for implementation. One-to-many publishing applications can significantly reduce the cost of producing, printing, shipping and updating corporate information. Two-way transaction driven applications can improve information quality and provide a highly efficient alternative to paper-based business processes. Finally, many-to-many interaction facilitates the exchange of information between interested individuals, perhaps, forming a part of a newsgroup or workgroup.

Whilst an intranet services the internal organization and extranet extends the capability to major trading partners, it is quite likely that at some point open access to the Internet will be required.

**SECTION D: Libraries in electronic information environment**

The large amount of information produced in the world posses many problems in information handling, retrieval and dissemination. The increased
availability of CD-ROM products, the electronic publishing activity, the education and training activities in the country have focused on the application of new technology in libraries. This has resulted in the expansion of utilization of computer and their application in many areas. Computers and their multifarious roles have evolved to such an extent that they have reached almost every area of human life including libraries. It is now possible through a computer to read and download information, texts of articles, reports, and other material. This has brought about a revolutionary change in the way some libraries adapt and function shifting from print to electronic information dissemination. Such libraries are called Digital libraries.

2.D.1. Digital libraries

The Digital library could be referred to as a computerised network system where all the information is stored in electronic format, which can be accessed and transmitted through networks enabling retrieval of desired information by a large number of users. Users will normally access the information they desire using a terminal desktop computer at their place of work.

(a). Definitions:

Digital libraries have been variously defined. They may be defined as electronic information collections containing large and diverse repositories of digital objects, which can be accessed by a large number of geographically distributed users.

Yorkey\textsuperscript{36} has defined digital libraries as “Electronic libraries in which a large number of geographically distributed users can access the contents of large and diverse repositories of electronic objects”

Cleveland\textsuperscript{37} has given the following working definition: “Digital libraries are libraries with same purposes, functions, and goals as traditional libraries- collection development and management, subject analysis, index creation, provision of access,
reference work, and preservation. A narrow focus on digital formats alone hides the extensive behind the scenes work that libraries do to develop and organize collections and to help users find information.

The institutions involved in the American Digital Library Federation came up with a similar notion of digital library. "Digital libraries are organizations that provide the resources, including the specialized staff, to select, structure, offer intellectual access to, interpret, distribute, preserve the integrity of, and ensure the persistence overtime of collection of digital works so that they are readily and economically available for use by a defined community or set of communities."38

The Association of Research Libraries (ARL) has explained what qualities a digital library has or should have:

- A digital library is not a single entity.
- It requires technology to link the resources of many.
- The linkage between the many digital libraries and information services is transparent to the end user.
- Universal access to digital libraries and information services is a goal.
- Digitally library collections are not limited to document surrogates; they extend to digital artefacts that cannot be represented or distributed in printed formats.39

(b). Characteristics of a digital library:

Digital libraries have the following characteristics:

- Users span the publishing / end users spectrum, from authors and publishers to traditional library functions to end seekers of information
- Digital libraries integrate meta-information about non-digital information with digital information
Digital libraries support a wide range of service models for security, authentication, intellectual property control, billing and payment.

The materials in digital libraries are in a variety of forms, including text, image, video, 3-D models etc.

Digital libraries include meta-information in addition to full text.

(c). Digital library-functions:

According to Fuller the key functions of digital libraries are,

- To manage large amounts of digital contents of information,
- To preserve unique collections through digitalization,
- To perform searches that are impractical manually;
- To protect content owners information,
- To improve access to information,
- To deal with data from multiple locations, and
- To enhance the distributed learning environment.

(d). Advantages of digital libraries:

- Ability to search: Online searching has for some years been replacing printed abstract journals. Since most current material is now produced via computers, it can generally be provided in the ASCII form and be searched. For those documents which are searched rather than read (e.g. many reference books, compilations, etc.), electronically, can be expected to take over shortly. Printed encyclopedias, for example are giving way to CD-ROMs, which are small, cheaper, and a more effective.

- Ubiquity: Another key advantage is ubiquity. Many simultaneous users can access a single electronic copy from many locations. Copies can be delivered with electronic speed, and it would be possible to reformat the
material as per the reader preference. Since readers get a screen display of the object, rather than a physical object, loss rates by theft are eliminated.

Support wider range of material: Digital storage also permits libraries to expand the range of material they can provide to their users. Digital material can also permit access to videotapes and new kinds of multimedia materials that are created only on computers and have no equivalent in any traditional format.

Preservations: Another major advantage is preservation. Digital information can be copied without error. As a result, preservation of information in a digital world does not depend on having a permanent object and keeping it under guard, but on the ability to make multiple copies, assuming that at least one will survive.

Access to current information: For researchers, digital libraries provide access to up-to-date current literature and thereby help them to be aware of current trends.

The benefits of the digital library include – (a) reduction in the physical storage of information, less wear and tear on objects; (b) opportunity for several people to view at the same time; (c) the ability to view the contents at home, office or any other non-library locations and (d) the potential for increased cost-effectiveness.

(c). Limitations:

Digital libraries are mostly dependent on suitable telecommunications link and computer system for proper utilization and information transfer.

They depend much on suitable technology and training of the end users in handling a variety of retrieval software, search strategy formulation, and cost consideration in the case of online search.
As on today the technology has not percolated to the required level, to make digital libraries acceptable on par with the conventional libraries with printed documents.43

2.D.2. Virtual libraries

Digital library or electronic library may not necessarily be networked, but would largely contain digitalized information along with print based publications, but the virtual library is a library without walls, spread across the globe, from where one is able to retrieve the whole world of information through properly networked workstation.

(a). Definitions:

The concept of "virtual libraries", defined simplistically, embodies a phenomenon that any person who has a computer (or a terminal) and by which he can make a connection to the library network(s) can access not only the resources of that library but also access variety of information that is available nationally and internationally through networks, like the internet, intranet, without being physically present in the library. That is, virtual libraries provide their patrons the facility to use the information resources any time (some libraries may have time restrictions) and from virtually anywhere, provided the patrons have the access to right network(s). Further, virtual libraries may have: (1) Multimedia capabilities that let the library users see graphics (e.g. Maps in a geographic information system) and listen to sound or voice and (2) hypertext capabilities that incorporate the techniques of hypertext and multimedia.

The virtual library according the Gretchen Reed “The information has to go where the people are, not vice versa. We have created an environment where essential information, expertise and data are always available to every one – day or night, at home or at work”.

75
Timothy Green, director of business research at the Centre for Business Knowledge (CBK) defines virtual library as “A set of services that gives customers the knowledge they need to make the highest quality business decisions in the least amount of time”.

The electronic library of today is more than just a virtual version of the older book stacks, it is really a transformation of how information is conceived and delivered.

(b). History of virtual library:

The virtual library formally opened its doors to the public in April, 1995 at Public Library of Charlotte and Mecklenburg County (PLCMC), North Carolina. According to Lois Kilka, PLCMC new technologies manager, it was the demise of the library’s collection of 16mm films and phonograph records that led to the birth of the virtual library.

The PLCMC virtual library is a showcase for emerging communication technologies and electronic information access that serves as a community computer-learning laboratory.

The PLCMC captured the 1996 American Library Association / information today, Inc ‘Library of the future’ award for its virtual library – a place where area residents can use and evaluate a multitude of software packages, multimedia CD-ROMs, and electronic information resources.

The PLCMC’s virtual library is a computer-learning lab for the whole community. Visitors can travel the Internet, explore interactive multimedia, try out desktop publishing and imaging, and learn to use a variety of computer applications.

(c). Characteristics of virtual libraries:

Sherwell (1997) describes the characteristics of virtual library as: There is no corresponding physical collection. Documents will be available in electronic format.
Documents are not stored in any one location. They can be accessed from any workstation. Documents are retrieved and delivered as and when required, and effective search and browse facilities are available.

(d). Virtual library in an academic library of the 21st century:

What is needed is a vision of what the academic library of the 21st century will be and that requires examining our basic assumptions about the future role the library will play in higher education. Involving faculty and students as well as librarians in developing that vision can be the beginning of a process that will result in funding for a new kind of library integral to the teaching and learning process of the university.

The following are some of the assumptions common to Academic Libraries of the 21st century.

- Teaching and learning are becoming more collaborative: Today academic library users need group study rooms and table, individual and group carrels, and a mix of setting comfortable for various styles of working together. They also need access to media and technology in shared environments, especially network connections. One-way reader anticipates library centred learning.

- Learning should be free of space constraints: Learning should be anywhere, anytime, in a variety of environments, often social. Some students prefer to listen to music while they study. Classroom instruction is no more a learning process in the present digital world. A student can learn sitting anywhere in any environment. Hence, a digital library is the need of the hour.

- Constant training and retraining will be necessary in the new information environment: The information professionals require more skills than ever to monitor the changes, and design the system to exploit new resources and
help teaching faculty and students how to use those systems. Therefore, constant training and retraining of information professionals will be necessary to meet the constant changes as well as to provide sustained consultation.

Every one needs to be connected: In the digital library environment, the students are likely to carry their own computers with them and are looking for places to plug them in and get access to the campus network. Therefore, academic libraries should be wired for power and access using tables with adequate wire management systems to permit flexibility in furniture placement.

The merger of text and media: Libraries that cannot provide graphical interfaces and image-based systems are in danger of seeming irrelevant to students and faculty. But providing the technology necessary for that access is expensive and raises new set of issues such as, security, printing costs, and appropriate use of library computing. Therefore, the academic libraries need to plan for extensive multimedia use, including student requests to incorporate media into their research assignment and presentations.

Electronic resources change the role of paper: Electronic resources, that are digital form of information, have brought about unusual change in the role of conventional library systems. Each library will have to work with a different set of circumstances and constraints in planning and designing a library system. Therefore, the traditional system of libraries must be converted into a digital library system to meet the demands of the user in any academic library.

These assumptions may help to build a new age library for the 21st century where the academic libraries are enabled to provide better work stations, network
connections which are not available at present to students and faculty at home. These assumptions also make the library more conducive for learning.\textsuperscript{46}
References


