CHAPTER - IV

INFORMATION TECHNOLOGIES AND THEIR APPLICATIONS TO LIBRARIES AND INFORMATION CENTRES
4.1 Introduction:

"Ancient Carthage had a library of scrolls; the mediaeval monks had libraries of handwritten manuscripts. In the fifteen century, John Gutenberg invented movable type and thus, ushered in the era of mechanical printing. A relatively short time in 1658, John Amos Comenius Publicity. ORBUS PICTUS, considered to be first illustrated textbook. As time progressed, more efficient methods of printing, the advent of photography and the use of colour resulted in more, better, and less expensive books." Writes James Cabeceiras.¹⁹A He further writes more recently, libraries have been providing information in many different media. Libraries now circulate books. (Both hard cover and paper back), microforms, art prints periodicals, disc recordings (CDs), Audiotapes, Games and simultaneous, motion picture films, video tapes, laser video discs, filmstrips, computer programs, models, realia (Real things), animals and minerals. With the exception of perhaps four or five of the items listed, none were available in libraries just a few decades ago. The microcomputers - a seventees phenomena - is
a new type of print technology available to all areas of our society including the libraries. Libraries realigning the advantages of the microcomputer were quick incorporate it into the library’s information system."

From the time invention of printing to the present age of electronics, variety of information storage and transmission media have found their ways and have helped to preserve and transfer the culture, tradition, wisdom and knowledge from generation to generation.

Scholars have classified these information technologies in different ways. From among these, it is felt appropriate to mention the classification of technology made by Kenneth E Dowlin’s.

Dowlin\(^3\) grouped all these Information technologies into three segments they are.

a) Storage Technologies
b) Transmission Technologies
c) Both Storage and Transmission Technologies.

He also listed various technologies under these groups as detailed in table 1.
Table 1
Classification of Information Technologies by Dowlin

<table>
<thead>
<tr>
<th>Storage Technologies</th>
<th>Transmission Technologies</th>
<th>Both Storage and Transmission media</th>
</tr>
</thead>
<tbody>
<tr>
<td>Printed Text</td>
<td>Physical Transport</td>
<td>Video</td>
</tr>
<tr>
<td>Film</td>
<td>Telephone</td>
<td>Video Disk</td>
</tr>
<tr>
<td>Micro forms</td>
<td>Cable TV</td>
<td>Videotext</td>
</tr>
<tr>
<td>Audiotape or</td>
<td>Broadcasting</td>
<td>The Computer</td>
</tr>
<tr>
<td>Recording</td>
<td>TV</td>
<td></td>
</tr>
<tr>
<td>Videotape</td>
<td>Video Text</td>
<td></td>
</tr>
<tr>
<td>Video disk</td>
<td>Radio</td>
<td></td>
</tr>
<tr>
<td>Computer</td>
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</tr>
</tbody>
</table>

On the basis of Dowlin's classification the technologies for storage and transmission of information are detailed in Table 2 for the convenience of present discussion.

Table 2
Information Technologies and their forms

<table>
<thead>
<tr>
<th>Storage Technologies</th>
<th>Transmission Technologies</th>
<th>Both Storage &amp; Transmission media</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Printed Documents</td>
<td>Radio</td>
<td>Video</td>
</tr>
<tr>
<td>- Microfilms</td>
<td>Telephone</td>
<td>Video Disk</td>
</tr>
<tr>
<td>- Micro Opaque</td>
<td>Television</td>
<td>Video text</td>
</tr>
<tr>
<td>- Aperture cards</td>
<td>(Cable and Broadcasting)</td>
<td>The Computer</td>
</tr>
<tr>
<td>- Computer output</td>
<td>FAX E-Mail</td>
<td></td>
</tr>
<tr>
<td>Microforms</td>
<td>- Micro fiche</td>
<td></td>
</tr>
</tbody>
</table>
3) Audio visual materials
   - Films and Recordings
   - Still picture
   - Audio recordings

The above technology are discussed briefly in the succeeding paras.

4.2 Printed Documents:

Printing has significantly changed the social, economic, political, educational, scientific, technological and cultural activities of the human beings. There have been tremendous advances since Gutenberg in printing technology and in Book production methods. Emphasising the importance of printing J.C.R Licklider states that "A printed page has enough resolutions to meet eye's demand. It presents enough information to occupy the reader for a convenient quantum of time. It offers great flexibility of font and format. It lets the reader control the mode and rate of inspection. It is small, light, movable, cuttable, clippable, pastable, replicable, disposable and inexpensive".

Printed documents are published in variety of forms. They may be grouped differently on the basis of their form,
their content, their usage etc. On the basis of content the documents are grouped into primary, secondary and tertiary documents.

Primary documents contain new or original interpretations of known facts. They are organised in target audience oriented approach. Sometimes they may also be unconnected and presented as separate units. They may not necessarily be integrated into the general body of scientific, technical and societal knowledge.

Secondary documents are those derived from primary sources. They are generally organised and arranged according to definite plan. The scattered information is cohesively gathered. The secondary information have the tendency to deviation new information with older information in a helpful manner. They act as repositories of assimilated and digested data.

Tertiary documents are those that are based on the primary and secondary sources of information. They are organised and arranged according to a definite plan. The information presented is highly condensed to provide high density and relevant information in minimum number of expressions. They also act as aids to search primary and secondary sources.
Based on this tripartite structure the printed documents of variety of kinds may be organised as indicated in the following table.

**Table 3 Tripartite Structure of Printed Documents**

<table>
<thead>
<tr>
<th>Primary</th>
<th>Secondary</th>
<th>Tertiary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Periodicals</td>
<td>1) Bibliographies</td>
<td>1) Year books</td>
</tr>
<tr>
<td>2) Research/technical reports</td>
<td>2) Indexing and abstracting services</td>
<td>2) Dictionaries</td>
</tr>
<tr>
<td>3) Conference/ proceedings</td>
<td>3) Reviews, State of Art Reports, Progress, reports</td>
<td>3) Bibliography of Bibliographies</td>
</tr>
<tr>
<td>4) Official Publications</td>
<td>4) Advances Monographs</td>
<td>4) List of researches in Progress</td>
</tr>
<tr>
<td>5) Patents</td>
<td>4) Reference Books, Encyclopedias, Dictionaries,</td>
<td>5) Guides to information sources/ Organisations</td>
</tr>
<tr>
<td>6) Standards</td>
<td>Hand books, Tables formulation</td>
<td></td>
</tr>
<tr>
<td>7) Trade literature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8) Theses and Dissertations</td>
<td>5) Text books</td>
<td></td>
</tr>
<tr>
<td>9) Laboratory Note books</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10) Diaries, Memoranda etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11) Internal Research reports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12) Personal files etc.</td>
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</tr>
</tbody>
</table>
Printed documents serve different purposes of different users. Despite the fact that new advances in storage media have taken place, the printed documents have maintained a dominant position in the information market and as well as in libraries. It is hard to say that the new information storage media have completely replaced printed documents, they continue to be primary collection in libraries. This is true particularly with developing countries like India.

4.3. Microforms:

The terms microforms and/or Micrographics by definition are referred to photographic documentation of films involving considerable reduction. The prefix 'micros' is referred to a photographic copy that is too small to be read without magnification.

The birth of microphotography is traced to 1930's. It was John Benjamin Dancer in 1839 introduced 'Microphotography' and in 1853 ultimate success was achieved to produce stable microforms. The use of micro photographic materials in fact was first made in transmitting secret messages/documents in military operations. Their use was brought in library environment around 1930's. By 1960's and 1970's microform collection in libraries became popular.
Microforms available today are in varied forms and sizes and they are classified into following groups:

a) Roll Microfilm: It is the transparent (translucent) media, pages arranged sequentially. This form is available in 8, 16, 35 and 70 mm. sizes. The roll runs to a length of 100 feet. The roll films are packed in reels, cartridges and cassettes. The roll films are photographed in different modes viz., Cine mode, Comic mode, Duo mode and Duplox mode. The reduction of roll films ranges between 10x and 24x.

b) Microfiche: It is also transparent. Flat and pages are arranged in rows and columns. Microfiche is normally in the standard size of 148x105 mm. with 98 frames. But there are also fiche with 60 frames and as well as on the higher side of 98 pages. Most microfiche are printed on horizontal mode and the reduction ranges between 18x and 24x.

c) Ultra (Micro) fiche: These are ultra high reduction microfiche. The National Micrographic Association defines Ultrafiche as microfiche at reduction in excess of 90x. There are however minor disagreements. The reduction parameters range between 30X and 90X and are termed from medium to high rate. There are even examples of very high
reduction up to 150x. The National Cash Register's PCMI Library has microfiche with 3200 images on a 148 x 105 mm. size. This is at a reduction of 150x and is yet to be commercialized.

d) Micro-Opaques: Microprints and microcards are two versions of micro-opaques. They are printed on 75 x 125mm. (3"x5") microcards and on 148 x 105mm. (6"x4") microprint format. Microcards are produced from film masters on photosensitive paper and the microprints are printed by ink by offset process. Both are invariably positive in polarity and card will have usually 100 pages in 10 x 10 matrix.

e) Aperture Cards: The aperture cards are more common for drawings. A frame strip of 35 mm film is permanently fixed on to an Aperture made on a punched card. The punched card also bears a brief information about the contents of the strip and can be read without magnification. More than one image with related texts can also be combined into an aperture card similar to Jacket films.

f) Computer output Microform: (COM): Computer output on microform is a microfiche produced directly from machine readable text. This is a combination product of computer
technology and microphotography. The text stored in computer media can be directly reproduced in film with the help of CRT without creating a paper copy. COMs are available in 24x, 42x and 48x reduction. They are both in horizontal and vertical modes.

The storage capacity of COMs are much higher than normal reduction of 48:1. The COM of 148 x 105 mm. contains 270 frames hence can store 270 pages. COMs are found very useful in bibliographic recording and controlling and many libraries these days are producing their library catalogues in COM. Number of libraries in United Kingdom are using this technology for production of their catalogue.

The table below gives in brief summary of the most common microfische formats in an International Standard size 148 x 105 mm. (A6).
Table 4

Common microfische formants

<table>
<thead>
<tr>
<th>Size</th>
<th>Reduction(X)</th>
<th>Coln.</th>
<th>Rows</th>
<th>No. of Frames</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8---X11</td>
<td>24</td>
<td>14</td>
<td>7</td>
<td>98</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>8---X11</td>
<td>42</td>
<td>25</td>
<td>13</td>
<td>325</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>8---X11</td>
<td>48</td>
<td>28</td>
<td>15</td>
<td>420</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>8---X11</td>
<td>48</td>
<td>18</td>
<td>15</td>
<td>270</td>
</tr>
<tr>
<td>2</td>
<td></td>
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</tbody>
</table>

* Single images occupy two frames.

Microforms became popular because of the advantages over printed book forms. The advantages include high storage capacity, efficient preservation, durability less mailing cost and so on.

Thus, the growth rate in micro forms availability and acquisition to libraries was on an increase from 1950's to 1970s. During this period several micro publishing industries like UMI, British Micro Publishing Industry and
several such major and highly professional publishers became active and revolutionized the microforms production.

Microforms though had their advantages over printed books also carried certain disadvantages too, such as - high cost of production, need for reading machine and reflected light damages and dust magnified and such others. Further inventions particularly audiovisual forms and computers, overtook the micrographic industry and thus their use in libraries during 1980's and later has been on decreasing side.

4.4 Audio-Visual Materials:

Edision's 1877 patent of phonograph, a cylinder covered with tin-foil on which sound waves could be recorded and from which they could be retrieved, together with Hertz's work on radio waves in 1888 and in 1889, Berliner's first flat disc recording, prepared the way for all the developments in audio in the 20th century.

In 1900 Marconi demonstrated wireless telegraphy and 1920's saw the various recording media perfected. In 1940 PVC tape became available and Philips Cassettes in 1960.

In 1873 Joseph May, a telegraphist, noticed that his equipment did not work properly in sunshine. This observation
of the effect of light on salenium led on to the development of photo electric cell. The invention of the amplifying valve in 1896 and cathode ray tube in 1897, were essential components for an electronic camera. John Logie Baird, a Scottish inventor of Television (1926) is credited with a concept of disc-based video recording machine. In 1928 he devised a picture recording equipment in which a needle cut a groove into a revolving disc in response to electric pulses from a television camera, in a way similar to that of sound recording by electrical pulses coming from a microphone.

The major part a present day video recording is primarily on tape. The Black and White video tape recording was demonstrated in 1951, colour in 1957 and the disc recorder in 1968.

Audio and Video materials thus became popular information storage media. Today, variety of Audio visual materials are available and these form part of library collections. They may be grouped into three categories.

1) Films and video recordings: There are various sizes of films and video recordings primarily 35mm, 16mm, 8mm films are popular. The video recordings of 3/4 inch and 1/2 inch VHS and Beta are seen in the market. These are
available in forms of reels, cartridges, cassettes and video disks.

2) Still pictures - These includes slides, film strips, transparencies, flat picture and art production.

3) Audio recordings: These are available in the form of discs, tapes and cassettes.

    Audio and video tapes and disks can store a far greater amount of information in considerable less space. They are thus compact and portable and hence audio visual materials have become popular information storage media.

4.7. Computer

Misra and Phadke89 state that "The first generation of computer manufactured with the use of vacuum tubes which were more bulky and energy consuming came into being during early nineteenth century. The use of vacuum tubes for computers was replaced by transistor by Bell Telephone Laboratories during 1947 bringing down physical volumes of the computer to 1000 times smaller than first generation of computer. In 1951 the use of transistor was replaced by integrated circuits and this introduced third generation computers."
Rajan and Sathyanarayana\textsuperscript{101} state that "The developments during 1975-1990, leading to integration of hundreds of components are single Silicon Chip known as Medium Scale Integrated Circuit and later integrating over 30,000 components on a single chip known as Large Scale Integrated Circuits and further integrated over million components on a single chip of a size of a postage stamp known as Very Large Scale Integrated (VLSI), circuit increased storage capacity of the computer to greater extent and minimized the size of the computer and also enhanced the speed of operation. Thus the computers under this category are known as fourth generation computers. A fifth generation computer with still higher speed, capability and functional ability are already on the way".

There are primarily three types of computers viz

i) Digital (\textit{i}) Analog and (\textit{iii}) Hybrid. Further these are classified as Main Frame Computers, Mini Computers, Micro Computers and Super Computers.

\textbf{4.5.1 Computer Storage}

The Computer has two types of storage devices/ sections viz.,
(A) Primary or internal storage device/section

(B) Secondary or external storage device/section.

A) Primary or Internal Storage Device Section

The Internal storage section is basic to all computers. It is made up of several small storage area called location shelves, each of these locations can store a fixed number of bits called word length of that particular primary storage.

The storage capacity varies on the size and technologies used. Formerly, the storage capacity of large computer systems was more than smaller systems. With the use of latest technological advances like very large scale integration, even smaller computers have increased storage capacity and speed of operations.

The internal storage section is normally called by different names such as memory unit, internal storage, primary storage, main memory and so on. This internal memory unit is made up of solid state devices that may belong to one of the following two media: (a) magnetic core memory (b) semiconductor device. More recently, semiconductor memories are largely used in computers. There are two major categories of semiconductor memories: Read Only Memory (ROM) and Random Access Memory (RAM).
ROM has contents and used for permanently residence programmes and fixed data tables. RAM is used for transcendental programme and data. ROMs are three types (i) The first type of ROM is one, in which the data is placed at the time of manufacture. The second type is field programmable by the user. This type is known as programmable read only memory (PROM). The third type is a reprogrammable read only memory/erasable Programable Read Only Memory (EPROM). The contents of EPROMs are erased by ultra violet light and reprogramme by electrically.

B) External storage/secondary memory devices:

The processing of the data is done with the fast primary device. But with the increase of data in the primary storage device, it becomes insufficient. Therefore the secondary storage devices/Auxiliary memories are used to store additional information. These secondary storage devices include Punched Paper Tape, Tape Cassettes and Cartridges, Magnetic Disk, Floppy disk, Winchester Disk, Magnetic Drum and Optical Disk.

These different devices can be used as secondary storage but one selected for a particular application mainly depends upon how information needs to be accessed.
1) Punched Cards:

   It is one of the oldest storage device to input the data into computer. It’s length is 19x8 cm. and has eighty columns numbered from one to eighty. Further, each column is divided into twelve horizontal rows. The data can be stored on the card by punching rectangular holes at appropriate positions by key punching machines. These punched cards are then fed into card reader which translates the meaningful holes into corresponding data that go to the computer memory. However, due to development of newer storage devices, the old punched cards have now become obsolete.

ii) Magnetic disk:

   Magnetic disk is a thin, circular metal plate/plates coated on both sides with a magnetic material. It has many concentric circles, which never touch each other, called as tracks. Data are recorded on these tracks, usually on both the surfaces which remain there permanently until they are overwritten.

   A disk consists of a number of these disks. Three or more mounted about 1/2" apart from each other on a central shaft which rotates a speed of 2400 or more revolutions per
minute (rpm) All the disks of pack move simultaneously in the same direction, and at equal speed.

iii) Magnetic tapes:

A magnetic tape is continuous strips plastic tape coated with magnetic materials and wound on to a reel, similar to audio tape in appearance. Data are encoded on tapes surface in rows called tracks or channels that are seven to nine in numbers, acrossing the tape length. The records or group of data are stored on the tape sequentially and between two or three records. The magnetic tapes are available in various sizes with different storage capacities. During 1950, 1/2 inch wide 2400 feet long tape wound on tube a 10 inch diameter reel introduced which became very common for mainframe and minicomputer instalations. Later, small computer cartridge tapes have become much popular because of their reduced size, lesser length of tape, and with more storage capacity.

During recent past cartridge tapes of different sizes and different storage capacities have been introduced by different companies.
An advanced Mini Cartridge Tape is also available from 3M Co, USA. It contains 7mm. wide and 307.5 feet long tape encased in a 3 inch cartridge. It holds 120 MB of data.

In 1990, Gigatek introduced the first QUIC data cartridge with 525 MB capacity. Stevens\textsuperscript{124} has reported that quarter inch/mini cartridge from 3M Co. USA will offer upto 10GB capacity by 1995. Russell\textsuperscript{109} states that Hewlett packard Ltd. has also projected future capacity of DDS -4 Cartridge upto 16GB by 1997.

Magnetic tapes are less versatile than magnetic discs. The data from tape only be accessed sequentially. The tapes, therefore have long access time with low data transfer rates. Hence, their use with the introduction of new devices like magnetic disk has been reduced.

iv) Floppy disk:

It was introduced by IMB Inc in 1970. It is circular in shape and also flexible. It contains a protective jacket with linear and various holes. The Floppy rotates when data are recorded in a digital code on magnetic surface of the disk. It measures 8" in diameter. Further 5.25 inch diskette with storage capacity of ranges from 360KB to 1.2 MB depending on the sides used for recording and number of
tracks per inch was introduced in 1971. In 1980, 3.5 inch floppy diskette was introduced with a typical storage capacity of 1.44 MB was introduced. Further by 1989 and several companies introduced 2 inch floppy disk with a storage capacity of 7.2 MB with double-side disscatte. Recently several companies have introduced 3.5 inch floppy discs with double sided recording capacity of 10 MB. Presently four types of diskettes are popular

a) Single sided single density
b) Single sided double density
c) Double sided single density
d) Double sided double density

Floppy disks are cheaper, easy to handle, reusable and flexible and also provide a cost effective means of secondary storage.

v) Winchester Disk:

There is one more type of relatively new disk storage unit known as Winchester disk. In this unit disks are permanently housed in sealed and contamination-free containers. Winchester disks are fast and highly reliable, yet low-priced compared with conventional hard-disk device. They are normally 5.25 or 8 or 14 inches diameter and storage
capacities of 10, 20 and 40 MB are typical. Some Winchester units employ dual disk drives in which case the storage capacity is doubled.

vi) Magnetic Drum:

Magnetic Drum is a direct access storage device that can be used for both sequential and random processing. It consists basically of a cylinder whose outer surface is coated with a thin layer of magnetizable material. A motor rotates the cylinder on its axis at a constant and rapid rate.

vii) CD-ROM:

CD-ROM is one of the several optical systems, including CD-Interactive, CD-Vedio, Optical cards etc., The data is encoded in the disk surfaces by mass production process. Once disk is made no more data can be added. It can only be read. Compact disk popularly known as CD-ROM (Compact Disc Read Only Memory) are more popular than any other media. These disks are of 12 cm. diameter and hole of 1.5 cm. at the centre and it has 0.12 cm. thickness. The CD-ROM disk is made of a tough plastic substance material called polycarbonate and as per ISO-9660 standard. The recording of the data on CD-ROM is done by using the laser beam. The
information in the CD-ROM can be read only by using a computer and an appropriate software.

The information or data is recorded on one side of the disk only. The CD-ROM disks store a huge amount of information/data. In each disk approximately 600 megabytes of information can be stored; That is, equivalent to 1500 floppy disks to 2,50,000 pages of text, 75 minutes of music to 18,000 pages of computer graphics, 4500 hours of digitized voice or an entire text of 20 volumes of encyclopedia.

Most of leading databases are currently made available on CD-ROM. the leading CD-ROMS manufactures are Philips, Sony and Hitachi.

The CD-ROMs have the following advantages; they are:

- It is permanent, durable, and has large storage capacity. In data protection nobody can enter or erase the data. The production cost is low. It can be accessed by a personal computer. Many can search data many time, we can transfer/mail it to anywhere and to any other medium such as paper, magnetic disk etc., through personal computer. It is ideal for library storage and it reduces the shelf space, It can be useful as mass media in dissemination of information,
It is a useful tool for training programme before entering into online search.

viii) WORMS: (Write Once Read Many Times):

Bennett\textsuperscript{10} Optical disks and erasable re-writable disks are also developed recently. WORM drives for micro computers are usually of the same size as full height 5 1/4 inch diskette drives with capacities ranging from 200 to 500 MB per side.

ix) Erasable disks:

These are new in the market.

4.6. Transmission Technologies

Some of the transmission technologies of today include Radio, Telephone, Television, Cable Television, Telex, FAX and on-line, E-Mail.

4.6.1 Radio:

Though radio has been an important transmission media, it is not being used by the libraries for the dissemination of information.
4.6.2 Telephone:

Telephone is widely used through transmission channel, it has cut across the geographical boundaries. It is one of the most advanced and reliable person to person method for communication in the world. It is a primary mode of rapid communication. It is taken for granted that a connection can be made from any point of this country to any other point in a matter of minutes.

There are over 400 million telephone connections and over 60,000 telephone exchanges all over the world.

In India as on 1st April 1948, the country had about 80,000 working telephones served from a total of about 320 exchanges. There was not even a single Telex exchange. The total number of telegraphs office were of the order of 3300. Since then, the telecommunication network has grown manifold. We have now more than 4 million telephone connections working from about more than 12,500 exchanges.

We have a network of about more than 250 telex exchanges serving more than 40,000 connections. The number of Telegraph Office has increased to more than 40,000.

By the end of the century, there will be a need to provide 20 million telephone connections, extend telephone
service to all the villages as against only about 35,000 villages having telephone facility and build up a network for about 8,00,000 instigated voice/non voice subscribers.

In India switching system, has changed from electro-mechanical switching to electronic switching, Analogue transmission to digital transmission, co-axial to Fibre optics etc. When one subscriber wants to communicate with another, a connection is established between the two at the exchange. Since the connection is established by switching appropriate lines between in calling and the called party, the telephone network is known as public switched telephone network (PSDN). Further by the demand of the business people, a separate telephone network has established that is known as integrated services digital Network (ISDN).

An ISDN is a network, in general evolving from a telephony ISDN, that provides end to end digital connectively to support a wide range of services, including voice and Non-voice services to which users have access by a limited set of standard multipurpose user network interfaces.

4.6.3. Television

According to Kabeer* "A Television is the most popular media of modern times. It is a powerful media to arouse
social and political consciousness and to create a sense of unity among the citizens. Emerged in 1940's, Television stations began to function in large numbers after the World War II. TV is of common use now and is considered as part and parcel of our life. It is now a mass entertainer, educator and disseminator of information. The use of TV is so successful because it is used extensively by all class of people both educated and uneducated. Even the uneducated can be educated easily through this channel pictorially and with verbal conversation. The rate of growth of TV in India in the last 10 years has been faster than in any other country of the world. With the spread of the TV, libraries have become the potential use of the medium.

As the teaching-learning process focus more towards self-learning, the entire spectrum of instructional materials and media have undergone a thorough change. To this, TV in libraries has assumed a predominant position and called Androgenic learning system. It can be used for advertising library services effectively. Advertising is essential for the promotion of use of documents and library services. TV is an excellent device to attract readers to the library. The ideas to be advertised through TV include:
a) Library operations rendered in a library and availability of its resources;

b) Programmes on new books which will draw readers to the library;

c) Types of information services that are offered to its users;

d) Programmes that can awaken the public to utilise the resources and services in an effective manner, and

e) Programmes to stimulate public thought to action.

Oflate, there are two types of Television Technologies being used in libraries, viz., i) Interactive Television ii) Cable Television.

i) Interactive TV: Interactive Television makes TV a powerful and interactive learning medium. Here the TV viewers can interact with the people participating in the telecasted TV program. In an interactive TV system, the students in the class room watching the program can ask questions to teacher who appears on the TV.

ii) Cable Television: Cable Television has become popular in India in spite of the blame on it that it is a threat to serious communications. But it has tremendous public
access potential. In the library environment LCN (Library Cable Network) is the realization of the public access potential of the cable television. LCN is operating in developed countries to give library services to workers, immigrants, children in baby care centres and individuals with learning disabilities.

4.7 Both Storage and Transmission Technologies.

4.7.1 Video:

The term video encompasses the use of a camera (which digitises the images), recorder (which stores the digital signals on a magnetic medium), and a television set (which presents the digital image in visual form). A complete production studio, a portable unit, and the ability to telecast over the air or cable television can all increase the ability of the libraries and information centres to use this medium, but they are not required.

4.7.2 Video Recordings:

There are varied formats of video recordings, they are primarily grouped into three categories.

a) Open reel video tapes
b) Video cassettes and,
c) video discs
a) Open Reel Videotape:

Videotapes are available in 1/4, 1/2, 1 and 2-inch (0.63, 11.27, 2.54, 5.08 cm.) widths. Two inch videotape is used for broadcasting, and there is little likelihood that libraries would be involved with this size. One inch videotape is used mostly for studio production. Half inch videotape was most popular open reel format for localized viewing. During recent past quarter inch tape is in the market.

Presently, most professional studies record on 1 or 2 inch formats and duplicate onto 1/2 and 3/4 inch (1.90 cm.) formats for marketing.

The use of open reel videotapes is considered only if the type of equipment owned by the library is the open reel format. Otherwise, the 1/2 inch (1.27 cm.) videocassette is strongly recommended for the following reasons:

It is rapidly becoming the standard of the domestic market; unlike the videocassette, open reel videotape requires manual threading, which to an inexperienced person, can be a complex task, and if the video tape is improperly threaded, it can be damaged; and furthermore, most television studios that produce video programs for library acquisition
are presently using the 1/2 inch videocassette as their marketing format.

b) Videocassette:

Videocassettes containing 1/2 and 3/4 inch (1.27 cm.) and (1.90 cm.) videotape are presently realizing tremendous growth. It requires no special skill to operate videocassette playback equipment, which means the user will have little or no difficulty using it. However, the threading mechanism of a videocassette playback unit is extremely complicated, and it is advisable to be quite careful when moving the equipment.

The 3/4 inch (1.90 cm.) U-Matic was the first videocassette format designed and was intended primarily for industrial and educational use. It had the distinct advantage of being compatible with all sizes as videocassette recorders, regardless of manufacturer because it complied with the EIA (Electronics Industry Association of Japan) standard. The 1/2 inch (1.27 cm.) videocassette systems were designed and intended for home use; however, the quality of the equipment and the good resolution of the televised image is such that it is making them a growing favorite of industry and education as well. The number of 1/2 inch videocassette units being sold indicates that they may eventually become the only formats with which the library will have to contend.
The only apparent disadvantage of the 1/2 inch videocassette is that it is available in two popular but noncompatible formats - the Beta and the VHS. The library could, without any difficulty, acquire tapes in only one of the 1/2 inch videocassette format, if the videocassettes are to be used only on library equipment. If the library intends to make videocassettes available for home use, it may very well have to acquire information in both the Beta and VHS formats.

c) Videodisc:

Today, it is ultimately the videodisc that libraries are using as a standard for acquiring commercially prepared materials. Videodisc systems are manufactured recorded and sold by many agencies. Several educational agencies are producing video recordings in videodisc format for educational purposes.

The videodisc systems available popularity in the present day market include; (i) the consumer optical videodisc used in entertainment and instruction programmes, and (ii) the high density storage optical digital disc used for both digital and image storage. Apart from its application as one of the most promising computer mass storage technologies, it is already being used in transmitting graphics to complement on-line interactive
information systems. The technology is bound to have profound impact on the information society.

1) Optical Videodisc:

A videodisc is a plastic disc of the size of a phonograph record, containing information, both records and pictures, stored in billions of microscopic pits, which are etched by a high intensity laser in a reflective information surface. The information surface is coated with a protective acrylic layer. The data are arranged on the videodisc in 54,000 circular tracks or videoframes for continuous or individual display, on each side of the disc. The videodisc is used for individualized interactive instruction, record stores, or home entertainment.

The disc is read by a low-intensity laser beam. Two versions of the videodisc player and disc are available - the consumer and the industrial types. The consumer models are marketed by Magnavox and Pioneer, chiefly designed for movies and music. The industrial units are being marketed by Soni, DVA, and Thompson CSF, and are of particular interest to the IS & R community. The RCA introduced an interactive video disc player. The discs have a video play-back time of 1/2 hour or 1 hour per side. The industrial videodisc systems, incorporating a keyboard control, a microprocessor and the
player, are being used by some organisations, because of their capability of instant access, freeze frame, slow or fast motion.

ii) Optical Digital Disc.

The optical digital discs represent a high potential, very high density, low cost, archival mass storage media. Optical discs have a significantly longer life span than magnetic media. The digital disc has enormous storage capacity, as compared to print and magnetic storage devices. These units can store $2 \times 10^{11}$ bits of information. Its capacity is likely to be raised to $2 \times 10^8$ bits in a few years. The capacity is equivalent of 41,150 full text pages. It would be possible to employ juke box arrangement in the optical disc storage units for online access of as many as 1,000 discs. The storage capacities of these units are projected as shown below:

a) Optical digital disc pack (10 discs) - $2 \times 10^{13}$ bits or 4,115,000 full text pages;

b) Optimal digital disc pack (1000 disc) - $2 \times 10^{15}$ bits or 4.12x$10^8$ full text pages;

While the optical video discs are produced by mastering and replication process, the optical disc uses DRAW (Direct-
Read-After-Write) system, developed by Philips, which allows machine-readable data to be written and read immediately after. Several companies, including RCA, Thompson CSF, IBM, Drexter tech, are involved in the development of optical disc storage systems.

For information storage the optical disc appears as a formidable rival to microforms. According to Sustik and Terrence the optical disc offers the following advantages:

a) A videodisc is a mass storage medium that can store data representing text, pictures or sound, in analog or digital form; both formats may be encoded on the same disc.

b) Standard 12" videodiscs available today can store the equivalent of 108,000 still pictures (one hour of motion pictures) and two hours of audio. These capabilities are expected to increase with new designs in the near future.

c) Information can be accessed at random in three seconds or less, and also via a computer disc and communication channels.

d) Computer-generated text and graphics can be combined with videodisc displays on the same screen if desired.
e) In future, local duplication may also be possible.

f) The disc may have the longest life of storage media for archival purposes.

g) The videodisc system can be very economical.

Comparing the storage capacity and the unit cost, a standard x 24 microfiche contains approximately 100 frames per transparency, and the NCR ultrafiche contains 2380 frames per transparency. Containing $10^7$ bits of information on each fiche, as against $2 \times 10^{10}$ bits in the optical digital disc, 2000 fiche are required to match the capacity of one optical disc. With the recording density on the digital disc projected to $2 \times 10^{11}$ and $2 \times 10^{12}$ in the near future, the potential for using optical digital disc rises rapidly.

d) Videotex:

John Markeff states "Videotex is the generic term for the digital transmission of words and pictures to the home or office via telephone line, cable television, or over the-air television". Videotex is composed of two technologies, viz. Teletext and Videotex.
a. Teletex:

It is a subset of videotex, uses the blanking interval of over the air broadcasting and does not require a wire between the provision and the receiver. The entire data base is broadcast continuously with the receiver having the ability to "capture" specified "pages" of information. (Teletext was pioneered in Britain is a service of the British Post Office, now known as British Telecom). Since the size of the database is limited by the amount of time to broadcast all of the "pages", it seldom exceeds one hundred such "pages". It cannot be considered truly interactive. Teletext is one way only.

b. Videotex:

It has a two way of transmission system, which allows the user to select what is transmitted. The videotex systems that use cable television and telephone lines allow a user to search the menu for the pages desired, and then sends only that information. The inter-activity of these systems is limited to accessing the prestored "pages" through a series of menus. Thus, the user is still limited to highly structured inquiries. There is no ability for Boolean searches.
The major advantage of videotex is the ability to provide pictures with the text of the quality seen on television. Thus, it is a much more visual format than are computerized databases. The merging of the computer and the videodisc looks promising for transmitting high quality visual images with computer generated text. The storage of the information takes place through computer technology. Videotex may permit the user to originate messages or transactions. It is designed for a mass market, rather than for speciality use.

According to Martin, a videotex system involves the following activities:

1) The user employs a television set with a keyboard and added electronics for displaying information;

ii) The information displayed is from a remote computer which may perform computations as well as store data;

iii) The information is received at the user set by telecommunication, which could include radio transmission, telephone cable, cable television, or optical fiber. Today usually a telephone connection is used;
xiv) Still frames are displayed on the television set, though simple animation of images is possible; and

v) The information appears on the screen at the user’s command and is part of a larger selection of information which the system makes available.

A number of videotex systems have been developed, namely Prestel, system in Britain; Bildschirmtext system in West Germany; Teletel system, in France; Viditel system in Holland; Data Vision system, in Sweden; Telset, in Finland; CAPTAIN system, in Japan; and Vista, in Canada and many others.

Videotex is a serious contender for a major share of the information market.

4.7.3 Telex:

It is a text communication technology in which text is communicated over the telephone network and received at the other end by teletypewriter. The receiving teletype is activated automatically on dial up and prints the message. Because of its low transmission rate, this technology is getting obsolete in comparison to other text communication technology.
The principle development in recent years the low cost facsimile (FAX) machine which are now on the market in abundance. According to Mackean* states that, Facsimile is the only non-surface mail document delivery method which can handle graphic as an integral part of the text, which transmits non-Roman alphabets with ease, and which can convey a signature, had written drafts, sketches etc. This is because it is image, not character orientated.

Many libraries now own FAX machines. They can be used for just about any sort of communication and correspondence, though mainly they are used for interlibrary loan.

The true FAX machine offers something that no other technology offers: instant reproduction of paper documents, including graphics, in most cases, to remote locations (i.e. to other FAX machines).

Ordinary electronic mail may send the information contained within a document, but it will not send an exact reproduction of the document itself. This is because the FAX device is more like a combination of modem and copy machine which sends graphics as digital code. The receiving FAX machine merely decodes the information and reproduces it on
its copy machine component. As a result, pictures (if the FAX machine has halftone or gray capability) and other graphics can be sent as well as the exact page layout, signatures, etc.

Of course FAX machines, just like computers, printers, and automobiles, are not equal. Some have more features than others, and it is up to the purchaser to investigate and make an effort to buy the right machine for his purpose. Their low price has made them appeal to a vast market.

Whether or not the FAX phenomenon will actually become as popular as telephones and personal computers, they have been divided into two classes - personal and business. The chief difference between the two categories is that personal machines do not have as many features as the business machines.

The FAX machines are also classified into Groups I, II, III, and IV. Groups I and II are analog devices and require six and three minutes to transmit a letter respectively. Group III is digital and sends the same letter in one minute. This may explain why Group III has been taken over the market. Group IV is digital and will zap the letter in three seconds and requires a special network, and machines in this category are, more, expensive.
a) FAX and PCs:

It is now quite possible to FAX or receive a FAX sent document using an IBM or Macintosh equipped with a special add-on apparatus. This special equipment is simply a special FAX "board" and can be seen as just another add on for a micro, hundreds of which now exist that do many things. One thing we do need if using an IBM PC is an open slot into which the FAX board will fit ROM. Software instructions will often do the conversion of the text and graphics into a FAX file and then zap it via modem to another machine. FAX operations on a PC are memory intensive, easily taking a megabyte for anything significant which makes a hard disk drive mandatory.

b) FAX Modems:

A variety of modems now exist which will make the microcomputer perform many of the functions of a FAX machine. Apple Computer, for instance offers Apple FAX Modem for Macintosh users which allows communication with Groups II and III FAX machines. It still allows for the addition of a modem for communication with regular microcomputers because it is equipped with an extension serial port.
Other modems exist that do the same thing. One of these is the Light Fax, modem available for both the IBM and Macintosh. It features automatic dialing, auto answer, full document editing, transmission journal, schedule sending, file queueing, scanner support, and many other features. It has its own software available and is compatible with laser printers. This software will run under the Microsoft Windows operating environment, gives password protection, file format conversion and many of the other requirements of FAX users.

c) FAX on Wheels:

A message or other document may be sent by FAX machine to any location that has both a FAX machine and an RJ-11 telephone jack. Theoretically, one could transmit while travelling using the hotel phone, a restaurant phone, a phonebooth or in a motor vehicle (while the vehicle is not moving).

This is particularly helpful for interlibrary loan applications, where, in the past, a document had to be mailed (in one way or another) to another library or processing center, but now it can be sent immediately over the telephone and the receiver will have an exact duplication of the request.
The only expense in receiving a FAX document is the paper. The cost for sending a document is the telephone line charge. FAX machines are quite dependable. Wide variety of FAX machines are available today in the market.

d) FAX on the Networks:

Compu Serve and others have recently added FAX capability to their list of services for Group III FAX machines. What this amounts to is sending a paper copy of an electronic file on demand. There seem to be an increasing demand to this service from potential subscribers.

4.7.5 E-Mail:

Developments in telecommunication technology have made it possible to send messages speedy and accurately through enhanced telex systems known as electronic mail, or electronic messaging.

Electronic Mail or more popularly called as E-mail refers to the transmission of a message electronically through electrical signals. In other words, E-mail is non-simultaneous interpersonal electronic communication.

In the E-mail system typically the sender types the message using a computer keyboard and then the message is
sent through a computer system by using telecommunication channels to a defined mail box (i.e., to the addressee) and there it can be stored in the receiving end computer memory for the delivery to the receiver.

E-mail system allows creation and transmission of messages which can be addressed to an individual or to a selected group of individuals. The recipient can then read the message, answer it, store it or forward it to another individual, print on a paper or delete it. It is basically a computer mediated communication system. The specialised message handling softwares are available which can be run on both PC-AT and mini or mainframe computers. These softwares help the E-mail users to edit, format the message during entry and send the mail to the distribution list.

a) Usage of Electronic Mail.

Use of E-mail system has significantly increased during the past 6-7 years. The individuals and organisations who are part of the Academic, Research, Business and Library and Information Networks have started using this facility to a greater extent. E-mail has really become a very popular and faster mode of interacting with individual scientists and scholars. Academic Networks like BITNET (USA) JANET (UK) and
ERNET (India) have been offering the E-mail facility to their users.

According to Electronic Mail Association, there were about 5 million electronic mail boxes worldwide in 1986. It was estimated that the number of messages transmitted during 1990 were more than 120 million. So the trend is towards increasing degree of interconnection between the computer systems.

Recently Videsh Sanchar Nigam Ltd., (DOT) Government of India has introduced a Gateway Electronic Mail Services (GEMS), which is based on CCITT X400 message handling system for easy access to International Databases and E-mail users. Access is provided through PSTN of PSPDN and initially this service is mainly used for interpersonal messages and currently available in four metropolitan cities. viz. Bombay, Calcutta, Delhi and Madras.95

b) Application of E-Mail for Library and Information Services

E-mail has all the potentialities of using it for some of the library and Information Services and has already become an integral part of the libraries in the developing nations. Library and Information Centres which are part of Academic networks or independent information networks have
started using it widely and extensively. Some of the major areas where the E-mail could be used as effective media are:

i) Inter-library loan;
ii) Document ordering and claiming;
iii) Document delivery and claiming;
iv) Professional communication;
v) Reference service.

4.8 Computerisation of Library House-Keeping Operations:

According to Riaz any activities related to acquisition of books, classification, cataloguing, book circulation and book maintenance are traditionally known as house-keeping operations. Until recently, these activities were highly labour intensive. In recent times many libraries in India are attempting to computerise some of these activities.

A brief description of the computerisation of some of the housekeeping activities are outlined in the succeeding sections:

i) Automated Circulation Control Systems

Circulation of books and other materials is an important part of library services. This section deals very delicately
with the readers community. Here, one finds flow of reading materials, but the flow must be controlled by library operation so as to serve the users in the best way with available resources. It is the duty of this section to check misuse and promote proper use of library documents. Simultaneously, it is necessary to record the movement of material and maintain statistics in order to display strength and weakness of stock and provide guidance for collection development in future.

It is also expected that circulation should be as simple, speedy and effective as possible. All the stages of movement must be recorded and records be cumulated. The books requested for reservation must be trapped and the user served.

a) Objectivities of Circulation Control

The objective of circulation control may be summarized as follows:

1) To get information about documents to be borrowed;

2) To identify the borrower by particulars, such as name, address, borrower number, category, whether membership is lapsed, present status, borrower's signature, etc;
3) To identify the document to be borrowed, such as call number, ISBN, other identification numbers author, title, edition, year etc;

4) To record the borrowing with particulars, such as the date of loan, the date of return, to whom it is lent, any restriction regarding loan, category of loan, etc;

5) To trap the reserved documents;

6) To ensure rapid charging and discharging of documents;

7) To keep records of the number of documents on loan to individuals;

8) To check overdue documents and to prepare reminders;

9) To update loan files; and

10) To prepare statistics about use of documents and related aspects.

b) The Development of Automated Circulation

Circulation is one of the widely automated library operation, and it is often the first activity that libraries consider for automation. There are several reasons for this. For example most circulation control operations are primarily clerical in nature. These are error-prone activities in
begger libraries charging and discharging of library materials is highly labour-intensive. Detailed and accurate maintenance of circulation statistics manually is herculean task. Automated circulation system overcomes these limitations.

c) Functions of Computer-based Circulation Control System

A Computer-based circulation control system should perform the following functions:

1) Provision of information on the location of circulating items either all items or only those items on loan or elsewhere, i.e., at the binder, on reserve, being catalogued, etc;

2) Identification of items on loan to a particular borrower or class of borrowers;

3) Recording of holds or personal reserves for items on loan but desired by another borrower, often with additional provision for notifying the library staff when the item is returned and printing a book available notice for mailing to the person who requested the item;

4) Printing recall notices for items on long-term loan;

5) Renewal of loans;
6) Notification to the library staff of overdue items and printing of overdue notices;

7) Notification to the library staff or problem borrowers (i.e., those with unpaid fines, or overdue documents) either at the time of an attempted loan, or at the time a borrower is leaving the institution or on request from the library;

8) Calculation of fines, printing of fine notices, recording receipt of fines, and sometimes printing of fine receipts;

9) Calculation and printing of statistics of various types;

10) Analysis of both summary statistics and statistics for the circulation of particular items for use in acquisitions, planning of services and for other administrative purposes;

11) Provision for handling special categories of borrowers and special type of materials; and

12) Provision for printing due date slips, automatically generating orders for lost books or needed (additional) copies and printing mailing labels for remote borrowers.
These functions may not be necessary for all libraries. The outline justifies the possible features of an automated circulation control.

ii) Automated Cataloguing System

Automated cataloguing is possible by adopting any one of the following systems:

1) participating in a bibliographic utilities, such as OCLC, WLN, etc;

2) Using commercially available systems such as Mini or Macro MARC or software package used primarily for cataloguing;

3) Applying integrated system which is also used for acquisition and/or circulation purpose;

4) Utilizing book jobber or COM vendor services; and

5) Adopting simple local input from the acquisition system;

iii) Automated Acquisition System

An automated acquisitions system is expected to perform certain managerial functions in addition to certain clerical function. Systems are usually designed to respond to regular orders, blanket orders, exchanges etc. It is also designed to handle regular receipt, non-receipt, out of print
documents with wrong billing, unwanted documents with right billing, and so on. The typical functions of an automated acquisitions control system are:

1) Receiving records of items for acquisitions;

2) Ascertaining whether those items are already in the library or in the order procedure. If items are in the library how many additional copies are to be ordered? If previous editions are there what are the identities of new editions recommended for the order? etc;

3) Making input of the order in the specific format;

4) Checking whether orders are overdue and if so either cancelling the order or sending reminder(s) to supplier(s);

5) Checking of invoices or bills if supplied;

6) Accounting under fund details and sending bills for payment;

7) Maintaining record files for items or order;

8) Accessioning of the items received;

9) Keeping statistics; and

10) Maintenance of master file.
iv) **Automated Serial Control**

Automation of serial control system helps us to handle processing of serials more easily, quickly and economically. The system has to perform the following functions:

1) Inputing serial data (those data which are essential to the system);
2) Ordering new serials;
3) Renewal of presently subscribed serials;
4) Cancellation of presently subscribed serials, if necessary;
5) Accessioning of individual issues, as and when the issues are received;
6) Sending reminders, if necessary;
7) Claiming the issue, if necessary (such as, request for replacement of a defective copy);
8) Selective follow-up of missing issues;
9) preparation of various lists like a) List of periodicals received during a specified period. b) List of periodicals cancelled during a specified period; and c) List of holdings with their status; on shelf, on binding, on circulation, etc. (the lists can be by subject, by country of origin, by title, etc.).
10) Keeping track of the amount spent on serials subscriptions, serials binding etc. (subject-wise, if necessary);

11) Estimation of the budget for the next academic/financial year; and

12) Binding control.

There shall be additions to these functions depending upon on local needs.

v) Automated Information Retrieval System

Information retrieval (IR) concerns with the techniques and processes of representation, organisation, storage and accessing of information pertaining to a set of items. Functions of this system are as follows:

1) Classification and indexing—constructing representations of documents; for example, preparing main entries, cross-reference entries, added entries including subject index and then arranging the entries in a helpful sequence;

2) Search formulation (constructing representations of information requirements of users queries);
3) Searching (matching representations of documents against requests);
4) Retrieving (Printing or typing in a manual system);
5) Feedback (repeating any/all of the above four steps with modifications in response to an evaluation of the results obtained in each of the steps (1) to (4));
6) Indexing languages construction (the generation of procedures or rules of representations) and such other related activities.

vi) Automated Reference Service

From the very beginning, reference service has been defined in variety of ways. Sharma and Arya\textsuperscript{117} defined reference service as "that part of library administration which deals with the assistance given to the readers in their use of the resources of the library". Margaret Hutchins narrates "reference service includes the direct aid within a library to persons in search of information for whatever purpose and also various other library activities especially aimed at making information as easily available as possible".

The function of reference service is to assist library users in obtaining access to required information. It is
entirely a public service activity in which the librarian functions as a professionally trained information specialist. Much of the reference work entails two types of transactions. Firstly, it is a ready reference question which requires a factual response. Secondly, it is literature searching activity which demands more time to prepare bibliographies on specific topics.

Methodologies employed to answer both the queries are the same. The reference librarian interviews the enquirer to clarify the question; formulates strategy, and then identifies appropriate sources. In response, the enquirer is directed to these sources. In other words, the librarian actually does the search and provides factual information or bibliographic citations to the enquirer.

Till recently all types of reference activities were manually operated, that is the preparation of bibliographies in specific topic relied on printed indexing and abstracting journals. Bibliographic listings and other sources providing access to monographs, periodical literature, technical reports etc., were manually prepared.
system is also referred to as interactive i.e., conversational or real time which means as they occur. This interaction takes place through terminal connected to computer through communication lines. Thousands of abstracts and indexes, bibliographic and non-bibliographic data are stored on disks and used online.

a) Types of Reference Service Available Through Online

According Sitaram there are many types of information services and they vary greatly. The following are some of the types of searches that can be done using online services:

1) Retrospective Search:

It is a common search which goes back to the earliest dates covered for one or more databases. A retrospective search may cover a specific journal or some other particular area, but more often it is exhaustive.

2) Comprehensive Search:

Comprehensive search is usually done on a specific topic. It typically covers all documents types, all author and all time periods covered by the appropriate databases. For example, a comprehensive search may pertain to
vii) Machine Readable Reference Sources

For an automated reference service, the availability of machine readable reference sources is an indispensable prerequisite. The early 1960s witnessed the era of offline computer based systems. During this period (1960s - 1970s) many publishers of printed bibliographies and indexes started using computer based text-editing and photosetting techniques. Saffady states (30) that in the late 1960s and early 1970s, publishers of indexing and abstracting journals and bibliographies began to sell machine readable versions of their products in addition to or in place of their printed equivalents. This data was and is still offered on the reels of magnetic tape. MARC tapes are among the earliest examples of such machine readable bibliographic data products.

viii) Database

The term database denotes an integrated accumulation of computer processible data organized in a manner suited to a wide range of applications. It is synonym today for a collection of printed or numeric records which have been transformed and stored in a computer. A database may range everything from a standard index, to an encyclopaedia, to a statistical collection such as census reports etc.,
Databases may be classified into the following categories:

1) Bibliographic (or Reference) databases
2) Non-bibliographic (or source) databases.

The number of bibliographic and non-bibliographic databases is growing all the time. CD-ROM is being heavily used for this purpose along with other optical storage devices.

ix) On-line Information Retrieval Service

According to Railkar during the late 1960s and early 1970 information retrieval service remained offline. After receiving query, reference librarian used to formulate suitable search strategy consisting of a combination of commands and search terms. These search requests were then key-punched and batched for processing against one or more databases at predetermined schedule. When processed, the computer used to produce printed lists of citations for each request. The search results consisting of these retrieved citations (output) would be mailed to the enquirer or the originating library.

Online computer search is just like two way conversation between searcher and computer system. Therefore, online
patents, or government activities, or legislation etc. It also ensures exhaustive search.

3) Selective Search:

Selective search means a bibliography of recent research about a specific author or ongoing research conducted by a specific organisation. A list of newspaper articles on a recent event or on specific topic is another example. Online search is more amenable in such case than that of manual methods.

4) State of the Art Search:

The state of the art search identifies the current status of an area of research in a particular industry. It helps to discover what an organisation or individual is doing presently.

5) SDI Search:

A search profile can be stored indefinitely on an online retrieval system and search profile is updated automatically on many databases. The user simply enters the profile and citations are retrieved, then automatically mailed periodically to the user.
6) Ready Reference Search:

Many quick-reference questions can be answered by using online services. This is because online databases contain large amount of primary information in machine-readable form. Bibliographic databases may be used for citation, verification for inter library loan purpose. Directory or numeric, textual type databases available online provide immediate answer.

7) Patent Search:

Patent search is popular in business, commercial and industrial libraries. Manual patent search is highly time consuming and labour-intensive. Online patent search takes far less time and is less expensive. Patent issues and applications are both searchable.

4.9 Software Packages for Library Management:

According to Vyasamoorthy Libraries need computers, application softwares and trained manpower for computerizing their activities. Now a days even personal computers with greater memory and speed even suitable application software packages are in the market today. However, libraries lack trained man power.
According to Lohner Software refers to computer programme, rules, associated documentation and data pertaining to the operation of a computer system. In other words, software for library management is that component of the computer system which permits it to function usefully for a designated task in a library. In contrast to hardware components of a computer which can be seen and felt, software is not directly tangible. But without software, computer can not do any useful work.

Rahelamm and Sinha state that the term "software" stands for a set of computer programmes designed and developed to accomplish a task. Its two important characteristics are that it should be hardware independent as far as possible and it must fit specifications yet be easily altered to meet changing circumstances. For example, a book acquisition system must be able to change and incorporate acquisition routines also, without affecting the entire structure.

There are two types of softwares available: packaged software and custom-designed software. Packaged software is pre-written and commercially available. Custom-designed software is specifically developed to meet particular needs of individual library.
Package software is not available for specific requirement of a library. It is not of desired quality and does not measure up to desired standard and the product cannot be integrated with other related system or a data architecture.

4.9.1 Internationally Tested Software Packages for Library Management:

There exist some standard packages developed for library application. Some of the important application software packages have been discussed below in brief.³²

(1) CDS/ISIS

CDS/ISIS stands for Computerized Documentation Service/Integrated Set of Information Systems(4). It is a UNESCO supported library software package. It is a table driven system designed specially for handling non numerical information. This package consists of a set of programmes that performs different functions related to information processing, storage and retrieval.

CDS/ISIS contains six programmes, i.e., three users programmes and three system programmes. Major functional components of CDS/ISIS are file maintenance, retrieval and sorting and printing facilities.
This software was first developed in 1964 by Library and Documentation branch of the International Labour Office (ILO), and named Integrated Set of Information Systems (ISIS) for its library. In 1985, a computer version of the package was developed for IBM compatible PC and called Computerized Documentation System/Integrated Set of Information Systems (CDS/ISIS) version 1.0 in 1989 version 2.3 was released to some organizations. 1992 version 3.0, 1994 3.2 appeared.

**Single User/Multi User:**

Upto version 2.33 it was a single user software. Version 3.0 provides full Local Area Network (LAN) Support. Convertibility—Data conversion in possible.

Operating system Environment includes PC-DOS/MS-DOS IBM Compatible PCs. Versions available for WAG PCs and VAX-VMS (2.7). The software is Interactive, Menu-Drive editing facility, help. Data security is possible through use of passwords. Field length is variable. Multilingual facility available. Its Capacity is 16 million records; each record can accommodate 8000 characters; maximum 200 fields in a record. It has facility for redesigning the system menus—Display and print format can be defined as per the user requirement. It also has browsing facility and provision for term dictionary for choosing a particular search term. It
further has facility for import/export of data in ISO form. This software is distributed free of cost by NISSAT in India.

There are about 400 CDS/ISIS installations in India. It has been provided with no formalized customer support. However, training through the initiatives of NISSAT, INSDOC, DRTC, ILA, IASLIC and others has been extended. About 50 and odd training courses have been conducted by these agencies. Some of the limitations in this package are regeneration of serial number after sorting the entries, control of right margin in printing, retrieval of numerical data etc.

(ii) MINISIS (Mini Computer based Integrated Set of Information System)

MINISIS is also an ideal package for bibliographic information management and textual databases applications. It is a member of the ISIS (Integrated Set of Information Systems) and developed by International Development Research Centre, Ottawa, Canada. It is on-line interactive system for information processing, storage and retrieval and provides, facility for catalogue, circulation, serials control, report generation, etc. It also provides interfacing facility to remote online information systems.
Minisis installation requirements are written in Hewlett Packard's system programming language (SPL). Therefore, Minisis runs only on the HP-3000 minicomputer with minimum 512 kb memory. This package is being used in about 200 libraries in the world and in about ten libraries in India like Central Secretariat Library, New Delhi, National Library Calcutta, National Informatics Centre, New Delhi. NCAER, Delhi and Indira Gandhi National Centre for Arts, New Delhi.

(iii) SUPERDOC:

This package is developed by the THERMODATA Group in Grenoble, France. It is also a user friendly package quite flexible to apply in many applications in the field of library and information science such as production of indexes, catalogues, bibliographies etc. This package can run on IBM compatible micro computers.

(iv) CAIRS (Computer Assisted Information/Library Retrieval System)

CAIRS was developed by the Leatherhead Food Research Association, Survay, England, in 1972. The CAIRS series run on mainframe, mini and microcomputers providing a total automated system of information retrieval and management. This package is useful for management of non-numerical as
well as numerical data. It has four data entry methods, i.e.,
direct online entry, batch data entry, document data
preparation and data prepared by using external systems.
INFODOC, Washington DC has been given right to distribute the
CAIRS system.

4.9.2. Software Packages Available in India:

Among the library softwares that are available in India
reference may be made to micro CDS/ISIS software developed
and promoted by UNESCO. Distributed free through NISSAT in
India.

It has had remarkable success, especially in institutions
in Delhi, Gujarat, Karnataka, Madya Pradesh, and West Bengal.

(i) LIBSYS (Library system)

Mr. A.K. Jain, through his own initiatives and efforts
developed the package of a good deal of trial and
demonstration. This package was first marketed in late
1980's. It is continuously adding more and more facilities.
Supplier : Libsys Corporation, D-7/A, Rockview Flats,
Munirka, New Delhi - 110 067 is the supplier of this package.
The system covers following library functions and has 5
modules:
a) Acquisition System
b) Public Access System
c) Circulation System
d) Serials System

Its search speed is adequate. It is multiuser software. Data conversion is possible from this package to CDS/ISIS and dBASE. Software environment for its operation includes UNIX, VMS, LAN on PC/AT and Minis-micros. It is user friendly, interactive, menu-driven editing facility and help menu. Data security is ensured through the use of passwords. Field length is variable and thereby ensures optimal utilisation of disc storage. Multilingual facility is available. Its capacity is unlimited. There are about 40 installations in the country including NIC, INSDOC, TIFR, DOE, AIIMS, BHEL, IGNOU. The supplier provides guaranteed customer support and 2-week training to buyer.

ii) SANJAY (Augmented CDS/ISIS package for Library Automation):

On NISSAT's request DESIDOC developed an integrated library automation package based on CDS/ISIS (2.3). Covering the additional facilities like size of databases integration of all the program modules, a PASCAL interface facility for interfacing PASCAL programmes or designed additional
applications like library house-keeping operations, searching capability, printing facilities, minor calculations etc.

SANJAY is capable of handling all types of library management activities in addition to information storage and retrieval.

Special features of SANJAY include Numerical operations like data specification and budget control, acquisition, circulation and such similar functions. It facilitates inter-linking 2 or more databases for a single application like books and members for the circulation system. It is User friendly. Number of predefined display from sortwork sheets, print work sheets are provided for the generation. It is a Menu driven software/programme.

iii) MAITRAYEE:

It is a joint ventures of NISSAT and CMC in transforming the concepts into reality. It is supposed to be a complete solution towards library computerization and brings the participating libraries into a network of its own kind. Commissioned by NISSAT, CMC Ltd., did the complete feasibility study and came out with a well defined functional specification. Finally, it was designed, coded, implemented
and packaged to deliver one of the most sophisticated packages to accomplish the desired end.

The library functions for which it is applied include acquisitions, budgeting, cataloguing, circulation, user search services, serials control, central host and networking services - Document Transfer to remote, remote database access and electronic mail.

Its special feature is that it is based on the INGRES DBMS Platform on which all the database related activities are developed, the key features of this software are portability, maintainability, security, flexibility, recovery etc. The CALIBNET participating Institutes have installed this software.

iv) CATMAN (Catalogue Management Software - Package for Libraries):

National Science Library, INSDOC has developed a user friendly, menu driven software for libraries. This package released on 20th March 1992, provides possibilities for creation, maintenance, search and retrieval of catalogue records. It is a stand along package that allows the user to add/modify, index, update and query the data. The software can handle upto 50,000 records and is suitable for small
libraries. Its speed of search is adequate. It is a single user. It operates on MS DOS operating system (bases on dBASE DBMS platform). It can handle up to 50,000 records and ensures good back-up of customized service. The supplier provides two weeks training to the buyer.

v) dBASE

dBASE IV is a major version from Ashon - Tate series of DBMS packages. First three are dBASE II, dBASE III and dBASE III plus. The supplier of this software is Ashon - Tate corporation. All library house keeping functions can be integrated by writing customised application programme. Speed of Search depends on hardware. Facility for both single User/Multiuser is available and convertibility is possible.

It operates on MS-DOS, UNIX, environment. It is User friendly, interactive and has menu-driven editing facility. Data Security is also available in this software. Its capacity includes 1 billion records and maximum record length is 4000 character and has 128 maximum number of fields; field length is 255 characters; (max.) and minimum fields - 4000 characters. It has a beautiful screen design facility; colour interface is possible; SQL is incorporated and control center is a new feature. Training is also provided by
supplier. Its limitation is that it is slow in comparison to RDBMS.

vi) **DELMS (Defence Library Management):**

DELMS helps librarian to create and manage structured databases to manage all library management functions independently. It allows the creation of a database of holdings, documents issued and library members/users. DELMS has been designed with librarian and library user in mind. It is very easy to use the package and it does not presuppose any prior computer skills or knowledge on the part of the user. It allows concurrent updating of information in the databases. Also, an online help facility is provided in every module to give information on command. It is COBOL based package. User friendliness is possible in DELMS.

vii) **TULIPS (Tata Unisys Library Information Processing System):**

This package consists of five modules, viz acquisition control, cataloguing, circulation, serials controls and utilities. This package is supplied by Tata Unisys Ltd., Mumbai.
The objectives of TULIPS are:

1. To provide better and faster library information services to users;

2. To control the clerical and technical processes involved in producing catalogues and retrieval of information; and

3. To capture, organise and maintain information relating to borrowing borrowers and books and loan transactions.

The functions of this software include generating keyword directory, card catalogue, current awareness reports; bibliographic search; access to information relating to transactions; online reservation of books, generating overdue notice and availability slips.

It has optimal storage structure and adopts efficient access methods. It is a Multiple users access system with integrity/security mechanism and with minimum modification, its application can be expanded.

The limitation of this software include:

1. The number and size of files tends to increase with time and applications;

2. The contents of the files become ambiguous and duplicated;
3. File processing outside the patent organisation becomes time consuming and difficult; and

4. Data relationship are maintained apart from the other data.

viii) Liberator:

Liberator is from the Computer Maintenance Corporation (CMC). The software will liberate the full potential of the library. Streamlining its every function, and then networking with libraries of the world to create a mega library, as vast as the intensity of knowledge.

Liberator modules include acquisition and fund accounting, cataloguing, circulation, serial and binary control, user search services, and central host and networking. The software may be installed either as an integrated package or in the form of individual plug in modules. Userfriendliness is possible in this software. The software requires following Hardware and Software package.

Hardware - IBM compatible PC/AT 386 with 12MB, RAM, 300MB

- winchester X.25 card
- 60MB cartridge drive
- 1.2MB floppy drive
- 2 COM ports for async terminals.
Software - UNIX V.3.2 compatible (runtime only)
ingres 5.0 or 6.2 or upwards (runtime only)
TCP/IP on X.25 (for particular machine)
DOD R-series utilities, FTP, TELNET, SMTP.

Supplier - CMC Limited, Calcutta, are the supplier of this package.

In addition to the software packages listed above the following packages are also considered useful for library operations.

4.10. ONLINE SEARCH SOFTWARE

(i) Headline

Headline works on CP/M, CP/M86, MS-DOS operating system software. Its special feature is the possibility of line by line or block by block transmission of search. With the help of this software one can download records with optional headform.

(ii) SCI-MATE

Features: Command language - Menu or Host system

The host restrictions include DIALOG, BRS, NLM, SDC, ISI
SCI-MATE operates on CP/M, Apple II, IBM, PC, TRS-80, II,
Vector 3-4 operating system software. It can also be used with the source computer, server, etc. In SCI-MATE downloading is possible with optional personal manager.

(iii) CORTEX

Command language - Host system There are no Host Restrictions. It operates on SIRIUS (128 KB) operating system software. It can be used with EDITOR and LOCAS files on BLAISE. In CORTEX edit downloading of records possible.

4.11. Some Software Packages Available for Circulation Control:

There are primarily 3 software packages for circulation control, Viz: Machent circulation module, Book self and Librarian.

i) Machent circulation module:

Some of the features of this module include:

Max. No. of records - 10,000
Max. loans per borrower - set by the library
Use of Bibl. record - Yes
No. of loan periods - 8
No. of categories - 10
Use of bar code reader - Yes
Links with full catalogue - Yes
ii) Bookshelf:

The following are some of the features of 'books shelf' software package.

- Max. No. of records - Hardware dependent
- Max. loans per borrower - Set by library
- Use of Bibl. record - Yes
- No. of categories - Set by library
- Use of bar code reader - Option
- Links with full catalogue - Yes

iii) LIBRARIAN:

- Max. No. of records - Hardware limited
- Max. loans per borrower - Specified by the library
- Link with circulation - Yes
- Multi user - Yes

4.12. Advantages of Library Computerization:

The advantages of computerization are far-reaching. It is possible through the computerization programmes to have access to external data which can be exploited to a greater effect by a computer based system. In resources sharing, all or a part of the library activities, such as acquisition, processing, storage and its availability to each of the end-
users are significant factors in the computerized cataloguing system. Bibliographic access to the holdings of so many libraries, bibliographic control on specialised subject areas, preparation of union catalogues, speedy availability of information - such facilities can be obtained by the computerized system. The advantage of computerization are ready availability of information, access to more documents management control facilities and relatively less cost as compared to its speed, service, comprehensiveness, access to information etc.

Recently more and more libraries are planning for computerization. The facilities of time sharing and online services have made library automation more effective for efficient and appropriate services.(18) Computerization can relieve the pressure of workload in libraries to a great extent, can offer efficient services, can open up a new vistas in cooperative cataloguing and bibliographic control in a coordinate way and can also provide access to required data-bases in the country and abroad.

The computer is capable of enormous information storage. While data are collected, analyzed, and processed after being compared with variables, these constitute the mass or information to be exploited and utilized for specific
purposes. The computer can store large amount of information, otherwise impossible, for longer periods of time in minimum space in the electronic-readable form, and information is capable of being recalled with ease and utmost speed. The computer can arrange and rearrange information so that, it can be more suitable for particular purpose and specific application.

4.1.3. Conclusion:

Since invention of printing to the present age of computers variety of information storage and transfer media have found their ways and have help to preserve conserve and transfer in the culture tradition, wisdom and knowledge from generation to generation. Currently various information technologies such as microforms, Audio-visual materials, computers, Xerox CD-ROM, FAX, E-Mail etc, in addition to traditional information storage and dissemination media have influenced libraries. The phenomena growth of scientific advances have resulted fast technological introductions, leading to societal changes. Change is the only permanent concept today. Hence libraries are no excretion. They have to adopt new technologies methods and technique to survive themselves and to serve user community. The preceding sections discuss briefly all these technologies that have
media greater impact in libraries. For the purpose of discussion they have been categorised broadly into three groups. Viz - information storage technologies, information transmission technologies, and information storage and transmission technologies. The succeeding chapter presents the data relating to availability and use of these information technologies in university libraries in India.