CHAPTER III

DEVELOPMENT OF COMPUTERS AND INFORMATION TECHNOLOGY

3.1 Brief History of Computers

Charles Babbage, created the first modern computer design to solve the equations and many complex formulas, Babbage began developing a steam powered machine, which he called the Difference Engine. Later Babbage turned to planning a far more ambitious device, the Analytical Engine. The machine was designed to use a form of punched cards for data input.

The first electronic computers were complex machines that required large investments to build and use. To describe the computer’s technical progress since World War II, computer scientists speak of “computer generations”. Each generation of technology has its own identifying characteristics.

3.1.1 The First Generation (1946 to 1959)

The first generation of computers usually dated from 1951 to 1959 used vacuum tubes. First generation computers were large and slow, and they produced lot of heat. The vacuum tubes failed frequently, so first generation computers were “down” (not working) much of the time. But they caught the public imagination.

First generation computers were given instructions in machine language, which is composed entirely of the numbers 0 and 1. Machine language was designed in this manner because electronic computers use the binary number system. Because machine language is very difficult to work with, only a few specialists understood how to program these early computers.

All data and instructions came into the first generation computers from punched cards. Computer’s secondary storage consisted of magnetic drums. It was not until 1957 that magnetic tape was introduced as a faster and more convenient secondary storage medium. A single tape could hold the contents of approximately 1100 punched cards (about 21 pages of information).
3.1.2  The Second Generation (1959 to 1965)

First generation computers were notoriously unreliable, largely because the vacuum tubes kept burning out. The second generation computers were created with transistors instead of vacuum tubes, these computers were faster, smaller and more reliable from first generation computers.

In the second generation, memory was composed of small magnetic cores strung on wire within the computer. For secondary storage, magnetic disks were developed, although magnetic tape was still commonly used. Second generation computers were easier to program than first generation computers. The reason eas the development of high level language is not machine specific ; this makes it possible to use the same program on computers produced by different manufacturers.

Second generation computers could communicate with each other over telephonic lines, transmitting data from one location to another. Communication was fairly slow, but a few method of exchanging data and ideas was now available.

These second generation computers had some problems. The input and output devices were so slow that the computer itself frequently sat idle, waiting for cards to be read or reports to be printed. Two different but equally important solutions solved this problem. Although both projects began during the second generation technology, neither was completed until well into the third generation.

3.1.3  The Third Generation (1965 to 1970)

As with the first generation of computers, a device that ended the second generation was invented before the second generation began. In 1958, Jack St. Clair Kilby and Robert Noyce invented the first integrated circuit. Integrated circuits incorporate many transistors and electronic circuits on a single wafer or chip of silicon integrated circuits and sometimes called chips because of the way they are made. By the second generation, scientists knew that more powerful computers could be created by building more complex circuits. But because the circuits had to be wired by hand, these computers were too complex and expensive to build. Integrated circuit technology removed this barrier. The result was a computer that cost no more than first generation computers but offered more memory and faster processing.

The first commercially available minicomputer was introduced in 1965. The PDP-8 (Programmed Data Processor) could fit easily in the corner of the room and
did not require the attention of a full time computer operator. Most unusual, the computer could be accessed by users from different locations in the same building. This mini computer’s price tag was about one-fourth the cost of traditional mainframe.

Another significant development of this generation was the launching of the first telecommunications satellites, enabling worldwide communications between computer systems.

3.1.4 The Fourth Generation (1971 to 1980)

In the early 1970’s an Intel Corporation Engineer, Dr. Ted Hoff, was given the task of designing an integrated circuit to power a digital watch. Previously, these circuits had to be redesigned every time a new model of the watch appeared. Hoff decided that he could avoid costly redesigns by creating a tiny computer on a chip. The result was the Intel 4004, the world’s first microprocessor. A microprocessor chip holds on a single chip the entire control unit and arithmetic-logic unit of a computer.

The significance of the microprocessor cannot be overstated, it has changed the world. The techniques, called Very Large Scale Integration (VLSI), used to build microprocessor enable chip companies to mass produce computer chips that contain hundreds of thousands, or even millions of transistors. The large computer companies considered the microcomputer nothing but a toy, and the first microcomputers were aimed at computer hobbyists. The MITS Altair, marketed in 1975, was the first commercially available microcomputer. The Altair used Intel’s 8080 chip. Calling the Altair a microcomputer may be dignifying it more than it deserves. However, it had no screen, no keyboard, and no capability to store programs or data. Third party firms quickly developed these additional devices for the Altair.

During the last 1970’s, many companies released microcomputer kits, but they were difficult to assemble. However, the Steve Jobs and Steve Wozniak wanted a microcomputer so simple that you could take it out of the box, plug it in, and use it, just as you use a toaster oven. They founded Apple Computer Inc., in April 1977. Its first product, the Apple I, was processor board intended for hobbyists, but the experience the company gained in building the Apple I led to the Apple II computer systems.
The Apple II was a huge success. With a keyboard, monitor, floppy disk drive and the operating system, the Apple II was a complete microcomputer system. The introduction of the first electronic spreadsheet software, visiCalc, in 1979 helped convince the world that these little microcomputers were more than toys.

In 1980, IBM decided that the microcomputer market was too promising to ignore and contracted with Microsoft Corporation to write an operating system for a new microcomputer. The IBM Personal Computer (PC), with a microprocessor chip made by Intel Corporation and a Microsoft Operating System, was released in 1981. Because Microsoft and Intel were independent contractors, they free to place their products on the open market. As a result, many different manufacturers produced microcomputers that are now known as IBM compatibles.

The main features of Fourth Generation are:

- VLSI technology used
- Very cheap
- Portable and reliable
- Use of PC's
- Very small size
- Pipeline processing
- No A.C. needed
- Concept of internet was introduced
- Great developments in the fields of networks
- Computers became easily available

Some computers of this generation were:

DE 10
STAR 1000
PDP 11
CRAY-1(Super Computer)
CRAY-X-MP(Super Computer)

3.1.5 Fifth Generation (1980 to 1997)

In the fifth generation, the VLSI technology became ULSI (Ultra Large Scale Integration) technology, resulting in the production of microprocessor chips having
ten million electronic components. This generation is based on parallel processing hardware and AI (Artificial Intelligence) software. AI is an emerging branch in computer science, which interprets means and method of making computers think like human beings. All the Higher level languages like C and C++, Java, .Net etc. are used in this generation.

AI includes:
- Robotics
- Neural networks
- Game Playing
- Development of expert systems to make decisions in real life situations

The main features of Fifth Generation are:
- ULSI technology
- Development of true artificial intelligence
- Development of Natural language processing
- Advancement in Parallel Processing
- Advancement in Superconductor technology
- More user friendly interfaces with multimedia features
- Availability of very powerful and compact computers at cheaper rates

Some computer types of this generation are:
- Desktop
- Laptop
- NoteBook
- UltraBook
- ChromeBook

3.1.6 Sixth Generation

The sixth generation computers are very large sized super computers. These computers facilitate various national and international networks in transmitting huge quantities of data across the world. The Centre for Development of Advanced Computing developed Asia’s second largest super computer “PARAM-10000” in 1998 is an example of sixth generation of computers.
3.2 Information Technology

Information technology is new technology applied to the creation, storage, selection, transformation and distribution of information of many kinds. “Information Technology” has its counterparts in the French ‘Informatique’ and the Russian ‘Informatika’. Information technology simply represents an attempt to make respectable some commercially motivated developments in electronics and politically motivated moves to control the access to information. Information technology has its origins in the technologies related to a restricted view of information, the generation, processing and the distribution of the representation of information.

The term ‘Information Technology” (IT), has been defined variously by many people. Marshal (1984) defined it as the coming together of computing and telecommunications for the purpose of handling information; the application of technologies to information handling; including generation, storage, processing, retrieval and dissemination. It is also concerned with the acquisition, processing, storage and dissemination of information- textual, numerical, pictorial and vocal. It is a broad-based term comprising the gathering (acquisition), organisation (packaging), storage and retrieval (dissemination) of information that can be in textual or numerical (books, documents), pictorial and vocal forms (audio-visual) or a combination of all the above (multimedia), using a combination of computer and telecommunication devices. Emuakpor (2002) defines it as all forms of technology applied to the processing, storing and transmitting information in electronic form; stressing that the physical equipment used for this purpose include computers, communication equipment and networks; fax machines and electronic, pocket calculator. Ayo (2001) viewed it is the use of computer system and telecommunications equipment in information handling; consisting of essentially three basic components viz: Electronic processing using the computer; transmission of information using telecommunication equipment; and dissemination of information multimedia.

It becomes explicit from the above that IT in libraries comprises all the electronic infrastructure and facilities employed by libraries to improve and provide efficient services. Such facilities, in broad term, consist of hardware, software and communication links between the service outlets of different libraries to facilitate the sharing of common resources; especially the library networks. Osundina (1973) pointed out that the library today should not merely store documents and preserve
them; it must also devise means by which the contents of such documents can be rapidly and effectively transmitted for use. Trostnikor (1970) opined that rapid expansion of a mass of diversified information is occurring, which has received the name “information explosion”. Thus, the need arose for a scientific approach to information and for elucidation of its characteristic properties, leading to two principal changes in interpretation of the concept of information. One, it was broadened to include information exchange not only between man and man, but also between machine and machine. Ogunsola (2004) explained that the pace of change brought by new technologies has had a significant effect on the way people live, work and play worldwide.

Capron (2000) revealed that mail, telephone, television, radio, books, newspapers and periodicals are the traditional ways users send and receive information. However, data communications system-computer system also transmits data over communication lines such as telephone lines since the mid 1960s. Internet use has, today, revolutionalized access to information for the business world, libraries, education and individuals. A few of the most popular include E-mail, www (World Wide Web), FTP (File Transfer Protocol) Usenet, and Telnet. All these technological devices are regarded as central to the concept of globalization. The internet and its technology continued to have profound effects on the promotion of information sharing; especially in the academic world, making possible rapid transactions among businesses and supporting global collaboration among individuals and organisations. These technologies have the potentials to develop “virtual campuses” and “virtual libraries” thus, increasing students’ access and participation (Ogunsola, 2004). According to Daniel (2000) Nancy Schiller was one of the first writers to use the expression “virtual library” which she defined in 1992, simply as “libraries in which computer and telecommunications technologies make access to wide range of information resources possible”. Today, the concept is referred to variously as “digital library”, “electronic library”, “community network”, or simply “library without walls” (Ogunsola, 2004)

The organisation of information/knowledge is an essential preliminary to its effective exploitation and dissemination. As the quantity of knowledge expands, the need to organise it becomes more pressing. A vast number of different means of organising information have been devised and exploited since the earliest times. With
the vast output of new information and ever-increasing degree of specialization in all areas of human knowledge, heavy demands are being placed on library information storage and retrieval systems, which can be scarcely met by the traditional methods except with the use of IT devices. The improvements and change in computing and telecommunications and the integration of the two fields have had a huge role to play in the methods of information processing and dissemination in academic libraries; thus improving the quality of use to which such libraries are put.

3.3 Objectives of Information Technology

The objectives of IT are to provide better means of information of data messages in the form of written or printed records, electric, audio or video signals by using wires, cables and telecommunication techniques, IT plays a vital role in information handling due to developments such as reduction in computing time, capabilities of files on video discs, use of T.V as readymade information screen, telecommunication and satellite communication facilities etc.

The objectives of IT in ICLs can be categorized into the following four groups.

i) Supporting technical functions associated with acquisitions, technical processing, serial control, SDI/CAS, OPAC and circulation work.

ii) Supporting information storage, retrieval and dissemination systems.

iii) Supporting management information services for libraries, especially analyzing library statistics.

iv) It can best be used in service and orientation courses for practicing librarians, continuing education programs for faculty teachers of library and information science, correspondence studies and library extension services.

3.4 Components of Information Technology

Technological change is becoming a driven force in our society. Like the internal combination engines at earlier era, IT is shaping and changing the capabilities of libraries, a description of these developments is essential. The IT can be broadly grouped under the following major areas:
3.4.1 Computer Technology

The wide spread use of computer technology has made magic development in the information transmission processes, in every field of human endeavour during the past few years. It is likely to changes the information infrastructure by merging itself with other related technologies. Highly sophistication service from elaborate abstracting and indexing services to computerized database in almost all scientific disciplines are in wide use all in the world. If two decades ago, computer was something that was within the reach of only a privileged few technologists and scientists but today the hard reality has gradually dawned on all of us, that must either live with computers or get lost. Computer is an automatic IS & R transferring electronic machine and a landmark in IT history, capable of performing a series of operations according to a set of logical instructions with utmost speed. Its storage capacity facilitates access to billions of characters of data in the storage and retrieval of vast and ever increasing information. Recent developments in computer and communication technologies have brought in new hope towards information management. Through central processing and storage, any information centre can access the world of information irrespective of geographical location via terminals. From vacuum tubes to transistors and then onto integrated circuits and silicon chips, computers have improved their refinement and efficiency with each successive generation. Though much cheaper now, these computers use better in memory capacity, computational speed and I/O time. Interactive working in time-sharing and multiprogramming is also possible now. The developments have resulted in the era of low cost computers having smaller dimension and with low power requirements. This is of great importance to scientific and technical communication. In house, microcomputers are the key stone of new technologies used for more sophisticated data and text processing, database manage and a variety of other applications. It provides extremely rapid access to the information that is necessary to support decision making in the clinical as well as in the research and teaching environments of college, institutions, hospitals, etc. Computers are used for precision, accuracy, speed and manipulation of large amount of data involving complete operation. With the advent of microprocessor technology, it was possible by integrated circuit device to put a very large scale data into a quarter of a square inch. Computers have been grouped into four categories such as: microcomputers, microprocessors,
minicomputers, mainframe computers and super computers. Today, everyone is compelled to understand capabilities, limitations and potential application of computers in their respective areas of specialization to cope up with the increasing demands of modern society. The use of computers for IS & R began with the production of computer generated and printed indices for scientific and technical literature in late 1960s. Subsequently, several organizations have started using computers not only for generation and printing indices but also for creation of factual and textual databases containing all length documents. The initial small silicon chips contained only a few components and circuits, but the average number of chips components has doubled each year since 1965. Early Small Scale Integration (SSI) efforts, first gave way to Large Scale Integration (LSI) chips that contained thousands of components. Now Very Large Scale Integration (VLSI) chips contain hundreds of thousands elements and Ultra Large-Scale Integration (ULSI) chips with millions of components are also going to be available in near future. By early 1970s, several indexing and abstracting journals were published for library applications, viz., Index Medicus, Chemical Abstract, Biological Abstract, etc. These were not only produced by computer but were also made available as computer readable databases on magnetic tapes and/or CD-ROM. Several organizations had started subscribing them on magnetic media to organize local IS & R services. By the mid 1970s, several organizations including National Library of Medicine (NLM) (USA) and System Development Corporation (SDC) had started offering online searches, from remote terminals from a variety of machine readable indexing and abstracting databases. The microcomputer, a complete computer on a single silicon chip, is behind many of the recent changes in information handling technologies. Microcomputers (PCs) can perform many of the information handling functions traditionally run on larger computers, such as, acquisition, circulation control, catalogue card production, Current Awareness Service/ Selective Dissemination of Information (CAS/SDI), Information Storage and Retrieval (IS & R), etc. In addition, the introduction of microcomputers for information handling has resulted in the development of a number of innovative applications viz. Reference Librarians. Enhancement System (REFLES), retrospective catalogue conversion on MINIMARC, etc.
3.4.2 Communication Technology (CT)

The recent IT revolution has transformed the communication-conscious human society into, an information global village in a short span of just two decades. The new technologies like the laser, fiber optics, telephone, teleprinter, telex, television dicta phone, silicon chip, internet and many other telecommunication devices have come to constitute an important and inevitable component of written and oral communication media network. These modern communication technologies have the potential to bypass several stages and sequences in the process of development encountered in the earlier decades. The advents of communication technology have revolutionized the activities of library and information system. The concept of virtual or digital library has emerged and is synonymous to future library which largely works with ever-shifting arrays of allies, instead of acquiring large number of document employing staff to process them. The word communication is derived form the Latin word *communis.*, which means commons. In its application it means a common ground of understanding. It is a process of exchange of facts, ideas, opinions, feelings and as a means that individuals or organizations share meaning and understanding with another. Communication is interdisciplinary such as mathematics, electronics, linguistics, systems analysis, etymology, cybernetics, etc. Communication is the vital aspect to change behaviour of the receiver. As matter of fact no executive can be successful. Message is in the form of words, symbols, signs, letters or actions. Communication is a tool of management to get the things done through people. Generally the process of communication demands the necessity of a transmitter, message, symbols, channel, decoding, receiver, action and feedback. It is a continuous process or cycle of sending message and feedback. The basic methods and guiding objectives of development and technical co-operation are richly embodied in the term communication. Who’s many means includes *Sharing* and *Equity*. Communication Technology is a vital aspect of human activity and LISc faculty members and students are no exception to it.

3.4.2.1 Advantages of Communication Technology

The impact of communication technology in information science has been increasing in importance, as interactive information retrieval systems have been developed, that allow users dispersed over wide region to obtain access to these systems on a real time basis. Computer based information retrieval system form one
broad class of system that can be linked to users in their office, homes as well as to users in libraries and other centres.

i) **Time Saving**: Modern communication technologies avoid errors, duplication resulting in saving of time. They have more speed with accuracy and can transmit quickly. The message lead which the machine can do is definitely more and resulting in saving of time of superiors and subordinates in the organization.

ii) **Saving Labour Cost**: New communication technologies are labour saving devices. They save labour as well as payroll cost. Less number of workers or staff are sufficient with the installation of modern communication devices. The staff thereby released can be utilized for alternative works.

iii) **Speed**: A large quantity of information can be fed into the machine, which in term transmits with considerable speed. In respect of certain matters, speed and quickness are necessary to take quick decision. The handling of transmission is assigned to electrically or electronically or radio-wave operated machine which are known for greater speed of dispatch. Frap Palo, gives an example where with advanced fibre optics, it is possible to transmit the entire contents of the library of congress (60 terra bytes of information of 60 billion sheets of paper) from Chicago to New York in only two hours. Over the traditional copper wirings the same transmission would take 2000 years to complete.

iv) **Reduce Monotony**: Routine respective work may lead to fatigue or monotony mechanization of communication system reduces the fatigue of the staff and resulting in improving the efficiency and quality of the work. For instance use of visual and audio-visual aids will reduce fatigue, which improves the quality of work.

v) **Equality**: New technology can achieve equality in the provisions of communication reaching particularly with reference to geographical location.

vi) **Standardization**: Standardization of work can be achieved through machines. The ensure consistency uniformity in the quality as well as quantity of work the principle of standardization is so important that no one can afford to ignore its advantages.

vii) **Accuracy and Efficiency**: Correctness of message transmission is necessary to enable a receiver to understand in same spirit and to act accordingly. The systematic
and automatic technology promotes accuracy. The new technology in general increases efficiency.

### 3.4.3 Telecommunication Technology

Telecommunications are devices and techniques used for transmission of information over long distances via wire, radio/satellite without damaging/loss due to noise and interference. Telecommunication was born in 1844, when the message, “WHAT HATH GOD WROUGHT” was transmitted across a 40 miles span by telegraph. Thirty-two years after Samuel FB Morse’s legendary feat, Alexander Graham Bell uttered a call for help on his invention that thrusts telecommunication industry into the era of Voice Communications. The major trend in telecommunications at present is a fundamental shift from mechanical to electrical furthermore, electronic , and within electronic, analogue to digital modes of transmission involving all types of communications voice, facsimile, computer transmission, TV communicators, microwave and satellite communications, and radio links. On the other hand, certain applications of microcomputers (PCs) have opened new vistas for the transfer of information by telecommunications. The development of microelectronics has led to home minicomputers and TV based information terminals. Recently, there have been considerable activities in evaluating the potential for DDS on satellite communications. Applications in the information field include remote browsing, using TV, searching of automated catalogues (OPAC), searching of bibliographic and numeric data, SDI/CAS services, DDS via various telecommunication devices. Electronic communication consists of telecommunication and data communications. Telecommunication involves use of telephone, teleprinter, telegraph, radio or TV and satellite facilities to transmit information, either directly or via computer. Data communication is the transfer of data/information between computer devices, and is a common that each of us has probably seen it in action everyday life without thinking about it. The other major current developments in CT are: E mail, electronic imaging, electronic publishing and DTP, tele-text, teleconferencing, video-text technology, fax, voicemail, satellite, telemedicine, etc. Advent of Computer Technology (CT), IT and communication technology has revolutionized the activities of library and information system. The advent of telecommunication technology and the tremendous speed, with which it is changing, require adaptability to change in present information society. Hence, it should be
essential element in professional preparation of future library and information science personnel. The concept of digital library has emerged as synonymous to future library which largely work with an ever shifting arrays of parts and allies instead of acquiring large number of documents and employing people to process them.

3.4.4 Optical Communication Systems

Optical communications are a recent addition to the armoury of telecommunication systems. Their main uses are in long distance digital networks. Here light is the carrier of information and optical fibres are the medium of transmitting the light signals. Optical fibre transmission has come of age as a major innovation in the telecommunications. Such systems offer extremely high bandwidth, freedom from external interference, immunity from interception by external means, and cheap raw materials like silicon. Optical fibres are made of glass, which in turn, is made from sand, an inexpensive raw material available in unlimited amount. Fibre optic cables are similar to coaxial cables, except without the braid. At the centre is the glass core true, which the light propagates. In multimode fibres, the core is fifty Microns in diameter, about the thickness human hair. In single-mode fibres are more expensive but can be used for longer distances currently available single mode fibres and transmit data at served Gbps for 30km. Even higher data rates have been achieved in the laboratory for shorter distance. Experiments have shown that powerful lasers can drive a fibre 100-km long without repeaters, although at lower speeds. The core of the fibre cables are surrounded by a glass cladding with a lower index of refraction than the core, to keep all the light in the core. Next comes, a thin plastic jacket to protect the cladding. Fibres are typically grouped together in bundles, protected by an outer sheath.

3.4.5 Satellite Communication Technology

Satellite communication is one of most popularly extensively used technology now a day. In the 1930s and early 1940s, scientists tried to set up communication system by bouncing signals off metallised weather balloons. Unfortunately, the received signals were too weak to be of any practical use. In 1946, J. H. Trexler of Noval Research Laboratory, USA used Moon, the natural satellite of earth, to bounce off UHF signals as part of his project. Subsequently, it were these moon bounce studies which enabled Browne and some other scientists to discover, the
Transionospheric Faraday Rotation Effect., which is being successfully used now with transmission from artificial earth satellites for a variety of studies related to the total electron content of the ionosphere. Several series of orbiting satellites by NASA and Soviet Union were tried for communication and surveillance with different degrees of success until the concept of Geostationary orbit materialized and gave a quantum jump to satellite communication. Further progress in the celestial communication satellite was launched in 1962. The key difference between an artificial satellite and real one is that the artificial one can amplify the signals before sending them back, turning a strange curiosity into a powerful communication system.

3.4.6 Computer Communication Technology

Computing and communication are natural allies. Both concern information when computing, we manipulate and transform information; we transport information. Though this distinction seems logical enough, computing and communication are so intertwined that it is difficult to determine where one stops and the other begins. Shannon recognized that information was a common element. Indeed the utility of both communication and computing resides in the information they supply to users. The convergence of computers and communications resulted in the emergence of new technology which has been called Computer Communication Technology. It is a descriptive term and there is no doubt that this new technology is going to have an increasing important role throughout the communities in the office, factory and Library. Communication technologies will alter, regulate and control many of social interactions.

3.4.7 Reprography, Micrographic and Printing Technology

Theses technologies are still widely used technology in libraries globally. The technology of reprography makes a big impact on the document delivery systems. Most of the research libraries have reprographic machine and provide photocopies of any document on demand. Ever since John Benjamin dancer, the father of microphotography produced it as early as 1939. There have been predictions that microforms will have a great impact on libraries and the world of books will be replaced by the world of microforms. By using micrographic and reprographic techniques, we can condense the bulky archives and newspapers and solve the storage problem. They help in resource sharing and save users time. Library is a store home
of knowledge and it store, process and communicate the information in different forms and formats.

3.5 Problems facing libraries in India

Library and information services are fundamental to the goals of creating, disseminating, optimally utilizing and preserving knowledge. They are instrumental in transforming an unequal society into an egalitarian, progressive knowledge based society. It is well known that in India most of the libraries function in the government sector. These are in academic and research institutions and under the public library system, which is again under the state and central governments. At present, education being a state subject and coming under the purview of different apex agencies, there is no common direction or coordination among them. It is imperative that all libraries (public, academic, research and special) change gear and develop at an accelerated pace. Developments in information communication technology (ICT) have enabled libraries to provide access to all, and also bridge the gap between the local, the national and the global. Yet the library and information services (LIS) sector in India has not kept pace with the paradigmatic changes taking place in society. There are few libraries which are using state of art technologies to disseminate knowledge to their respective user community. There is lack of cooperation among libraries which cause the lack of union catalogues at national level. The national library failed even to do this immense task. One of the major problems faced by LIS sector in India is lack of bibliographic control at national level which causes duplication in research. A considerable number of libraries had not been developed bibliographic databases of their documents for putting them on network.

The major constraints faced by Indian libraries include:

- Lack of knowledge minimising the use of library’s collection;
- Poor financial support to public libraries;
- Lack of professional staff against sanctioned posts forcing most of the services to be operated by temporary non-professional staff;
- Improper support from national policies for promoting ICT as a tool for development of library systems and services;
- Insufficient IT professional in libraries;
- Inadequate funds for enhancing hardware and software requirements of libraries; and
• Resistance on the part of library staff to change from their traditional practices towards new information technology based services.

3.6 Application of Information Technology in Libraries

In libraries, several systems have been developed for their house-keeping chores and more still are being designed and refined, due to the technology of large scale integration. These are known as microcomputers; designed to handle any of the library processes like acquisitions, cataloguing and classification, serials control, circulation control, bibliographic control, or Selective Dissemination of Information (SDI) (Ogunsola, 2004). IT is applied to the operation of libraries and information centres to ensure that information delivered is timely, accurate, precise and relevant (Madu, 2002). The concept, library automation, thus became popular and of which Cobin (1985) explained that “in the traditional manual library system, staff perform the various tasks required to complete each operation, but if a computer is used to perform some processing operations, an automated library results”. The development and availability of information and communication technologies (ICTs) in libraries have today not only increased and broadened the impact of information resources at their doorsteps, but also placed more emphasis on effective and efficient services. Their applications in libraries, commonly known as library automation, have in deed continued to ease and promote quick and timely access to and transfer of information resources that are found dispensed round the globe.

3.6.1 In House Operations

Following are the areas of in house operations where IT is being used.

3.6.1.1 Acquisition

Acquisition and ordering system in libraries cover the selection, ordering and accessioning of items into the library’s collection. Computers are used;

* to send order slip and chasers for unacknowledged or overdue orders to the book sellers;

* to produce lists of books on order;

* to keep accounts of money spent;

* to produce accession lists of recently acquired books.
The detailed input to an acquisition system covers

- New orders
- Amendments to existing orders
- Bookseller’s reports
- Acknowledgement of receipt of items in the library

Selection of new books can be done from commercially available services which disseminate information about forthcoming documents, or directly from MARC tapes or any local inputs. Two files are maintained in a computer-based acquisition system. One is the main file containing record of all current orders. The second is a file with the names and addresses of book sellers used by the library. A code number for each book seller links the two files, so that book seller’s information is not repeated in the order file. The system prints out the orders addressing the appropriate supplier printing of orders can also be done on special pre-printed stationary that can be sent directly to the book seller.

By checking with the date of entering the order record into the file, ‘chasers’ can be sent to the book sellers, if no information regarding the order has been received within a predetermined time.

When the item is received in the library, the order record with the bibliographic details becomes the basis of the catalogue record. The edited record is merely added to the catalogue file in an integrated system.

Other processes that can be performed by a computerised system are:

- Listing items on order, by author, department or subject;
- New acquisitions listing;
- Notifying individuals who have recommended a particular book, about the receipt of that book;
- Control of accounts;
- Production of relevant statistics to help management decisions.

3.6.1.2 Circulation Control

This is one library service that is most accessible to computerisation. The advantages are specially seen in the amount of time saved in issue and discharge routines, and the avoidance of bottlenecks, which are the basic of any library.
Circulation systems using computers have the details of the book issued and the person borrowing it is entered on files. Date of return are on the basis of the period of loan (one week, a fortnight or a month etc.). Daily check of the files will identify what books are due or overdue and notices can be typed and sent to the users who have borrowed them. Provisions for reservation data will make it possible to pick out these books for which there is a request and a user can be asked to return that particular book. The circulation process in a computerized system depends on giving unique identification codes to books and to users. An accession number or a call number can be used as this is a unique identification key for a book. Users can be given individual identity codes.

3.6.1.3 Cataloguing

Cataloguing includes the job of describing, recording and displaying details of the holdings of the library. Computers are used to aid in the production, maintenance and updating of catalogues. The quality of the catalogue depends ultimately on the cataloguer. In other words, initial input data is still the cataloguer’s work.

Bibliographic details are gathered from relevant sources or from the acquisitions system. Usually there is one main or master file for the holdings of the library, and a temporary file for cumulating the additional records, because printing the master file in done only once in a while.

After initial input of the records, the computer can perform simple tests on the record structure, and errors can be located and checked. Again, if a basic record structure of a package format as that of the CDS/ISIS is used, entry of data becomes a very simple process. The computer can be asked to generate added entries, if required, which can later be sorted into the main file. Separate listing for authors, subject and key points of access can be created. A postings file and an inverted index help the computer search and display record relevant to a specific query.

3.6.1.4 Serial Control

Serial control through the use of computer is perhaps one of the most complicated tasks of housekeeping. This is perhaps because of the literally unpredictable nature of serial publications. Some of the functions of the serials control systems that can be handled by the computer are:

* listing of serials holdings;
accessioning of serials (which includes relation, ordering, checking-in, renewal of subscription, studying notices when issues are not received).

i) Listing of Serials Holdings: is basically producing a catalogue of serials. However with serials, there are problems relating to change in title, periodicity etc. A listing system will depend on the bibliographic record of each serial being available in machine readable form. From a master file of each serials records, individual listing can be made based on title, subject, publisher, supplier etc. Union lists of serials holdings by librarians within a geographic region can also be produced by computer.

ii) Accessioning of Serials: must take into account receipt of issues, and periodicity of the serial, likely date of receipt in order to be able to send claims notices to suppliers for items not received, and to update the holding file. To predict the arrival of periodical parts, each record must contain information about the publication pattern of the serial. This relates to the number of volumes per calendar year, number of parts per volume supplements, if any, the pattern of numbering parts, and the frequencies of publication. Prediction cards called ‘chaser’ notices can be sent to the suppliers when an issue is overdue. Details of the suppliers and the price per volume are necessary for the system to handle subscription, renewal and accounting functions.

3.6.2 Services

The various services provided in the libraries are complimented by available facilities, some of which are technology driven. In modern library, technology application in the provision and performance of library services provided by libraries to patrons. The utilization of emerging technologies in recent times in libraries worldwide has proved beyond reasonable doubt, that a library, whatever its services can perform better when facilities are adequately provided to enhance access to the content of the library. However, the services rendered in a library differ from one library to another, depending on the clientele, the parent body and type of library. Idowu (2011) enumerated the following library services according to the international standard:

- Reference services
- Document delivery service
- Borrowing, renewing and reserving
- Computerized interactive search
• Technical services
• IT services
• E-library services
• Serials services
• Exhibition and displays
• User education
• Selective dissemination of information (SDI)
• Current awareness (CA)
• Referral service
• Reprographic Service
• Counselling service
• Webliographic service

3.6.3 Role of Library in effective library services

Neankwo (2006), opines that ICTs application to library works and services could be seen as the best way that could be used to assist researchers to adequately solve their literature need for effective research activities. The application of ICT to library operations, greatly help in the provision of efficient reference and information services, the utilization of network operations such as cataloguing, authority control, inter library loans and cooperation and in the participation of international bibliographic project. Also Dike (2000) claimed that instant access to information from a multiplicity of source is one of the major roles of ICT application to library services. Not only can it help in locating the materials where the required information can be found easily but ICT helps in sorting out what information is relevant from amass of irrelevant information. The use of ICT has impacted on library services according to Igbeka (2008), Adebisi (2009)and Uwaifo (2010) in the following ways:

* Online Public Access Catalogue (OPAC): It is the computer form of library catalogue to access materials in the library.

* No Physical Boundary: The user of a digital library need not go to the library physically once it is connected to the internet.

* Storage Capacity: Digital libraries have the potential to store much more information, since it requires very little space to contain it.
* Indexing and Abstracting Services: With the aid of ICT, database of print and audio-visual materials can be created and indexed. Also, ICT has made it possible for information seekers to conveniently access a wide range of library produced abstracts (indicative or informative).

* Preservation and Conservation: An exact copy of the original can be made any number of times without any degradation in quality.

* Inter-Library Loan: Needed materials from other libraries can be received within the shortest time through the email, courier services.

* Access to Electronic Resources: Electronic resources are internet based resources such as electronic journals, reference sources, books etc.

* Document Delivery Service: Document can be sent to needed users through e-mail, fax, etc.

* Library Retrieval Systems: This involves using Compact Disc Read Only Memory (CDROM) technological mechanism of acquisition of specialized CD-ROM databases in various courses such as sciences, law, technology, agriculture, social sciences, medicine, humanities etc. the prominent ones are MEDLINE in medicine, AGRICOLA and AGRINDEX in agriculture, LEXIS and NEXIS in law, INIS and AGRIS in pure sciences and Public Affairs in social sciences. They are available commercially. Online Public Access Catalogue (OPAC) is a great relief to users of the library catalogue in the sense that, different users can search for the same information at the same time using different terminals which is impossible through the traditional card catalogue. Also, users can search the online library catalogue through ISSN, ISBN, and combination of title and author etc. Overdue notices are generated and sent to users through their e-mails. Users can reservation and overdue notices in the OPAC system. In the area of reference services, chat technologies, Ask a Librarian, Electronic-mail, fax, telephone, Compact Disc-Read Only Memory (CD-ROM) are used to answer users queries by the Reference Librarian in the technological age (Segun, 2003). Students and researchers can search, read through a single CD-ROM the 30 volume Encyclopaedia Britannica/Americana in the library and printout needed pages. Adequate security of those materials must be taken care of by the porters and other library staff. It may also be noted
that current and relevant information are accessed and downloaded by users through the internet. Some higher institutions libraries are connected to the internet and subscribe to online journals where various databases are searched and used by students and staff in various disciplines. It is a plus to those libraries in the area of providing current and relevant information to their users.

3.6.4 Security Devices

There has been a number of devices which are being used in libraries not only to secure library documents but also to keep record of the visitors of library. These devices are becoming necessary for libraries having larger number of users and collection. Some of the important security devices used in libraries these days include, RFID technology, Tap Technology and CC Cameras etc.,

3.6.4.1 RFID Technology

RFID (Radio Frequency IDentification) is the latest technology to be used in library theft detection systems. Unlike EM (Electro-Mechanical) and RF (Radio Frequency) systems, which have been used in libraries for decades, the RFID-based systems that libraries began to install in the late 1990s not only detect the unauthorized removal of library materials, but speed staff charge and discharge, simplify and speed patron self-charge and self-discharge, support electronic inventorying and shelf searching, and interface with materials handling systems. RFID is a combination of radio-frequency-based technology and microchip technology. The information contained on microchips in the tags affixed to library materials is read using radio frequency technology. A reader (aka sensor, scanner, or interrogator) looks for antennae on the tags and retrieves information from the microchips through them.

The tags used in RFID systems can replace both EM or RF theft detection tags or targets and barcodes, although the hybrid system that 3M introduced in 2000 replaced only barcodes and retained the EM strips in the belief that EM is superior to RFID for security. 3M did introduce a comprehensive RFID product that replaces both EM and barcodes in 2004 and now is one of the major suppliers of RFID technology for libraries. This change of position by 3M reflects how quickly RFID was accepted in the library community.
3.6.4.2 Components of RFID System

All RFID systems have at least two components: tags and readers; some may also include a server.

Tags

Each razor-thin tag contains an etched antenna and a microchip with a capacity of at least 64 bits. The most common sizes are 50x50mm (millimetres) and 50x75mm. However, the tags may be included in a label that is substantially larger. There are three types: “read only”, “WORM,” and “read/write.” Tags are “read only” if the identification is encoded at the time of manufacture and not rewritable. This type of tag contains nothing more than item identification. It can be used for items acquired after the initial implementation of RFID and by libraries that have collections without barcodes. Such tags need not contain any more than 96 bits.

“WORM” (Write-Once-Read-Many)” tags are programmed by the using organization, but without the ability of rewriting them later. They can be used when a retrospective conversion of a collection that is already barcoded is undertaken. The main advantage over read only tags is that information in addition to the identification number can be added. However, it must be information that won’t need to be changed. That could be an author and/or truncated title if the tag has enough capacity, but not library location or circulation status. The tags usually have a capacity of at least 256 bits.

“Read/write tags,” which are chosen by an increasing number of libraries, can have information changed or added. For example, a library might add an identification code for each branch. That information could be changed were the holding location subsequently changed. When a vendor includes a “theft” bit that can be turned on and off, the RFID tag can function much like an EM or RF tag. In library RFID, it is common to have part of the read/write tag secured against rewriting, e.g., the identification number of the item. The tags usually have a capacity of at least 1024 bits. A minimum capacity of 1024 bits is essential if the tags are to be used in electronic inventorying and/or with a materials handling system. While vendors now almost always offer 1024 bit tags, larger capacity tags are available.

All of the tags used in RFID technology for libraries are “passive.” The power to read the tags comes from the reader or exit sensor, rather than from a battery within...
the tag. “Active” tags, which have their own power supply, are substantially larger and more expensive than the tags used in library RFID applications. It is these active tags that can be read at distances of ten or more feet. Warehouse pallet inventory and EZ Pass tags are examples of active tags.

Standard tags can be affixed to books, magazines, video cassettes, or media cases, but not to CDs and DVDs because the metallic content of these media may affect the signal of standard tags. These require circular tags with a donut hole that can be affixed to the inner circles of CDs and DVDs that have no metallic content. Some vendors offer two donut hole tags, including a larger one that covers more of the CD or DVD and has a lower rate of failed reads. When looking at systems, librarians should ask for samples of all available tags.

The tags used by most vendors of library RFID are not compatible even when they conform to the same standards because the standards in existence through the first quarter of 2011 seek only electronic compatibility between tags and readers. The pattern of encoding information and the software that processes the information has differed from vendor to vendor; therefore, a change from one vendor’s system to another would require modifying all of the software. To avoid this, 3M introduced its “Tag Data Manager” in mid-2008 to increase interoperability. It has the capability to read non-3M tags in non-standard formats. That allows libraries with RFID tags that conform to older standards the option of upgrading their systems to 3M hardware and software without having to retag their existing collections. 3M also made its own tag format available to its customers on request.

Readers

A typical system includes several different kinds of readers, also known as sensors when installed at library exits. These are radio frequency devices designed to detect and read tags to obtain the information stored thereon. The reader powers an antenna to generate an RF field. When a tag passes through the field, the information stored on the chip in the tag is decoded by the reader and stored, sent to a server, or communicated to an integrated library system when the RFID system is interfaced with it. When there is no server, most of the software is on the readers.

The types of readers include conversion stations, staff workstations for circulation desk charging and discharging, patron self-charging and discharging
stations, book drop readers, and longer-range walk-through exit sensors to detect and read an RFID tag passage for purposes of determining whether it is a charged (authorized/no alarm) or discharged (non-authorized/alarm) event. The exit sensors are sometimes called “antennae,” but that is not correct because an antenna is only one component of an exit sensor. Finally, there is a portable device that consists of a scanning gun or wand attachment to read a group of items on the shelves for inventorying, shelf order, or locating missing items.

RFID exit sensors at exits look much like those installed in libraries for the last several decades; however, the insides are very different. One type reads the information on the tag(s) going by and stores that information, communicates it to a server, or sends it to the library’s integrated library system. If there is a “theft bit,” an alarm will be activated. As an option, a library may choose to automatically lock the turnstile gate if one or more items have not been properly charged. This option is rarely exercised. If a server is used, the server, after checking against the circulation database, activates an alarm if the material is not properly checked-out.

A bookdrop reader can automatically discharge library materials and reactivate security. Since they have already been checked-in, they can go directly back onto the shelves unless a library wants to check for holds, returns to the wrong location, and interlibrary loans. These units can also be used with a materials handling system, including conveyors and sorters. The sorters then separate out the holds, returns to the wrong location, and interlibrary loans.

Server

A server may be configured with an RFID system. It is the communications gateway among the various components. It receives the information from one or more of the readers and checks the information against its own database or exchanges information with the circulation database of the library’s integrated library system. The server typically includes a transaction database so that reports can be produced.

Standards

Standards for RFID in libraries are essential because library materials are not only used by the owning library, but also by others via interlibrary loan. Common standards would make it possible to circulate borrowed items without entering information manually.
2.6.4.3 Advantages of RFID System

1. The use of RFID reduces the amount of time required to perform circulation operations. The most significant time saving, are attributable to the fact that information can be read from RFID tags faster than from barcodes. That is due to the fact that the tags can be read regardless of item orientation or alignment (i.e., the technology does not require line-of-sight or a fixed plane to read tags as do older technologies) and that several items in a stack can be read at the same time. While initially unreliable, the anti-collision algorithm that allows an entire stack to be charged or discharged now appears to be working well. Finally, RFID tags can be read from distances of up to 24 inches—distances far greater than possible with lightpens and barcode wands. That is what makes RFID systems not only faster, but able to support electronic inventoring of materials on the shelves with handheld devices.

2. For patrons using self-charging, there is a marked improvement because they do not have to carefully place materials within a designated template and they can charge several items at the same time. Patron self-discharging, which can be achieved by installing readers in book drops or with self-discharge stations, shifts work from away from staff so that they can focus on service.

3. The readers are highly reliable. Several vendors of RFID library systems claim an almost 100 percent detection rate using RFID tags.

4. There are fewer false alarms than with older technologies once an RFID system is properly tuned.

5. Some library RFID systems have an interface between the exit sensors (a term often used to describe readers that are used at exits) and the circulation module of an integrated library system to identify the items moving out of the facility. Were a patron to run out of the facility and not be intercepted, the library would at least know what had been stolen. If the patron card also has an RFID tag, the library will also be able to determine who removed the items without properly charging them.

6. Other RFID systems encode the circulation status on the RFID tag. This is done by designating a bit as the “theft” bit and turning it off at time of charge and on at time of discharge. If material that has not been properly charged is taken past the
exit sensors, an immediate alarm is triggered. Another option is to use both the “theft” bit and the online interface to an integrated library system, the first to signal an immediate alarm and the second to identify what has been taken.

7. A unique advantage of RFID systems is their ability to scan materials on the shelves without tipping them out or removing them to access the barcodes. A hand-held inventory reader can be moved across a shelf of books at a distance of up to six inches to read all of the unique identification information. Using wireless technology, it is possible not only to update the inventory, but also to identify items that are out of proper order. When the tag numbers of missing items are entered into an inventory reader, it is possible to search for missing items on the shelves.

8. Another application of RFID technology is an interface with a materials handling system, a system that consists of conveyors and sorting equipment that can move library materials and sort them mechanically by category into separate bins or onto separate carts. This significantly reduces the amount of staff time required to ready materials for re-shelving. Given the high cost of the equipment, especially for systems with five or more bins or carts, this application has not been widely used.

3.6.4.4 Disadvantages of RFID System

1. The major disadvantage of RFID technology is its cost. While the readers used to read the information are comparable in cost to the components of a typical EM or RF theft detection system, the tags are far more expensive than barcodes, EM strips, or RF targets. However, tag prices dropped by 50 percent or more between mid-2009 and mid-2011, with the price depending on the amount of memory and the quantity purchased.

2. The tags from one vendor are not interoperable with those of another vendor even if the same tag manufacturer has been used by both. That is because of the lack of a data model standard. A data model specifies what information can be stored on a tag and where it will be located on the tag. Until there is a widely adopted standard, a library risks the loss of its investment in tags should it change vendors after initial installation of its RFID system.
3. It is possible to compromise an RFID system by wrapping the protected material in two to three layers of ordinary household foil to block the radio signal. Clearly, bringing household foil into a library using RFID would represent premeditated theft, just as bringing a magnet into a library using EM technology would be.

4. It is also possible to compromise an RFID system by placing two items against one another so that one tag substantially overlays another. That may cancel out the signals. This requires knowledge of the technology and care in substantially aligning the tags.

5. RFID tags are typically affixed to the inside back cover and are exposed. Recently, the technology of tags has been improved to make them much thinner and more difficult to detect when covered with a bookplate.

6. While the short-range readers used for circulation charge and discharge and inventorying may read the tags as much as 100 percent of the time, the performance of the exit sensors is more problematic. They must read tags at up to twice the distance of the other readers.

### 3.6.5 Networking

Computer networks are described and categorized many ways. One way of describing, is the way computers or nodes are connected, (centralized and non centralized networks). Another method is in terms of the physical or geographic allocation of the Nodes, (LAN.s and WAN.s). Networks may use circuit or messageswitching or both. The modem telephone network is of this kind and has been used extensively for data transmission. The network contains many switching nodes. A local switching node can connect local terminals to a local computer, thus there need not be as many computer ports as terminals. For longer distances, connections (called trunks) between switching centres can be used. Trunks may be used by many different terminals on different occasions. Transmission facilities between centres may be multiplexed, so that they can carry many simultaneous communications. One of the important methods of describing networks is in terms of the physical or geographical location of the nodes. The two basic types of such networks are known as Local Area Networks (LANs) and Wide Area Networks (WANs).
3.6.5.1 Local Area Networks (LAN)

A local area network is private communications network connecting two more computers directly by a cable within a limited local area, such as room, a building or a cluster of buildings. LANs vary in the types and numbers of computers that can be connected, the speed at which data can be transferred, and types of software used to control the network. The basic benefit of a LAN is that it reduces hardware costs because several computers and users can share peripheral devices. Users can also share data and software. The LANs have horizontal topologies in the form of star configuration, bus configuration, ring configuration etc.

3.6.5.2 Wide Area Networks (WAN)

A Wide Area Network (WAN) consists of two or more computers that are geographically located in distance places and are linked with by communication channels, such as telephone lines or microwave relays system. They often use vertical topologies, including the hierarchical and mesh topologies.

3.6.5.3 Metropolitan Area Networks (MAN)

These Networks are used to interconnect LANs that are spread around a city. MAN is a high speed network that can carry voice data and images at up to 200 Mbps or faster over distance of up to 75km. A MAN can include one or more LAN as well as telecommunication equipment such as microwave or satellite relay station. It is smaller than WAN.

3.6.5.4 INTRANET

Intranet can be designed as a network connecting an affiliated set of clients using standard Internet protocols, especially TCP/IP and HTTP. Another definition of an Intranet would be that an IP-based network of nodes behind a firewall, or behind several firewalls connected by secure, possibly virtual, networks.

3.6.5.5 EXTRANET

Extranet is an acronym for .extended intranet.. An extranet is a network that links business partners to each other over the internet by providing access to certain area of one another corporate intranets. (59). It can be defined as a business to business intranet that allows limited, controlled, secure access between a company’s
intranet and designated, authenticated users from remote locations or in other word’s an intranet that allows controlled access by authenticated parties.

3.6.5.6 THE INTERNET

Internet is truncated version of internetworking, which refers to interconnecting two or more computer networks. A computer network is interconnection of autonomous computing systems through communicating systems through a communication media. The major goals of networking are to felicitate resource sharing and communication among users connected to hosts. Internet, being network of networks, has the same major goals and spans across the entire globe, compared to limited geophysical area covered by local area and wide area networks. Consequently, the Internet can be thought of as vast pool of computers, people and information spread across the entire world.

3.6.6 Digital Technology

3.6.6.1 INFLIBNET

The Information and Library Network (INFLIBNET) Centre is an autonomous Inter-University Centre (IUC) of the University Grants Commission (UGC) located at the Gujarat University Campus, Ahmedabad. Major activities and services of the Centre are geared towards modernization of academic libraries and information centres, to promote information transfer and access, to support scholarship, learning and academic pursuits. The Centre, acts as a nodal agency for networking of libraries and information centres in universities, institutions of higher learning and R & D institutions in India. The Centre was established as an independent autonomous Inter-University Centre of the UGC in May 1996 and set out to be a major player for promoting scholarly communication among academicians and researchers across the country. The technology being a driving force in the contemporary education system, the Centre, on behalf of the UGC, has taken-up a number of initiatives for the benefit of the academic community. These initiatives include:

i) UGC-Infonet Connectivity Programme that provides for networking of university campuses and Internet connectivity;

ii) UGC-Infonet Digital Library Consortium that extends access to selected scholarly electronic journals and databases to the universities in different disciplines;
Shodhganga: A Reservoir of Indian Electronic Theses and Dissertations, that enables online submission of theses and dissertations by research scholars in digital repository set-up at the INFLIBNET Centre;

iv) Open Journals Access System (OJAS) @INFLIBNET that facilitates faculty and researchers in Indian universities to launch their open access journals on OJAS platform offered by INFLIBNET Centre; and

iv) Access management technologies that would facilitate users to access e-resources irrespective of their physical location. Besides, the Centre has recently launched a project entitled “National Library and Information Services Infrastructure for Scholarly Content” (N-LIST) that provides access to electronic journals and electronic books to eligible colleges.

3.6.6.1.1 Objectives of INFLIBNET

The objectives of the INFLIBNET Centre are as follows:

1. To promote and establish communication facilities to improve capability in information transfer and access that provide support to scholarship, learning, research and academic pursuits through cooperation and involvement of concerned agencies;

2. To establish information and library network - a computer communication network for linking libraries and information centres in universities, deemed to be universities, colleges, UGC information centres, institutions of national importance and R&D institutions, etc. avoiding duplication of efforts;

3. To promote and implement computerization of operations and services in the libraries and information centres of the country, following uniform standards;

4. To evolve standards and uniform guidelines in techniques, methods, procedures, computer hardware and software, services and promote their adoption in actual practice by all libraries, in order to facilitate pooling, sharing and exchange of information towards optimal use of resources and facilities;

5. To evolve a national network interconnecting various libraries and information centres in the country and to improve capability in information handling and services;
6. To provide reliable access to document collection of libraries by creating on-line
union catalogue of serials, theses / dissertations, books, monographs and non-
book materials (manuscripts, audiovisuals, computer data, multimedia, etc.) in
various libraries in India;

7. To provide access to bibliographic information sources with citations, abstracts,
etc. Through indigenously created databases of the Sectoral Information Centres
of NISSAT, UGC Information Centres, City Networks and such others and by
establishing gateways for online accessing of national and international
databases held by the national and international information networks and
centres, respectively;

8. To develop new methods and techniques for archiving of valuable information
available as manuscripts and information documents in difference Indian
languages, in the form of digital images using high density storage media;

9. To optimize information resource utilization through shared cataloguing, inter-
library loan service, catalogue production, collection development and thus
avoiding duplication in acquisition to the extent possible;

10. To enable the users dispersed all over the country, irrespective of location and
distance, to have access to information regarding serials, theses/dissertation,
books, monographic and non-book materials by locating the sources wherever
available and to obtain it through the facilities of the INFLIBNET and union
catalogues of documents;

11. To create databases of projects, institutions, specialists, etc. for providing online
information services;

12. To encourage co-operation among libraries, documentation centres and
information centres in the country, so that the resources can be pooled for the
benefit of helping the weaker resource centres by stronger ones; and

13. To train and develop human resources in the field of computerized library
operations and networking to establish, manage and sustain INFLIBNET;

14. To facilitate academic communication amongst scientists, engineers, social
scientists, academicians, faculty, researchers and students through electronic
mail, file transfer, computer/audio/video conferencing, etc;
15. To undertake system design and studies in the field of communications, computer networking, information handling and data management;

16. To establish appropriate control and monitoring system for the communication network and organize maintenance;

17. To collaborate with institutions, libraries, information centres and other organizations in India and abroad in the field relevant to the objectives of the Centre;

18. To promote R&D and develop necessary facilities and to create technical positions for realizing the objectives of the Centre;

19. To generate revenue by providing consultancies and information services; and

20. To do all other such things as may be necessary, incidental or conducive to the attainment of all or any of the above mentioned objectives.

3.6.6.1.2 Research and Development Activities

1. Database Management R&D group

2. IndCat: The Union catalogue of Books, Journals, Theses and Videos

3. Union Catalogue of Serials

4. Union Catalogue of Theses

5. CEC’s Video Database: An INFLIBNET-CEC Collaborative Endeavour

6. Software Tools Used for Building, Maintenance and Searching of Union Catalogue

7. Subject Experts Database

8. Research Project Database

3.6.1.1.3 Software R&D Group

The Software R & D Group of the Centre is involved in development of software based on the functional requirements, day-to-day activities and services of the Centre including development on library automation system called SOUL 2.0 and customization of open source software.
SOUL 2.0

The SOUL 2.0 (Software for University Libraries) is state-of-the-art integrated library management software designed and developed by the INFLIBNET Centre based on requirements of colleges, universities and other academic libraries. It is user-friendly software developed to work under client-server environment. The software is compliant to international standards for bibliographic formats and circulation protocols. After a comprehensive study, discussions and deliberations with the senior professionals of the country, the software was designed to automate all house-keeping operations in a library. The software is suitable for the academic libraries as well as for all kinds of other libraries. SOUL 2.0 is compliant to international standards such as MARC21 for bibliographic format, Unicode based Universal Character Sets for multilingual bibliographic records and NCIP 2.0 and SIP 2 based protocols for RFID, electronic surveillance and control. The Soul 2.0 was released in January 2009 and was well received by the academic libraries in India. During the year under report, several new features were added to SOUL 2.0 including new Web OPAC, provision for circulation of loose issues as well as several minor enhancements in reporting and other functionalities. New updates of the software are made available through the SOUL 2.0 website at no cost to existing users.

3.6.6.1.4 Subject Gateway Management System (SGMS)

Subject Gateway Management System (SGMS) is designed to facilitate entry of Internet resources and extending its access to users. SGMS supports browsing of Internet resources by Dewey Decimal Classification (DDC) Scheme. The main functional parts of subject gateway are:

- Dewey Decimal Classification (DDC) Search;
- Search Cloud;
- Free-Text Search;
- Alphabetical Search;
- Resource Type Search; and
- Intute Search

UGC-Infonet Digital Library Consortium
3.6.6.2 Developing Library Network (DELNET)

DELNET was started at the India International Centre Library in January 1988 and was registered as a society in 1992. It was initially supported by the National Information System for Science and Technology (NISSAT), Department of Scientific and Industrial Research, Government of India. It was subsequently supported by the National Informatics Centre, Department of Information Technology, Ministry of Communications and Information Technology, Government of India and the Ministry of Culture, Government of India.

DELNET has been established with the prime objective of promoting resource sharing among the libraries through the development of a network of libraries. It aims to collect, store, and disseminate information besides offering computerised services to users, to coordinate efforts for suitable collection development and also to reduce unnecessary duplication wherever possible.

DELNET has been actively engaged with the compilation of various Union Catalogues of the resources available in member-libraries. It has already created the Union Catalogue of Books, Union List of Current Periodicals, Union Catalogue of Periodicals, CD-ROM Database, Database of Indian Specialists, Database of Periodical Articles, Union List of Video Recordings, Urdu Manuscripts' Database, Database of Theses and Dissertations, sample databases of language publications using GIST technology and several other databases. The data is being updated in these databases and is growing rapidly. All the DELNET databases have been resident on DELSIS, an in-house software developed on BASIS Plus, an RDBMS, the product of Information Dimensions Inc. of USA which has been provided to DELNET courtesy National Informatics Centre, New Delhi.

DELNET provides an array of facilities. DELNET'S relentless efforts in resource sharing have proved extremely effective. It has contributed a lot towards the modernisation of libraries in India.
3.6.6.2.1 Objectives of DELNET

- To promote sharing of resources among the libraries by developing a network of libraries, by collecting, storing and disseminating information and by offering computerised services to the users;
- To undertake scientific research in the area of Information Science and Technology, create new systems in the field, apply the results of research and publish them;
- To offer technical guidance to the member-libraries on collecting, storing, sharing and disseminating information;
- To coordinate efforts for suitable collection development and reduce unnecessary duplication wherever possible;
- To establish /facilitate the establishment of referral and /or research centres, and maintain a central online union catalogue of books, serials and non-book materials of all the participating libraries;
- To facilitate and promote delivery of documents manually or mechanically;
- To develop specialised bibliographic database of books, serials and non-book materials;
- To develop databases of projects, specialists and institutions;
- To possess and maintain electronic and mechanical equipment for speedy communication of information and delivery of electronic mail;
- To coordinate with other regional, national and international networks and libraries for exchange of information and documents;

3.6.6.2.2 DELNET Databases

- Access to Union Catalogues and Other Databases

Other Services

- Interlibrary Loan and Document Delivery Services
- Retro-Conversion
- Reference Services
- Professional Training
3.6.6.2.3 Software Development

DELNET promotes the use of Koha, the open source library management software. It has been decided by the National Mission on Libraries that Koha will be used by public libraries in the country. The libraries that use DELPLUS, the library management software developed by DELNET, continue to receive support for the software from DELNET.

3.6.6.2.4 DELNET Consortium

The following GALE/ CENGAGE packages are being offered under the DELNET consortium. Some new packages have also been introduced since December 2012:

1. InfoTrac Engineering, Science and Technology Collection (IESTC)
2. InfoTrac Management Collection (IMC)
3. InfoTrac Medical Collection (IMedC)
4. InfoTrac Pharmacy Collection (IPC)
5. Health & Wellness Resource Centre (HWRC)
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