IT Applications in Academic Libraries

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Abstract

Present study indicates the use of information technology applications on academic libraries and IT infrastructures in academic libraries, this article also covers information on varies aspects such as Components of IT, computer technology, microchip technology, CD Rom technology, communication technology, library automation, information storage and retrieval, resource sharing and networking, library2.0 and web3.0.

KEYWORDS
Academic libraries; IT Applications; Resource sharing; Networking; library Automation.

1. Introduction

Technology is changing the nature of libraries and librarians, and continues to exert a major influence on the strategic direction of libraries in society. Today, the library services are transitioning from local traditional collections to global resources provided on demand via the most advanced networking technologies. It is now possible to retrieve information independently of time zones and geographical location, and to obtain the most up-to-date information from the form of the library without walls, or the virtual library.

Advanced technologies in the field of information have enhanced the ability of libraries to serve their communities, lower their costs, and fully participate in the new-networked world. It enables the readers to understand the process of electronic dissemination of information, the impact of the Internet on libraries, the changing responsibilities of library professionals, the new paradigm for evaluating information, and characteristics and functions of today’s library personnel. It will be highly beneficial for practicing librarians and students in library science and the social sciences.1

2. Meaning and Definition

It is said “Information technology is the product of fusion of information science and technology, information science comprises of set of practices and related disciplinary studies,
which is concerned with the transmission, organization, storage, retrieval and use of information. Technology is the branch of knowledge that deals with industrial arts, applied science and engineering”.

Information technology is a combination of computer and telecommunication technologies, which has made possible to help the people at work, in education and at home. Thus, it is all about the application of varieties of electronics to the information organization. The term ‘Information Technology’ (IT) is of recent origin and is a comprehensive term. The term encompasses the notation of information handling; IT has defined in different ways by the different scientists and organizations as follows:

2.1. Definitions

There have been various definitions proposed for IT. Albeit, from “the library and Information Science point of view, it can be defined as application of various technologies for the acquisition, processing, storage and dissemination of information”. Various technologies include microelectronic-based computers, telecommunication, reprography, printing etc.

The UNESCO definition of IT also offers a broad view of this newly evolving discipline: It is also defined as “scientific, technological and engineering disciplines and managerial techniques used in information handling and processing, their application, computers and their interaction with men and machines, and associated social, economic and cultural matters”.

According to ALA glossary, “Information technology is the application of computer and other technologies to the acquisition, organization, storage, retrieval and dissemination of information”.

Information technology is comprised of computers, network, satellite communication, robotics, videotext, cable television, electronic mail, electronic games, and automated office equipment. Information industry consists of computer, communication, and electronics-related organizations, including hardware, software, and services. Completing tasks using information technology results in rapid processing and information mobility as well as improved reliability and integrity of processed information.
3. Components of Information Technology

Information technology connotes an ensemble of technologies. They particularly cover the computer capability to store and process information, known as information processing and the telecommunication technology, which are capable of transmitting information to distances. The breakdown of these technologies is presented by James Williams (1982) in his paper “Information Technology – A state of the art.” He presents the data in terms of the following six major new technologies that appear to be relevant to modern libraries and information system:

a. Processor, memory and input/output channels;
b. Micro, mini and large scale computers;
c. Mass storage technologies;
d. Data communication, networking and distributed processing;
e. Data entry, display responds technology; and
f. Software.

These technologies can also be grouped into three major areas (1) computer technology (2) communication technology, and (3) reprographic and printing technologies.

A number of on-line information services are available today on commercial and institutional level. The reproduction technology has advanced to a considerable extent so that we are having great number of choices for selection and adoption in information work.

Based on the aforementioned definitions, IT developments and areas of applications, the libraries use information technology to:

- Automate housekeeping operations,
- Networking of libraries for sharing and exchange of library resources, and
- Create databases to provide services to the end-users more efficiently than before.

It is experiential that, whenever the utilization of information technology is properly effected, it helps growth and development of libraries in different directions.
4. Computer Technology

Computer technology (or Science) is the study of operating principles of computers, programming languages and algorithms for solving theoretical as well as practical problems. It involves the development and use of devices for data processing. A computer is a machine that accepts data (in various forms), performs certain operations to process it and presents the results in finished forms according to the instructions provided to it. Computers are used in all aspects of modern living i.e. medicine, education, publishing, business, transport, communication etc and in personal use also.

The history of computer technology can be traced back to those years (e.g. 3000 B.C) when the orient civilization used the abacus for calculating the simple arithmetic problems. However, Blaise Pascal developed the first mechanical adding machine in 1642, which laid the foundation for the modern computing machines. During these years the computers developed from very large in size to very handy in size and their speed of operation from very slow to unimaginable high speed. The most popular computers of today are the personal computers (PCs) manufactured by different companies such as Apple, IBM, Compaq, Hewitt Packard and others.

The widespread use of computer technology has made dramatic developments in the information transmissions process in every field of human endeavor during the past few years. Highly sophisticated information services ranging from elaborate abstracting and indexing services to computerized data bases in almost all scientific disciplines are in wide use all over the world. The current developments in computer technology include mini computers, microcomputers, personal computers, portable computers, super computers, speaking computers, computers with IQs. See the robots, microchip technology, artificial intelligence, software developments, CDROM technology, machine readable data base etc.

5. Microchip Technology

The phenomenal increase in computer capacity and dwindling down of costs are on account of the new and faster development in electronics technology. The invention of transistor in 1947 at Bell Telephone Laboratories made a history in electronics. Within a decade the device consisted of speak of silicon or germanium crystal encased in a pea size metal can, with a complex of electronic switches commonly called as the ‘chip’. This integrated circuit technology initiated in 1959 has advanced the technological capacity in quantum jumps.
The race is on to build smaller and denser microchips, the work-hours of the electronics age. Microelectronics has acquired momentum with the advent of mustachio package technology. This dramatically reduces the cost per interconnection by mounting as many as 118 chips on, for example, a single ceramic carrier with up to 704 circuits on each chip.

5.1. CD-ROM Technology

Both the print media and its users are becoming obsolete due to exponential growth of information and information sources. The storage media for information are fast changing in a fascinating manner as follows:

- PRINT MEDIA (papers, metal sheets, other hard materials)
- FILM MEDIA (Microfilm, microfiche, etc)
- MAGNETIC MEDIA (Magnetic tapes, drums, etc)
- ELECTRONIC MEDIA (Floppy, hard disc, microchips, etc.)
- OPTICAL MEDIA (CD-ROM, Videodisc, CD-WORM, CD-I, etc).

CD-ROM is an acronym that stands for Compact Disc Read only memory. It is an optical disc of 120 mm diameter and a hole of 15 mm at the center with thickness 1.2 mm. Data is recorded in digital form using laser beam. Each disc can store approximately 600 mega bytes of information equivalent to 3 lakh pages of text or 1500 floppy disks or an entire text of 20 volumes of encyclopedia.

Advantages of CD-ROM in information storage and retrieval are (1) permanent storage, (2) high density storage, (3) durability, (4) portability, (5) low cost, (6) unlimited use, (7) data protection, (8) personal computer based, (9) no telecommunication, (10) ideal for library storage, (11) networking and data exchange, (12) as mass media, etc.

6. Communication Technology

Communication or telecommunication technology consists of electromagnetic devices and systems for communicating over long distances. The principal examples are telephone, radio, television, and cable.
The history of communication technology can be equated with the history of civilization itself. It developed along with human beings communicating to one another. The use of clay tablets, hieroglyphics, alphabets, printing techniques, photographic techniques, communications through telegraph, telephone, radio and television: all seemed to develop to facilitate better communication of ideas, expressions etc among human beings. Recently the telecommunication technology developed along three directions to provide i) better communication channels, ii) better networks, and iii) better sending and receiving devices.

The need to communicate more quickly and more efficiently has become a central focus in our technological society. Economy, industry, education and security of the industrial nations are going to depend heavily on the use of the latest means of communication technology and to transmit information. In the form of signals between remote locations, using electrical or electromagnetic media as carriers of signals. Telecommunication has achieved impressive advances in recent years. Channel capacities, reliability and error rates have improved dramatically. The major developments in the area are:

The following are the major modes of communication, which are forms for sharing purpose.

1. Telegraph
2. Telephone
3. Radio
4. Cinema, motion picture
5. Television
6. Computers
7. Communication Satellite
8. Online technology
9. Internet
10. E-mail
11. Facsimile Transmission (FAX)
12. Teletext and videotext
13. Data system and Network
14. Teleconferencing
15. Fiber optics and microwave
16. Networking

These are Audio-technology, audio visual technology, teletext and video text, fax, online search, e-mail, satellite technology, fiber optics, ISDN, Networking, teleconference, cellular telephones, voice mail, pagination, communications, etc.

7. Internet
Simply, the Internet can be defined as the global network of networks. It is a network of interconnected World Wide Webs of different types of organizations like universities, business, defense and science organization. It has emerged not only as an important search device for research and development community but also for political activists, farmers, librarians, journalists, scientists and many others. The various basic facilities that can be availed through Internet may be summarized as follows (Sinha and Dhiman, 2001).

8. Impact of Information Technology on Library Functions

As an old proverb goes present is the child of the past and father of future. Similarly knowledge of the past stands tall as an enduring monument to man’s skill and his desire for advancement of civilization. His craving for learning never ends and still intrigues the learned, the learner and the learning for more and more introspection. From time immemorial, library is considered as the seat of learning, collecting knowledge, literature kept and preserved for access to the users in various formats. The past glory of libraries was not in any way inferior to the present trend. Wonderful wealth of information was stored, processed and disseminated at large.

The information contained in such documents was strictly for few privileged/exclusive users than for dissemination to all. Doors of the library were opened only at the will of owner of the collection. Learning was monopoly of philosophers, scholars patronized by religious institutions and monarchies, as a number of manuscripts and other documents were limited. The development in modern printing technologies has resulted in startling proliferation of literature and spreading of education, which has completely changed the concept of library. Consequently, libraries grew in size and also in number of users. Communication of right information to right reader expeditiously through various methods and media was the goal of library service. The rates of growth of information was accelerated to such an extent that manual or semi manual methods of information handing were not enough to meet the situation and were proving ineffective for service. This led to further innovations for making libraries and information services more relevant and effective. The single force that has brought revolutionary changes in functioning of libraries is information technology. The introduction and application of these modern means have elevated the library to a very high pedestal, improving and altering its image function and service to revolutionary extent and with great efficiency and effectiveness.
Information technology has virtually immense potential for a variety of applications in libraries. Information technology helps libraries in creating database of their collections and making them available for easy access to users inside as well as outside through network. Information technology enables libraries to provide most efficient and specialized information service. It has been fairly established that efficient information support and effective communication and organization are closely associated with high performance, productivity and innovation. Computers can be used in performing most of the respective works of library in a desired number of times speedily and economically without fatigue and wastage of time. Most of the operations within library are inter-related, inter dependent and mutually supportive of the overall mission of library. Use of information technology, application, interface and integrate each function with the other which saves lot of staff times as the same data used need not be entered at every stage.

The information technology is applied in four ways in libraries:

- Library automation
- Information storage and retrieval
- Office automation
- Resource sharing network.

8.1. Library Automation

Automation has helped libraries for improving library operations and accelerating their work. Now the computers are being used in the areas like acquisition, technical processing, circulation control and serial control.

The computer acquisition system has eased the burden for reorder checking of duplicate purchase, orders and follow up action can also be taken automatically. Information technology has speeded up the accession processing work by eliminating a large amount of repetitive and time consuming work. Machine readable cataloguing is easy to manipulate as it can be searched online and from which varieties of outputs are available. Online bibliographic databases have significant effect on collection development. The lengthy and time consumable procedures of conventional circulation system are taken by the technological devices like computers, barcode scanners, and its software helps in performing these operations quickly and easily and thus saving the time of users and staff. Information technology helps charging and discharging of documents, reservation of documents, sending
reminders, collection of overdue maintenance of various records. Computers help in periodical subscription and subsequent monitoring of the receipts of individual issues. It helps in maintaining the record of budget sanctioned and amount expended for different categories of serials.

In the process of inter-library lending service, information technology has influenced very much. By using the modern information technology devices like computers, fax e-mail, etc. the libraries and information centers (LICs) can easily search the On-line Public Access Catalogues (OPAC) of other libraries for a particular document and send the requests for inter-library-lending and get the document in a short time.

Reference service is influenced by the information technology more than any other services of the library and information centers. The new information technology has reduced the response time for reference query. The major reference sources are readily available as optical discs as well as on-line databases.

8.2. Information Storage and Retrieval

After acquisition and processing of documents through computerized system, the focus is to retrieve and disseminate the required information. Online information retrieval is one of the speediest and the most effective means of getting the required information.

The main advantages of using on-line information retrieval are;

- Specific queries with reference to information requirement can be searched with great speed
- A large volume of information can be searched rapidly and accurately
- It is possible to search databases to which the library and information center does not subscribe. This is of great advantage since very few libraries/information centers have the financial sources to have all the databases because they are costly.
- Many searches easily done on on-line would be extremely difficult to do manually
- One can search and get the required information on-line in a matter of minutes what would take perhaps many hours or days by the manual method.
8.3. Resource Sharing / Networks

The libraries are also using computers for resource sharing. It can be a part of local library network or a part of large joint program, now widely known as resource sharing network. Libraries having computerized their working and services can be linked with one another through a suitable telecommunication network system. The system enables the participating library to obtain material from one another’s collection in the form of list of books indexes and abstracts of required article, facsimile copies of required pages or documents charts, figures, graphs, drawings by using computer terminals attached to a large or very large network system and databases coupled with Visual Display Units (VDUs) and attached with printing facility. Information can be scanned first on the screen and if required, relevant information can be obtained in the printout form.

Information technology facilitates the library and information centers in providing the literature search service by searching various information sources in print or non-print form within the library. Outside the library or at national or international level, in a short time with accuracy, CAS and SDI services have become easy and it can be provided without causing any delay by using the new information technology.

Thus information technology is showing its impact on the time accuracy, efficiency and effectiveness of various library and information services. It has become inevitable to adopt such technologies by the libraries and information centers, due to advantages of information technology devices.

8.4. Advantages of Information Technology

A variety of advantages can be derived by the appropriate use of information technology. The advantages can be referred to anything produced with the assistance of technology which allows completing more tasks with greater accuracy and better quality in less time and for lower costs. It could be higher productivity, better quality or it might be less tangible like ensuring users to have better image of the library and improve response time or improving staff morale and motivation, in certain nature of jobs. Hours of manual work are possible for completion within minutes through it. Perhaps, there is a number of operation or service where you cannot apply information technology. The benefits of it are in the following ways:
Information Technology

- Helps to avoid duplication of effort and work in library operations.
- Facilitates cooperation and resource sharing through library network.
- Helps to introduce new services and improve existing services.
- Allows integration of various library operations.
- Executes repetitive nature of works.
- Facilitates faster information communication.
- Helps to increase the quality and range of services.
- Increases morale and motivation of library staff.
- Facilitates easy and wider access to all kinds of information, sources.
- Helps to increase efficiency and effectiveness in library operations.
- Ultimately helps to save time, space, energy and resources.
- Helps to improve productivity and image of the library.

9. Web development in India

The World Wide Web was started originally in 1989 and the first implementation appeared in 1990. Web development beginning at CERN (Centre European de recherché Nuclear) is a short history explaining how Tim Berners-Lee and others brought together the technologies needed to be able to share documents using web browsers in a multi-platform environment which evolved from those humble beginning into the World Wide Web as we know it today. Digital resources are as the universe of network-accessible information (available through your computer, phone, television or networked refrigerator). Today this benefits society by enabling new forms of human communication and opportunities to share knowledge. One of W3C’s primary goals is to make these benefits available to all people, whatever their hardware, software, network infrastructure, native language, culture, geographical location, or physical or mental ability. People currently share their knowledge on the web in language intended for other people.

10. Information Technology in Indian Scenario

India has made remarkable progress in the field of book production and publication, telecommunication, satellite, computer and laser technologies. Promoted by these
technological changes and innovations, the scenario has metamorphosed to include a variety of endeavors in the field of library and information science. Information programmes like NISSAT, ENVIS, BTIS NILNET, INDONET, VIKRAM, NMIS INSDOC, BARL, SLET SENDOC, SAIL are being evolved and generated successfully due to advancement in information technology. Besides, the International Information System (IIS) such as ASTINFO/UNESCO, INIS/IAEA, AGRIS/FAO, GEMS/UNEP, TIPS/UNDP have their focal points in India.

There are more than 20 organizations in India offering computerized bibliographical information service. Besides information processing packages have been developed by different organizations for (i) SDI and retrospective searches, (ii) current awareness, indexes, catalogues etc. (iii) the source and classers, (iv) online query processing, (v) cataloguing, (vi) acquisition, and (vii) circulation control.

In library applications, Tymnet and GTE-Telnet are widely used to access the online bibliographic search services. INDONET is an integrated information management and distributed data processing facility spanning the entire country. Attempts have been made to get databases from various organizations and make them accessible online through INDONET. An international gateway in Bombay is set up with the cooperation of Videsh Sanchar Nigam to enable Indian users to access international databases available from LOCKHEED/DIALOG, SDC/ORBIT and ESANET.

INSDOC has arranged for online access to the ESA/IRS databases from terminal installed in Bombay. The information centre for aeronautics in NAL, Bangalore conducts information searches from the ESA databases. Informatics India limited at Bangalore offers information services, now on a commercial basis. Again we have a programme named INFLIBNET, a computer communication network for linking libraries and information centers in universities, deemed universities, institutions of national importance, UGC information centers, R&D institutions and colleges.

However, in Indian context, only special libraries and information centers are adopting to the new technological changes. But there seems to be very little efforts in the direction of introducing the technological developments in the academic and public libraries. This may be due to(i) lack of motivation and awareness on the part of the library managers;
(ii) non availability of skilled personnel; (iii) lack of training opportunities to handle sophisticated tools and machineries; and (iv) financial constraints.

But this state of affairs will be set right if the librarians come forward to adopt themselves to the general and prevailing trend.

11. Library 2.0

According to Miller (2005a), Library 2.0 is a term coined by Michael Casey on his library crunch blog. Though his writings on Library 2.0 are groundbreaking and in many ways authoritative, Casey (2006a) defines the term very broadly, arguing it applies beyond technological innovation and service. In addition to Casey, other blogging librarians have begun conceptually exploring what Library 2.0 might mean, and because of this disparate discussion with very wide parameters, there is some controversy over the definition and relative importance of the term. With the nature of this controversy Lawson (2006), Peek (2005), and Tebbutt (2006) explore and begin to adequately rectify, and Crawford (2006) provides a very thorough account of the ambiguity and confusion surrounding the term, partially suggesting that there is nothing inherently novel about the idea.

Library 2.0 is a user-centered virtual community. It is a socially rich, often egalitarian electronic space. While Librarian 2.0 might act as a facilitator and provide support, he or she is not necessarily primarily responsible for the creation of the content. Users interact with and create resources with one another and with librarians. In some ways, it is a virtual reality for libraries, a web manifestation of the library as place. A library’s presence on the web in Library 2.0 includes the presence of that library's constituency and utilizes the same applications and technologies as its community, a concept Habib (2006) recognizes in a very useful model for Library 2.0 in regards to academic libraries.

Librarians have been quick to pick up on web 2.0 and its potential to extend interaction between content and clients. Enter Library 2.0 (a term reputedly coined by Michael Casey on his Library Crunch blog), which borrows from the philosophy underpinning web 2.0, in part the user’s active and central role in shaping services.

The term is widely defined and interpreted. ‘Web 2.0’ was reportedly first conceptualized and made popular by Tim O'Reilly and Dale Dougherty, of O'Reilly Media in 2004 to describe the trends and business models that survived the technology sector market...
crash of the 1990s (O’Reilly, 2005)\(^\text{15}\). The companies, services and technologies that survived, they argued, all had certain characteristics in common; they were collaborative in nature, interactive, dynamic, and the line between the creation and consumption of content in these environments was blurred (users created the content in these sites as much as they consumed it). The term is now widely used and interpreted, but Web 2.0, essentially, is not a web of textual publication, but a web of multi-sensory communication. It is a matrix of dialogues, not a collection of monologues. It is a user-cantered web in ways it has not been thus far.

The implications of this revolution in the web are enormous. Librarians are only beginning to acknowledge and write about it, primarily in the ‘biblioblogosphere’ (weblogs written by librarians). Journals and other more traditional literatures have yet to fully address the concept, but the application of Web 2.0 thinking and technologies to library services and collections has been widely framed as ‘Library 2.0’ (Miller 2005a\(^\text{16}\); 2005b\(^\text{17}\); 2006a\(^\text{18}\); 2006b\(^\text{19}\); Notess, 2006\(^\text{20}\)).

Most writers on Library 2.0 would agree that much of what libraries adopted in the first web revolution are static. For example, online public access catalogs (OPACs) require users to search for information, and though many are beginning to incorporate Web 2.0 techniques by gathering data regarding a user (checked-out items, preferred searches, search alerts), they do not respond with recommendations, as does Amazon.com, a more dynamic, Web 2.0 service. Similarly, the first generation of online library instruction was provided via text-based tutorials that are static and do not respond to users’ needs nor allow users to interact with one another. These, however, have begun evolving into more interactive, media-rich tutorials, using animation programming and more sophisticated database quizzes. Libraries are already moving into Web 2.0, but the move has only just begun.

11.1. Upgrade now! Web 3.0

For those familiar with Web 2.0, the news that Web 3.0 is on the horizon may be equal cause for jubilation or despair. Web 3.0, is still very much at the conceptual stage, though the idea has surprisingly been around for some time (within the context of the web’s short but phenomenal life). In fact, Web 3.0 is sometimes referred to (though not exclusively) as the Semantic Web, a concept coined by Tim Berners Lee, who along with colleagues at CERN, first established the programming language underpinning the web.
At the heart of the Semantic Web is the applications of rich descriptive tools like URIs (Uniform Resource Identifiers) and RDF (Resource Description Framework)--the semantic web comes with its own jargon set, to identify and link information that can then be easily read by machines.

This deep level of description allows for deductive and initiative decision making by sophisticated software agents when they access and process the information. For example, when searching from webpage to web page they will not only ‘read’ keywords but make meaningful inferences based around the context and content of the pages in relation to others--unlike current search engines.

**Conclusion**

In today's information technology age, Internet is a boon for faculties and researcher as has brought information technology scattered all over the world within the easy reach of the researchers. Internet can help faculty members to get the nascent information in their field without time log and hence save their time, avoid duplication and improve the quality of research and teaching. But to gain full advantage of IT and internet it is required that institutions of higher education make better internets facilities available and also make an effort to make their faculty members, researchers, students aware of the merits of IT applications and use internet effectively to meet their information needs.

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