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"The library connects us with the insight and knowledge, painfully extracted from Nature, of the greatest minds that ever were, with the best teachers, drawn from the entire planet and from all our history, to instruct us without tiring, and to inspire us to make our own contribution to the collective knowledge of the human species. I think the health of our civilization, the depth of our awareness about the underpinnings of our culture and our concern for the future can all be tested by how well we support our libraries."

-Cosmos
Carl SAGAN
1.1 Introduction

A library plays a pivotal role in ensuring the success of higher degree of research. The important activities of university libraries include the Collection Development, Reference Service, Document Delivery, User Education, Access to Electronic Resources etc. University libraries are expected to provide cost effective and reliable access to information using the state-of-the art information technology tools.

Information technology has revolutionized the information handling activities in the academic libraries during the past few years. The Information Society demands that all the relevant technologies; that are involved in information processing, consolidation, repackaging and retrieval be merged so as to evolve an integrated system; capable of providing diversified services. In this direction the automation of individual university libraries is a first step, rather a pre-requisite for the development of such an integrated university library and information system. The promising trend in the development of information services with effective networking of these libraries will facilitate the optimum utilization of information resources.

Today in our country there are 273 universities and institutions including 52 deemed to be universities. Of these 162 are conventional universities including 34 institutions for specialized studies, 40 are agricultural universities, 33 technical institutions, 18 medical institutions, three information technology
institutions, 6 law universities. This vast academic community needs a wide variety of information services in the changing academic environment (Universities handbook, 2002).

The need and the importance of university libraries was well emphasized by the Radhakrishnan Commission (1948), Kothari Commission (1964) and various other UGC Committees in the past. Due to liberal UGC grants under the Chairmanship of the late Dr. C.D. Deshmukh and as a result of the recommendations of Education Commissions, a majority of the university libraries have good physical facilities and moderate document collections.

1.2 Developments in Information Technology

During the last twenty years, the rapid developments in information and communication technologies have had a profound impact on Higher education in India and abroad. The new technologies have not only changed the way information generated, organized, stored, and distributed, but more importantly they have become indispensable tools for teaching, learning, and research activities in the country. As a result, the method by which instruction is delivered and research is conducted, is never going to be the same again. It is an established fact that today in most of the institutions of higher education in the western countries there is an ample use of Intranet and Internet to access the global information. It is regarded more as necessity, and not a luxury. In general, the mission of the university libraries is to provide effective access to
scholarly and professional information resources for its members and other participating library members. Achieving this requires organized use of computing tools in all facets of library activities. Rapid proliferation of information, overgrowth of information resources and multifarious needs of users posed a critical challenge of delivering timely information to the satisfaction of the users. Traditional tools and techniques are unable to keep up this time aspect. Hence academic libraries do not really have any choice, but to embrace, the available technologies judiciously to meet the expectations of their users.

The developments in the Information Technology sector have proved the death of distance and the death of time. University Libraries are fertile areas for the introduction of Information Technology for providing and making accessible the best possible information from anywhere any time and from any sources for the users community. Network is going to be the essential partner in this exercise as it facilitates access to vast information services. Networks have potential to improve library services in several ways. The continuous improvement in the networking technology helps libraries to reduce the cost of information provision, thus creating new opportunities for the libraries to play their role in information provision to its end users. In recent years libraries worldwide have been affected by an uncertain financial environment in which resource buying has been restricted, causing them to look at the ways of
extending their purchasing capabilities to compensate for reduced budgets.

The situation is like ‘United we stand, divided we fall’

With so much of information stored on networks and a desire to share that information, better access tools were developed which took advantage of enhanced technology. Mosaic, in 1993 was the first information browser released for use with the personal computer. The early developers described the connected network of information resources as the World Wide Web (WWW). Mosaic was succeeded with new generation browsers now popularly known as Netscape Navigator and Microsoft Internet Explorer. Libraries with Internet connections provide access to these browsers, which are used to search the web for information on the Net.

1.3 Application of Information Technology in Academic Libraries

The Library and information Centres are increasingly being called upon to provide more relevant, up-to-date and timely information to a wide range of users. To satisfy the varied needs they require availability and accessibility to a variety of information resources and formats. The libraries, like those in most developing countries, suffer from inadequate funding or stringent budget cuts. This has affected the level of services offered to users both in terms of quality of collections and the degree of staff support provided. In the present circumstances only a few libraries can afford to have a wide range of information resources within their budget. The situation calls for change in the
approach and to be wiser or cost-effective to avoid duplication of information resources among the libraries in the country and leads to sharing of resources using cooperative purchase through consortia approach.

The electronic resources, which are available in libraries today is an outcome of the advances in both computer technologies, with powerful computers the information storage and delivery mechanisms, such as CD-ROMs and user-friendly interfaces. In most of the academic libraries in the western countries, Online Public Access Catalogues (OPAC's) have almost replaced card catalogues, offering enhanced search capabilities for accessing the local collection and often expand coverage to include the holdings of other area or regional libraries. Many libraries also provide a web interface to their library and information system. The library and information system with a web interface often includes direct links to electronic journals, books and Internet resources.

1.4 Review of the Related Literature

An attempt has been made here to identify the related literature published in the area of study. Libraries have undergone a remarkable transformation over the years due to the introduction of computer-based information technologies. Information Technology has expanded rapidly in research and academic libraries during the past few years. The information sources consulted for the review includes Books, International Dissertation Abstracts, Library and
Information Science Abstracts (LISA), Journal Articles, Publishers site viz. Emerald, EBSCO databases and other resources.

The application of technology in a library and information network study conducted by Mohammed Zakari (Zakari, 1994) is to design a model structure of an integrated automated library and information system and library and information network system for Nigerian University and Research libraries. The findings of his study shows that there is an inverse relationship between increasing demand for the services of the Nigerian university and research libraries and their ability to cope up with such demands effectively and efficiently. The staffing, funding, collection and services are inadequate under manual operations. The development of integrated automated operated systems will enhance the services and reduce costs. Multifunctional integrated database systems are to be developed.

To propose a Library Networking Model for the Caribbean region Depew John (Depew, 1991) studied the probability, desirability, and feasibility of developing and implementing the networking model. Findings of the study shows that, all the respondents except one agreed that there is a need for a networking structure in the Caribbean region. Inadequate funding of library and information services was the major obstacle to the development and implementation of a library network. The components of the proposed structure include objectives, functions, governance structure, composition of
the network structure, types of members funding and financing sources, type of structure, and the operational requirements of the structure.

The purpose of the study by Asgeirsson (Asgerisson, 1993) was to investigate and evaluate the impact of information technology on academic libraries. Electronic information retrieval systems included in the study were online catalogs, library resource sharing networks, CD-ROMs, and online searching systems. The impact of these information systems was examined in relation to public and technical services, with special attention to instructional methodology and library collection management. The Chi Square Test was administered to determine the relative impact of information technology on library operations. Collection development, circulation, information services and document delivery were found significantly affected by information technology. This affirmed that information technology has had an impact on the management of the library collection.

Academic libraries have long desired one-stop shopping for their customers and, in this electronic age, their customers are demanding a way to search from a single point at any physical location, retrieve information from the library catalogue, citations from journal indexes, and full text information from electronic resources. The one system, one library concept by working together as a coordinated university library system will provide students, faculty, staff and citizens with access to truly great university library
collection and to a global network of electronic information resources (Wisconsin System, 2001).

Networking technology has had very real implications for information services and "Academic institutions and their libraries were the early beneficiaries of national electronic networking initiatives" (McClure et al., 1993). Libraries made the transition from the card catalog to the online catalog, allowing electronic access to the information and making keyword searching a real possibility, a real boon to novice library users. Telnet and gopher access to libraries were the first popular manifestations of information-sharing and communication technologies, allowing remote access to collections and predicting the global information networks available today.

The creation and development of a gateway interface at Cornell University's Mann Library is well documented in the library literature. A major multi-campus project to provide one-stop shopping for academic library patrons has been undertaken by the California State University system. These are just two examples of a trend toward better-integrated access. Interest within the library profession regarding gateways is reflected in the devotion of several conference programs to the issue.

Success and effectiveness in automated library systems are two related issues that all users are normally looking for when buying or designing a new
system. On the basis of the available literature and opinions of automated library systems experts, 26 factors\cite{Hossein Farajpahlou, 1999} were identified as criteria for the success of automated library systems. Attitudes to these criteria of Australian university librarians and systems managers were examined in a survey conducted in 1993; 23 of these criteria were approved by the survey sample, and the other three were rejected.

Further study by Fotovat\cite{Fotovat, 1997} on Australian Library networks in change and development was to examine the evolution of library networks in the light of new information technology and higher education development in Australia. Close investigation of the impact of these developments revealed that changes have occurred at every level in the networking environment. It was found that library networks experienced a great shift in the nature of their services to cope with increasing expectations of libraries. Library networks responded to this changing environment by offering new services beyond cataloguing services.

M. Kovacka\cite{Kovacka, 1993} discusses the development of the Integrated Library and Information System (ILIS) initiated in the 1980s by the Slovak National Library. The concept of the ILIS, which aims to intensify the potential of Slovak libraries through automation, is based on setting up an Automated System of Slovak National Bibliography and a Central Catalogue. This will enable libraries to cooperate in the area of online cataloguing within
a cooperative library network and, in addition, the Slovak National Bibliography will be available online.

The library catalogue plays equally important role in an Integrated library system as most libraries now have an OPAC (Online Public Access Catalog), which is accessible both within the library and outside, listing all the materials such as books, journals and other materials included in the library collection. The access to information about library holdings is practically universal, with no restrictions for those who are not part of the primary user-base.

Access to electronic journals and full-text data is another important component of an integrated library system. providing access to full-text resources in an electronic library setting. The consortia models helps to provide better access to scholarly literature. The access to electronic resources will enable the researchers what they want, when they want it, where they want it. Full-text electronic resources offer access to resources unrestricted by either location or library hours. More literature relating to Integrated University library and information system has been dealt in a separate chapter taking into account the review of related literature on the topic.
1.5 Overview of Library & Information Networks

The term 'Network' is used in the present times in place of 'Resource Sharing' or 'Cooperative systems'. Networking and Modernization are becoming very important in all types of libraries as they enable the users to have access to the resources of many other libraries in addition to their own. The benefits of networking include: preparation of union catalogues, retrospective conversion, provision of bibliographies, optimum use of resources including rare collections, cooperative acquisition of documents, resource sharing, time saving and minimizing cost of the library services.

The library networks offer much potential and new capabilities for sharing information among different library and information centres at Local, Regional, National and International level and eliminate the size, distance and language barriers among users through resource sharing.

Objectives of library and Information Networks:

Library and Information networks

- Provide reliable access to document collection of libraries i.e. Union Catalogues etc.
- Provide access to world wide bibliographical information.
- Provide document delivery service.
- Optimize information resources through resource sharing mechanisms.
- Facilitate computerization of all the libraries.
• Facilitate communication among Teachers, Students, Scientists and others.
• Provide effective access to library resources.
• Encourage resource sharing.
• Training manpower required by participating libraries.
• Evolve standards, uniform guidelines, methods, and procedures, both for data capturing as well as Hardware and Software.

Data Communication is an integral part of the modern information storage and retrieval systems in terms of their online access. In the initial stage, the information networks operated in an off-line mode, where in, a query was loaded into a computer, which was later matched with the database for relevant bibliographic records. The search results consisting of such records on the subject of query was generated as an output. This process was not satisfactory for effective and efficient retrieval of relevant records. Further progress in computer and communication technology has made it possible to carry out this process in an online interactive mode wherein a user can access the online host via a micro computer from a remote location and can define and redefine the query based on the search results obtained till he/she is fully satisfied with the final outcome.

With the rapid advancements in the technologies such as telecommunications, satellite communications, computers etc several networks either functional or in formative stage in India.

They can be grouped as:
General Networks viz. NICNET, INDONET, VIKRAM, Subject Networks viz. VIDYANET, BTISNET, SIRNET, ERNET, INFLIBNET, Specialized or business networks viz. BANKNET, RAILNET, COALNET, SAILNET, TOURNET, Geographical Networks viz. ALIBNET, DELNET, HYLIBNET, MYLIBNET, PUNENET, BONET, ADINET etc.

Modernization of University Libraries started in the early 1990’s but the progress in the beginning was very slow and steady. In majority of the university libraries, computers entered with most reluctance due to lack of competence among the professionals. With the advent of INFLIBNET of UGC, All India Council for Technical Education (AICTE), NISSAT and other organizations of national stature with a good blend of traditional IT skills gave new facelift to university libraries in the modernization of libraries. Now the use of PCs and CD-ROM, for developing local databases literature searching, Internet connectivity is quite common in almost all the universities making the automation activity smooth.

University Grants Commission (UGC) started INFLIBNET (Information and Library Network) as a Programme to help the academic libraries and to modernize them to deal with this fast emerging scenario. This Centre was established based on the recommendations of the Inter Agency working group set by UGC; to facilitate optimum utilization of available resources through various methods; by creating an effective delivery mechanism to support and
INFLIBNET Centre has got the status of Inter University Centre under Article 12(CCC) of UGC Act. It is a registered autonomous society with major activities include networking of libraries, promotion of resource sharing, training, computerization of university libraries, creation of databases and organizing information services for academic work in the country.

1.6 Statement of the problem

Universities in India have fairly good libraries developed over the years. Due to the technological innovation, lot of changes occurred in day today activities of human being. Libraries are not an exception. Drastic cut in funding, devaluation of currency, user expectations, initiatives from government and other organizations are various reasons for libraries to embark on available information technology. These technological innovations lead to library automation, library cooperation, library networking, resource sharing, use of Internet in the libraries, electronic access to scholarly journals, access to other library catalogues through union catalogues etc.

Most of the libraries have traditionally tried to own resources as much as possible, because owning an item provides faster access to patrons than waiting to borrow or purchase on demand. However the increased cost of maintaining a collection of primary sources and the increased demand for information has resulted in a shift of emphasis from that of ownership to
access. In the present situation, as the academic libraries in India have been largely affected by financial constraints in which resource acquisition has been restricted. Most university libraries are ill-equipped to satisfy user needs within their resources with exponential rise in information. Libraries are unable to continue subscription to many publications due to price escalation and high foreign exchange rates. At the same time there is a conscious duplication of costly library holdings in the absence of convenient sharing mechanism. Scholars in remote areas feel mentally isolated. It is also impossible to fund all libraries to make them self-sufficient to meet the resource requirement are some of the challenges facing the academic libraries.

Over the years, Indian universities have been using the information technology tools for the providing effective information services. The university libraries in India are at some stage of development in the application of information technology tools in their day-to-day activities. Present study "A study of design and development of an Integrated University Library and Information System in India with reference to recent advances in Information Technology". This is an attempt to identify the impact of information technology in university libraries by studying the status of information technology application in Indian university libraries at various levels. The study focuses on the requirement of an Integrated University library and Information system to provide one stop solution as the "academic world is looking at the university libraries for a total solution or one stop shopping for
their requirements. The concept one system, one library will provide students, faculty, staff and citizens with access to not only university library collection but also global access to electronic information resources and provide integrated solution.” (Wisconsin System, 2001).

The study is an attempt to evolve a suitable model for Indian universities to provide an integrated solution with the help of an integrated university library and information system by effective utilization of information technology tools. The proposed model will help to integrate all the services that are required to be supported by the university library system to provide an integrated solution to the end users.

1.7 Need for the study

The purpose of the study is to investigate the level of information technology (IT) applications in the Indian University Library System and the role of local, regional, national, and international agencies to support such activities. The availability of infrastructure at Individual libraries for the implementation of IT has paved way to improve the library services to the extent possible. The latest application tools are acquired, more and more activities are getting importance in the academic sector. The application of IT has been taken seriously by some and some are slowly developing the interest. There are few attempts by individuals to study the information technology applications in different libraries viz. public, academic and special libraries. It
appears that, no study has been undertaken specifically to study the impact of information technology in Indian university libraries and to study the development of a model for integrated university library and information system based on its requirements. This study is an attempt in this direction.

This study would be helpful for the following reasons.

1. To understand the availability of infrastructure in the university libraries.
2. To know the collection of these libraries in electronic form.
3. To help to understand the implementation of IT tools for providing effective information services in libraries.
4. To know the future plans of these libraries in the electronic era.
5. To provide access to resources by way of cooperative acquisition.
6. To study the model integrated library and information system to provide an integrated solution to the users of the library.
1.8 Objectives of the Study

The objectives of the present study are:

1. To study the status of information technology in Indian university libraries at various levels.
2. To study the various services being provided by the university libraries using the state-of-the-art of information technology tools.
3. To study the implications arising out of application of information technology in the universities in terms of problems, issues, benefits and impact.
4. To understand the preparedness of university libraries to handle the emerging information technology in the context of current status and to study the future strategies proposed by university libraries to handle the emerging information technology.
5. To understand the methods for providing access to resources both in electronic and printed form.
6. To develop a model for providing integrated solutions by studying the features of an integrated university library and information system.
1.9 Methodology

Choice of a method is based on the nature, scope and objectives of the research. The scope of the study covers the adoption of new information technology. The response from the participating libraries is expected to cover the history and present status in terms of automation at individual libraries, implementation of information technology tools at different levels and various services being offered using the state of the art technology, future plans and strategies through pre-designed questionnaire.

Keeping in view the objectives of the study an effort has been made to evolve a suitable methodology for the research. The principle tool for data collection covering the universities spread across the country is 'survey research' supported by the observation on the IT applications in different libraries. Additional information was collected from various sources published and unpublished literature.

The universities / institutions were selected randomly to cover different types of libraries viz. Central, State, Deemed to be Universities, Technology Universities, Medical Science Universities, Agriculture Science Universities, Open Universities, and Language Universities etc. Sufficient care has been taken to cover all the states spread across the country.
The data collected was then analyzed in terms of various aspects related to the study using the SPSS (Statistical Package for Social Sciences) software. A chi-square test was also applied wherever required. The data was interpreted in terms of objectives defined. The university library has to act as an integrated university library and information system to provide one stop solution to the library users. The factors that are required to provide such solutions are studied with a concept of 'one system, one library'. The various steps and action items are discussed in a separate chapter to serve as an integrated university library and information system.

1.10 Scope and Limitations of the study

The study covers approximately 25% of total number of universities in the country. It is hoped that the data collected and analyzed would be very much useful to understand clearly the status of universities at large and their future programs to clearly understand the model system.

1.11 Significance of the study

The study and the proposed model will supplement the efforts made in this direction based on the initiative taken by government organizations, institutions. Since the study is concentrating more on the university libraries to offer better services to an academic community, a model is being studied which could be an ideal solution to the academic libraries to understand the
basic requirement and to serve as an integrated university library and information system.

An Integrated university library and Information System in India will be a model for libraries to integrate all its services. One of the reasons that Ranganathan's laws are still useful is that they help us to focus on two key aspects of library services (Peter Brophy, 2000). The role of the library may be analyzed from number of perspectives. The traditional approach has been to emphasize collection building and collection management. In essence the library's key task is to build broader and deeper collections and to arrange for users to access those collections for long-term integrity. The study aims at the need for an integrated library and information system that can provide integrated solutions to the user requirements.

1.12 Chapterization

The entire study is divided into six chapters. The brief coverage of each chapter is given below:

The first chapter provides an introduction to the research problem. The chapter discuss the Developments in Information Technology besides discussing the application of Information Technology in academic libraries. The need for undertaking the study with objectives, methodology, scope and limitations and also the significance of the study is emphasized.
The second chapter deals higher education scenario in India giving the steady growth and development of universities and its libraries. The role of UGC, AICTE in higher education has been discussed. The chapter also deals with the possible impact of information technology in the university library system.

The third chapter gives review of the published literature. The review covering the areas of library automation, networking, resource sharing, collection development, information services, electronic publishing, the concept of digital library, Internet applications and library consortia, and the integrated library systems which are the major components for any Integrated university library and information system.

The fourth chapter deals with analysis, tabulation and interpretation of the collected data through a questionnaire. The data in respect of general information, availability of IT infrastructure in the university libraries covered under the study, Application of IT tools, data relating to factors responsible for IT introduction in the university libraries, the university library services based on automation functions, external sources and internet based sources etc. The preparedness of the university libraries and the factors required for integrated university library system has been studied.

The fifth chapter deals with a study of model for integrated university library information system with the concept of one system, one library. Discusses the
need for integrated university system. The design of model university library system is presented to take care of the concept ‘one system, one library’.

The sixth chapter deals with suggestions and summary of findings with conclusions followed by bibliography and appendix.

1.13 Conclusion

Libraries are changing. The old concept of library as a store house of knowledge are giving way to concepts based on development of 'Intermediary' roles in hybrid environment in which the resources are either traditional or in electronic formats. Librarians will need to be very clear about the purposes that their libraries serve, and will need to re-design the range of services they offer with those purposes in mind. Libraries exist to serve their users, but the user population is increasingly heterogeneous. In seeking to provide appropriate services, it is essential that needs of all the different users are taken into account and that the library plays its part, by providing opportunities for the development of information skills, in enabling all users to make the most of their interactions with information resources.

All academic libraries virtually depend on the IT systems for their basic operations such as acquisitions, cataloguing, circulation, serials control etc. The development of IT based systems by organizations with which the
libraries deal and within the institution it self has meant that much closer attention has to be paid to the integration of the library's system with others. The functions that are required to provide effective delivery of information requirements need to be integrated. The integrated university library and information system can provide one-stop information services using the state of the art information technology tools. The system designed to serve as integrated university library and information system is expected to cover all the aspects required so that the integrated system can support technologies such as Internet, electronic publications etc to provide integrated services.

The vast information sources which the library gives access to are not only the item held by or owned by the library but also given access to remote information sources and handling the resultant requirements to authenticate and authorize users. These are the key challenges for the modern academic librarian. (Wendi, Arant, 2001)

In the context of new millennium, a university's position should be advanced as a leader among the colleges and universities in using the information technology and library services in providing an enriched learning environment. There is a desperate need for a university to make information technology and library services a pervasive and transparent part of the lives of students, faculty and staff.(William Patterson, 2001) The information resources are pervasive when they are available to every one. Those resources
are transparent when information, applications and services are available without any delay or limitation of hardware/software etc. Users must experience information resources as seamlessly integrated into their activities. The integrated university library and information system can provide pervasive access to information resources; to have a greater return with the use of computer and communication tools to return meaningful results for the benefit of research and academic community.

1.4 References


