INTRODUCTION

In recent decades, particularly after the two world wars, civilization has moved from an industrial society to a post-industrial society. In this society, Information is the predominant element than more industry and much of the labour force is working in this sector. The post industrial society thus can be called as information society. In such a society, capital alone does not ensure productivity, instead information is the key economic resource. Information, the self-regenerative resource is today the fourth dimension of society (other than 3 ms i.e. money, material and men). In order to gear up our control over information, the Libraries and Information Centres have become an inevitable part of the society. The Public Libraries at the various levels of the society to cater to the information needs of every citizen. The Academic Libraries to feed information to the students and teachers for their different academic pursuits and the Special Libraries to organise and disseminate information to the decision makers and scientists etc. to obtain the goals of their parent organisations. However, the exponential growth of information and demand for speed and accuracy have forced to implement automation in management of library services.

1.1 What of Automation?

The term automation has been described in literature in various contexts leading to different meanings. This term was first used by Mr. D. S. Harder of General Motor Company (USA) in 1836 and he defined automation as “the automatic link of parts between progressive production processes in relation to engineering industries”. Since then the term has been applied to a wide variety of automatic
machineries and systems and is commonly used to describe any operation in which there is substantial substitution of controlled actions of human efforts or intelligence. The term automation is being defined as follows in some of the recognized sources:-

"Automatic control of an apparatus, process or system by mechanical or electronic devices that take place of human organs of observation, efforts or decision" – Third New Webster’s English Dictionary

"Production system so integrated that materials move through the required operations with little or no human assistance". – McGraw-Hill Encyclopaedia of Science and Technology.

"The term automation is used in automatic manufacturing, control system, computing machinery or equipment that reduces the participation of human labour in production or services.” – New Encyclopaedia Britanica.

On the basis of the definitions of automation the following may be considered to be its essential characteristics-

i. The operations of processes are carried out automatically.
ii. Avoids or reduces human actions and thus saves labour.
iii. Increases accuracy and quality of work.
iv. Increases efficiency and speed-up the operations.

1.2 Library Automation

The phenomena of mechanisation of traditional library activities, such as acquisition, serial control, cataloguing, circulation control etc., was called library
automation. Today, the term Library Automation is used extensively to refer primarily to the use of computers to perform the library activities. In recent times the topics like computerised Information Storage and Retrieval, semi-automatic/automatic indexing, networking of automated systems were also treated as a part of Library Automation. Though telecommunication plays a vital role in automatic information storage and retrieval in general and for networking in particular but this study is restricted to the use of computer-system for various library activities i.e. house keeping routines, information storage and retrieval and networking.

The history of automation begins from 1880, when Hollerith invented the punched card for tabulating the census figures. The University of Texas was perhaps the first to use these punched cards for circulation control in 1942, the Montclair Public library in New Jersey installed two specially designed book charging machines for recording individual transactions automatically on punched cards. The library of congress used the Unit Record Machines for the production of catalogue cards for the first time in 1950. In this era, until 1950’s, the speed of operations, the capacity for manipulation and analysis of data were very limited.

In the second era of Library Automation during 1960’s general purpose computers became available for performing traditional library activities. A few important developments of this era are: MEDLARS Project of National Library of Medicine, USA; computerised serial control at Southern University of California at San Diego, computerised circulation system at Southern Illinois University at Carbondale; computerised book catalogues for five new university libraries at Ontario at University of Toronto; and initiation of MARC Project.

The next era of library automation began with the success of MARC and INTREX (Information Transfer Experiment) projects. In 1967 on-line systems like OCLC (Ohio College Library Centre) and BALLOTS (Bibliographic Automation of
Large Library Operations using a Time-sharing System) started functioning. In the early 1970’s, on-line systems were in operation in several libraries viz. Bell Telephone Laboratories and Eastern Illinois University had on-line circulation system, Larel University at Quebec had an on-line serial control system and Washington State University had an on-line acquisition system. Library Automation in the early 1980’s entered into the modern era, wherein the microcomputers are being used extensively for library operations.

After reviewing the history of Library Automation it would be rational to have a look on development of library automation from system’s angle. The first stage of development could be dated back to 1960’s which saw libraries beginning to utilize the resources of mainframe computers and the data processing staff. Punched cards were used to record transactions such as circulation. A number of libraries developed computerised circulation system based on Batch-Processing techniques. The library functions automated were clerical type. Computation capabilities had developed but not so for storage. Stress was on utilizing automated technology for increasing efficiency of unit operations. Technology was still not at the informating stage.

The second stage of Library Automation begins with the development of comparatively low-cost mini-computers, which had moved beyond Batch-Processing capabilities and the need for punch cards. The computers of this age were capable of handling several tasks simultaneously and could accommodate rapid access and large capacity storage devices to support on-line activities. The new circulation system provided useful reports with valuable and up-to-date information about patron activity, item usage and others. From these data, library operations could be streamlined leading to better resource management. At this stage the technology had moved beyond codifying separate activities or procedures to a more comprehensive system. Access to stored data meant access
to far more than discrete pieces of information. Also through the early 70’s, fee-based search services, operated by the producers of machine readable databases or other organisation like large research libraries, became available. This was possible because of exponential growth in storage capacity.

In the third stage micro computers are getting linked to one another so that they can be used independently or in conjunction with databases. These systems can also be linked to external databases and communication networks. At this stage as Information Technology restructures the work situation, it abstracts thought from action. The abstraction, explicit inference and procedural reasoning combined together, in micro computers, result into a set of competencies that ‘Zuboff’ called intellective skills. The informing process takes learning as its pivotal experience. Its objective is to achieve the value that can be added from learning in the situation Information Technology in its first stage helped in automation while now in its third stage it is entering information stage. The activities associated with both automating and informing represent intellectual efforts, but their objectives and the nature of the organisation processes, they entail, are different. Automation preserves what is already known, it treats as negligible the potential values to be added from learning that occurs in the living situation. The informing organization uses technology to do far more than routine jobs. It uses the new technology to increase the intellectual content of work. This is knowledge management. At this stage the information personnel / librarians have to act as consultants and educators, maintain the reliability of the database, improve its breadth and quality and develop approaches to system design.

Ref. – Zuboff (s) – “In the age of the smart machines : the future of work and power :- Newyork : John Wiley, 1958 P. 76.
1.3 Why of Library Automation?

Information is now considered as important resource for socio-economic development of society. Information is the key-element that marks the difference between the highly developed and the developing societies in the world. The wavering information explosion has created problems in proper handling of information. At present there are approximately 24 million of publications and if each paper runs for 10 pages and for each paper 10 copies are maintained there will be more than 2 billion sheets of paper for storage. The quantitative growth of scientific and technical information is accelerating exponentially i.e. the volume is swelling by about 10 percent annually due to the multiplication of disciplines, their marked specialization and interdisciplinarity. The generation of voluminous information has become a great challenge for the libraries and information experts. Therefore, Automation of library services is imperative for efficiency and effective working of a library system. For efficaceousness and economy of library systems Automation is meaningful. ‘Kimber’ says “Library is no different from other office or factory considering the use of computer to perform a given job of work most economically, where the difference does arise, however, is in the concept of library services.”

Automation of library facilitates more accuracy and efficiency and library staff finds considerable support of equipment used in automation in their routine work performance. Manpower is an essential input in all organizational activities. The manpower when disciplined to creativity becomes human resource. The development and efficiency of a library depends upon mainly on human resources, collections and other facilities. Human resource is an important component and

plays a vital role. The success of any automated library depends upon human resource in terms of available skilled manpower for designing, operation and implementation.

The following factors have necessitated Library Automation –

a) Information and literature explosion.

b) Emergence of new techniques.

c) Depth of content-analysis, selection and manipulation.

d) Immediate access to specialized information.

The automation in libraries has become necessary due to multi-dimensional development of activities and ever-increasing work load. Hence to keep the house-keeping routines up-to-date and clear-up the pending jobs Library Automation has become a must. Through automation various jobs can be done with great speed and accuracy. Computers can easily handle and cope-up with the ever-increasing work load of libraries. They can be used mainly for two types of jobs, i.e. a) House – keeping routines and b) Information services.

Under house-keeping routines falls jobs like ordering of documents, acquisition, classification, cataloguing, circulation control, serial control and maintenance of statistical and other records important from the angle of management. With the use of computers for routine jobs better and quick services are assured. Under information services computers are used for generation and collection of information, Information Retrieval, Current Awareness Services (CAS), Selective

Dissemination of Information (SDI), consultation of data bases, information transfer etc. During last 4-5 decades it has been experienced that by using computers, the libraries could achieve better standards, efficient organisation, better control on collection, best co-operation & co-ordination and improved services.

To emphasise the need and objectives of library automation, the opinions of some eminent library scientists, quoted below –

Jessey H. Shera lays stress on “the use of machines in libraries is a solution to the problems of staff and storage and result in reduction of mistakes. A high speed and better quality of tasks in less time is assured.

G.M. Taylor mentions library automation as “more items at less cost”.

Jahoda & Accola are of the opinion that automation in library operations reveals improvement in services and savings in certain personnel and others. The speed and accuracy, better control of records, their uptodateness and elimination of duplication of work are the other specialities. They also opined that it will be more advantageous if machine is used for variety of purposes and cost is shared by several libraries.

T. Stein :- is of the opinion that the cost of machine and its operation is very high and that automatic search of information is much more costly than the conventional methods, therefore time – sharing methods and operating the machine on loan or rent is being recommended.

B.C. Vickery :- opines that library automation has following three aspects –
a) Replacement of human-brain and manpower by machine for routine jobs.
b) Automation is economic only when there is a continuous flow of information to be manipulated.
c) Automatic information processing operates at a very high speed and it is very economic if a large quantum of information is to be manipulated.

However, the objectives of library automation can be concluded as follows –

1- Easy Functioning :- Several jobs which are tedious and time-taking, if done manually, can be performed easily by using computers.

2- Accuracy – To error is human nature, also their decisions may be affected by a number of factors e.g. economical, social, psychological or environmental and hence every possibility of a mistake. Through automation chances of mistake are eliminated or reduced to minimum.

3- Promptness in Service :- Some jobs like stock-verification, compilation of union catalogue and / or bibliographies, if done manually may take months or even year / years. Such tasks can be done by computer in a short time.

4- Economy – The use of computer saves human labour, money and time and thus results into great economy.

5- Elimination of Duplication in Work – The information fed in computer once can be used and manipulated for various purposes and thus duplications is avoided.

6- Better Services and Ready Access to Information – Through computers, users are served with their desired information immediately. The search for desired specific information which is tedious and time-taking job for human beings can be done within a few minutes by computers.
7- Great speed in manipulation of data - If the same information has to be used for various purposes, in a manual system it is a slow and tough task but in Data Processing System its speed is very high.

1.4) Scope of Library Automation:

Despite of the above descriptions, the concept of Library Automation would not be very clear unless the areas or library activities, wherein computers could be used efficiently and effectively, are being identified. The scope of library automation is being described by some eminent scholars in the following words –

Dr. Jesse H. Shera laid emphasis on the use of machines in libraries particularly for bibliographic and indexing operations. Further comments that “Automation has already proved itself an effective means for facilitating certain types of bibliographic and indexing operations.”

Dr. S. R. Ranganathan Experimented automation in classification, circulation, information retrieval and reprography at DRTC, Bangalore. In his opinion, “Mechanization is time saving device and can be applied if economical to circulation of books and Information Retrieval”.

Jahoda & Accola: have observed by making survey that automation is applicable and truthful in acquisition work bibliographies, budget record, cataloguing, circulation control, serial control and binding record.

H. L. Griffith has divided library data processing into three groups-

   a) House keeping functions.
   b) Information dissemination.
   c) Retrospective searching.
D. Melchar observes that automation is not only used in clerical jobs but also in publishing notable type of composition, indexing, directory compilation, S.D.I. and machine translation.

E.V. Christeansen recommends that Library Automation may have two areas of application for special libraries—

a) actual application of automation derived from its use.

b) Intellectual application of automation.

He further suggested the following three areas of library activities in which automation can be applied—

i.) Organisation of activities.

ii.) Dissemination of current information.

iii.) Information retrieval.

Through these areas overlap yet automation is applicable in disseminating the information, preparation of bibliographies, abstracts, regular acquisition slips and indexing.

1.5. Activities to be Automated:

The various activities to be automated in a library may be summarized as follows-

A) Acquisition work:-

A1) Ordering work:-

A11) Preparation of order slips and cards.

A12) sending orders to vendors.

A13) Updating the record file.
A2) Recording work-
   A21) Verification of books according to order file and bill file.
   A22) Printing out the lists of documents received and documents not received.
A3) Maintenance of accounts:-
   A31) Income, expenditure and balance of allocated part.
   A32) Budget control.

B) Cataloguing :-
   B1) Preparation of catalogue cards.
   B2) preparation of authority file/subjects headings’ list.
   B3) Arranging of catalogue cards into a desired sequence.
   B4) Preparation of shelf list.
   B5) Preparation of list of items catalogued.
   B6) preparation of list of holding or printed catalogue cards (for use in centralized and co-operative cataloguing)
   B7) Compilation of union catalogue

C) Circulation control:-
   C1) Registration of members.
   C2) Issue of borrower’s cards.
   C3) Charging of documents.
   C4) Discharging of documents
   C5) Updating record files.
   C6) Reminders for overdue.
   C7) Maintenance of Statistics.
   C8) Information Retrieval i.e. which books are issued to whom? How many books issued to any individual and date of return?
   C9) Inter Library Loan.
D) **Serial control**

D1) Ordering work  
D2) Recording work  
D3) Updating the recording file  
D4) Reminders to vendors and publishers  
D5) List of serial in binding  
D6) List of holdings  
D7) List of new additions.  
D8) Any other information.

E) **Documentation and Information Retrieval**

E1) Indexing of micro and macro documents.  
E2) Preparation of Thesaurus.  
E3) Abstracting.  
E4) Searching and print out of answers to the queries.  
E5) Preparation and updating of database.  
E6) Selective Dissemination of Information service  
E7) Current Awareness Service.  
E8) Preparation of Documentation Lists/Bibliographies.

F) **Stock verification**

F1) Preparation of list of accession numbers of the total documents accessioned in the library.  
F2) Preparation of list of accession numbers of documents available in the library.  
F3) print out of list of accession numbers of missions documents.  
F4) print out of list of missing documents with full bibliographical descriptions.
Besides the above, efforts are in progress to computerize the most intellectual activities like classification of documents and the day is not far when using computer systems with artificial intelligence and a very large internal memory, all the activities related with jobs and services of libraries would be fully automated.

1.6 FEASIBILITY OF LIBRARY AUTOMATION:

Although the history of automation, in general, and that of library automation, in particular, is not very old but the developments in this field are very rapid. The ever increasing workload in libraries due to manifold increase in number of documents and users, the overall change in concept of librarianship, and the specialized services of the micro-nascent thought form inside as well as outside the library are the factors which forced library staff to use machines i.e. computers for their rescue to keep pace with these factors. Also the developments in electronics which resulted into availability of fast computers and personal computers, comparatively at a very low price, has made it possible to use computer in libraries. But inspite of these factors the computerisation may not be useful or beneficial in all the libraries. Before taking a decision to computerise a through study should be undertaken to ascertain its feasibility in terms of time, finance, staff, user's level, infrastructure and other possible constraints.

Library Automation is a major undertaking which requires a positive operational justification, an examination of the pros and the cons and a realisation that it will in the course of time, change the whole nature and approach of the library. Whether that change will be for the better or worse will depend on three things; how the introduction was undertaken, how reasonable were the original projections of what could be accomplished by the use of computer; and how realistic were the objectives in library terms.
The initial impetus for the introduction of a computer is often the existence of a problem area where the service does not match the standards the librarian wishes to reach. However, computers are not magic. We do not change a library with serious operational problems into a place where all readers receive all the books they want in what they regard as a reasonable time just by the wave of light pen wand. The touch of a computer will not turn frogs—into princes. Some of the failing of a library may be solved, or alleviated, by the use of a computer, others will simply be automated and produced in milliseconds rather than minutes or hours. Here it is always to be remembered that the universe works in a balance, and what we take off one side we have to put on the other. Thus it should not be surprising to find that for every saving made by a computer something has to be put on the debit side.

It is important to know what computers can and cannot do. They can count far quicker than the average human; they can compare strings of numbers or letter and put them in ascending or descending order; they can search for a particular set of characters in the data they hold. If they have a built-in clock, they can be told when something should happen, and report on whether it has or has not.

However, the feasibility of computerisation should be studied by a team comprising some library experts and some relevant computer expertise. The team initially should study the existing systems and then visit some similar libraries being already computerized. This would give a clear and comparative picture of merits and limitations of the system already installed and used practically. The team should also study the latest hardwares and softwares available in market, because the developments in these disciplines are very fast and latest systems and softwares obviously have an edge over the previous ones.
India being a vast country with drastic diversities, and old cultural heritage and ocean of knowledge has a very large number of libraries ranging from a tiny one (having a few hundred documents housed in a couple of almirahs within a small room) to the giants (having millions of documents housed in a multistoreyed building having several thousand ft² carpet area. Also that some have only a few hundred users in one whole year while the others have more than thousand users per day. Due to this diversity any general study for feasibility of computerisation of libraries may not be possible at all. Though for almost last two decades computerisation of libraries has remained a burning topic among the professionals (librarians) and teachers and from ordinary citizens to the top level executives and policy framers in the government but as yet only a small fraction of total libraries could be computerised. The reasons behind the slow progress in this behalf seems to be as follows-

(1) most of the very large and old public and academic libraries which are very rich in collection, heavily used and have a huge quantum of work, but due to lack of essential infrastructure like availability of computer system, trained staff, awareness of users and above all desired funds etc. could not go for practical computerisation.

(2) On the other hand the special libraries which already have or can easily afford to have the desired infrastructure i.e. well trained and competent staff, well aware users and funds etc. have a very limited number of a regular visitors, small number of staff and limited (only selected) collection. Also the clienteles

and their specific topics of interest are so well known to the library staff that the need for automation has not been given a serious thought.

The major problem areas related to computer applications are: hardware, software, power failure, time-sharing, virus, manpower training etc. Libraries in India are today facing difficult challenges as they attempt to automate. Like their counterparts in other countries Indian libraries face these challenges at a time when financial resources are dwindling and the costs of automated systems are increasing. The opinions regarding library automation run from trumpeting automation as the beginning of a new age era of universal access and enlightenment to assertions of an orwellian—society finally coming to pass. Librarians will either become the new high priests of the information age, or they will soon be standing in welfare lines filling out job applications.

It is for these reasons that in Indian libraries the beginning of automation took place from those belonging to large and specialised organisations viz: Oil and Natural Gas Commission (ONGC), Indian Institute of Science, Banglore, Indian Statistical Institute, Institutions of Indian Council of Agricultural Research (ICAR), Indian Council of Medical Research (ICMR), and Council of Scientific and Industrial Research (CSIR), Indian Council of Social Science Research (ICSSR), INSDOC, DESIDOC, Indian Institutes of Management (IIM), Indian Institutes of Technology etc.

1.7 SCOPE OF THIS STUDY:

As is known well Indian Institutes of Technology happen to be the pioneering centres for advanced technical education and research in India. The first IIT was founded in 1950 in Kharagpur (WB) with the assistance of UNESCO. Later IIT, Bombay (now Mumbai) in 1958, IIT, Madras (now Chennai) in 1959, IIT Delhi,
in 1960 and IIT Kanpur in 1961 were established though Russian, German, British and American Collaboration respectively. Lately in 1994 the sixth IIT is founded in Guwahati to cater to the needs of north eastern part of India and in 2001 University of Roorkee is being enhanced by Ministry of HRD as IIT, Roorkee. At present all the seven IITs are being founded and governed by the Government of India. The IITs have excellent infrastructure for conducting research as well as implantention of latest techniques. The funds are ample i.e. adequate recurring grants from Government. of India and non-recurring funds under several projects. Time to time financial assistance is received from national and international organisations and industrial enterprises also. IITs possess a huge team of specialists and scholars of international repute in different disciplines of Science, Technology and also Humanities. The institutes are equipped with the best machines and computer system. Besides having the money, manpower, machines and materials these institutes also have the last of 5Ms i.e. Market of excellence. Here the term market is used in context of clientele of library’s resources and services. The students doing B.Tech., M. Tech. courses are selected on All-India level competitions i.e. JEE and GATE respectively and hence obviously the cream of intellectuals. They are very sincere, disciplined and have a quest for knowing more and more. They are also most co-operative to the library staff. The faculty member are of very high calibre and are authorities in their disciplines. The over all environment of these institutes is very systematic, disciplined and most favourable for academic and research pursuits. Thus it can be said that the IITs have the best suited infrastructure for automating their libraries work and services.

I was fortunate enough to begin my career as Professional Assistant in IIT, Mumbai and put my services in central Library from 1979 to 1985. I also had opportunities to visit personally the libraries of Indian Institutes of Technology at Kanpur, Delhi and Chennai. My this affinity to IIT’s forced me to take up this study.

In this study an attempt is being made to analyse the State of Art of Automation in IIT libraries. The systems and programs used by these libraries are given special attention. The other aspect studied is the cost benefit analysis or cost – effectiveness of automation. Though this aspect is very difficult to analyse for the reason that libraries are non-profit making organisations and benefits or effectiveness can not be measured in terms of money. Hence savings in terms of time and staff and improvement in quality of services has been considered to assess the effectiveness. This study may be useful for those large and medium sized. Libraries who are planning or in the process of automating their services and routine job. They may be able to make a feasibility study of automations, get the guidance in selecting suitable systems i.e. hardware, software and humanware.

1.8 HYPOTHESIS & METHODOLOGY:

In the present age of Information and Computerisation most of the large and medium sized libraries of India are striving for automation. The ever-increasing work-load. The limited number of staff and demand for more and more new information services within a very short span of time is one force in favour of automation. The other force is that automation or use of computer services has become a status symbol for any organisation. An executive, who has no e-mail address on his/her visiting card, and a library not having its website and internet connection, is being looked down by the contemporary persons/organization. The number of such libraries may be very large which wish to use computer for their
routine work and services but do not have concrete ideas about what can be automated, how can be automated and who would automate? The marketing personnel and advertisement go on trumpeting merits only of their particular products, but it is very difficult to take the crucial decision of choosing the hardware and system of the suitable capacity. Similarly number of software packages are available in market, but most of the library personnel do not have enough knowledge that which particular software would be suitable for which operations as well as economic and easy going with their requirements and available infrastructure.

The libraries of IIT's do not have uniformity as far as automation is concerned. Some has computerised a few house keeping routines other have got some different job routines automated. Also there exist lot of variations in the programme packages developed in house by each IIT. The idea behind taking this study is that the results would prove helpful to the libraries which are in the process of planning for automation. The study of systems being used in IIT libraries as well the benefits accrued from them would give guidance to other libraries. A particular IIT library, if has developed and used an ideal software for particular operation, the same may be used by other IIT libraries too. This may lead to uniformity in libraries of different IITs. All the IITs have worked and experimented individually and independently for the automation of their library operations and services. By a close analysis of their individual achievements, something better may come out. The study of cost benefits may help other libraries to decide if they should go for automation or not; and if yes then at what cost?

The methodology used for this study is through questionnaire (sample appended). The libraries of IIT, Delhi, Kanpur and Mumbai had been visited personally. The staff members were consulted and important data collected. The system had been studied personally and their functioning was observed. The staff of these libraries
had been co-operative enough and helped me in the study by providing not only desired information but also some documents related to the hardware and software used. The books and articles published in various journals on the topic as well as reports of IITs were consulted to frame the study. Thus the methodology used is a combination of survey of libraries personally and gathering information through questionnaire and literature available on the subject.