The Literature Survey gives an overview of the literature related to the areas of IT application in libraries and the factors potentially affecting the IT movement in libraries and information centers in the field of S&T. The literature indicates that there has been a steady movement introducing IT in to information storage and retrieval for both traditional and new areas of application. The literature points conclusively that the movement of IT application in will not depend only on the technological change in the hardware and software but also on the current data processing environment in the libraries. The literature also includes a few surveys conducted to investigate the computer application in libraries. These surveys did not, however, go beyond the description of current practices. This survey attempts to explore the literature related to the current trends in the light of the current situations in libraries and their status of their data processing affairs.

3.1 An Overview:

In order to define the criteria for the study of "Information Technology (IT) in libraries of Science and Technology (S&T) organizations. A comparative study of selected libraries of Delhi". a review of relevant literature is undertaken. The literature survey is divided into two parts. In parts A, the literature related to the S&T libraries mainly its: i) Goal and objectives, ii) its Management, iii) Management process, iv) Information systems in S&T library, v) Systems approach, vi) factors of success and failure of Information systems, v) Change in the management in libraries, vi). Its Organizational resources, & organizational culture, vii). New information technologies, viii). Concept of SWOT Analysis in the management of S&T libraries, and v). Design and development of Information systems for information storage and retrieval.
Since the subject scope of IT application in S&T libraries is of highly interdisciplinary nature and secondly there is very few literature covering IT use in libraries, therefore, in addition to the Library and information Science Abstracts (LISA), the other sources of literature for the purpose of study were also used. Some of the sources were: a) Information Science Abstracts, Plenum Publications, New York covering IT related literature from 1980 to June, 1994. b) CD-ROM Search of Compendex Plus covering literature from 1985 to June, 1994. Besides, the other literature sources such as relevant references quoted: a) in the Encyclopedia of Management, b) Encyclopedia of Computer Science and Engineering. (both Published by Van Nostrand Reinhold Co., New York.), c). Wiley Encyclopedia of Electrical and Electronic Engineering, 1999, John Wiley and Sons, Inc, New York, d). Encyclopedia of Computer Science (2000) Nature publishing group, London, e) Various Journals including Electronics one, technical reports, review articles, and d). many other classic books, research dissertations etc on management sciences etc. For reference and literature survey the various libraries located in Delhi mainly, the Central Library of IIT, Delhi, & National Science Library of INSDOC, New Delhi were used.

Literature survey of the following online resources were also made:

http://browserwatch.internet.com/
AltaVista (advanced) http://altavista.digital.com/
http://www.altavista.digital.com/av/content/about-our-story.htm
Infoseek Ultrasmart http://infoseek.com/
AltaVista (advanced) http://altavista.digital.com/cgu-bin/query?pg=ac&what=web
OpenText http://index.opentext.net/
Excite Search http://www.excite.com
HotBot http://www.hotbot.com/
Webcrawler http://www.webcrawler.com
Lycos http://www.lycos.com

Meta and Multi Search Engines
Metacrawler Multisearch

Dogpile http://www.dogpile.com
Inference Find http://www.inference.com/find/
Profusion MetaSearch http://www.designlab.ukans.edu/profusion/
Highway 61 Multisearch http://www.highway61.com

Beaucoup 600 Search Engines

Mumma Mother of All Search Engines http://www.mamma.com
Cosmic Mother Load Insane Search http://www.cosmix.com/motherload/insane
CNETs Search.com Multi-Search Page http://www..search.com
Webreference Search Engine page http://www.webreference.com/search.html

Specialized Search Engine

AT1 Database search: The invisible web http://www.at1.com/
Edirectory search engines from around the world http://www.edirectory.com/
Muscat EuroFerret Eugopean Site Search http://www.muscat.co.uk/euroferret/
International Regional Search Engines http://searchenginewatch.com/regional
Search Net Happenings http://www.mid.net:80/NET/
Inquiry Com Information Technology search http://www.inquiry.com
Mediafinder http://www.mediafinder.com/custom.cfm
Internic's Whois Domain Information http://ds.internic.net/wp/Domain
Study Web Research Site http://www.studyweb.com
Library of Congress Search http://leweb.loc.gov/harvest/
FindLaw Legal Search http://www.findlaw.com/index/html
Legal Search Engines http://www.uklaw.net/lawsearch.htm
Directories

Yahoo (directory) http://www.yahoo.com

Yahoo Search Options http://search.yahoo.com/bin/search/options

Magellan (directory) http://www.mckinley.com

Magellan Search Options

Galaxy Professional Directory http://www.einet.net/

Galaxy Adv. Search http://www.einet.net/cgi-bin/wais-text-multi

Lycos A2z Internet Directory http://a2z.lycos.com/

Infoseek Directoy http://www.infoseek.com/

Nerd World subject Index http://www.nerdworld.com

Jump City (+newsgroups) http://www.jumpcity.com/list-page.html

Your Personal Net http://www.ypn.com/

Starting point http://www.stpt.com/

Suite 101 http://www.suite101.com


Martindal's REference Centre http://www.sci.lib.uci.edu/~martindale/Ref.html

The Mining Company subject Site Guides http://www.miningco.com/
Top Site and Award Directories

Lycos Pointcom Top 5% http://www.pointcom.com/categories/

Netguide Live (go to Best of the Web) http://www.netguide.com


Looksmart Directory http://www.looksmart.com

NBN News Editor ChoseAwards http://nbnews.com/

Web Scout Best Link http://www.webscout.com

Cnet's Best of the WEb http://www.cbet.com/Content/Reviews/Website/Pages/Ws.categories.html

Roadkill Caf's 175 Great Sites http://www.cakwev,cin/-roadjukk/great.html


Top Web Site Lists

Web21 100 Hot Web Sites* http://www.web21.com/

The Web 100 http://www.web100.com/listings/all.html

WebCounter Top 100 http://www.digits.com/top/both-100.html

Zenation's Top 100 http://www.zenation.com/loto.htm

WebSide Story Top 1000 http://www.hitbox.com/wc/world2.html


3.2 Basic Goal of S&T Library:

The importance of S&T library system in the process of education and research has been established and acknowledged since long. The library exists as an interface between the universe of knowledge and a particular users population. The overall objective of the library is to make the universe of knowledge maximum accessible to its users. Hemberg, M. etal. (1974) stated library objectives differently "Maximize the exposure of library users to the universe of bibliographic material) to the entrust of users population, actual or potential, to organize and display these material in various ways and to make them available to users.
Ranganathan (1957) discussed these objectives of libraries through its five laws of Library Science. These are:

1. Books are for use.
2. Every reader his/her book.
4. Save the time of the reader.
5. The library is the growing organism.

This first law implies the entire concept of the library as an interface between users and bibliographic resources, the second to accessibility and third implies to the exposure, in the fourth law indication is towards internal efficiency of the library and the fifth law is concerned with the growth of knowledge resources in varied forms and in varied dimensions. These fourth and fifth laws indicates towards the management aspect of library.

3.2.1 Information System in S&T Library

Radford has devised the information system for an organization into two categories. These are the internal information systems and the strategic information systems. The Internal Information System includes the operation of an organization. This also includes Electronic data Processing (EDP) and it involves repetitive processing of routine data. These are meant for providing information support to administration of resources and conduct of operations. Basically these systems are designed for satisfying the information needs of junior and middle level managers. The output of these systems is also useful to the top management for budgetary control as well as strategic decisions based on past performance.

The Strategic Information Systems is mainly concerned for the external information. Such information is required by the top management to set priorities, develop overall corporate strategies, initiate programs, and establish corporate goals. This is a blend of summarized internal and detailed external information.

To accomplish the goal of a S&T library and its organizational structured is the one that provides a system through which people can perform their assigned activities. This structure in a library is highly complex one as there are many activities to be performed by many people of different skills and attitudes. It contains internal as well as external environments, varied resources, different libraries, norms, values, roles, policies, rules,
standards, etc. Gopinath (1990) equates the library with any modal business organization where management tools, techniques, procedures, theory and principles are applied. To get these activities performed through people is the job of the managers. In this complex organization the managers are at three levels. These levels in the academic library satisfy the Anthony model of decision making.

3.2.2 Management Process in a S&T Library:

A process is defined by Oakland (1993) as the transformation of sets of inputs which can includes action, methods, and operations into output that satisfy the users needs and expectations in the form of products, information services, or result/output. Every thing we do is a process. The output from a process is that which is transferred to some where to some one - the user. Library managers like managers in business organization have to make decisions in performing their management functions. Decision making is one of the most important tasks of managers and administrators in management of modern academic library. For decision making the relevant data is required. This data is collected, processed and made available to the managers. According to Evans (1976) the successful decision are the result of several factors. One factor is the information available. In the management process adequate, accurate, timely, data about the problem are collected, organized, and evaluated with the past situations. Based on some standards, criteria, experience, and research, a particular decisions is taken.

3.2.3. Cultural diversity and dynamics of Change in the Management of a S&T Library:

Cultural diversity may affect how an individual or organization relates to its environment, thereby influencing corporate strategy formulation (Schneider 1989), how negotiate agreements and joint activities with potential foreign partner (Graham, / Mintu / Rodgers 1994), Tung 1991, leadership styles and managerial values (campbell / Bommer / Yeo 1993) , Ralston / etal 1993, Performance appraisals (Vance / McClainin / Boje / Stage 1992) , training (Li,1992), and management development (Richards,1991).
Successful organizations continuously look for ways to recognize and exploit cultural diversities apparent in a multicultural workforce to create an advantage based on cultural synergy is less common (Lolla / Davis 1991). Hoppe (1993) notes that professionals, despite their similarities, carry with them the (mostly invisible) norms of their country, as reflected in the country differences, uncertainty avoidance, individualism, masculinity.

3.2.4. Application of IT in S&T Libraries:

The concept of IT application in library information and storage was originated in 1968 and became the buzzword of almost all attempts to relate computer technology and systems theory to data processing mainly in the business environment. Though application of computer in libraries was first time demonstrated successfully in the late 1950's and right from the beginning of 1960's many librarians in the west and a few in the east took matter of computerization of library operation rather seriously. Remarkable of them are:

- In 1959 Dr. H.P. Luhn of IBM demonstrated first time that indexing could be mechanized. The repeat publishing in the books "Keyword to context Index for technical literature) KWIC Index), York Town, Height (NY), 1059.
- On 6th April, 1960, American Chemical Society (ACS) brought a sample issue of the first automated periodicals called chemical titles.
- In 1963, Gilbert (WK) submitted his survey report on the automation of Library of Congress which resulted in the development of MARK - I format.
- In 1964 National Library of Medicine, (USA) brought out Index Medicos using Computers.
- In 1967 ACS ahead with Computerization of activities providing concrete indication of chemical compounds and their biological activities.
- In 1968 again ACS again proceeded CA Condenses covering full range of document abstracted in chemical abstracts.
- The creation of computerized data base here after went on unabated. Attempts were on to access these databases online. In 1968 Advanced Research Agency of US Department of Defence achieved success in online access of database.
- In 1970 the National Library of Medicine of US initiated MEDLERS which became online in the name of MEDLINE afterwards.
• During 1970's the remarkable efforts were made at national and international levels towards evolving a common communication format suitable for interchanging bibliographic data not from one organization to many but among various organization in the world. Common Communication Format (CCF) of Unesco was the one example.

• The use of computer in Indian libraries may be traced to 1960's at INSDOC, New Delhi and DRTC, Bangalore. INSDOC presented the union list of serials using IBM 1602 (Raizada, 1964).

• As reported by Neelamgham (1968), in 1967 INSDOC compiled a Rooster of Scientific translations using IBM 1602 and later produced a keyword index to Indian Science Abstracts using IBM 360/44.

• Kamath (1990) in his survey, reported that in 1970 National Aeronautical Laboratory (NAL) library, Bangalore experimented computer in libraries using ICL 1004 system for circulation control. By 1970, there were 9 libraries in India using computers in their selected operations.

• Roy (1989) reported that on 80's some libraries and information centers began the use of computers. Specials efforts were made by library organizations like ILA, IASLIC, and GILA to promote automation. They organized conferences, workshops, Seminars, and training programs. NISSAT financed in organized the several training program in the application of CDs/ISIS software. As a result bibliographic databases were produced in the several libraries in India.

• Srinivasan (1987) has sown the growth of application of Computer in Indian Libraries.

• It was 1980 when some literature emphasizing the use of computer-based MIS in libraries began to appeared in research journals, Abstracts and Indexing journals.

• In 1991 Tim Berners -Lee, produced Internet first browser. According to him the dream behind this was to scan any document, picture, graph, photo or Video on Internet and share the resources by an individual on mutual basis. Now, the Internet has emerged as the most powerful medium for storage and retrieval of information. It works round the clock and connect every nook and corner of the globe.

• In 1999 Bill Gates (Penguin Books, London 1999), announced that the now all kind of information, numbers, text, graph, sounds, video can be stored in to a digital form and forwarded or access through Internet.
• The newest media available on Internet is the world wide web popularly known as WW. It is a huge collection of interconnected hypertext documents, which contains links to other documents, files and sites on the Internet.

• In Library and Information Science Abstracts (LISA) the total article published on Computer-based MIS appeared in the Journal of repute up to July, 1994 were 78. Out of this 27 were relevant to the library application. In the year 2000 (Winter) it reach to the 122. Out of the 122 abstracts in LISA plus, more than 90 abstracts were of direct relevance to the libraries. This may be shown in the table as given below:

<table>
<thead>
<tr>
<th>Year</th>
<th>Year</th>
<th>Year</th>
<th>Year</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keywords/subject</td>
<td>2000(Winter)</td>
<td>2000 (Autumn)</td>
<td>1,999</td>
<td>1,998</td>
</tr>
<tr>
<td>Management</td>
<td>31997</td>
<td>31325</td>
<td>29932</td>
<td>28856</td>
</tr>
<tr>
<td>Systems</td>
<td>32629</td>
<td>32205</td>
<td>31692</td>
<td>30870</td>
</tr>
<tr>
<td>Information</td>
<td>113870</td>
<td>111888</td>
<td>108237</td>
<td>100496</td>
</tr>
<tr>
<td>Computerization</td>
<td>21852</td>
<td>21432</td>
<td>20380</td>
<td>19329</td>
</tr>
</tbody>
</table>

Some remarkable library literature on IT application in libraries is given as below:


In the beginning of 1990's the literature related to the modern concept of system theory, the Total Quality Management in libraries were also began to appear. Few of them are:


3.3. Systems Approach:

Kindred (1993) Summarized the characteristics of System as follows:

- Systems are made up of different parts or components. These parts are related and have definite interactions or interdependencies. A change in any of the components is likely to produce some sort of change in other components and in the system as a whole. All the components work toward some particular purpose or function which is the primary object of the system. The system is usually a complex structure having diverse components such as person, ideas, materials, forces, procedures, and other factors. System may be a part of another large system, just as it is likely to be divided into many subsystems.

- The Systems approach has been applied to diversified type of systems. However, for this study, the systems concepts is used as it applies to computer based system in libraries. The systems approach represents a valuable tool as philosophy to guide the study of organizations and their management and as a useful mainframe to aid the design of computer based system.

Many authors (Atwood, 1’77): Kanter, 1977: Raymond, 1990; Ahituv and Neumann, 1990) used the systems module to illustrate the system concept as it relates to the development of computer based system. Such module consists of five elements: input, processing, output, control and feedback.

Atwood(1977), defines each element as follows:

1. Input: Any thing which enters the system.
2. Processing: Any action upon the input.
3. Output: Whatever is produced by the processing of the input.
4. Control: The direction or adjustment to the processing.
5. Feedback: A measurement or indication of the quality of output.

Systems approach for the development of computer based system for S&T Libraries means trying to access the whole library needs, rather than identifying some specific
information needs where the need for information may be most apparent. This implies that systems approach concentrates upon relationship of the whole system (Matthew's, 1971).

3.3.1. System Analysis:

The systems analysis approach is the analysis or design work start with the idea that the object to be studied must be viewed as a system. In relation to the development of a Computer-based system, the systems analysis is a comprehensive process and a very useful tool to guide the development of a particular system. The systems analysis work to determine the information requirements of any organization represents a crucial phase in the successful development of computer-based system. Samprevivo (1978) described systems analysis as the process of studying of the network of interactions within an organization and assisting in the development of new and innovative methods for performing necessary work. Similarly Cougar (1973) provided the following definition:

"Systems analysis consists of collecting, organizing, and evaluating facts about a system and the environments in which it operates. The objective of the system analysis is to examine all aspects of the system - the equipment's, personnel, operating conditions and its internal and external demands - to establish a basis for designing and implementing a better system".

3.3.2. SWOT Analysis:

Strategy formulation is often referred to as strategic planning or long rang planning and is concerned with developing a corporate mission, objectives, strategies, and policies. It begins with situation analysis - the process of finding a strategy fit between external opportunities and internal strength while working around external threats and internal weakness.

In SWOT analysis a superior way of change may be suggested. To understand the dynamics of change in an academic libraries the SWOT analysis is adopted. The SWOT stands - S for Strength in an organizations, W for its Weakness, O for its Oppotunies, and T for threats in an organization.

In the Strength the main factor may be considered in the SWOT analysis of an academic library are diversity in Culture, Experienced top management, vertical integration, employee relations, international orientation. In Weakness the factors such as Process
oriented R&D, distribution channel, financial position, facilities etc. In Opportunities economic integration, demographics, economic development, trends. The threats may be Government policies, strong competition, users demand, new advancements etc.

Following six questions are used as base in designing tools for the SWOT analysis of the academic libraries under study:

**Table 1. SWOT Analysis:**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Questions</th>
<th>Steps SWOT analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Where are you now</td>
<td>Step 1. SWOT's Present. Trend analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Step 2. SWOT's Present. Present status</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Step 3. SWOT's Present. Present strategy</td>
</tr>
<tr>
<td>2</td>
<td>Where will you be if you continue strategy</td>
<td>Step 4. SWOT's Future. Target,</td>
</tr>
<tr>
<td>3</td>
<td>Where do you want to be</td>
<td>Step 5. Gap analysis</td>
</tr>
<tr>
<td>4</td>
<td>What should be the overall strategy to achieve the short term and long term goals.</td>
<td>Step 6. Examination of options and strategy selection</td>
</tr>
<tr>
<td>5</td>
<td>What should be your overall strategy to achieve your short and long term goals?</td>
<td>Step 7. Strategy documentation and evaluation</td>
</tr>
<tr>
<td>6</td>
<td>How should you monitor your plan's performance</td>
<td>Step 8. Documenting and formatting the annual plan, policies.</td>
</tr>
</tbody>
</table>

3.3.4. **Concept of Change management:**

According to Ansoff (1995), Flexibility in Information Systems planning is the ability of planning systems to anticipate crises, identify opportunities, and adapt unanticipated changes. In figure 1 below, Sushil (2000) defined the flexibility as an exercise of free will or freedom of choice on the continuum to synthesise the dynamic interplay of thesis (flexibility) and antithesis (rigidity) in an interactive and innovative manner, capturing the ambiguity in systems and expending the continuum with minimum time and efforts.

The ranges of options created in the process can be mapped on the continuum ranging from the thesis to the antithesis. The type of Change mechanism or dynamic synthesis are created for continuous renewal and adoption. The freedom of choice can be identified in terms of various actors involved in problem context. According to Sushil (1997), the flexibility is the ability to change or react with little in time, efforts, costs, or performance. It implies openness in thinking, adaptive to the environment, responsiveness to change, versatility of action, non-rigidity, multiplicity of process setting, freedom, liberalization,
informal attitude, autonomy of function, agility in actions, customized or tailor made solutions

The interactions and interrelations that occur among the components of a flexible organization exerts pressure of change (Dynamics) to get benefits of opportunities, whereas in a rigid organization a pressure is exerted to resist the change (static).

In the strategic management, there should be built in flexibility in the organization to allow adoption of information system process of new opportunities, i.e. The strategic management allow its managers total freedom on certain things, partial on some other, and rigidity on a few areas such as value systems.

3.3.5. Use of IT in S&T Libraries:

With the fast pace of technological changes affecting every known aspects of business, more so often in service industry, the S&T library can not remain aloof from the impact of such change. S&T libraries in India are also affected from such change impact. These libraries are adopting such changes in the management of their day to day activities. But, it is observed that the adoption of new advancement specially (IT) by such libraries in India is not uniform. Some S&T libraries are in advance stage of adopting such changes. The others are in planning stage.

Like any business organization, the change in the management of S&T library is also normal, natural, and inevitable, because its environment, both internal and out side is dynamic and there are many challenges and pressures i.e. factors and forces that causes change. These challenges are due to socio-cultural environment, technological environment, legal, political, government policies, linkages, etc. Strategic Changes may be categorised as below:
• Structural Changes: Includes changes in - job description, job design, basis of departmentalisation control mechanism, policies, procedures and practices, authority, business relationship.

• Technological Changes: Includes changes in tools, techniques, equipment's,

• Socio - cultural Change: includes changes in the attitude, perception, values, behaviours, skills etc. in an organization.

The study concern to the socio - cultural, & technological environment, of the S&T libraries available in Delhi state.

3.3.6. Socio - cultural environment: In a S&T Library the culture and values concerns to its readers, staff management, within library and management systems and procedures. The culture and values of the of an academic library are crucial for matching the organizational resources to its environment.

3.3.7. The technological environment: The information technology (IT) is composed of following technologies that enable the acquisition, representation, storage, transmission, and use of information.

- Computer Technology
- Communication Technology
- Optical/Video (CD-ROM) technology

3.4. Factors of Success and Failure of IT application in S&T libraries.

The development of IT based Information System (IS) in libraries is complex and multi phased process. There are many factors that are required to be managed in order to avoid the failure the IS. The list of suggested reasons for the general failure of IS is well
documented in the literature (DeVBrander and Edstrom, 1977); Harzilinger, 1977; Hines, 1977; Lucas, 1973; McManis and Parker, 1978; Rymonds, 19990; Ahituv and Neumann, 1990). These are:

- Lack of information for decision making.
- Lack of familiarity with the system approach.
- Lack of top down design.
- Lack of hardware orientation.
- Human factors.
- Lack of user involvement
- Communication gap.
- Lack of qualified personnel.
- Lack of planning of IS projects

The development of IS must be managed and controlled by the managers of the S&T libraries. In order to accomplish this essential requirement, managers might apply commonly used management techniques, such as Gantt chart, Program Evaluation and Review Techniques (PERT), or Critical Path Methods (CPM). In addition to the management control and evaluation of the progress of the development of the IS, it is very important that the designers of the IS should use appropriate methodologies to develop these systems.

3.5. Structure of a IT-based Information Systems(IS):

Arya-Marin, Adrin (1982) suggested the following components of a IT-based information system.

- Users: includes different levels of management and follows the hierarchy approach described by Anthony (1965).
- Procedures: includes the standards and necessary manuals used to access or request new reports and any additional manual to facilities the use of system.
- Data Processing management: includes all the data processing personnel.
- Hardware Components: includes the computer system used to support the Library Information system. It may be large, a mini, or a micro computer. Networking, Internet.
- Peripherals: includes the operating system, data base management system (DBMS), data dictionary software, etc.
- Software Components: includes the operating system, data base management system (DBMS), data dictionary software, application software, decision models software, etc.
- Data base: includes the common depository of data to produced the information needed by the users of the system.
- Data dictionary: includes the repository of information about data of institution.
- Decision models: Includes the integration of decision models software in to the system to expand the options to generate some specific reports for decision making.