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# STRATEGIES FOR THE ADOPTION OF NEW INFORMATION TECHNOLOGIES IN INDIAN LIBRARIES

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## 1. Introduction

Indian libraries today are no longer confronted with the question of whether or not to apply new information technologies to their operations, products and services. They are now more concerned with decisions about what technologies to use; and the costs, benefits and impacts of such use. They are also confronted with decisions of an operational character, e.g., what formats to use, how to go about doing retrospective conversion of their catalogues, what CD-ROM subscriptions to take.

Evidence for the above view is in the increasing database development activity seen in libraries of all kinds, the spurt in metropolitan area and national library networking initiatives<sup>1,2</sup> in the last few years, new indigenous software that has become available for library and information related work in the country, increased availability of CD-ROM products and services in libraries, increased electronic publishing activity in the country, and new training and educational activities focussed on the application of new technologies.

The IT options available to libraries have increased considerably during the last few years requiring them to consciously evaluate the different options before investing in hardware, software, and other information technology products and services.

The impetus for adoption of new technologies by libraries has come both from within organizations in which libraries function as well as from external agencies, e.g., the University Grants Commission (UGC) under the INFLIBNET programme and the Dept. of Science and Technology under the NISSAT programme.

The economic liberalization policies pursued by the Govt. of the country have also contributed to the easier and wider availability of information technology products and services by libraries in the country.

The technological and political climate of the country has never been more conducive than it is today for the adoption of new technologies by libraries of all kinds. In such a climate many decisions concerning the adoption of new technologies in libraries are often driven by user pressure, vendors, and peers, and not necessarily by careful and informed analysis and evaluation of available options.

This paper presents the author's perspective on broad strategies that may be useful to be followed by Indian academic and special libraries in the adoption of information technologies (IT). The term adoption is being used in its widest sense, viz., selection, evaluation, acquisition (including develop in-house or purchase decisions), training, implementation, marketing of IT based services and monitoring of IT for libraries.

## **2. Rationale for adoption of IT in libraries**

The main reasons why academic and special libraries seek the application of IT solutions are to :

- obtain increased operational efficiencies,
- relieve professional staff from clerical chores so that they are available for user-oriented services,
- improve the quality of services,
- provide new services not hitherto possible,
- improve the management of their physical and financial resources,
- facilitate wider access to information for their clients,
- facilitate wider dissemination of their information products and services,
- enable their participation in resource sharing library networks, and
- enable rapid communication with other libraries (including outreach libraries) and professional peers.

The above mentioned reasons are not mutually exclusive. Benefits of the application of IT have been known to have a spill over effect. Also, it is well known that a library beginning with one application and reaping the benefits therefrom soon begins to look for other areas where IT solutions are possible and useful.

It is essential, however, that a library seeking IT solutions should critically examine the above mentioned reasons and prioritize these taking into account the context in which they are working. A college library's priorities may be quite different from that of an university library. A

college library may need to give higher priority to automating its circulation system and in expanding its capacity for inter-library loans than to developing an OPAC. The prioritization should obviously take into account the potential impact possible. Similarly, a research library may need to give higher priority to improving user services than to better management of its resources. Prioritization is also useful in that it could provide the guidelines for an implementation strategy.

As a strategy, the prioritization of the above mentioned reasons why IT should be applied should be done in consultation with the user community, management of the organization and the library staff - the stake holders. This could be done in a structured manner in one or more formal meetings with representatives from the stake holders where their views are sought, with the library staff providing the background papers, facts and figures, on which informed discussion could be based.

Such a prioritization exercise would help in building awareness among the stake holders and in obtaining the explicit concurrence of important players in seeking relevant IT solutions. This would pave the way for the next steps in the adoption process.

Before we can look at the strategies that may be useful in the adoption of IT in Indian libraries, however, it is useful to consider the factors that influence the adoption of IT.

### **3. Factors that influence the adoption of IT**

Several overt and covert factors in organizations and in libraries actually inhibit the adoption of new technologies<sup>3</sup>. On the other hand, some factors are conducive to the adoption of IT. It is useful to look at these factors objectively and examine if the inhibiting factors can be overcome through deliberate and planned action. The factors may be grouped under those internal to the library and those external to the library.

#### **3.1 Internal factors**

Several factors within Indian libraries seriously inhibit the adoption of IT and these are :

- the lack of trained personnel,
- the lack of leadership,
- fear of new technologies and the unwillingness to change, and
- poor understanding of what may be expected of new technologies.

It is important that these inhibiting factors are addressed a priori before one can think of IT applications. An objective assessment of these

factors by an external agency (e.g., INFLIBNET) or by the management of the organization of which the library is a part can be extremely valuable in promoting a climate which is conducive to the effective adoption of appropriate information technologies in libraries. In practice, however, these factors are seldom addressed explicitly and are often the cause for the slow or poor uptake and utilization of new technologies in many Indian libraries. The factors relating to skills and attitudes are best addressed through focussed in-house training for library staff at the managerial, supervisory and operational levels, and by exposure to the work of other libraries where new technologies have already been applied.

### 3.2 External factors

Several factors external to the library but internal to the organization are also known to be inhibitive to adoption and use of IT in Indian libraries. A few of these are :

- limited resources for capital investment,
- inability to absorb recurring costs, e.g., CD-ROM subscriptions,
- low prestige given to library and information professionals,
- lack of management support to the modernization of libraries,

and

- inadequate understanding of the value of good library and information services on the productivity and quality of work done within the organization.

Strong leadership within the library and information function and an enlightened management are vital in overcoming the inhibiting effect of some of these factors. The use of external consultants, formally or informally, to advice on IT related matters has been used quite successfully in mitigating the influence of some of these factors. More and more managements of institutions in the country have now become sensitized to the need for the application of IT in the library and information function and one may more easily expect support from managements today than a few years ago. The onus of getting management support must however be born by professional librarians who must demonstrate a commitment to modernization including the use of IT for real benefits to the user community.

Funding for IT related projects is now becoming available from external sources, e.g., from the Dept. of Science and Technology under the NISSAT programme. Similarly, other bodies, e.g., ICSSR, CSIR, UGC, ICAR, have either already funded specific IT related activities or

are quite willing to consider funding IT applications in libraries of institutions within their purview. Here again, however, it is essential that the lead is taken by librarians to develop well thought out project proposals, similar to research project proposals with clearly identified objectives, activities and milestones. It would be helpful if INFLIBNET and NISSAT could organize courses for the senior library professionals on project formulation, feasibility study preparation, systems analysis and project negotiation. These are not normally taught in formal educational curricula and are extremely important managerial skills for a forward looking library.

Many of the large university libraries in India spend close to a crore of Rupees on acquisitions and salaries. UGC should consider allowing these libraries to reserve a part of their acquisitions budget at least for a few years to pay for IT related acquisitions including the acquisition of hardware and software. It is important for university managements to recognise that the library should not only acquire useful material but also manage its resources effectively so that these are made available widely and efficiently not only to its immediate clientele but to society at large, who in fact pay the taxes to support the university.

### **3.3 Helpful factors**

User pressure has been a significant factor leading to the application of IT in Indian libraries. Evidence of this is seen in many special libraries all over the country. Similarly, user pressure has been responsible for some of the elite centres of higher learning taking to IT solutions in the last few years. Good examples of these are the IIT at Kanpur and the Central University at Hyderabad. It would appear that user pressure has not been significant in the other universities.

Computer centres in different institutions have also played a positive role in influencing the application of IT in library and information related functions. In many cases, computer centres have taken the lead in developing applications suitable for the library. They have also participated in the evaluation of hardware and software required for library automation and information retrieval, and decision making concerning modernization of libraries. However, there have also been examples of poor applications arising out of computer centre initiative primarily because (understandably) systems have been developed without a thorough understanding of needs, standards, and intra-system relationships.

Librarians will do well to actively cultivate users and computer

centre staff and involve them in discussions concerning the development of services including the potential use of IT applications. Users at different levels are responsible for allocation of resources and decision making. The most effective way of obtaining management support is via user groups (e.g., students, faculty, research scholars). Librarians in India need to take a more proactive approach in influencing decisions concerning resource allocation for the modernization of libraries.

#### **4. Adoption strategies**

University and special libraries in the west have quite successfully followed a systematic course in planning, designing, and initially automating their libraries, and in the subsequent upgradation and/or introduction of new technologies, e.g., networked CD-ROM systems, client-server software. In contrast, most library automation in India is being done in a relatively unplanned and ad-hoc manner. It would be useful to look at the methods followed by libraries in the west and draw lessons from their experience.

##### **4.1 Feasibility study**

Before any new IT application or upgradation of an existing system is considered, it is useful to do a formal study of the feasibility of the new system or application. The terms of reference (TOR) of the feasibility study may be defined using the prioritized list of benefits sought (described under 2 above). The TOR should also spell out constraints, if any, in finance, staffing and timing and the proposed application or system.

Ideally, except in simple applications, the feasibility study should be conducted by a team comprising library, computer and management specialists.

The feasibility study is intended to spell out the ideal objectives of the new system or application and how it proposes to overcome the limitations of an existing system (manual or computer-based). The feasibility study collects data relating to the information flows, size of files, frequency of processing, validations needed, outputs required, staff and user involvement, and costs of the existing system. Study methods include questionnaires, observation, and interviews with library staff, management and users.

The feasibility study team also survey hardware and software or turnkey systems that are considered suitable and some estimates of costs are provided.

Using all the information collected during the feasibility study, it should be possible to outline the requirements of the proposed system or application and to outline possible alternative solutions. Potential benefits of the different alternatives are identified and costed, ideally using a cost-benefit analysis technique, e.g., the net present value method<sup>4</sup>.

At the end of the feasibility study, a report is prepared for presentation to decision makers. The report should contain the following elements<sup>5</sup> :

- a brief description of the existing system including its limitations and drawbacks,
- one or more alternative methods of providing a solution,
- the cost of the existing system and outline of costs of proposed systems,
- the benefits of new systems proposed, quantified as far as possible,
- implications for staff levels, space requirements and policy support,
- a description of the further work needed before the new system can be implemented,

The importance of a formal feasibility study cannot be over emphasized as it provides to management, an investigative report of the possibilities, costs and benefits. Library staff and managements are provided a basis for discussion and if it is decided that the costs and/or benefits of implementing the new system are not justified then it is possible that a more efficient way of operating the existing system may have emerged from the work done during the feasibility study. It is usual for the managements to use the feasibility study as the basis to approve further actions required before a system is developed or acquired and implemented.

#### **4.2 Analysis, design and system specification**

The analysis stage is a continuation, in greater depth, of the investigations done in the feasibility study. In this stage, the outlines worked out during the feasibility study are fleshed out and possible alternatives in meeting the desired objectives of the new system, application, or upgradation are investigated in greater depth. Examples of hardware-software alternatives investigated could be : i) acquiring a software package to run on the organizations' main-frame; ii) building a microcomputer-based local area network (LAN) for the library with bridges to the

organizational network, iii) obtaining the services of a network or vendor, or iv) developing software in-house. The kind of alternatives will obviously vary with the nature and size of the application or system desired and the funds available.

As a rule, western libraries have eschewed the option of developing needed software in-house. It has been found that except in rare cases, the cost of the development effort in terms of staff resources and time required to develop software is higher than acquiring readily available software. The opportunity cost of not being able to quickly adopt new technologies should not be forgotten when confronted with make or buy decisions. It should also be remembered that the initial effort needed to develop software is only part of the cost. Real costs are in maintaining the software and updating/upgrading it, e.g., moving from a menu driven system to a Graphical User Interface (GUI) based application.

The situation in India is no different. In-house development of software except for very simple applications would mean the use of computer centre and/or library staff trained in computer programming and systems analysis. Not enough spare capacity of computer centre staff is available in most institutions for the development of systems suitable for libraries. Even if such staff are available and capable of developing software in-house, the total cost of such development would probably be as high as compared to buying off-the-shelf software.

This does not mean that librarians should not learn computer programming or systems analysis. In fact it is essential that they are in a position to write computer programs to take advantage of the fact that many packaged software permit the use of specially written programmes to interface with the software. Librarians with skills in computer programming are able to take full advantage of packaged software.

As a strategy, librarians in India should be trained in computer programming that would enhance their usefulness vis-a-vis systems already installed within the library. For instance, although Micro CDS/ISIS is widely used in India and several courses are organized on this package, there have been no courses specially organized on Micro/CDS/ISIS Pascal.

Once the requirements of the proposed system are agreed upon, and a decision to obtain software from an external source is taken, it is usual to invite software houses to tender. The invitation to tender (ITT) is sent to those vendors whose software is considered to be potentially useful in the proposed system. The ITT, depending on the complexity of the

proposed system can be an elaborate document spelling out the mandatory and desirable requirements, the volume of data that is to be processed, and other details of the proposed system. The vendor is asked to spell out details of the software or hardware-software solutions that would meet the stated needs. Following the responses to the ITT, it is usual to invite vendors for discussion and clarifications regarding system specifications and later for demonstrations of products, and visits to libraries where the software is being used.

Once tenders from vendors are received and discussions have taken place, there is need for a systematic evaluation of the tenders. It is necessary to establish functional criteria as well as criteria about the software's robustness, response time, documentation, training aids, maintenance, the vendor's capacity to update/upgrade the software, and experience of other users of the software. An important criterion for the evaluation of software is the extent to which it supports well established standards, e.g., whether it allows import and export of data into well known exchange formats. Another important criteria is whether the software is available under different hardware and operating system platforms. The establishment of criteria is best done jointly by library and computer centre staff. The scoring of each candidate software for the various criteria is then done independently by members or jointly by a team to facilitate the final selection of a package that is best suited to the system proposed.

No software package can meet all the requirements of a given library system. Inevitably some compromises will be needed in work flows, input, output and report formats. Although vendors promise to customize software to suit individual library needs, the experience in India is that this can be quite time-consuming. In the process of customization, other problems could arise requiring attention by the vendor leading to implementation delays that defeat the purpose for which the software was being acquired in the first place. In the evaluation of the software therefore it is important to prioritize requirements and ensure that the chosen software meets most if not all the high priority requirements of the system.

An important decision to make during the analysis and design stage is whether to seek an integrated solution, i.e., a system which would enable automation of a library's important functions under the control of a single piece of software, or to seek solutions first for the high priority operations of the library but with a perspective for later integration. This decision is dependent on the relative priorities of the library and the funds available.

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In the analysis and design stage it is also important to look at those desirable features and capabilities that lie beyond the functional needs of the proposed system. Very importantly, attention must be given to capabilities for the production of management information that would help in better decision making and not just better operational control. It is important also to recognize the need for end-user access (including remote access) to information including access to information that is traditionally considered to be useful only to library staff, e.g., information about status of books ordered.

### **4.3 Implementation**

Implementation of a new system involves both computer-related and library-related tasks. Once the details of the new system are known, e.g., record structure for patron records in the circulation system, plans to create such records can be made even before the system is actually acquired and put in place. Given the centrality of catalogue records and the fact that other library systems (acquisition, circulation) revolve around the catalogue record, most libraries will be concerned with conversion of existing records to suit the new system. One approach is to take up the creation of a record for an item only when the item is needed for a specific purpose, e.g., when it is to be loaned. This is the least expensive method. However, dependence on this method alone would mean several years before the entire (or active) collection is converted. Other methods of conversion including the use of commercial companies will no doubt become available with increases in the pace of library automation in the country. A combination of methods would probably be needed for retrospective conversion of records. Starting with the on-going acquisitions and going backwards may be a good general rule for retrospective conversion.

It is absolutely vital that attention to quality is given when converting existing records for an automated system. It is incorrect to think of the computer catalogue as an electronic replica of the card catalogue. The real advantage of a computer-based catalogue is that it enables multi-dimensional access to bibliographic as well as content information of library catalogues. University libraries must also not forget that their machine readable catalogues will need to serve as sources of cataloguing data for other smaller libraries in metropolitan and wide area networks that are being planned.

Computer-related tasks include the testing of the software on a

newly acquired computer or an already existing computer and the development of procedures for ensuring regular backups of important database and index files, providing necessary authorizations to enable users and library staff to access the database and other files, and ensuring the security of the database. If there is need for special purpose programs to be written, these will need to be developed and tested. Ideally, the computer and library related tasks and procedures will be written down as operating manuals to guide staff in the efficient running and maintenance of the system. Once the required procedures are established and understood, and the software-hardware side of the implementation is addressed, the move to implement the new system in an operational mode begins. Planning for the shift from the existing system to the new system can take one of the following approaches, depending on the size and complexity of the new system.

— **Phased implementation.** In this the new system is divided into sections. Each section is installed individually and only when it is considered to be operating fully satisfactorily will the next logical section be installed. This method is suitable in situations where there are a large number of transactions.

— **Parallel implementation.** In this both the old and new systems are operated in parallel for a specified period of time until the reliability of the new system is established. This method is adopted for complex systems.

— **Pilot implementation.** In this the system may be installed in a smaller scale, e.g., in a departmental library before it is installed in the main library. This way the problems of the new system can be better understood and tackled without upsetting a major area of operation.

— **Complete changeover.** In this the old system is replaced on a specified day. This is feasible when the new system or application is relatively simple and there is not much preparatory work needed to replace the old system in one operation.

Implementation of a new system includes setting up procedures to ensure that the hardware and software components of the system are maintained. This may involve trouble shooting, revision of specially written software to meet new demands that were not foreseen in the first instance, ensuring that files are backed up regularly and so on. Some of these tasks may involve one or more vendors in service contracts.

The success of a new system depends to a great extent on the presence of a key person to function as a focal point for staff and users of the

new system. Such a person will act as trainer and trouble shooter until staff and users are comfortable with the system. He will also be the liaison between the library and vendors or software team.

Another factor that influences the success of a new system is the extent to which supervisory and operational staff are involved in the planning, design, analysis and implementation of the new system. The psychological barriers to change must be addressed ab initio with all the staff who will be involved in one way or the other with the new system. Long before the full fledged implementation of the system, staff that will be involved in running and managing the system will need to be carefully trained.

It should not be assumed that just because a system using a new technology is implemented will automatically lead to user acceptance and success of the system. It is important to 'market' the new system or service arising out of the new system to users, especially when the new system is targeted to users or when the new system is likely to change the way users were already receiving a service. Here again, a direct approach to user groups in formal or informal presentations about the new system is important. The reasons for introducing the new system and the benefits to users and library staff should be explained and some instruction on how to use the new system given.

## **5. Technology trends and roles of libraries**

The technological developments of the last few years in the areas of telecommunications, multi-media and digital technologies have the potential to change the way we generate, organize, present, disseminate, share and use information<sup>6</sup>. These developments will have a significant impact on the role of libraries and on the library and information profession.

In a study by the Information Industry Association in 1989, many technological changes during the last decade of the century were predicted. A few of these are :

- microcomputers will have a processing power of 20-40 million instructions per second (MIPS) as compared to 1-3 MIPS today.
- optical storage density will increase by a factor of 6 through data compression techniques.
- the telephone system (in the developed world) will become fully digital enabling it to carry text, graphics, images, voice and full motion video.

- fiber optics will become the dominant transmission channel in telecommunication systems.

Some of these predictions are well on their way to becoming reality. We are slowly but surely moving into a digital and visual information age. At the centre of all developments is the so called Information Super-highway fuelled by the success and rapid growth of INTERNET. Billions of dollars are being spent by the entertainment industry to re-wire America and Europe to build the digital highway that promises to deliver multi-media game and entertainment programs on-demand. The new channels that are being opened including those on INTERNET provide exciting new opportunities for libraries to deliver knowledge based products using multi-media and not just print media.

In another contribution<sup>7</sup>, Macdonald predicts that 'the future belongs neither to the makers of technology nor the providers of information. In the final analysis, it will be defined by the users of information - the consumers, who will decide what technologies, what sources, what vendors, and what modes of access will prosper and support them across the millennial meridian.'

Macdonald believes (and there is already evidence that the beliefs are well founded) that the convergence of a technological tried will pose the challenges to librarians and these are : i) Individualization of computing, ii) Ubiquity of communications, and iii) portability of devices.

The rapid growth of microcomputers and its percolation into millions of homes, and the software industry fuelling microcomputer applications is proof enough of the rapid individualization of computing. More than 45000 networks worldwide are on INTERNET and about 15 million users worldwide use INTERNET resources. This figure grows almost each day. The technology of networking with fibre optics, high speed error correcting modems, data compression techniques and satellite links enable the tyrannies of distance and time to be annihilated leading credence to the belief that computer-based communication will be the predominant way people will communicate with each other. Together with miniaturization, that led to the affordability and individualization of computing, there is an increasing use of wireless devices in communications networks, e.g., pocket radio networks. Importantly, these networks can feed into wired networks such as INTERNET freeing people from desk-top devices and providing both portability and connectivity.

As computers and communication systems show greater and greater convergence there is the potential for another quantum jump into univer-

sal information access. This would mean that anyone, anywhere could talk, write, confer, or send both textual and visual information to anyone else in the world<sup>6</sup>.

On the more conventional front, there are shifts in software paradigms which will have impacts on library usage of new technologies and their capacity to deliver information and services to users. An important shift is in the increasing use of client-server architectures for database systems including library-related software for end-user access to library catalogues and information retrieval systems. New standards relevant to client - server computing will become important also for libraries in India.

SilverPlatter's recent announcement of their technology called Electronic Resource Library will enable wide-area networked access to CD-ROM databases. This technology could have a profound effect in developing countries.

High speed scanner and fax-based technologies for the electronic delivery of documents is another area of growth that has potential to make a significant impact on the way libraries will function.

Lastly, technologies to permit distributed networking and access to databases; files; software; and multi-media and conventional documents in a totally distributed manner as epitomized by INTERNET offer exciting possibilities even in the developing world. There is no reason why INFLIBNET should not seek to become a fully distributed network enabling scholars all over the country to have equal and easy access to the rich resources of university and other libraries in the country, and through links with INTERNET, to resources elsewhere in the world.

The above mentioned trends are by no means the only ones. The technologies of the 1970's and 1980's brought about a shift in the directions of libraries. The kinds of shifts that took place are given below.

- from library centred to information centred.
- from the library as an institution to the library as an information provider not only of the bibliographic type but also other types including multi-media.
  - from using new technologies for library automation to using technology for the enhancement of information access and delivery irrespective of whether it is held by the library or not.
  - from library networking to area networking for all types of information providers.

The technologies of the 1990's do not negate the above mentioned

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shifts but require that these shifts be further accelerated. In addition, however new directions for libraries have emerged and some of these are:

- from information-centered to knowledge centered.
- from information access to information selectivity
- from operating as centralized information systems to operating in distributed information systems.
- from being on national networks to being on a global network of networks.
- from using technology that supports library staff to using technology that will empower the library user.

It is inevitable that many of the new technologies that are emerging today will not be easily affordable by us in India in the near future. Libraries need to be aware of these trends and shifts and seek solutions which are appropriate to our needs. We would also need to equip ourselves for capabilities to link with global solutions for the benefit of our users.

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