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INFORMATION TECHNOLOGIES IN LIBRARIES A FUTURISTIC PERSPECTIVE*

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1. INTRODUCTION

The term information technology (IT) is most commonly used to mean computer technology and communication technology. The technologies of optical/video systems like CD-ROMs, are also included in the computers group by the books and periodicals on computer technology. In the field of journalism, IT is generally meant as a technology used for information dissemination which includes systems like telex, fax, teleprinter and so on. For a librarian, IT has a wider connotation which includes the technologies and systems like microfilms, microfiches, CD-ROMs, computers, information networks, etc. The librarian's connotation of IT in my view should include all those technologies which the libraries and information centres use for collection, processing, storage, retrieval and dissemination of recorded information. These technologies are operative in the following environments.

(i) Library Management (classification, cataloguing, indexing, database creation, CAS, SDI, etc)

(ii) Library Automation (organising databases and automating library housekeeping operations)

(iii) Library Networking (for resource sharing and information dissemination)

(iv) Reprography (photography, microfilms, microfiches, audio and video tapes, printing, optical disks, etc)

(v) Technical Communication (technical writing, editing, publishing, including DTP systems, etc)

One may not agree with the broad scope I have set out for IT, but I would like to stick to it for the present, as all these areas are

* *Based on the First ILA Ranganathan Memeorial Lecture delivered on 12 August 1994 at New Delhi.*

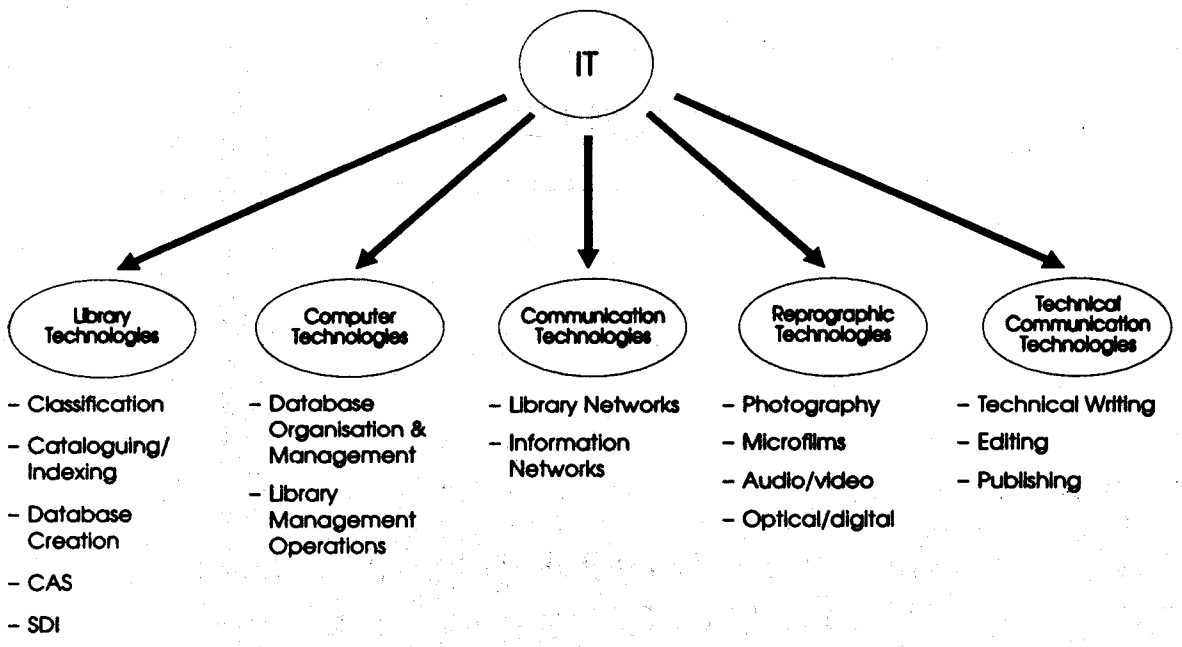

Figure 1. Areas of information technology

relevant to library management and it would enable me to cover the developments in these areas in a somewhat systematic manner.

2. GLOBAL FUTURISTIC SCENARIO

Any IT development usually first occurs in an advanced country and then moves to the developing countries like India. Of course, during Dr Ranganathan's time, quite a few innovations and new ideas in the field of library science and technology were generated in India and moved to the West. But in other areas of IT mentioned above, the technology transfer continues to be from the First World to the Third World. While some technologies move fast, many others move slowly. Thus, if we consider the trends in technological developments and the predictions of these developments in the advanced countries, we can expect their arrival to the Third World and particularly to India in due course of time. So, I shall now discuss first the futuristic scenario of the advanced countries as predicted by experts* and then present the possible IT scenario in India. These projections will cover a period of about a decade from now. Since the developments are so vast and innumerable, I have to be selective in discussion here. Before I discuss any of these developments, one important indicator I must mention, is that during the next decade IT developments are expected to be only 'evolutionary' and not 'revolutionary'. This means, no path-breaking or startling innovations that may revolutionise the IT world are likely to take place.

2.1. Library Management

Before I discuss the trends in the library management, I must mention about the developments in a closely related field, namely education. Since libraries and education go hand in hand, I shall mention some of the IT developments in the field of education which have a bearing on libraries.

* An excellent overview of the projections is given in Martin, J, et al. Information UK 2000. Bowker-Saur, London, 1991. pp. 7-34.

- Educational institutions, even middle and high schools, will have increasing IT environment.
- Satellite channels dedicated to education and training will increase.
- Interactive training programmes through cable TV will be quite common. Multimedia (a combination of text, graphics, pictures and animation) learning stations will proliferate. Some electronic universities, wherein all the educational programmes are conducted through electronic media and satellite channels, are likely to come up.
- Artificial intelligence (AI)-based training will also increase.

Some of the developments which the library managers will notice are :

- Library budgets will continue to decrease in real terms. So, libraries will shift their efforts from acquiring and maintaining comprehensive collections to providing comprehensive access to information available in databases. This trend will lead to continual increase in resource sharing arrangements. Thus, libraries will increasingly play the role of switching centres rather than resource centres. Also, use of CD-ROMs and other new portable storage media will increase. Image databases and multimedia publications will also increase. However, shift towards the use of these IT media will not be as fast as it should be, owing to the resistance by users. Readers will continue to prefer paper-based literature as far as possible because of the ease of use. They will use new media only as an alternative whenever necessary. This will keep the use of paper on the increase, in spite of the increasing usage of the electronic and optical media. Parallelly, more and more scientific and technical information, and reference information used for corporate functions will be disseminated online and on CD-ROM.
- Remote browsing of libraries through networks and teledelivery of documents (reading of text remotely and downloading of electronic publications and training courses) will come into use. Similarly, music or video materials will be available for listening or viewing from homes, the desired portions being downloaded for subsequent use – all on payment basis. Such facilities may largely replace audio/video rental shops and also lead to reduction in sales of such items.
- Depth of technical processing like classification, cataloguing/indexing by the libraries will reduce. These activities will be contracted out.
- The information retrieval systems will be more and more user-friendly and customised. So, library users will increasingly be carrying out information searches online and on CD-ROM by themselves and ordering document copies through e-mail or on networks. Information intermediaries will be required only for specialised and complicated searches. They will be using expert systems and hypertext methods also for carrying out such searches.
- Since information services will be priced by almost every organisation, users' expectations will be much higher in terms of relevance, currency and accuracy. Pricing of online searches may depend more on results rather than on the time of search and the quantum of information retrieved. As the prices/charges for information services increase, litigations on the responsibility for accuracy or authenticity may come in.
- Many organisations may integrate their bibliographic and MIS databases for operating decision support systems.

- Library services will be increasingly expected to be self-reliant and budgetary support will be decreasing continuously. Governmental support to libraries to keep up their services to the public will be questioned and debated.

- Value-added services of libraries, like current awareness, SDI, digests, etc will meet with increasing competition from private agencies. Concurrently, partnership of public and private sector agencies will grow in providing information services.

- Retroconversion of catalogue data of major libraries into machine-readable format will be completed by the end of this decade. Most of such libraries will operate OPAC (online public access catalogue).

- Database producers will play a more powerful role in providing access to their databases than vendors or hosts. This will lead to the producers taking over of the marketing of the databases and developing the necessary sales forces or arrangements. As regards retrieval efficiencies, Boolean searching models will be replaced by other methods such as similarity/word-association-based searching methods.

- Library networks will develop more rapidly and will form subsets of major national networks.

- Library suppliers will make stock information available online. Acquisition staff in libraries will therefore be able to know the availability of the titles required and place instant orders electronically.

- Bookshops will offer more and more of non-paper and composite media (a combination of paper, floppy, video, etc) publications. Readers will increasingly use pocket computers, lap-top computers or other PCs, to manipulate the information and download for their notes.

- Traditional library posts will decrease. Library professionals will be increasingly called upon to function as specialised information intermediaries, database producers, online information providers, information network managers and so on. For functioning effectively in these roles, library professionals will need good educational qualifications, wide general reading and good communication skills, IT skills, initiative and readiness to adapt to the new technologies. They will necessarily have to work very hard to occupy top positions.

2.2. Computers and Telecommunications

There will be several changes in the fields of computers and communications in the coming decade and it will be quite difficult to cover all those changes because, firstly, being basically a library professional, I cannot comprehend all the changes expected in the world of computers and communications. I believe even a specialist in computers cannot do justice for such a coverage in telecommunications and *vice versa*. Secondly, all the changes in these fields may not be relevant to libraries and so need not be covered. Therefore, I would restrict my coverage of these fields to the changes expected in the coming years as relevant to the library professionals. Some of them are as follows.

2.2.1. Hardware

- In the coming decade we will see faster processors, increased memory and cheaper mass storage, and overall reduction in hardware prices will continue. Parallel computing techniques will increase. This is considered advantageous in searching bibliographic

databases, as using parallel processing architecture and techniques, one can partition a database and search the portions parallelly on different processors. The use of specialised coprocessors for bibliographic information processing applications such as text compression and string matching will also increase. In the parallel processing environment, the database structure will shift from inverted files to serial files as they can be more readily distributed across a parallel processing system. This arrangement will permit quicker updating of text databases.

- PCs will have more and more power and PC-based networks will provide a viable alternative to minis and small mainframes.

- Much of the memory of the PCs will be occupied by system software, more sophisticated packages, and graphics-based interfaces. PCs will have voice outputs also. They will take voice inputs from newsline and give printouts of desired portions in desired formats. Portable (hand-held) PCs will be very common. Lap-top PCs which can provide colour pictures and animation, with cellular and infrared networking capabilities will be available.

- Speech (limited vocabulary) and touch-sensitive screens will be increasingly used but the keyboard will continue to be used for accessing databases.

- Disk storage will be used to a greater extent than tape storage as the costs of the former will continue to decrease.

- Digital image processing (DIP) systems, similar to fax machines but faster, will be increasingly used for processing large number of document images. Digital signal processors will be used for reading and enhancing of poor quality originals of documents. More and more powerful scanners will be available which can capture a whole document instantaneously rather than line by line.

2.2.2. Software

- Dramatic changes in software are unlikely because of high investments required for achieving path-breaking or startling developments and the high costs of expert manpower.

- UNIX will be the most widely used operating system. CASE tools and object-oriented programming will be more widely used.

- Full text databases with images/graphics will increase. It is unlikely that natural language processing or speech processing techniques or expert systems will be commonly used for searching large databases because of the huge amount of knowledge base required for efficient retrieval. Similarly, hypertext databases are also not likely to be used widely because of the high manpower costs of their creation and other problems. The need to acquire new reading skills will inhibit their use except for integrating text, sound and image data.

2.2.3. Telecommunications

- Telecom will heavily influence computer specifications as online networks will be more and more common.

- Voice traffic will continue to grow but non-voice traffic (data and graphics through fax, e-mail, file transfer, etc) will grow faster. Video phones will mostly replace the existing phones.

- Packet-switching networks will continue to expand. Charges for inland and international calls over these networks will continue to fall but the quality and range of facilities will continually improve.

- The channels of value-added networks (VANs) will be mainly used for online access to databases.

- Wireless communication systems—which can make and receive long-distance calls and divert the calls to persons who are on the move on road, rail or aeroplane—will come up in a decade or two. The development of intelligent pocket computers with built-in communication facilities, will bring in the era of 'Virtual Enterprises' which will not be confined to the limits of walls of buildings but employ and get work done by suitable persons wheresoever they be located in the world. Such persons will be able to receive messages and instructions even while on the move.

- PABX systems connected to public telephone exchanges (CENTRIX) will be quite common and these will successfully compete with traditional PABX systems. ISDN (Integrated Services Digital Network) will be available but its use will not be as much as presently expected. Telex, being obsolete will decline fast. Higher and higher capacity digital transmission channels will be available at rapidly falling communication costs. By the year 2000 AD, channels with data transfer rate of up to 4 G bits/s will be available. Demand for private channels will exceed the supply, leading to a steep increase in the prices of such channels.

- X-terminal with x-window communication protocol will play an increasingly important role in network operations. This coupled with a laser printer will be commonly used for retrieval of textual and graphic information instead of ASCII terminal and dot-matrix printer.

- Because of high R&D costs in this field, telecom companies, even large ones, will increasingly collaborate in carrying out R&D projects and also in executing large projects/installations. Small companies will form consortia to survive the onslaught of telecom giants.

- Standardisation problems in the areas of telecommunications, computing and broadcasting and related areas will continue.

2.3. Reprography

In this category I would like to cover, as stated earlier, the areas of audio and video including digital optical systems, as relevant to libraries. The following are some of the important developments expected to take place in the coming years.

- The coming decade will be an era of image processing. For archival storage of documents, document image processing and digital optical storage will replace microfilm systems. Similarly, electronic media will replace 16 mm film fully (this has already become outdated) and 35 mm film gradually. Electronic disk still cameras will out perform 35 mm cameras. Full-length productions will be distributed on disc. Digital HDTV (high-definition TV) will not be common till the middle of the first decade of the twenty first century. Thereafter it will dominate over the analogue HDTV in the market.

- Presently, CD-ROM does not provide high performance searches in a multi-user environment, and is presently being used as a transfer medium. Databases on CD-ROM are transferred to hard disk and put in multi-user systems for enabling high performance searches. This will change. High performance multi-user CD-ROM systems will be available and CD-ROM networks will be common. Also, CD-ROM networks with OSI architecture will be in use. We will also see portable CD-ROM readers, and CD-TV shortly.

- Optical disk (OD) will dominate in the area of video systems. Interactive OD with sound, text and graphics will be common in libraries. However, WORM will also continue.

- Digital video will gradually come into use but will not supersede analogue video in the video film consumer market in the coming decade.

2.4. Technical Communication

Effective communication of information is an integral part of information dissemination. Before any information is disseminated, it is to be repackaged or reshaped to match the requirements of the user. Such repackaging calls for high communication skills both in form (medium) and content (language, style, typography, graphics, etc). However, this area is generally not given adequate emphasis in the library science schools. Development of communication skills and use of appropriate technologies greatly helps the library professionals and they would do well after knowing the developments in this area also. The following are some of the major developments expected to influence the library profession in the coming years.

- Notwithstanding the proliferation of electronic publications, publications in print form will increase. Most professional publications will continue to be in print form. The number of publications coming out both in print and in electronic form will increase only gradually. The shift to electronic publication will gather momentum with the increase of print production costs, ease of retrieval of information and ease in updating information. In the coming years we will see textbooks also published in CD-ROM and in multimedia along with the printed versions. Already we see New Grolier Multimedia Encyclopedia, Guinnes Multimedia Disk of Records, Picture Atlas of the World (of National Geographic Society), and 1993 Time Almanac in CD-ROM format.

- Books and journals will have a shorter span of currency. Market for popular paperbacks and magazines will largely be affected by entertainment systems like lap-top TVs and portable videos and players.

- On-demand publishing will be common. This method ensures preserving of edited, composed and formatted text in electronic form and producing copies only on receipt of orders. Buyers will have choice of type style, paper, binding and so on. This will obviate the need for holding large stocks of publications by publishers and distributors.

- More and more authors will generate their works on DTP systems and use spell-checks, thesauri, and style checkers and provide camera-ready copy (CRC) to publishers. Many of the authors will be designers of their own publications and some of them will bring out multimedia publications. Editorial work will also be carried out by exchanging messages and comments electronically during the pre-CRC stage. Authors will increasingly publish their own works and make distribution arrangements with marketing and distribution agencies. This will increase the problem of bibliographic control.

- Publishers may enter data about their publications directly into the national bibliographies. Archival repositories will receive more and more documents in electronic form.

- Copyright and intellectual property rights problems will continue.

- Multimedia presentations for presenting scientific, technical and research ideas will be common.

3. INDIAN FUTURISTIC SCENARIO

As you are aware, in India there are pockets of excellence in several subject areas while in many areas the level of attainment is not significant. As someone said, we have the jet aeroplanes and bullock carts operating parallelly in the aviation and agricultural sectors respectively. Similarly, in some of the IT areas, India is not much behind the advanced countries, particularly in the computer software development, library management methods and techniques, etc. The country's achievements in the field of telecommunications and computer hardware are also significant if we look at the work of C-DOT and CDAC under the Department of Electronics, and ANURAG in DRDO. However, in the field of reprography, including audio and video technologies, there are hardly any notable innovations and we have been only using these systems and equipment after importing them. But the coming years are expected to witness certain developments which may change the present scenario for the better. Against this background I would venture to make some predictions on the IT futuristic scenario. Again, I shall proceed to present some important developments in the four broad areas of IT which I mentioned earlier.

3.1. Library Management

As you may be aware there are about 230 university libraries, 5200 college libraries and 3290 special libraries (libraries in R&D and other specialised institutions) in India. While most of the libraries do not use IT for their activities, the situation in S&T libraries, which come under the category of Special Libraries is somewhat better. A good number of libraries, though a small number when compared to the total number of libraries in the country, use current IT products and systems like computers, e-mail, CD-ROMs, and online searching. Table 1 gives a simplistic view of such use.

Although the use of IT in libraries is presently quite low, it is expected to go up in the coming years with the prices of the hardware and general software coming down. Also, the extent of use in the libraries which are already using the IT will increase several-fold.

In the academic institutions the following picture is likely to emerge.

Table 1. Use of IT products/systems in Indian libraries

Product/system	*No. of libraries*	
Computers	272	(3% of 8700 libraries)
CD-ROM systems	53*	(0.6% of 8700 libraries)
Online searching of foreign databases	93	(1% of 8700 libraries)
E-mail	125**	

Source : NALANDA database compiled by ILA.

* A supplier of CD-ROM systems has claimed in an informal discussion that his firm has supplied over 300 systems in the country but all of them may not have been installed in libraries.

** R&D institutions have e-mail facility which is also available to their libraries.

- More and more university departments, colleges and elite schools will have more IT environment. Their libraries will also be using PCs.
- A dedicated TV channel is likely to come up for education and training.
- Multimedia learning systems will be available in many elite institutions.
- AI-based training will be available at advanced training institutions (including those in the R&D and industrial sector)

In the Indian libraries, the scenario may be as follows :

- Budgets will decrease in real terms. Emphasis will shift from comprehensive collections to comprehensive access to information.
- Library science as a discipline will have limited growth. The field will be increasingly dominated by IT. Library professionals are likely to lose top positions to other IT specialists. To go up in the profession, and to acquire senior positions, library science specialists will have to develop expertise in database production, network management, etc.
- Resource sharing will grow only slowly. Use of CD-ROMs will increase. Multimedia collections will develop only in the libraries of elite institutions.
- Shift to the use of IT among library users will not be as fast as we expect. Readers' preference will continue for the paper-based materials.
- Remote browsing and teledelivery of documents will be used only on an experimental level.
- More and more library users will carry out CD and online searches by themselves. So, library professionals must develop expertise in conducting complicated searches and in using expert system/hypertext methods.
- About 75 per cent of the retroconversion of library holdings data will be completed in special libraries by 2000 AD. A large number of databases will come up in S&T, industrial and commercial sectors.
- Major library suppliers will provide stock position through e-mail and some online. They will supply more non-paper and composite publications.

3.2. Computers and Telecommunications

- Many of the new computer hardware and related technologies coming up in the advanced countries will be arriving in India owing to the large market and globalisation of the Indian economy.
- In software, more and more powerful indigenous packages will come up. Expert systems and artificial intelligence systems will be used only by a few elite libraries and information centres, on an experimental basis.
- Packet-switched networks will be common by the year 2000 AD. However, tariffs for the communication services may not come down. Digital transmission will be available on trunk routes. Glass fibres and optical laser channels will be introduced in a limited way.
- Library networks like DELNET, CALIBNET, INFLIBNET and a few other metropolitan networks will be operational by 2000 AD. However, the level of services will significantly vary among them in terms of sophistication and efficiency.

3.3. Reprography

- Many of the new systems/equipment developed in the advanced countries will be arriving in India for use. A few Indian

ones will also come up based either on licence production or indigenous development. But the R&D efforts in this field in the country will not be significant barring a few sporadic efforts and developments.

3.4. Technical Communication

Although there is hardly any R&D work going on in the country in this field, advanced systems like the colour-graphics-based DTP, parallel-processor-based composing and multimedia technical presentation systems will be used. In the coming years we will find the following scenario :

- On-demand publishing will be common. Authors will increasingly use DTP for preparing their texts. Product (publication) design by authors will not however be common.
- By the year 2000 AD, there will be only a few electronic publications, not more than a couple of dozens and thereafter this speed will increase to a considerable extent.
- Multimedia technical presentations will be common among elite institutions.
- Lap-top TVs and portable videos will be common.

4. CONCLUSION

I have so far presented a futuristic IT scenario both at the international level and at the national level, based on my perception and projection of the IT developments. Some of them may happen and some may not happen and yet some others may happen in a different way. But you can see one important point in all these developments. Ranganathan's principles will continue to be relevant in most of the developments of the present and the future. For example, all databases and CD-ROM products are aimed basically at saving the time of the user (reader) in getting exhaustive as well as specific information. Again, some users feel comfortable to use these current media while some others will continue to prefer paper-based information. So, every user or reader will get his medium and every medium will have its users. Thus, if you try to correlate the famous Five Laws of Ranganathan with the IT-based library services you will find all of them will be relevant in the new library environment. I hope R&D work will be carried out to adopt his methods and techniques like Colon Classification and Chain Indexing to the library and information activities and services in the current IT environment.

"New opinions are always suspected, and usually opposed, without any other reason but because they are not already common."

- John Locke