

IMPACT OF INTERNET ON LIBRARY AND INFORMATION CENTRES : A REVIEW

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1. INTRODUCTION

Computers, communication and information access technologies are effecting revolutionary changes in the way the information is stored, retrieved, and disseminated. Information technologies had an everlasting impact on the library and information centres (L&ICs) which has been dealt in detail elsewhere (Lakshmana Moorthy, et al, 1990, 1995, 1996). Internet is perhaps the most important development in the field of information technology which has been described as arguably the most complex structure yet discovered in the world. Internet, a network of more than 30,000 (as of May 1994) networks (Neesham, 1994), also called variously as the Cyberspace, Information Superhighway, the Net, etc has enabled global level inter-connectivity of computers and computer networks. Internet, a traditional avenue for sharing research data and information, has brought in a new era in global communications. It is an open computer communication infrastructure of the world.

The growth of Internet has been global and continuous. And it is growing at a rapid pace. In 1991 the Internet was in the reach of only 73 countries; 100 countries accessed it in 1993 and in 1995 it reached 148 countries. The number of host computers/sites and the number of users are almost doubling every year. In 1994, it had a user base of 20-25 millions with over two million connections which was expected to be doubled by the end of 1995. Now, Internet has about five million host computers with a new host added every ten minutes (see Treese, 1994), spread over 160 countries around the world. The Internet Architecture Board, one of the three erstwhile managing bodies of the Internet Society, has estimated a monthly growth rate of 10-15 per cent for computer hosts. It is providing connectivity to over 50 million users. And in North America alone, the Internet has over 37 million users. At present with a base of about 6.8 million subscribers, it is expected to reach 20 million by the turn of the century. It has been estimated that every month two million new users try to browse what Internet can offer them (Eager, 1994).

There have been tremendous developments in the area of transmission speeds at which the information/data files are transmitted over the Net. Initially the transmission speeds used to be 64 kbps; this reached 1.5 Mbps in 1993. However, recently the speeds at which the information transmission is taking place reached 45 to 622 Mbps (in advanced countries) and is leaping towards achieving Gbps rates.

2. INTERNET AND LIBRARY & INFORMATION CENTRES

User applications on Internet cover a whole gamut of variety of subject fields and areas—advertising, business, commerce, culture, education, finance, research, recreation, science and technology and so on. The avenues for exploitation of Internet by L&ICs are unlimited and endless. Internet provides access to a variety of commercial and non-commercial information sources which include: bibliographic and full-text databases; table of contents of primary journals; electronic and online journals, books and newsletters; OPACs, graphics databases, multimedia walk through programs, and audio visual clip art databases; e-mail, directories, product and library catalogues, campus information systems, etc. Internet is also a test bed for electronic document delivery, electronic publishing, publicity and marketing of products and services, and integrated access to local and external information.

Internet is a resource of many varieties of information. For example, free software developed at various academic institutions and research organisations as well as by individuals is made available through Internet; newspapers, electronic shopping merchandise, product information catalogues of various institutions and organisations, bulletin board discussion forums for exchange of professional views, news and research; shareware/clipware (made available for free trial before actual purchase, albeit with deletion of important routines), research articles and preprints are a few to name. A lot of free of cost public domain software is available on various Internet sites which can be downloaded for personal or official usage (but not for marketing purposes).

Internet provides a wealth of information for the L&ICs. Internet sites of Librarian's interest including various sites offering information on topics like business addresses, defence, employment, genealogy, statistics about govts, health and medicine, humour, law, etc have been discussed by Judith Wolinsky (1996). A few library-related sites are also listed by her. The advantages provided by Internet to the technical services librarian including acquisitions, cataloguing, technical and reference services, serials, specialised resource management and some of the information sites associated with these functions were dealt by Barbara Stewart (1996).

Technologies for accessing information sources on Internet are changing rapidly. Starting with a provision of basic tools like e-mail, Telnet, and FTP, Internet has shifted emphasis to navigation aids like Wide Area Information Servers (WAIS), Archie, Mosaic, Usenet, Gopher, and the consumer-oriented home pages of the World Wide Web (WWW or simply the Web). Many authors discussed in detail about the various Internet tools and their usage (see, for example, Curtois, 1994; Curtois & Baer, 1995; Curtois, 1996; Fazuluddin & Chikkamallaiah, 1996; Rajashekar, 1996; Shukla, 1996; Subbaram, 1996, Valauskas, 1994; etc).

Some of the avenues of Internet which have potential applications in L&ICs are briefly dealt in the following paragraphs.

3. ACCESSING INFORMATION ON THE WEB

The Web is a subset of the Internet using a high level protocol called HTTP (Hyper Text Transfer Protocol). HTTP specifies the way the hypertext documents are transferred over the Web and Internet. The Hypertext Markup Language (HTML) provides rules for Web publishing. It supports text, graphics, audio, video and multimedia. On the Internet today, WWW is the largest information resource of easily accessible information. The information sources around the world are getting inter-linked through Web pages and Web servers spread around the globe.

Many organisations maintain an online catalogue of their publications over Internet/WWW which could be searched using navigational tools. The users can select items of interest and click for further processing. Many publishers maintain the contents pages of their journals on WWW. For example, Elsevier Science Publishers maintain a table of contents (called ESTOC — Elsevier Science Table Of Contents) of about 900 journals published by them. The contents pages appear on the Web at the same time as the printed issue is released. Elsevier also provides this service free of charge on e-mail (on Internet only) two to three weeks in advance for browsing. Blackwell Scientific, Taylor and Francis and Aslib along with eight others are also planning contents of about 250 electronic journals the full text of which will be available online from January 1997. Such services can be effectively used for CAS/SDI services by the libraries which are subscribing the journals.

Several projects have also been initiated which focus on developing digital libraries to provide remote access over Internet to very large multimedia document collections, stored on distributed servers. Artificial intelligence techniques are also used for the retrieval of information available over Internet (Shukla, 1996).

Information about how to access (i) computerised library systems of universities around the world, (ii) hundreds of online bibliographic databases and libraries, and (iii) accessing newsletters about cataloguing, indexing, etc is also available over the Web. Lists of online Internet public access library catalogues, databases and library newsletters are also available on the Web besides the databases of well known libraries like the Library of Congress, University of Maryland, Washington University Services, etc. And the Hytelnet programme facilitates accessing library resources on an easy to use menu interface. Web documents of interest to the library professionals are listed by Narasimhamurthi and Amba (1995).

Advertising on the Web is one of the best ways to make the world know about an individual (say, a consultant) or a library. This would enable publicity about the various facilities, services and products offered by an L&IC or a consultant to the users. This means operating a home page on the Web. It was estimated that there were 25 million home pages available on the Web in 1995 which is expected to reach 200 million by 1999 (Subbaram, 1996). However, there are very few Web servers available in India. The foreign Web servers charge anywhere between a few thousands to a few lakh rupees for putting up a Web page.

Universal resource locators on the Web like Yahoo and Lycos allow the users to enter a Web page

under an appropriate category. This also enables the users of a particular category to see related home pages. Services like CommerceNet (<http://www.commercenet.com>) allows to add the home pages to the existing indexes as well as spread the information including printed directories. The creation of Web home pages is dealt extensively in the literature (see, for example, Duval & Main 1995; O'Kane 1996; and Spear 1995).

4. BULLETIN BOARD SERVICES

An off shoot of the e-mail facility, the Bulletin Board Service (BBS) is essentially a many-to-many e-mail system (Buckland, 1987). WELL (Whole Earth Lectronic Link), the first BBS, was set up in mid 1980s by a group of enthusiasts (Neesham, 1994). This service disseminates professional information in an open bulletin board which will be read and commented by users in the field. The views and critical comments are 'posted' (appended) to the bulletin board which in turn will be seen by the moderator of the BBS and other professionals. Further comments, if any, can be posted again. There are two types of bulletin boards, moderated and unmoderated. Discussion groups and forums like PACS-L which discusses the applications of computers in libraries and LIS-FORUM (of IISc) which discusses the topics of interest to the librarians have been set up on the BBS. For LIS professionals, Public-Access Computer Systems Review and Current Cites give the latest information on the use of technology in L&ICs.

At present, thousands of bulletin boards covering a number of subject fields and subfields are available over the Net. The multiplicity of the BBS, discussion groups, newsgroups and others resulted in the development of searching programmes such as Archie, Gopher and Veronica to facilitate locating the required information with ease.

Many discussion lists are available specially for LIS Professionals. The Special Libraries Association, The American Library Association, and other associations support electronic conferences. Some discussion lists provide hundreds of abstracts in the subject field on a daily basis. These groups are helpful when one wants to locate, say, an important document which is out of print. These facilitate both for getting information and also supplying to others when needed.

5. NETWORK NEWSGROUPS

Another application is the establishment of newsgroups. A number of Usenet newsgroups are available over internet. There are 18 hierarchies (7 mainstream and 11 alternative) under which over 2300 newsgroups are functioning (in 1994) in various subject fields like, computers (526 groups), science (87), social sciences (97), recreation (295), etc. While mainstream hierarchical groups are created after a well-defined deliberative process, in the case of alternative hierarchical groups, it is not so. This resulted in many exotic groups in the latter hierarchy. All these have no charges for accessing. However, the 'clari' hierarchy of Clarinet having 239 newsgroups and containing news (as in a daily) can be accessible through subscription only. The information for clari is collected from various sources, edited and repackaged to suit Usenet format and is made available over Internet (Hahn, 1994). The customizable news services like Custom Clips, Farcast, Internet News Alert, NewsHound, Journalist, HeadsUp, etc provide only that news which is important and filter the noise to rescue the user from information overloading. These carry subscription charges and connect hour charges also (Muchmore, 1996).

6. ELECTRONIC/ONLINE JOURNALS

An electronic journal is defined (McMillan, 1991) as any serial produced, published and distributed nationally or internationally via electronic networks such as Bitnet and the Internet. Electronic journal is different from an online journal (Langschieb, 1992). The latter are the electronic counterparts of journals in print. The usage, impact and implications of electronic publishing and online journals on L&ICs has been discussed by Lakshmana Moorthy & Karisiddappa (1996).

Internet developments related to the publishing of scholarly journals and L&ICs include the increase in publishing of electronic and online journals and other primary sources of information like preprints and technical reports, and access to table of contents of journals and full document delivery. Several journals are available online on the Net. Some journals like the Journal of Universal Computer Science, Electronics Letters Online, Online Journal of Knowledge Synthesis in Nursing, and Current Clinical Trials have no print equivalents and are available only on the Net. The number of journals available 'online only' are increasing day by day.

There is a well-established system for distribution and provision of access to abstracts and full texts of preprints and technical reports in the areas of physics, mathematics and computer science in the academic community around the world. Services like 'Uncover' of Blackwell and 'Contents First' of OCLC offers Internet access to table of contents of several thousand journals, followed by online ordering of papers. Institutions have begun to take such services into account while planning their acquisitions, particularly journal subscriptions.

Major publishers like American Chemical Society, Institute of Physics Publishing, Blackwell Scientific, Springer-Verlag, Meckler, and Elsevier are offering their journals on Internet and OCLC. Professional associations like the Association of Computing Machinery have nodes on Internet. These offer mail forwarding accounts for their members at competitive rates.

Electronic Letters Online of the Institution of Electrical Engineers (UK) and all the eleven titles of IEE Proceedings are available over Internet along with many other scientific electronic journals through OCLC's Electronic Journals Office (EJO) system. These are accessed through the graphical interface GUIDON of the OCLC and using the NetScape and Mosaic browsers.

Starting from 1996, the Institute of Physics Publishing of USA started issuing all its 31 journals in both printed and online (electronic) form. The online journals are available, along with the printed version, to the subscribing institutions on WWW at no extra cost. This has speeded up the dissemination/delivery of the primary journals by three weeks. The Scientist, the bi-weekly newsletter of the Institute for Scientific Information is also available online.

McGraw-Hill is offering electronic version of its *Business Week* on America Online which has attracted new readers. As per one estimate, it receives over half a million clicks on its pages every week and each 'click' generates revenue. This 'feedback' enabled editors to analyse and feel the pulse of the readers' interest to revise content (The Economic Times, 1995). Penthouse magazine of USA on Internet attracts about 2 million clicks daily, a record on the Web. Readers are allowed to comment through an interactive message board appearing at the end of the feature.

Now there are over 400 daily newspapers, 800 magazines, 1500 newsletters and other products are available, online via communication networks and the Internet. In 1995, the Association of Research Libraries brought out a Directory of electronic journals, magazines, newsletters and academic discussion lists and the updates are being announced in the NewJour on the Internet. this is a useful tool for identifying an electronic publication of interest.

Internet and OCLC Online Computer Library Centre

OCLC is a pioneering agency striving to provide access to online journals over Internet. Through its EJO service, OCLC offers peer-reviewed journals online over Internet. The electronic publication programme of OCLC started in July 1992 with the introduction of *The Online Journal of Current Clinical Trials* in association with the American Association for the Advancement in Science. This is the first scholarly peer-reviewed journal made available in the online environment (Dykhuis, 1994). This was followed by *The Online Journal of Knowledge Synthesis in Nursing* and *Electronics Letters Online* (September 1993).

First Search Information System of OCLC is now available on Internet/WWW. Using Web browsers like Mosaic and Netscape through FirstSearch, users have access to a world of information on topics including arts and humanities, business and economy, conferences and proceedings, education and training, engineering and technology, general and life sciences, medicine and health, general reference sources, social sciences, and news and current affairs. The member libraries of OCLC are rapidly increasing their use of Internet and the WWW. Approximately 85 per cent of FirstSearch usage is on Internet.

Subscribers can browse the contents of the online journals or search the entire collection by a variety of indexes, Boolean operators and proximity indicators. The Windows-based software Guidon of OCLC provides both colour and graphical images and equations along with the text (OCLC Newsletter, 1995).

8. SCHOLARLY PUBLISHING

Scholarly publishing on WWW and the Internet is on the increase. Though very insignificant portion

of the world's publicly available data is contained in the Web and Internet (a fraction of one per cent), it is estimated that in the next five to six years it would be increasing thousand fold and may hold about 80 per cent of the publicly available data (quoted in Cronin & McKim, 1996). Institute for Scientific Information, USA recently announced the inclusion of some titles available on Internet for indexing and coverage in its databases. However, there are a number of problems associated with electronic scholarly publishing (see Lakshmana Moorthy & Karisiddappa, 1996) which are to be addressed. A detailed discussion of the scholarly publishing on WWW can be found else where (OCLC, 1995). The various problems associated with scholarly publishing over Internet such as cost, conviviality and convenience, novelty, community, and legitimacy are discussed by Cronin & McKim (1996).

Further, the vulnerability of electronic data which is amenable for manipulations, poses the problems of authenticity and reliability of electronic information. Already a few cases of plagiarism have been reported (Denning, 1991), wherein certain individuals have plagiarised already published material by manipulating the 'electronic papers'. Although mechanisms to prevent such fraudulent acts of information from digital libraries are being introduced (for example, SCAM—Stanford Copy Analysis Mechanism), such incidents may become common as it is very difficult to detect such acts. However, the rate of progress depends upon several factors such as user acceptance, economics, commitment to established products and services and also the pace of technological advances.

9. ELECTRONIC COMMERCE

The Internet has brought a new concept called electronic commerce, in the marketing and business. Electronic commerce has been, perhaps, one of the most impressive benefits of Internet which made the institutions, industries, individual professionals having expertise in various fields and commercial organisations joining Internet in a big way contributing to the Internet information resources and also gaining by way of increased marketability of their products, services and expertise.

As per a recent report published in the Economic Times, the value of Internet commerce was US\$ 18 million in 1994 and US\$ 436 million in 1995. The report also estimated the 1996 value at US\$ 2.9 billion which is expected to reach US\$ 150 billions by the turn of the century. The Web-based revenues for the year 1996 was estimated to be US\$ 70 million and by the year 2000 this is expected to reach US\$ 2 billion (Brand Equity, 1996). With more than 100,000 Web sites doubling every two and half months, 23,540 companies, 370 online shopping malls (O'Kane, 1996) and over 50 million users the Net can make a lot of difference in the business world. Whereas in the conventional commerce the advertiser goes to the consumer, in the Net commerce the latter goes to the former.

This explains the high advertisement tariffs the magazines like Playboy (~800,000 clicks a day with an ad rate of US\$ 50,000 per quarter) and Hotwired Cyberstation (US\$ 30,000 per 8 weeks). An electronic-only news paper on the Web, The Nando Times receives 5.5 million accesses (clicks) daily (Sussman & Pollack, 1995). It was reported that the electronic products account for 35 per cent of the McGraw-Hill's total revenues (The Economic Times, 1995).

The Internet will continue to have an important role in electronic commerce including online ordering by libraries. Books and journals can be ordered through Web-based ordering systems or through EDI on the Internet. Electronic commerce is an exciting area where individuals also have a major role to play. The individuals could be the professionals offering consultancy in their areas of expertise or they could be the public at large who wish to utilise the various resources available on the Internet.

Publishing industry is already exploiting the Internet by way of offering online journals, table of contents of journals, and catalogues of books and products over Internet. Well-known bookstores around the world are offering their holdings over Internet. It is possible to order a book from, say, Blackwell (<http://www.blackwell.co.uk/bookshops>), which maintains a database of over 150,000 active titles. Bookwire (<http://www.bookwire.com>) has links to 150 booksellers and over 200 publishers to select publications and to order. Of particular importance to librarians is the Acqweb, a Web site intended for library acquisitions (see Barber, 1995 for a detailed discussion of Internet book ordering). Many sites of publishers tell the user about the books recently published, book reviews, electronic books, rare book dealers mailing list, reviews of new books and fiction, etc. Many well known (and also obscure) books are available free of charge for downloading from Online Book Initiative, a Gopher site (world.std.com).

These developments have resulted in two types of electronic payments through (a) credit-based

payment system with players like MasterCard/NetScape and VISA/MicroSoft, and (b) debit-based payment systems. Examples of the former include CyberCash (<http://www.cybercash.com>); and First Virtual Holdings (<http://www.fv.com>); and the latter include DigiCash's E-cash (<http://www.digicash.com>) which provides privacy of transactions and Mondex (<http://www.mondex.com>). Many online business organisations (around 100 now) accept electronic payments (Barber, 1995). The perils, pitfalls and experience of the First Virtual Holdings of practical cybercommerce has been discussed by Borenstein (1966). A detailed discussion of electronic fund transfer including DigiCash and E-cash has been presented by Panurach (1996).

10. INDIA AND INTERNET

The 'Internet fever' is slowly spreading in India also. Internet access is provided by networks including ERNET, NICNET, VSNL (through Gateway Internet Access Service—GIAS), CMC, and I-NET from public sector and SPRINT/RPG, BI Infotech, Datapro, UUNET, etc from private sector. However, ERNET, funded by UNDP, is facing an uncertain future. NICNET established the first WWW server in India allows users access to browsing tools like Mosaic and Cello, searching, display, publishing, Telnet, FTP, WAIS, Gopher and Hytelnet. The National Informatics Centre was to establish 30 Web servers all over India by July 1995 (Subramaniam & Gupta, 1995). However, there are only four Web servers available at present (personal communication with NIC). At present, NICNET is a prime agency providing Internet services. NIC proposes to provide access to about 15,000 medical, academic, R&D institutions and organisations. About 35 Indian Web Servers are listed by Wolinsky (1996).

Some Indian computer and business magazines are available on Internet; a few institutions like NCSI, IISc and banks like SBI have home pages on Internet. The trend is on the increase. For example, *Business India* magazine is accessible over Internet for about a year now (Pande, 1995). *Filmfare* (<http://www.filmfare.com>), *India Today* and *Express Computer* magazines are also available online on Internet. The international edition of *The Hindu* is available on the Web (<http://www.webpage.com/hindu>). Computer magazines like *Dataquest*, *PC Quest*, and *Voice and Data* are available to users around the world via *India World*, a Web site in Sandiego, USA. The latter is an electronic magazine having arrangements with several Indian publishers and companies for providing information with a subscription fee of US\$ 20 (<http://www.indiaworld.com>).

Internet developments have major implications in our country related to information access and supply. When L&ICs have Internet connectivity, they can tune their acquisitions keeping in view what is accessible through international networks. Also, such a connectivity, once in place, could be used for developing and offering services, both for domestic and international customers. However, the decentralised nature of the Internet, the WWW, and the lack of direct control of any participating host/network makes it impossible to provide the users with the same end-to-end network support that the users may get when subscribing to a network like NICNET, ERNET, SPRINT/RPG, etc.

Although the Internet boasts of reaching 160 countries, there is not much to be happy about its impact on developing countries. The balance is heavily tilted towards developed countries; very few nodes with inadequate infrastructure and unreliable telecommunication links are available in the developing countries. It is well established that the telephone infrastructure is synonymous with economic strength; poor infrastructure undoubtedly results in obstructing the economic growth. In a study undertaken in 1994, it was found that the computer nodes were strongly associated with per capita income. Of the 9,10,149 Internet connections in 1992, about 97 per cent were located in developed countries; about 65 per cent in USA alone followed by other wealthy countries of OECD. For her entire population of about 86 million, India had a mere 6 nodes. (Jacobson, 1994). Currently, the Internet usage in India amply makes it clear that the connectivity to the Net is available in Government and financially strong research institutions only. It will take a few more years before Internet and global network access technologies become easily available to all libraries in the country.

11. CURRENT STATUS OF NETWORKS IN THE COUNTRY

As bibliographic networks provide the access to the Internet for the L&ICs, it may not be out of place to recall the networking activities taking place in the country. The 1990s have witnessed renewed interest in the planning, development and establishment of library networks in India. Keen interest has been shown by the library professionals as well as policy and decision makers in the activities of library automation, database development and networking. One major development is the establishment of metropolitan library networks like DELNET, CALIBNET, ADINET, etc.; the national bibliographic information networks like IN-

FLIBNET, BTIS, NICNET and the establishment of computer communications networks like ERNET, NICMAIL/RENNIC which can also be used for transmission of bibliographic information. NISSAT of the Dept of Scientific and Industrial Research has been the backbone and the supporting agency for promoting the metropolitan networks like ADINET, BALNET, BONET, CALIBNET, DELNET, MYLIBNET and PUNENET, while the University Grants Commission has been promoting the INFLIBNET (see ref. 12 for a brief discussion of metropolitan networks like ADINET, BONET, CALIBNET, DELNET, and also the INFLIBNET).

While many libraries in the country have started efforts to create databases of their holdings, networking of these databases is yet to take shape. The library networks in the country are expected to play an increasingly important role in providing access to both indigenous and outside databases. Also, with the e-mail facility they are expected to provide users connectivity to communicate with remotely located people. However, to have Internet linking they are expected to subscribe to NICNET, ERNET or any other such public or private network. The participating L&ICs of the metropolitan networks and the INFLIBNET will be over 600 and when all these access and utilise the Internet resources, it would have a tremendous impact on the document acquisition, resource sharing, document delivery and information dissemination activities in the country.

12. CONCLUSION

Internet is changing the notion library as a closed place into a virtual library, i.e., a library without walls. Even public libraries like Atlanta-Fulton Public Library of USA are offering Internet access to the users including electronic reference service and remote log-in by dial-up (Agnew, 1996). Internet commerce is growing at a breakneck speed. Many constraints like institutional hurdles, government regulations, technological limitations, insecurity over anonymous payments, reluctance of financial institutions to adopt new technologies, are to be overcome before the cybercommerce is accepted. However, the usage of Internet will have a positive impact on the way the information is generated, processed, stored, retrieved and disseminated. The availability of e-mail and file transfer capabilities are expected to improve the dissemination of the information across the continents.

The day is not too far when one may be navigating through a favourite magazine or a primary periodical on Internet. The only hindrance to it comes from the computer display resolution technology and the size of the VDU. These make the electronic book reading or viewing a tedious option to the conventional book reading. This calls for development of reader-friendly VDUs for achieving the limitless usage of Internet resources.

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