

COPYRIGHT ISSUES IN DIGITAL ENVIRONMENT

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1. INTRODUCTION

Developed countries realized that technology is a crucial element in foreign investment and also a key to the rapid expansion of trade and services. As a result these countries have made legal provisions to protect intellectual property rights (IPRs). Several countries moved for inclusion of IPRs in the General Agreement on Tariff and Trade (GATT). Although developing countries offered stiff resistance, the IPRs were included in the World Trade Organization (WTO) Agreement under Trade Related Intellectual Property Rights (TRIPS). Naturally, the IPRs are perceived as an imposition of technologically strong countries and there exists a considerable disagreement between the developed and developing countries (haves and have-nots) on many issues of IPRs. The World Intellectual Property Organization (WIPO), the TRIPS, the GATT, and the various other organizations are creating an environment conducive for the export of intellectual property from the technology-rich countries to the developing and technology-poor nations. The reality is, even the developed countries, when they were in the category of developing countries, have not respected the copyright interests of authors other than their own. *This is true even in the case of the United States, from where Charles Dickens could not get anything out of the publication of his works, when the country was a net importer of intellectual property.* Of late the developing countries are also catching up with this trend as the value of IPRs is increasingly felt.

Copyright-related aspects include printing, paper, advertising, newspapers, etc. In totality, copyright-related industry is contributing significantly to the gross national product (GNP) and to the economies of nations. Book publishing is a multibillion-dollar industry dominated by the developed countries like US, UK, Germany and France that among them account for more than 50% of the book exports. The contribution of the book publishing industry to the GNP ranges from 3.2 per cent (Australia) to 5.8 per cent (USA); it is 5.06 per cent for India. The employment generated by this industry is also quite significant (roughly about 3 per cent in developing countries) (Alikhan and Mashelkar, 2004). India is the biggest producer of films, third (after USA and UK) in the publication of books in English, fifth in terms of volume of music recorded and is among the top 10 countries in computer software. The annual loss world over from piracy of books, music, films and software runs to billions of dollars. For example, in 2002, the US trade losses due to copyright-related piracy was estimated at US\$ 9208 billion (Eskicioglu, 2003); in 2003 India suffered a loss of Rs 350 crore due to piracy of films and video records (for US, the loss was US\$ 3.5 billions). In 2001 the Indian music industry suffered an estimated loss of Rs 6073 crore while world lost US\$ 4.3 billions (Parth and Varma, 2002, and Movies, 2004).

2. COPYRIGHT IN DIGITAL ENVIRONMENT

During the past few years, there was a quantum jump in the digital information resources made available through networks, particularly over the Internet and the Web. Publishers of scholarly, academic and reference works from almost all fields of human knowledge started bringing them in digital form. Many publications, especially periodicals, are brought out both on paper and digital versions while some are brought out in electronic version only. The libraries in science, technology as well as in academic fields are increasingly depending upon on electronic resources.

Digital environment makes the copyright protection a difficult task. A number of issues and concerns are associated with the usage of digital information. It is easy to create digital or digitized copies of material including text, photographs, music and video. The digital

information can be distributed across the globe through electronic mail, electronic bulletin boards and networks. The proliferation of personal computers and the decreasing costs of primary and secondary mass storage media all made it possible to download, store, display and print. Further, the downloaded documents can be forwarded to others without the knowledge of its rightful owner. In comparison to printed information, electronic information is not so permanent; it is highly vulnerable to manipulations, deletions, revisions and modifications without leaving any resemblance to the original. Unlike the case of printed journals, close monitoring and restriction of usage of digital documents is difficult. Many authors addressed various problems faced by the libraries in the digital/virtual library environment (for example, Chepesiuk, 1997; Collins and Berge, 1994; Crawford, 1998; Jasperse, 1994; Lakshmana Moorthy and Karisiddappa, 1996 1997, 1998a and 1998b; Lynch, 1994; Perryman, 1994; Sasse and Winkler, 1993; von Ungern-Stenberg and Lindquist, 1995; etc). Denning (1995) reported a few cases of plagiarism of digital material. Lynch (1994) suggested solutions like dedicated server, document digest algorithms, and cryptographic signatures to overcome some of these problems. Although efforts have been made to prevent fraudulent acts in digital library environment, infringements are becoming quite common due to difficulties in their detection.

2.1 Copyright Issues in Web Environment

As the existing fair use is applicable only to printed works, browsing of digital work (especially photographs) amounts to infringement. It is impossible to ascertain the usefulness of a digital document without browsing. If potential users of a digital document are expected to pay a fee for browsing, then they must be in a position to determine, in advance, the usefulness of the document and the fee. This is one of the most important issues that concern the users and librarians alike. In case of printed publications no additional charges are involved even if they are consulted by multiple number of users on a multiple number of occasions. But subscription to online or e-journals involves additional 'fee' in the form of platform fee, multi-user fee, password fee, etc which is not justified. For the benefit of rights owners and bona fide users, it is suggested to have simple fee structure.

Copyright applies to Internet; e-mail messages, material loaded on ftp sites, or www servers or anything else put up on Internet, are copyright protected so long as they fulfill the originality criterion. Access to e-mail by anyone other than those for whom it is meant, is infringement. However, Internet URLs, e-mail addresses, are facts so there is no copyright and can be copied. However, compilations of addresses, high-end indexes like Yahoo! and FAQ collections are protected by copyright (Oppenheim, 2000). There have been many cases of copyright infringements including distribution of copyright material, using Internet (for example, Napster and Online Guitar Archive). One issue related to the Internet era is the applicability of copyright when more than two countries are involved. In the case of print media, if an Indian work is published in the US and is copied in the UK, then the copyright law of UK will be applicable to the violation. However, if an Indian gives instructions to the computer server in US to download software from a UK website the same is not applicable. Cases of cyber frauds including cyber stalking, cyber hacking, cyber defamation through e-mails, cyber harassment, cyber terrorism, and cyber war are being increasingly reported in the media. Disputes dealing with same trademark and domain names and copyright protection for Websites have also been reported.

Internet is creating new and newer avenues for rights and consumer privacy violations. The world over, many cyber frauds are taken to courts (see, for example, Duggal, 2001 to 2005; Oppenheim and Turner, 1999; and Turnbull, 2001). This trend will increase in future. The growth of Internet is phenomenal. While in developing countries the number of hosts and users is increasing at high rates, developed countries are also registering increase in these areas. The millions of e-mails sent and the millions of web pages is mind-boggling. In practice it is rather difficult to impose copyright law on Internet users. In most of the copyright violations on Internet, the owner may be unaware of it or the infringer may be difficult to identify. Further,

most of the copying over Internet does not qualify under exceptions (i.e., 'fair dealing' in UK, 'fair use' in US and India, 'private copying' in European countries). Some of the copyright laws do not clearly distinguish electronic information from print media (for example UK and India) and so the fair dealing laws are not applicable to the digital environment. As the nature of the print and electronic media differ so must be the laws governing them.

Copyright forbids storing of a work in electronic medium (even for private use) and electronic transmission of copyrighted material by anyone other than the copyright owner is an infringement. In case a user of an online service violates copyright provisions, the service provider is held responsible unless he complies with safety measures to protect rights. Under this provision, Napster, a popular Internet music-swapping service that enables Internet users to share music files stored in their computer hard disks, was asked to comply with the law. Although the service was seen initially as a recreational one, the after effects were felt by the music industry once it became popular (25 million users in just over one year of its existence) and helping swap copyrighted material across the continents. Its impact on the Internet has been profound. Ultimately, Napster agreed to comply with the Court's injunction to prevent users swapping copyrighted material using its utility. Also, digitized documents, especially the multimedia products, are prone to rights violations.

2.2 Copyright Concerns in Cyberspace

Existing copyright laws have not caught up with the technological developments in cyberspace. Many a time there is no clarity whether the content of digital resources is free or priced. Although the copyright statements appear in many cases, they are elusive to locate in some cases. It can be argued that publishers of promotional, advertising and marketing material on the Web implicitly encourage downloading, printing and copying the material for redistribution to more than one in the same organisation (Ardito and Eiblum, 1998). However, one can see copyright notices on advertising and marketing material confusing the situation.

Many electronic papers on Internet allow personal and fair use; many more lack explicit statements if they are free or priced. One cannot forward free electronic resources available on Internet to colleagues and friends or through listservs. It is a copyright violation to e-mail a Web page by an intermediary to a colleague or a user strictly for information sake and even no financial gain is involved. In these circumstances, the user can only provide information about the URL where the piece of information appears; this restricts the availability of information to those having access to Internet which is against the principle of fair use. Even downloading e-mail is an offence under the new copyright regimes (Rosenoer, 1997).

2.3 Infringements in Cyber Commerce

Cyber commerce offers new ways of buying and selling for vendors as well as customers (users). The inexpensive and world-wide access to Internet available to business, public and private institutions and the general public coupled with the inherent weaknesses of the traditional paper-based transactions and payments made e-commerce an exciting opportunity. It offers cost and time saving through electronic data interchange, electronic fund transfers, online ordering and just-in-time delivery of goods/services. The growing value of Internet commerce is a testimony to its popularity. But lack of integrity and security leads to a loss of billions of dollars due to skilful counterfeiting, fraudulent replication of cheques and compromising credit card numbers.

In the process of e-commerce, information sent by users/customers can easily be scanned by clever hackers, eavesdroppers, system administrators or regular users while the mail passes through intermediaries before reaching destination. It would be easy to operate an automatic computer programme to collect credit card information which could be used for ulterior purposes including impersonating others (Schneider, 1997, p. 275). While sporadic usage of encryption of messages by users may arouse suspicion, its widespread use would

ensure security. A Consumer Protection Act for Digital Products has been proposed in USA to support e-commerce and to control the increasing abuse and lack of security over information highways (Hampel, 1996).

2.4 Security of Information Over Networks

Apart from Internet, there are many national, regional and the local area networks and intranets and extranets. Millions of people are hooked these networks. Most of the content distributed over the networks is copyrighted or is under some sort of contractual licensing. Although some recognize copyrighted material, they tend to think that non-commercial distribution is fair use and that it does not amount to rights violation. This leaves the network administrators in a tight spot over the liability of such infringements. Content liability (as to who will own responsibility) for the access of the seditious, and violent material accessed by users is an important issue, especially in the face of rising terrorism.

It is easy to create digital or digitized copies of text, photographs, music and video. Further, digital information is highly vulnerable to manipulations like additions, deletions, etc resulting in plagiarism. A digital document can potentially replace all printed copies in a networked environment and can be accessed by multiple users simultaneously. Remote access and downloading can virtually make one single document enough for all the libraries and users of the network. The most popular way to protect rights and provide secure access to electronic journals over networks such as Internet is through the usage of passwords. Many electronic journal publishers and vendors use this time-tested (by database vendors) mechanism. The Security and Rights Management System of ISI Electronic Library Project (Anderson and Lotspiech, 1995) employs password for providing secure viewing at the client level and digitally signed fingerprints for authenticity. Blackwell offers Electronic Journal Navigator service and allows subscribers/end-users log on and browse journals regardless of the storage format or location. The access is through user name and password. Elsevier Science introduced ScienceDirect service, a full text electronic information resource service of nearly 1700 journals, which also is operated through user name and password.

Many technologies have been developed for protecting the copyright of electronic information for delivering electronic information to users in a network environment. Many academic institutions and publishers have undertaken projects to develop electronic copyright management systems. These include Performing Arts Teaching Resources Online (Patron) at the University of Surrey, Electronic Reserve Copyright Management System (Ercoms) of De Montford University, and the Electronic Library and Information Retrieval Online Project (ELINOR) of Milton Keynes (all from UK); Project Cited of the European Commission; (Hoffmann, *et al.* 1993) TM Service of Bell Laboratories, TULIP of Elsevier, Security and Rights Management System of the ISI, and OCLC and Copyright Clearance Centre (all from USA) (for a brief description of some of these, see Lakshmana Moorthy and Karisiddappa, 1996, 1997 and 1998b). Security of information in a network environment involves three aspects, viz. authentication, that is, knowledge of the identity of sender to the receiver (and vice versa); confidentiality, that is, the message sent has not been intercepted by a third person; and integrity that the message is not tampered during transmission.

2.5 Databases

Database can be defined as a collection of works, data, or material arranged in a systematic and methodical way and capable of being accessed by electronic or other means. It includes materials necessary for the operation and consultation of a database such as an index. A database may contain information relating to names and addresses of clients or subscribers such as telephone directories, yellow pages, address lists, etc; a list of bibliographic references; full text of documents or periodicals such as patents or full-text databases; documents with mixed text and graphics such as multimedia directories, works); or

a compilation of drawings such as engineering and architectural drawings. The creator/developer of the database is generally treated as its author.

Bibliographic databases contain abstracts of already published articles or documents that are mostly copyrighted material. If these abstracts are short and condensed, report the facts in and do not substitute the original articles, there can be no infringement of rights. If, on the other hand, the abstracts act as substitutes to original text by reproducing them, then they are likely to be treated as copyright violation. In other words, abstracts should be surrogates leading the readers to the original articles to avoid copyright infringement.

The data or material included in a database is not copyrightable. The originality and intellectual work in databases include the content selection, internal coordination between the structural elements, the arrangement of all elements of a database, and the contents itself. By running a computer programme on one or more databases, a new database can be created. The computer-generated database thus created can be treated as original only if there exists sufficient skill and judgment in the new database. Although the contents of the constituent items are not original, because a reasonable amount of judgment in the selection of items has been used in creating it, the newly created database can be considered as compilation or directory for the purposes of copyright.

Berne Convention, WIPO Copyright Treaty, TRIPS Agreement of WTO and the GATT Agreement provide protection of computer software and databases. The Indian and UK laws extend the copyright protection to computer databases, treating them as literary works. The EU Directive on Legal Protection of Databases extends protection to the structure of the database and covers non-electronic (printed) databases also. It also enables a database owner to forbid or control the extraction or re-use of material taken from a database. Under the US Copyright Law, compilations of pre-existing material or data are non-copyrightable; copyright for databases is provided under collective and derivative works. In many countries, copyright rules are applicable to computer databases and are treated as compilations. Besides international agreements and copyright laws, the databases are also protected under contracts and licensing agreements between the owner of the database and the subscriber as well as protection through technological means such as hardware and software locks or dongles, electronic copyright management systems, digital signatures and watermarks and so on (Gupta, 1999).

Many database producers and vendors allow users download a portion of the database on to a 'temporary file' for research purposes under fair use principle. However, there are no clear-cut guidelines as to how much data can be downloaded at a time. In the case of printed documents, depending upon the size of the original, up to 5-10 per cent of the original document or a chapter can be photocopied under fair use. The same fair use principle cannot be applied in the case of databases, as even 5 per cent material would be voluminous when cumulative and large databases are used. And, when such downloading is made regularly over a period, say 2-3 years, then the resulting database would be considerably large. Such issues would become more frequent since users would like to keep the useful downloaded data in their personal library, much the same way they retain and maintain photocopies of articles in areas of their interest for re-use. Most of the CD-ROM databases are used in providing SDI services to the institution's research community. Sometimes, downloaded data against an SDI profile is sent by e-mail to save time. This is illegal as transmission of electronic information over communication networks is an infringement of copyright and is prohibited by all database owners.

2.6 Multimedia Works

Digital multimedia works, music, photographs etc. have proliferated in the last decade creating immense opportunities for the content creators, publishers, distributors and consumers. The advantages of digital media are many: Storage and manipulation, instant and

inexpensive distribution, and flexibility to customize the media as per the requirements of the users. Multimedia works are also prone to the infringement of copyright, as the increasing availability of high bandwidth networks makes it too easy to illegally duplicate and disseminate these documents without any loss of quality. Legislations by various nations do not clearly address the legal status of multimedia works. These works, though not explicitly, are covered and classified under audio-visual works by the USA, UK and Indian laws.

When multimedia works are commissioned under contract, they are treated as works made for hire where the copyright owner will be the person/institution who commissioned the work. However, mere payment for the work does not amount to ownership unless it is clearly distinguished in writing as work made under contract. This also applies to software developed by another sub-contractor as a part of a multimedia work. As it provides a cost-effective medium for dissemination many creators use the Web for publishing animation, images, video and music. With the increasing popularity of hypertext-based Web, the possibility of illegally obtaining the multimedia data is growing. This prevents the owners of multimedia works from releasing their proprietary information without proper security and rights management benefits.

Extensive research has been carried out for security of multimedia content over the networks (see for example, Cox, *et.al.* 1997; SPIE, 1999 & 2000; and Wong and Delp, 2000). The growth of networked multimedia calls for image copyright protection. This is achieved using signal processing, data compression, encryption and system level security protection. Another way is the incorporation of an invisible watermark (or a digital signature). However, it is easily identified by a computer programme, which decodes the key used to affix the watermark in a particular location on a page or part of the document and retrieves it. These invisible watermarks are of two types: those that are destroyed when subjected to manipulations and those that cannot be destroyed (Garofalakis, *et. al.*, 1997). Usage of watermarks can identify (a) the legal owner of the multimedia work, (b) the recipient of an authorized single user copy, and (c) when the multimedia work is modified or tampered (Civanlar and Reibman, 1997). The Multimedia Protection Protocol is another convenient way of ensuring IPR for all types of digital data (Rump, 1997). Wolfgang and Delf (1996) described two techniques of invisible watermarking of multimedia images, which can detect all but the minutest changes in the image.

3. TECHNOLOGIES FOR RIGHTS PROTECTION

Digital Rights Management (DRM) and Electronic Rights Management Systems ensure copyright through identifying and protecting the content, controlling access and use of the work, protecting the integrity of the work and ensuring payment for the access. These use one or more of the following technologies to ensure access to bona fide have users only. DRM technologies prevent illegal users in accessing the content. DRM technologies incorporate accessibility conditions, encryption, securing content distribution over networks, controlling permissions, tracking transaction and usage of content. There are many ways of charging the content (one time purchase, annual subscription, pay per use, etc).

The content protection is achieved by employing digital watermarking and finger printing, cryptographic keys and through tamper resistant hardware and software. Access is protected through user ID and password, licensing agreements and cryptographic scrambling. The content use is controlled through disabling printing and downloading options, copying only a porting of the work, copying specified number of times (through copy generation management systems), and disabling second generation copying from the first copy (from the original). The integrity of the work is ensured through scanned images, digital watermarking, encryption, digital signature, etc. Technical Protection Measures (TPM) are technologies that allow music, publishing and video companies to secure and protect content such as music, text and video from unauthorized use. They disallow copying and possible other uses of digital files, either by electronic marking and tagging or by encryption thereby making them

unreadable. These technologies control access to content. If an author wishes to collect fee for use of his or her work, then DRM technology can be used. In e-commerce, the TPM and DRM technologies are increasingly employed to sell and distribute content over the Internet.

Many technologies have been developed for the protection of copyrighted material from the infringements. These include cryptography, digital watermarking, digital signatures and electronic tagging. In the digital music area, Secure Digital Music Initiative and Content Scrambler System for DVDs have been developed to discourage infringements and to protect them from illegal copying. Some of these are discussed briefly here.

3.1 Cryptography

Cryptography is the oldest mechanism employed to ensure security and privacy of information over networks. Cryptography has been in use for protection of intellectual property rights. It is a common practice to scramble the cable and satellite television signals to prevent unauthorized viewing. This involves scrambling (or encryption) of the information to render it unreadable or not understandable language which only the legitimate user can unscramble (or decrypt). This is a common technique to protect confidential information from eavesdropping, preventing computer viruses and illegal copying of software etc. However cryptography protects the work during transmission or distribution only. After the work is decrypted, it does not provided any protection. Another method is employment of encryption protocols wherein the document server encodes, encrypts, compresses and sends to a registered user, where the software supplied by the network service provider decrypts and displays on the user's terminal.

3.2 Digital Watermark Technology

Digital watermarking technology complements cryptography in that it embeds imperceptible signals in a document or message and the content can vary accordingly. A digital watermark is a digital signal or pattern inserted into a digital document. It is similar to the electronic on-screen logos used by TV channels. A unique identifier can be used to identify the work or the message might contain information regarding ownership, sender, recipient, etc. or information about copyright permission and a system consists of watermark generator and embedder, and a watermark detector decoder. This technique enables protection of ownership rights of digital information. Unlike encryption, which warrants file transformation making it not understandable unless encrypted, digital watermarking leaves the original document intact and viewable. These watermarks persist during viewing, printing or re-transmitting, thereby establishing ownership. When an illegal copy bears watermark, the source of the piracy can be established. The legal user can remove these watermarks with a predetermined algorithm. This technology is different from digital finger printing technology. A detailed discussion of watermark embedding can be seen elsewhere (Barni, 2001; Decker, 2001; Martin and Kutter, 2001).

Apart from authentication, detection of unauthorized source of legal copies, the visible watermark also helps in discouraging illegal copying. The visible watermark uses a barcode on the first page of each article. Two types of watermarks are added to discourage unauthorized copying: one hidden in the image file of each page of the electronic article, and the other, a visible watermark encoding one Kbyte information in a two-dimensional barcode placed on the first page of each article. The illegal copies will not have the barcode, which means that copyright infringement has taken place.

Invisible watermarks can also perform these tasks. Two types of invisible watermarks are in use viz. those that are destroyed when subjected to manipulations and those that cannot be destroyed. Some invisible watermarks of multimedia images can detect even the minutest changes in the image. When an illegal copy bears watermark, the source of the piracy can be established. The Security and Rights Management System employs encryption

and watermarks for secure printing, guarantees document authenticity by means of a digitally signed fingerprint.

The watermarking technology is extensively used in protecting multimedia works. Digital watermarking technology ensures only lawful image and audio files are used, thus protecting against copyright infringement and so is helpful for the Webmasters. When combined with new tracking services offered by some companies that provide the watermarking technology, copyright owners can find all illegal copies of their works on Internet and take legal action. Argent, Cognicity, Copysight, EIKONAmark, Giovanni, JK_PGS, Musicode, Digimarc, PixelTag, StirMark, SureSign, SysCoP, unZign, etc are some of the watermarking tools available in the market place for the purpose (Roy, 1999). A detailed account of watermarking technology including counterfeiting schemes is discussed elsewhere (Berghel, 1997).

3.3 Digital Signature Technology

Digital signature includes the identity of sender (and receiver), date, time, any unique code etc. and can be added to digital products. This digitally marks and binds a software product for transferring to a specified customer. The Security and Rights Management System of ISI Electronic Library Project employs digitally signed fingerprint to guarantee document authenticity.

3.4 Electronic Marking

The electronic marking and identification technique can be employed to distribute electronic information over networks at the same time discouraging illegal copying. In this technique, a unique and indiscernible mark is automatically generated by the system and put on each of the document copies. The system also registers the recipient of an illegally copied document. It is difficult for an illegal user to find the unique marking pattern in the user's document. This technique can be used to protect copyright, IPRs and in electronic publishing where documents are printed, copied or faxed.

4. ISSUES AND CONCERNS OF LIBRARIANS

A number of issues and concerns are associated with the usage of digital information. These include issue of single articles versus full issues of e-journals, user-friendliness, incompatible hardware and software, formatting, graphics, scholarly recognition, and obsolescence. Some of the problems concerning libraries, librarians, and users like perpetual dependency, societal rights, pricing, ownership and repeated usage are briefly discussed here.

4.1 Perpetual Dependency

In the case of printed publications, library procures (*hence owns*) and issues them to its users as many number of times as required. In some cases, the publication is lent to other libraries on inter-library loan. But in the case of digital resources, the same is becoming infringement. For example, a CD-ROM publication cannot be lent out on inter-library loan. Initially, the libraries required returning the old CD-ROMs to the supplier when a new CD-ROM is received; this posed Audit problems. Further the time-lock in CD-ROM installation software renders it unusable after certain period. While in the case of printed publications, the library can use it perpetually as long as they are relevant and useful, it is not so with digital resources. It is not uncommon to retrieve information from the 'expired' CD-ROMs librarians changed the system date thereby meeting the information requirements. Is it not unfair of publishers to force librarians to resort to unfair means to retrieve information from legally-procured products? This leads to a perpetual dependency of the library on publishers. If due

to budgetary problems, the product is not subscribed, the information cannot be retrieved and is lost forever which is unfair.

4.2 Copyright vs Societal Right

No wonder, in the age of competition and pressures in professional advancement, authors are transferring copyright to the commercial publishers, who go on making huge profits. For instance, the pre-tax profit of Elsevier Science, publishers of about 1800 S&T periodicals, for the year 2003, is US\$ 2 billion or about Rs. 9500 crore (Balasubramanian, 2004). But the intellectual content marketed by commercial publishers is the result of many players. Referees and their institutions contribute time, resources and efforts in evaluating the research papers. The institutions to which the authors belong spend provide infrastructural facilities for carrying out the research: sometimes, these pay page charges for the speedy publication of the research work. The government extends grants, financial assistance, and budgetary support to these institutions from the tax payer's money. The library provides the authors necessary information for carrying out research. But in the end, it is only the publisher, who is reaping the benefits. What are the benefits to the authors who are the brains behind the intellectual content, the institutions and libraries that provide infrastructure and information, and the society at large that is responsible for the financial resources, except the marginal satisfaction of publication in a competitive world? Again the libraries of these institutions have to pay for the journals after their publication. Is it not the duty of profit making publishers to reward them? The Electronic Society for Social Scientists (ELSSS) has been formed in UK to improve the scientific communication and provide electronic publications of high quality, wide dissemination at low cost for the direct benefit of scientific community.

Many authors of journal articles sign away their copyright to publishers' without thinking. In an analysis of scholarly journal publishers' copyright agreements in 2003, Project RoMEO found that 30% of agreements don't give authors any right to do anything with their own works; 50% of agreements don't give authors the right to self-archive – the sure-fire way of gaining priority over your ideas and increasing the impact of your work; and 80% of agreements don't allow authors to assert their moral right to be identified as the author of the work. Project RoMEO suggests choosing journals that offer non-exclusive licenses, choosing journals with user-friendly licenses and amending existing licenses and granting to the publisher the exclusive and non-transferable right of first commercial publication, distribution and sale of work and keeping copyright with the author as alternatives to copyright assignment.

4.3 Pricing

Publishers make substantial investments and so naturally wish to protect their financial interests. All publication aspects like manuscript processing, peer review, editing, layout and design are common for both print and electronic versions except printing and distribution. As printing, binding, transporting and mailing the printed copies to the subscribers is labour intensive, and also as the electronic versions are bye-products in the process, when electronic versions only are subscribed, it should have been cheaper than the printed publications. A person with little knowledge of printing can easily distinguish that electronic or online (i.e. digital) version precedes the plate making process. The costs of paper, printing, binding, packaging and forwarding charges that roughly add up to 30 percent (24-36 per cent as per a study by Woolfrey, 1993) are saved in the case of these publications. This means that the electronic versions should be cheaper by 30 percent over print versions. Even after considering retrieval software and other overheads for providing access, their cost should be 15 to 20 percent less. But contrary to this expectation, publishers generally charge electronic versions almost equal to the subscription rates of the printed journals.

Further, as Internet is providing a way to cheaply distribute their products, it is expected that the publishers pass the resulting cost savings to subscribers, thereby bringing

back some of those who resorted to cancellation due to price escalations and budgetary deficiencies. E-journal subscriptions delivered through intermediaries involve additional access and archival charges, over and above the full subscription prices. It can be observed that some electronic products are cheaper than their printed counterparts, some are the same price and some more expensive. It is difficult to find any rationale behind such pricing structures as many publishers view the digital environment as an opportunity to enhance their revenues.

One more major concern with respect to the online publications is their pricing. While some publishers provide free access to full text online versions of the print journals some publishers charge about 10 percent extra over and above the print version prices, whereas a few charge more than 200 percent or more. In some cases, subscribing only online journals also costs more than 200 percent of the print version. The publishers who charge higher for online versions also price CD-ROM versions high depending on the plea that digital versions contain far more information than the print version (sic).

4.4 You Bought It – But Do You Own It?

Standards and specifications, issued by various government and professional bodies, are important primary sources of information for research work. Many of these consist of thousands of standards, and so these are brought out on CD/DVD format and are highly costly. However, publishers do not treat them as periodicals although periodical updates are issued. On an average about 1000 standards are revised every year. Thus, to revise all the standards it would take 10 years. It would have been highly helpful if these organizations periodically issued the revised standards separately like individual issues of periodicals. This would enable accessing all the standards whenever necessary and would be cheaper. Unfortunately this is not so. Each year, the revised standards (about 10%) are issued along with un-revised standards (90%) with cumulative index. As soon as the next update is received, the earlier one becomes obsolete. The library receives installation software every year it is renewed. This is leading to *un-revised standards* with revised standards every year, *although they are available with the library*. If, due to resource crunch, any product is not subscribed, all the old issues become inaccessible as they are issued with time locks. Although the library is the legal 'owner', the access is controlled by the publisher, forcing the library to renew it year after year. It is also the case with the publications of ESDU where about 2-3 data sheets of a series are revised annually. There are few thousand data sheets in 38 series. The library cannot buy *only the revised data sheets* but all the revised and non-revised data sheets of the series being subscribed! The CDs accompanying the printed works have time locks. To compound the issues further, if the subscription is broken and renewed after two or three years (due to resource crunch, of course), the library has to pay a higher cost than the normal renewal cost.

4.5 Repeated Usage

A printed publication could be used or lent out again and again without any extra payments. Digital resource, by analogy, should allow better usage over print material, i.e., simultaneous usage by many people, thereby leading to savings. But it is exactly the opposite—sometimes paying more than two times for the digital resources over the print material (as in the case of Jane's, IHS, etc) in stand-alone, single or multi-user price tags. Is it justified?

4.6 Impact of IPR Acts on Knowledge Society

Safeguarding intellectual property is necessary to reward the creators of artistic work and encourage for further pursuits. IPR laws are supposed to facilitate free flow of and access to information. However, the various provisions in the digital copyright acts impose severe restrictions on free and fair research studies thereby stifling R&D, academic as well as S&T

research and scholarly communications. Breaking the protection technologies is vital for developing more effective and better technologies. As circumvention technologies are made illegal, researchers cannot attempt reverse engineering. Research on firewalls, computer security and encryption will take a back seat as researchers face legal wrangles. These also hinder efforts to create interoperable software. The digital rights management technologies may increase revenue to the rights owners; but they severely restrict researchers' freedom and give rise to publishers' monopoly. The knowledge society that is being created is for the developing countries that control technology and information.

Traditional Knowledge vs IPRs

Traditional knowledge plays a vital role in a community. For example, this may provide relief to many common ailments including protection from natural and occupational hazards. The communities lack proper documentation, information or the procedures to safeguard their intellectual property. The knowledge is passed on from one generation to another, mostly through the word of mouth. It is not possible to bring in economics or financial gains in the communities as regards to the traditional knowledge.

The developed countries, at an advantageous position due to the various technological developments, try to exploit traditional knowledge of developing countries; just because of lack of proper documentation or due to the technology gap (digital divide?). Apart from traditional knowledge, geographical indicators, artistic manifestations, agricultural products that are in vogue for centuries are prone to exploitation.

The roles played by the Council of Scientific & Industrial Research (CSIR), Non-Governmental Organizations (NGOs), Indian Government, Indian Agricultural Research Institute, and the Directorate of Rice Research in revoking the patents granted to the turmeric, neem and Basmati rice are widely reported. The cases of Kava (an important cash crop) of Pacific Islands; some of the Ayurvedic medicines of India for jaundice (Hepatitis B) and vitiligo; Quinoa of South America; and *Hoodia* of Africa are hanging in balance with patents granted or pending, mostly from USA or UK or the European Union (Sahni, 2002; and Alikhan and Mashelkar, 2004). The respective governments and voluntary organizations are taking steps to prevent them from exploitation. Expectedly such efforts are opposed by some on the plea that protection under intellectual property law would deny access to the traditional knowledge. India has a vast repository of knowledge and practices with the *vaidyas*, *hakims*, artists and artisans that is invaluable. Educating communities and societies in preservation, documentation and dissemination of traditional knowledge, granting copyright protection or through *sui generis* system as provided for under Article 39(2) and 39(3) of TRIPS. Otherwise, we may well witness the patenting of various popular Ayurvedic medicinal plant extractions, Unani preparations, and even Indian dance postures and music *ragas*. In India, the Honey Bee Network is creating a database to help protect IPRs of grass root level workers. The CSIR in association with another department is developing a Traditional Knowledge Digital Library to safeguard the country's interests.

5. COPYLEFT

One of the developments of cyberspace is the culture of making software/advice/support/troubleshooting as a right free of charge. The FAQ websites in various subject fields are examples of such culture. Netizens are willing to share what they have and expect the same from fellow Netizens. Coupled with stringent copyright laws, some felt to free the software from the clutches of IPRs. One such movement is the Free Software Foundation (FSF) established by Richard Stallman of MIT Artificial Intelligence Lab. The FSF and other like-minded initiatives over the Net became proponents of 'Open Source' and advocate development of free software (as against licensed software). The free software entails the developer distribute it with source code, allow to share it with anybody, with freedom to modify/rewrite and redistribute to others freely. The GNU/Linux is free Operating System

software of FSF that was made available on these lines. Many a software packages are available for word processing (for example; Abiword, Text shield, etc).

To avoid any unscrupulous people modify the free software and distribute/sell without source code, FSF brought the concept of Copyleft. As per the description of the FSF website (www.gnu.org), to copyleft a program, first FSF copyrights it and then distribution terms are added which are legal instruments that give everyone the rights to use, modify and redistribute the program's code or any program derived from *it with a condition that distribution terms are unchanged*. Thus the code and freedom become legally inseparable. While proprietary software developers use copyright to take away the user's freedom, the FSF uses copyright to guarantee the freedom of users. That is why FSF reversed the name by changing copyright to copyleft. There are other similar initiatives like Open Source Initiative (www.opensource.org) and FreeBSD (www.freebsd.com). The importance of the free software is that it is highly relevant for poor countries.

5.1 Open Access Initiatives

The irony of the technology is that machines, meant to liberate us are instead stifling innovation. The technologies instead of controlling through accountability, are trying at incapacitation. Sony's computers use proprietary software to encrypt digital music writing the number of times a song can be downloaded. The software makes it difficult to duplicate any CD including the one created by the owner (Tenner, 2003). Statements in the user license agreement of Microsoft's Windows Media Player disable other programs.

The problems faced due to the strict IPR laws, licensing regimes and monopolistic attitude of software companies led the Free Software Foundation launch Open Source Initiative to promote free and open software. The movement encouraged software enthusiasts all over the world to freely download the software with source and object codes, alter and develop new applications, use them freely, and redistribute the applications with source code freely. The user is obligated to credit the authorship of the source code to the original author and that of the subsequent additions to the user under General Public License (GPL). However, licensing restrictions exist under the GPL agreement, to preserve its open source status and authorship right under copyright. The GNU/Linux operating system was followed by Apache, PERL, Tomcat, MySQL, Mozilla, Sendmail, FreeBSD, etc. Linux is fast becoming preferred operating system displacing Windows.

On the same lines as Open Source Software Movement, Open Archives Initiatives also gained momentum. Many scholars felt that the exorbitant cost of the professional journals deters researchers obtaining latest developments in their fields thereby hindering further research. Also, no institution can afford to subscribe or access all the journals in a given field. The efforts of thousands of scientists from about 180 countries led to the formation of Public Library of Science (PLOS) in October 2000. The breathtaking growth of web technology and the evolution of the Internet as a major publishing medium led to the Open Archives Initiative (OAI) in 2001. The former strives to bring scientific literature into open access format, while the OAI aims to bring all research publications into the open access fold. The publicly-funded research is being made available by BioMedCentral through its 100 open access journals. The Open Access Movement further helped in creating SciDevNet and HINARI of World Health Organization that allows free (or for small fee) access to over 2000 journals in the field of health (Balaram, 2003).

6. FUTURE OF COPYRIGHT IN THE DIGITAL MILLENNIUM

The technological advancements are outpacing the legislative measures for the protection of intellectual rights. The present copyright laws are failing in effectively preventing piracy or infringement. These laws are to be heavily modified to suit to the digital and networked environment. Although laws are stringent, there is little consensus on the extent of

copyright protection in the digital world. Groups like Association of American Universities are demanding copyright exemption of digital versions of scholarly journals; maps, newsletter archives and some databases. Their argument is that these materials are valuable mostly for their facts and so are not copyrightable. Librarians from Library of Congress, National Archives and Records Administration and the National Library of Congress also are supporting a looser interpretation of copyright in digital domain (Sherman, 2000). As such efforts would serve public good, similar initiatives should come from the professional community in developing countries also.

A number of distinguished commentators have observed that copyright has no future in the Internet era and in networked environment (see Oppenheim, 2000 and references 1, 27-30 referred there). It will become harder in future to enforce rights. However, copyright cannot be ignored as it provides the legal foundation upon which many licenses are based. Three types of rights have been suggested by copyright supporters: (a) pseudo-copyright, to protect databases by means of database rights or other non-copyright regimes; (b) para-copyright, to protect electronic copyright management systems and copyright management information; and (c) meta-copyright for extending protection by use of click-on licenses (Jaszi, 1998). In any environment, user's rights are to be promoted along with taking care of the interests of rights owners. New systems are to be developed for document supply in the electronic environment where both the copyright owners as well as users should get benefit. This type of owner-user cooperation, combined with some genuinely innovative thinking by legislators, owners and creators, is needed if copyright is to survive the network age.

There are enormous economic and ecological disadvantages to the all-digital library as users tend to print any thing that is more than 500 words, and a typical library would spend much more on printing and licenses than its current budget and would use at least 50 times as much paper as at present. A critical view of the death of printed text, universal conversion of collections into digitized form, digital communications and computer hardware, copyright vis-à-vis publishers and libraries is presented elsewhere (Crawford, 1998).

In digital environment, the librarians (or cybrarians) should have the same kind of fair dealing arrangement printed books. They should be able to read or browse electronic information without having to pay for it; preserve in digital format, copyright material held in their collections; and fulfill inter-library document requests electronically (Norman, 1995).

The major problem in a virtual library environment is the difficulty of proving rights violations when they occur. For legal experts, gathering evidence of digital crimes and to maintain its usefulness in a court of law are the greatest problems. The multiplicity of computing standards and data formats makes this still complicated. Systems developed cannot be 'fool proof'; as soon as it comes into vogue, hackers, who generally have greater resources, better skills and greater desire over those who try to prevent such illegal acts will make efforts to overcome (Barrett, 1997). One way of proving copyright infringement of electronic databases in a court of law is deliberately placing *seeds* into or *salting* a database, i.e., planting of errors and omissions. If a pirated database contains the same 'seeds' and errors, it is easy to prove the infringement. Sometimes a particular pattern that is not easily observed can also prove whether the database is a pirated copy. A clever pirate can detect and correct or eliminate some errors or omissions, but removing all, particularly in a large database is rather too unlikely (Losey, *et al*, 1995).

The regulatory steps like cryptographic techniques, authentication of users and limits to their access; protection at network, system, application and user workstation levels; metering access time; password regulations, etc while protecting the rights also work against fair use. The copyright laws were conceived to enhance, and not to prevent, the information access and usage. The attempts for ensuring and enforcing copyright may be seen by the end-users as non-user-friendly. The mechanisms developed for rights protection may restrict the access and use of digital information only to the privileged few who can afford to pay thus

defeating the main purpose of copyright law. Further, it is difficult to draw a boundary line between what is permissible, to what extent, and what is infringement. Small-scale violations which do not conflict with owners' rights may have to be accepted as a part of fair use for some more time.

It is always a win-win situation for the publishers while the libraries (consumers) or users are the losers. While there is a necessity to protect intellectual property from infringements protecting the rights of consumers is also important. The IPR laws should aim at advancing knowledge through rewards to the creators; in reality these deter potential users by curtailing free flow of information thereby defeating the Universal Declaration of Human Rights of providing free access to information irrespective of region, religion, cast or race. *The irony is that librarians have to buy back copyright materials as highly priced periodicals that their R&D, scientific or academic community has given away to the publishers free of charge!!!*

There is an urgent need for all the developing countries to enact Digital Consumer Protection Act to safeguard the interests of the customers of digital products against the software keys, time-locks, unduly high pricing, etc as well as extending legal protection. Provisions should be made for time-shift (recording digital work to use at convenience), space-shift (to enable using the digital content in different places as long as the use is personal and non-commercial), making back up copies of legally procured digital content and use it on the platform of user's choice, and right to use technology to achieve the rights mentioned earlier.

Librarians should unite for getting fair dealing privileges of copying rights and meeting the inter-library loan requests of digital publications to preserve the sanctity of the library and to prevent absolute monopoly of the copyright owner over the distribution of and access to copyrighted information. The loss of these provisions would greatly harm scholarship, research, teaching and education. To make libraries free from perpetual dependency, the software keys, and time locks must be removed from the CD/DVD-ROM products. The library should be able to access the information from the legally procured resources. When the library subscribes to both the print (or CD/DVD-ROM) and online journals, a standard pricing, say 10-15 percent, should be charged extra and not exorbitantly. Alternatively, the online versions can be provided free of charge like some publishers do now. When both print and electronic versions are available and when the libraries subscribe e-journals only, the prices of the latter should be 80-85 percent of the print versions. In the case of termination of subscription to an online only journal, the total data of the subscribed period should be given on CD/DVD-ROM without any locks or keys as backup to the library.

Lastly, responding positively towards open archives initiatives, all authors of government-funded research work should self-archive the output and offer free open access to them. This would not only maximize the visibility and impact of the research output, but also facilitate creation of huge knowledge base for the institution and the country. As suggested by Project RoMEO, librarians should advise authors to choose journals that offer non-exclusive licenses or with user-friendly licenses; or amend existing licenses and granting to the publisher the exclusive and non-transferable right of first commercial publication, distribution and sale of work and keeping copyright with the author as alternatives to copyright assignment. This would surely help securing the intellectual property of an institution.

REFERENCES

Alikhan, Shahid & Mashelkar, Raghunath (2004). *Intellectual property rights and competitive strategies in the 21st century* (69-87). The Hague, Kluwer Law International.

Anderson, Laura Challman and Lotspiech, Jeffrey B. Rights management and security in the electronic library. *Bulletin of the American Society for Information Science*, October-November 1995, **22**(1), 21-23.

Ardito, Stephanie C. and Eiblum, Paula. Conflicted copyrights — inevitability : Death, taxes and copyright. *Online*, January-February 1998, **22**(1), 81-85.

Balaram, P. (2003). Publishing wars. *Current Science*, **85**(9), 1249-1250.

Balasubramanian, D (2004). Open access to journals—a noble movement. *The Hindu*, 23 September. p. 16.

Barni, Macro. Watermark embedding:Hiding a symbol within a cover image. *IEEE Communications Magazine*, August 2001, **39**(8), 102-108.

Barrett, Neil. Digital crime: Policing the cybernation. Kogan Page, London, 1997.

Berghel, Hal. Digital village : watermarking cyberspace. *Communications of the ACM*, November 1997, **40**(11), 19-24.

Chepesiuk, Ron. The future is here: America's libraries go digital. *American Libraries*, January 1997, **28**(1), 47-49.

Choudhary, Abhijit K.; Maxemchuk, Nicholas F.; Paul, Sanjay and Schulzrinne, Henning G. Copyright protection for electronic publishing over computer networks. *IEEE Network*, May-June 1995, **9**(3), 12-20.

Civanlar, Reha and Reibman, Amy. Signal processing for networked multimedia. *IEEE Signal Processing Magazine*, July 1997, **14**(4), 39-44.

Collins, Mauri P. & Berge, Zane L. *IPCT Journal: A case study of an electronic journal on the Internet*. *Journal of the American Society for Information Science*, 1994, **45**(10), 771-776.

Cox, I. *et al.* Secure spread spectrum watermarking for multimedia. *IEEE Transactions on Image Processing*, 1997, **6**(12), 1673-87.

Crawford, Walt. Paper persists: Why physical library collections still matter. *Online*, January-February 1998, **22**(1), 42-48.

Decker, Steve. Engineering considerations in commercial watermarking. *IEEE Communications Magazine*, August 2001, **39**(8), 128-134.

Denning, Peter J. Plagiarism on the Web. *Communications of the ACM*, 1995, **38**(12), 29.

Denning, Peter J. & Rous, Bernard. The ACM electronic publishing plan and the ACM interim copyright policies. *Communications of the ACM*, 1995, **38**(4), 97-107.

Duggal, Pavan. See the column Brief Cases published in *Economics Times* on every Sunday, 2001—till date.

Duggal, Pavan. Cyberlaw: Satyam, shivam and sundaram. *In The Internet economy of India: Inomy knowledge book 2001a*, edited by Osama Manzar, *et.al.*(Eds). Inomy Media, New Delhi, 2001. pp. 84-92.

Duggan, Mary Kay. Copyright of electronic information: Issues and questions. *Online*, May/June 1991, **15**(3), 20-26.

Eskioglu, Ahmet M (2003). Protecting intellectual property in digital multimedia networks. *IEEE Computer*, **36**(7), 39-45.

Garofalakis, John; Kappos, Panagiotis; Sirmakessis, Spiros and Tzimas, Giannis. Digital data processing for intellectual property rights protection over World Wide Web. *In* Proceedings of Thirteenth International Conference on Digital Signal Processing (DSP 97), 2-4 July 1997. IEEE, New York, 1997. V 2, pp. 833-836.

Gupta, V.K. IPR issues in databases : An update. Paper presented in the ITT'99: Towards Information Content for Global Competitiveness, 16-19 November 1999, Hyderabad. NISSAT, New Delhi, 1999.

Hampel, Viktor E. A Consumer Protection Act for Digital Products. *In* Proceedings of the Conference on Information Protection and Network Security, 24-26 October 1995, Philadelphia. Viktor E. Hampel and Clifford Barlow Neumann (Eds). SPIE proceedings, V 2616. SPIE, Washington, DC., 1996. pp. 145-158.

Hoffman, Melia M.; O'Gorman, Lawrence; Story, Guy A.; Arnold, James Q. and Macdonald, Nina H. The RightPages TM Service : An image-based electronic library. *Journal of the American Society for Information Science*, 1993, **48**(8), 446-52.

Jasperse, Jaap A. Primary science on CD-ROM: The New Zealand experiment. *Journal of the American Society for Information Science*, 1994, **45**(10), 777-784.

Jaszi, P. Is this the end of copyright as we know? *In* 40 Nordisk Forum for hensingsfors. Nordinfo, 1998. pp. 58-65 (quoted in Oppenheim, 2000).

Lakshmana Moorthy, A. and Karisiddappa, C.R. Copyright and electronic information. *In* Access to electronic information: Papers presented at Sixteenth Annual Convention and Conference, 25-29 January 1997, Bhubaneswar. M. Mahapatra, *et al* (Eds). New Delhi, SIS, 1997. pp. 403-416.

Lakshmana Moorthy, A. and Karisiddappa, C.R. Copyright in networked environment. *In* CALIBER-2000:Seventh National Convention on Information Services in a Networked Environment, R. Vengan, H.R. Mohan and K.S. Raghavan (Eds). INFLIBNET Centre, Ahmedabad, 2000. pp. 4.18--4.30.

Lakshmana Moorthy, A. and Karisiddappa, C.R. Electronic commerce and networked libraries. *In* NAELIN 98: Library and information networking: Papers of the National Annual Convention on Library and Information Networking. H.K. Kaul, (Ed). New Delhi, DELNET, 1998. pp. 210-226.

Lakshmana Moorthy, A. and Karisiddappa, C.R. Electronic publications : Issues and concerns. *In* Electronic sources of information : Papers presented in the DRTC Annual Seminar held during 1-3 March 2000 at the DRTC, Bangalore, edited by IK Ravichandra Rao. DRTC, Bangalore, 2000.

Lakshmana Moorthy, A. and Karisiddappa, C.R. Electronic publishing: Impact and implications on library and Information Centres. *In* Digital libraries: Dynamic storehouse of digitized information. Papers presented at the SIS 96: Fifteenth Annual Convention and Conference, 18-20 January 1996, Bangalore. N.M. Malwad, *et al* (Eds). New Delhi, New Age International Publishers, 1996. pp. 15-35.

Lakshmana Moorthy, A. & Karisiddappa, C.R. Intellectual property rights and copyright in the context of electronic information. *In* Information Technology Application in Libraries: A Text Book for Beginners. M. Mahapatra & D.B. Ramesh (Eds). Bhubaneshwar, Reproprint, 2004. pp. 583-589.

Lakshmana Moorthy, A. and Karisiddappa, C.R. Intellectual property rights and virtual libraries. *In Towards the new information society of tomorrow : Innovations, challenges and impact. Papers presented at the 49th FID Conference and Congress, New Delhi, 11-17 October 1998. N.M. Malwad, et al (Eds). New Delhi, INSDOC, 1998. pp. IV.51--IV.61. FID Publication No. 719.*

Lakshmana Moorthy, A., Prahalada Rao, M. & Karisiddappa, C.R. Intellectual property rights of electronic information in the age of digital convergence. *In NACLIN 2001: Networking of Digital Resources for National Development: Papers of the Fourth National Annual Convention on Library and Information Networking, Hyderabad, November 2001. H.K. Kaul (Ed.). New Delhi, DELNET, 2001. pp.583-589.*

Losey, Ralph C.; Subin, Shams and Rosenbluth, Moran. Practical and legal protection of computer databases. *wisdom@digital.net.*

Low, Steven H.; Lapore, Aleta M. and Maxemchuk, Nicholas F. Document identification to discourage illicit copying. *In Proceedings of GLOBECOM 95, 13-17 November 1995, Singapore. New York, IEEE, 1995. Vol 2, pp. 1203-1208.*

Lynch, Clifford A. The integrity of digital information, mechanics and definitional issues. *Journal of the American Society of Information Science, 1994, 45(10), 737-744.*

Martin, Juan R. Hernandez and Kutter, Martin. Information retrieval in digital watermarking. *IEEE Communications Magazine, August 2001, 39(8), 110-116.*

NASSCOM. NASSCOM's guide to IPR law in India : A guide for copyrighting software. Mumbai, National Association of Software and Services Companies, 1996. 42 p.

Norman, Sandy. Electronic copyright - a time to act. *Library Association Record, 1995, 97(4), 209.*

Opperhiem, Charles and Turner, Margaret. Copyright and Internet fanzies. *Aslib Proceedings, 1999, 51(9), 290-301.*

Opperhiem, Charles. Does Copyright have any future on the Internet? *Journal of Documentation, 2000, 56(3), 279-298.*

Parth, Shubhendu & Varma, Yograj. How the CDR nearly killed the music? *Dataquest, 15 September 2002, 40-46.*

Perryman, W.R. The changing landscape of information access: The impact of technological advances upon the acquisition, ownership, and dissemination of information resources within the research library community. *Journal of Library Administration, 1991, 15(1/2), 73-93.*

Rosenoer, Jonathan. *CyberLaw : The law of the Internet. New York, Springer, 1997. 362 p.*

Roy, Atanu. Techtrends : The copyright crawlers : Digital watermarking. *Computers Today, 16-30 April 1999, 15(177), 90-92.*

Rump, Neils. Copyright protection of multimedia data: The Multimedia Protection Protocol (MMP) (<http://www.its.fhg.de/departs/amm/layer3/mmp/>).

Ryder, Rodney D. Information Technology Act: Regulating Indian Cyberspace. *Computers Today, 16-30 June 2001, 46-49.*

Samuelson, Pamela. Copyright and digital libraries. *Communications of the ACM*, 1995, **38**(4), 15-21,110.

Sasse, Margo Q. Winkler, B. Jean. Electronic journals: A formidable challenge to libraries. *In Advances in librarianship*, Vol.17. Irene P. Godden (Ed). New York, Academic Publishers, 1993. pp. 149-173.

Schneider, Bruce. E-Mail security. *In The electronic privacy papers: documents on the battle for privacy in the age of surveillance*, Bruce Schneider and David Banisar (Eds). John Wiley, New York, 1997. pp. 275-284.

Sherman, Chris. Napster: Copiright killer or distribution hero? *Online*, 2000, **24**(6),16-28.

SPIE. Eleventh Annual Symposium on Electronic Imaging '99: Security and watermarking of multimedia content. SPIE proceedings, 3657 San Jose 1999. SPIE, Washington, DC. 1999.

Tenner, Edward. You bought it. Who controls it? *Technology Review*, 106(5), 2003, 61-64.

Turnbull, Bruce H. Important legal developments regarding protection of copyrighted content against unauthorized copying. *IEEE Communications Magazine*, August 2001, **39**(8), 92-1000.

Wall, Ray. Electronic copyright confusion. *Aslib Information*, 1992, **20**(7/8), 280-81.

Wall, Raymond A.; Norman, Sandy; Pedley, Paul and Harris, Frank. Copyright made easier, Ed. 3. Aslib-Imi, London, 2000. 548 p.

Wolfgang, Raymond B and Delf, Edward J. A watermark for digital images. *In Proceedings of the third IEEE International Conference on Image Processing*, 16-19 September 1996, held at Lausanne, V.3. IEEE, New York, 1996. pp. 219-222.

Wong, P.W. and Delp, Edward J.(Eds). Proceedings of Twelfth Annual Symposium on Electronic Imaging 2000: Security and watermarking of Multimedia Content II. SPIE proceedings 3971, San Jose 2000. SPIE, Washington, DC., 2000.

Woolfrey, S. Economics of journal publishing and the rhetoric for moving to an electronic format. *In Proceedings of the 1993 International Conference on Refereed Electronic Journals*. Winnipeg, University of Manitoba, 1993.