

Paper: AR

ELECTRONIC JOURNALS: ACCESS AND DELIVERY MODELS

NV Sathyanarayana, Informatics (India) Pvt Ltd, Bangalaoe 560003
Email: sathya@informindia.com Website: www.informindia.com

Several factors have been successfully pushing the conservative science publishers to accept the transition to e-journals. Some of the influencing factors are, the conveniences of web for access & browsing, the economics of Internet for delivery, the digital library revolution etc. The paper discusses the technological history of E-journals, access models, archiving, pricing and other several issues.

1. JOURANL PUBLISING: A TECHNOLOGICAL TRANSITION

The writing is definitely on the wall for print journals that serve the purpose of scholarly and scientific research communication. In the emerging IT ruled Knowledge economy of the twenty first century, e-journal is emerging as an imperative. A recent article in the Nature magazine, which investigates the transition of print journals to e-journal, concludes that a journal without a web version is now rare, and probably endangered (1). Three major factors have been successfully pushing the conservative science publishers to accept the transition to e-journal:

- The convenience of web for access and browsing;
- The economics of internet for delivery
- The digital library revolution which is promising instant delivery of complete information, and not just the bibliographic surrogates, to user's desk top, in a seamless manner.

2. SEAMLESS ACCESS

Providing seamless access to information has always been the professional dream of librarians. The concept of seamless access to information has a special attraction today. This concept is going to define the rules and benefits of emerging digital library environment. The traditional models of information access and delivery follow two step process which generally happen as two separate events in time, often separated by frustrating time in waiting. First, the user searches a database and finds articles of probable relevance. Second, he checks his library

collection or alternative sources for obtaining a copy of the article. The second part always frustrated the user, often making the first part of the exercise futile. E-Journals and the emerging access and delivery models will completely eliminate this frustration, integrating the two steps in real-time. On finding the article of his choice from a database or from a reference list of citations while browsing an electronic journal, the user can instantly access the complete article through a mouse click. The database and the journal, although could and would exist in different remote locations, can reach user's work desk through a common interface irrespective of who the publisher of the journal is, from which database the article was found, or which library subscribes to the journal. This is the power of seamless access, which is finally breaking the walls of not only the library but also the publishing world. The web is re-defining the wall for the libraries, a wall that is transparent and yet exists and will continue to exist in the form "right of access", controlled by both the copyright and technology.

3. TECHNOLOGICAL HISTORY OF E-JOURNALS

The history of e-journal began with the full-text databases offered by traditional online vendors like Dialog during late 80s. This full-text was a misnomer and was really not complete text. What they offered was bare ASCII files of the journals and magazines which stripped off the diagrams, photographs, graphs and other image objects of the article. The technology of the day then made it difficult to offer the complete text as the storage costs were still expensive, the band-width then at 2.4kbps to 4.8kbps was simply inadequate and the access interface was non-graphical. However, the full-text was presented as a searchable text. CD-ROMs and the developments in compression technology made it possible to record and deliver complete-text of the journal as image file. They were the image replicas of the printed pages. But the text was not searchable. A searchable bibliographic database of table of contents provided the link to the corresponding image files of the articles on the CD-ROMS. These images, inspite of enormous compression, occupied a large volume of space. Although, a CD-ROM could store 200,000 plus pages of ASCII text, it could store not more than 10,000 pages of a scanned image, scanned at a resolution of 150dps. Being an image file, it was not searchable. This was the pre-GUI and pre-Windows day.

During early 90s, online vendors used the CD-ROM technology and the FAX technology to deliver almost instantly the complete-text, through a technological integration of online bibliographic databases with a CD-ROM collection of image files residing in a network of jukeboxes. It was like online ordering for articles found during a bibliographic search, to be delivered by fax within a span of 15-30 minutes. In this process, for the first time the bibliographic database, document collection in electronic format and the document delivery activity were integrated through different pieces of technology. The application of this technological integration found its way primarily for delivering patent delivery. Curiously, this application did not find its way to document delivery for journals, probably due to copyright issues which publisher would always like to jealously guard. UMI, now called Bell&Howel Information and Learning (BHIL) successfully promoted this technology model for journals and offered a LAN based solution with its image files of full-text CD-ROM databases for journals in the area of Management, Medical and Social Sciences. Similar LAN based models were supported by other aggregators of electronic journals on CD-ROM like ADONIS, and IEEE.

With the emergence of Internet, and the web during mid-90s, the full-text databases started including image objects like photographs and charts as link files. The text was ASCII. There would be a thumbnail image of the graphic object, which could be zoomed. Or, an icon with the caption of the image object would act as a link. The text was searchable.

The e-journal we see today is a transformation of this Internet version, which is generally a PDF image and an exact look-alike of the print with the text as a searchable file. While PDF is the preferred format for e-journals by a number of leading publishers and the libraries, a large number of publishers and third-party aggregators, offer e-journal in a variety of other formats, like HTML, SGML, etc. E-journals in the latter formats are not exact look-alike of the print although they offer complete text of the journal with graphic objects in the articles as embedded images.

Bibliographic databases, journals, and the document delivery are the three information resource components of information access and delivery mechanisms. In the past and particularly during the pre-computing era, these three areas were developed independently by different set of agencies. The physical linkages existed among the three components for obvious reasons. But, they all operated differently as independent models and rarely served the end purpose of document delivery efficiently. With the emergence of e-journals, these three components are likely to submerge, integrating all the three components through a common interface technology. The bibliographic databases and document delivery in future is likely to become byproducts of the evolving e-journal system. As a major benefit of the e-journal revolution the table of contents and abstracts for most of the scholarly and scientific journals are accessible today, free. This development can fill the database access gaps for Indian libraries to some extent.

4. ACCESS MODELS

Internet, by its very nature of technology and utility is a remote access model. Seamless access is a possibility through linking information resources like databases and e-journals distributed at several sites. Internet and its secured cousin Intranet have however, thrown up different access models that fits into the convenience of libraries. Three access models have emerged for e-Journals.

1. Remote Access (through Internet)
2. On site, at the library
3. Access through Databases (Link Model)

4.1 Remote Access

In this model, the publisher hosts the journal at his website. When the library subscribes to the e-journal, it is provided right of access. Depending on how this right is defined, the patrons of the library can have access either from a set of designated user-terminals or through library's LAN or campus-LAN. Publishers grant the rights to subscribing library through one of the following methods.

1. User-ID and Password

The subscriber gets a user-id and password, which can be used, from any user terminal in the library, largely restricted to one simultaneous user at a time. While access through Library's LAN or Intranet is possible through this method, this is generally governed by publisher's policy. This model is primarily suited for dial-up access users.

2. IP enabled (Intranet)

This method is ideal for libraries, which have campus wide LAN and intranet access to Internet. The intranet sever at the library is IP enabled by the publisher. This a controlled method of access where, publisher's server site will recognize and validate the IP address of subscriber's intranet server when each time a user logs into publisher's web site for a subscribed journal through subscriber's intranet. Large publishers like American Chemical Society and Elsevier find this method more secured for both themselves and the library. This method can be used by only those libraries who have an intranet based LAN in their library or campus. Obviously this method currently restricts a large number of libraries in India from accessing e-journals. Some publishers require both IP enabling and password control to ensure further security.

3. Combined

Some publishers offer both, either as alternative or as combined feture. The issue is largely decided by publisher's policy of how much to keep the access open and how much to restrict.

4.2 **On Site**

In this model, the library can host the e-journals within its campus. This model is driven by two factors.

First, the library feels more secured to maintain the journal at its end as it has paid for the journal and is used to the ownership concept, which has been practiced for over a century. Second, the local LAN certainly offers far wider and superior bandwidth for access compared to remote access through Internet in the first model. Local LANs generally offer 1 to 10 mbps bandwidth these days and possibly more to each user work desk. Internet access for dial-up users is still at Kbps level. ISPs like VSNL currently offer a maximum of 33.3 kbps to dial-up users, which in practice works far below 10 kbps, which is highly inadequate for e-journal access. Even if a campus has a dedicated high-bandwidth link to Internet at say, 2 mbps, when distributed across several user workstations, the bandwidth available to each user work desk will be a few kbps more. Internet bandwidth is however increasing fast with costs coming down. In the foreseeable future, Internet will provide more than adequate bandwidth to remote users for convenient e-journal access at affordable costs.

For on site access, publishers deliver the e-journal to the subscribers through one or many of the following media

- CD-ROM
- Down-load from the Publisher's website
- FTP option

4.3 Access Through Databases

Access models offered by publishers limit the access to their journals. But, the users often find articles of their interest through database. Over the years, the bibliographic database has emerged as a user's favorite interface for searching and locating information. The concept of seamless access demands instant linking between the article reference in a database to a corresponding full-text article in an e-journal. This is achieved through the link model offered by database producers and vendors. Some of the currently popular models are briefly presented here.

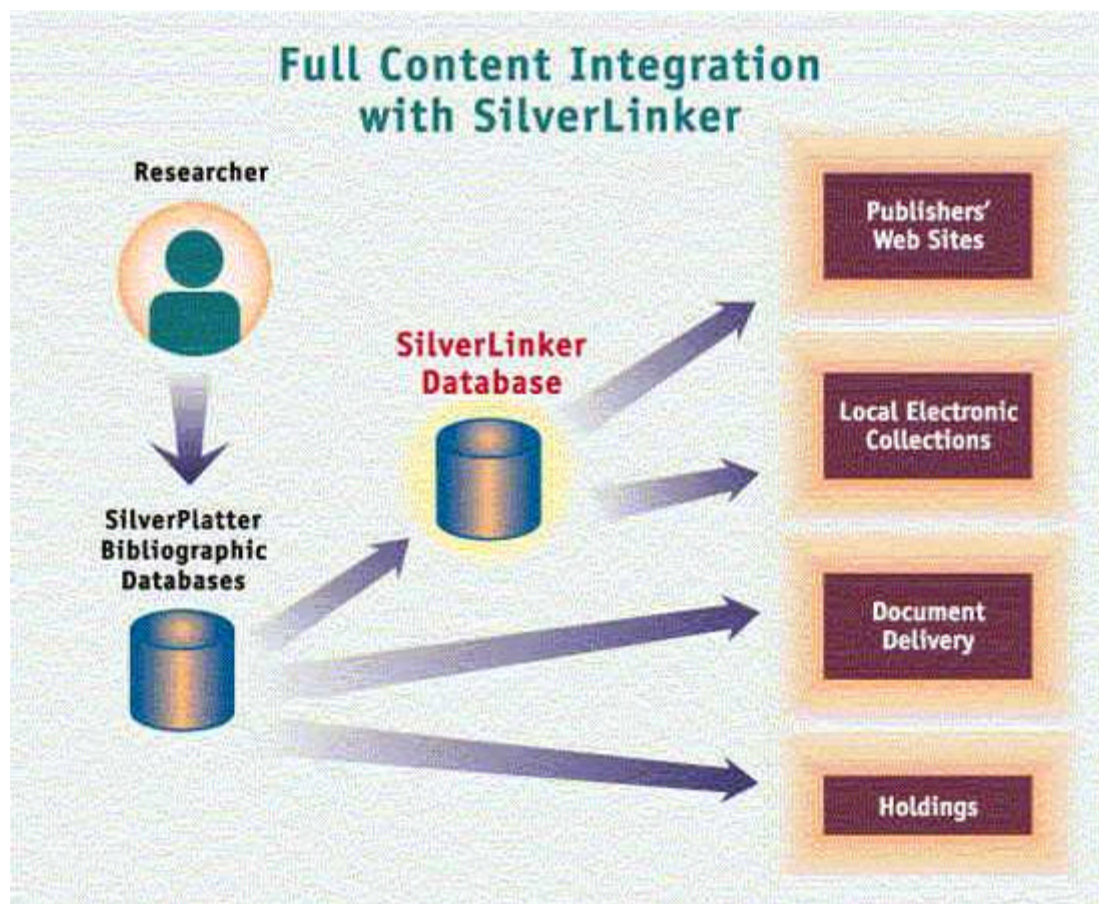
4.3.1 *SilverLinker from SilverPlatter (www.silverplatter.com)*

SilverPlatter is an electronic publisher and Internet based vendor of over 200 bibliographic databases. SilverLinker is a link technology and database of article level links offered by SilverPlatter. It carries the URL address to the articles for over 3,000 journals offered by several publishers on their websites. Following are some of the major publishers whose journals are linked by SilverLinker

- Academic Press
- Catchword Ltd
- Elsevier Science Direct
- Kluwer Academic Publishers
- Project Muse
- Springer-Verlag
- Walter de Gruyter

SilverLinker database acts as an interface link between several of SilverPlatter published databases like MEDLINE, BIOSIS, CAB, etc., and the e-journals located in participating publisher's website listed above. Imagine that a library subscribes to SilverPlatter's MEDLINE database and a set of biomedical journals from Elsevier and Kluwer. The users of this library can have seamless access to articles from the subscribed journals through SilverPlatter's Medline database. When a user at this library finds an article of his interest through a MEDLINE search, the SilverLinker database working behind Medline will provide automatic link to the corresponding article of Kluwer journal at publisher's website. A mouse click on the retrieved MEDLINE record activates the link and connects the user to the full-text of the article.

Silverplatter extends the links beyond publisher's sites to facilitate document delivery and inter-library loan transactions for designated participating libraries and document delivery agencies. The following exhibit is graphical representation of how SilverLinker and Silverplatter database works.



SilverLinker implementation by a library requires

- Subscription to any of the client required SilverPlatter database. This can be an Internet subscription or a subscription for local hosting at the library. If the library desires to host the SilverPlatter database locally, it will require to set up SilverPlatter's ERL/WebSPIRS which is SilverPlatter's intranet based local database access solution
- Subscription to SilverLinker database
- Subscription to desired list of e-journals that are covered in SilverPlatter's SilverLinker. The subscription arrangements will be directly between the publisher and the library and SilverPlatter does not act as subscription agents for journals.

SilverLinker can be implemented to locally hosted e-journals also, if the library maintains its own e-journal archive. This process involves substantial customization.

4.3.2 *ISI's Web of Science (WoS)*

ISI (www.isinet.com) is a world-renowned producer and publisher of high-quality bibliographic databases. Web of Science is the enhanced version of the Citation Index family of ISI databases designed for web environment. WoS covers around 8,100+ journals. The coverage spans 25+ years from 1974 to current. The database is updated every week. This cumulative version of the database is available only on the web and is not available on CD-ROM. As a unique feature, WoS provides three levels of link to every bibliographic record, which is shown on every record displayed on the screen, with the number of linked records

- Link to related records
- Link to cited record (the article cited by the displayed records)
- Links to citing records (the articles citing the displayed record)

For cited references to any articles, further link is provided to corresponding abstracts if the cited article happens to come from any of the 8,100+ journals covered in WoS.

To facilitate seamless access to e-journal from WoS, ISI offers link to the e-journal sites of the following publishers. WoS currently links to about 5,400 journals from the following publishers

- Academic Press
- American Institute of Physics
- Blackwell Science
- Catchword, Ltd.
- Cambridge University Press
- Highwire Press
- John Hopkins University
- John Wiley & Sons, Inc.
- Karger
- Kluwer Academic Publishers
- OCLC
- Royal Society of Chemistry
- SIAM
- Springer-Verlag
- Stockton Press

4.3.3 *IDS from Cambridge Scientific Abstracts (CSA)*

CSA (www.csa.com) is a producer of many leading databases such as Metadex, Life Sciences Collection, Sociological Abstracts, etc. Like SilverPlatter, CSA also acts as an Internet based vendor for several third-party databases such as Aerospace Database, NTIS, etc. IDS is Cambridge's database access model for all its databases and third party licensed

databases. Cambridge offers article level link for about 3,000 journals from several publishers. The link is offered as an integral part of IDS interface.

- Academic Press
- Blackwell Science
- Catchword Ltd
- Elsevier Science Direct
- HighWire Press
- Information Quest (RoweCom)
- OCLC
- Kluwer Academic Publishers
- Project Muse
- Springer-Verlag

4.4 Requirements at User-end

Moving towards e-journal requires libraries to develop IT infrastructure at their end which will eventually deliver e-journal to user's desk-tops which is the ultimate goal a digital library. If the library prefers to go for remote access model, it will have to invest in:

- Campus wide intranet with ability for every user terminal to access web resources
- A reliable and high-speed Internet access infrastructure with dedicated link to Internet.

Investment in high-bandwidth for Internet will be a critical need. The bandwidth capacity could vary 64kb to 2mb and more depending on the number of users. For efficient e-journal access through remote access model, it is recommended that every user workstation gets a minimum 64kb bandwidth.

On Site access model can avoid high-speed Internet. But, it will require:

- Campus wide intranet with ability for every user terminal to access web resources
- Reliable IT infrastructure for archiving and hosting the e-journals locally (discussed in detail in section 5 on Archiving)

5. ARCHIVING

In the history of publishing and librarianship, archiving knowledge has been a long assumed mandate and responsibility successfully carried and managed by the libraries till date. In the print journal era, Publishers completely stayed away from this responsibility. Several libraries stack today many research journals since their first volume. But, there is hardly any publisher who has complete collection of his journal archived for posterity. Perhaps respecting the role played by the libraries, the publishers were liberal in the enforcement of copyright during the print journal days. Internet and e-journals make the task of illegal copying and distribution easier. Equally it makes the task of policing very difficult. While the copyright permits only fair-use and prohibits all distribution whether for or non-profit, enforcing

copyrights in the electronic environment has become a complex task for the publishers and the Governments.

Internet and the e-Journals have created new paradigms for archiving journals resulting in controversial debates and throwing in new technological complexities. The very process of delivery is being reversed in the e-journal system. While the print journals were delivered to the libraries by publishers or the subscription agents, the libraries may have to now electronically visit the publishers to collect the journals. This alone adds a new set of cost and infrastructural dimension to the libraries. Many issues have emerged that require thoughtful debate and understanding to formulate effective archiving strategy by the library community. A few key issues discussed in this paper are:

- Rights
- Cumulation
- Aggregation
- Search Engine
- Interface Development
- Infrastructure & Maintenance
- Third-party archive

5.1 Rights

Currently, not all publishers allow archiving rights for e-journals to libraries. However, most of them are beginning to realise that they will have to permit this historically important and sensitive process as every publisher is not in a position to guarantee perpetual access for his journals. Each publisher is evolving his own commercial policy and is exercising customized technical features and controls for delivering e-journals to libraries for archiving. The future is likely to settle the rights issues for archiving, which may require certain changes in copyright laws. Some publishers have dual models. They offer a choice to libraries to either use publisher's remote archives or to develop their own archives.

5.2 Cumulation

The libraries always bound the journals as a means of archiving. What they did was physically cumulating the issues for a given volume or a year for which publishers published cumulative indexes at the end of a volume or a year. In the e-journal model, cumulation extends beyond a year or a volume and becomes possible for all the years for which the e-journal is available for access. If the libraries decide to archive a journal, they will have to carry the additional task of cumulating the index every year for the entire period of the archived journal. Without such a cumulation, access to the archive becomes difficult.

5.3 Aggregation

This will be a new task, which the libraries never carried during the print archive days. Electronic archiving makes it imperative that the cumulative index files of several journals are aggregated to create a common cumulative index for all the journals carried in the archive. This

index will need to be refreshed for new articles as the new articles and new journals enter the archive. Indexing and cumulation policies and practices vary from publisher to publisher. This variance will make the task of building an aggregated index for all journals in the library's archive rather a difficult and technically complex task. Aggregating index files provided by publishers may also lead to problems in retrieval. Some publishers may not provide the index to their journals. To overcome all these problems, the library may have to resort to do its own indexing for a common acceptable standard. This will lead to a major additional task of creating and updating a bibliographic database for the entire archive held by the library. For a library like Indian Institute of Science, which subscribes to about 1,000 journals, this task is equivalent to building and maintaining a database of about 150,000 articles year.

5.4 Search Engine

Most publishers who offer e-journals at their website do not even make available a search engine, nor do they provide any indexes for browsing. They host their journals as simple HTML or PDF files linked through table of content for each issue of their journals for easy browsing and downloading by the subscribers. Archiving these journals will require licensing a search engine from a third-party software company.

Some publishers offer their search engine along with the rights to archive. These come with additional cost to library. They will be proprietary to the journals of the respective publishers. Opting for publisher's search engine where offered will result in building a collection of several archives, each with its own search engine and interface. This will make the process of aggregation described in 5.3 impossible and will simply complicate the matter to the user who will surely find it difficult to access each journal with a separate search interface. The task of archiving too will become far more laborious.

The solution will emerge from the library licensing a separate search engine and aggregating all journals under one common interface. This will add a new dimension to tasks and responsibilities.

5.5 Interface Development

The companies, which offer search engine normally, offer a standard interface, which may not suit the library's needs entirely. It will invariably involve developing a suitable search interface to go with the archive pattern of the library and its user's needs. The library may require to add its own functionalities like linking the archive to the community's Union Catalog, facilitating inter-library lending relating transactions, etc. This will be an additional software related development responsibility for the library.

5.6 Infrastructure & Maintenance

Archiving journals in the past was relatively a simple task, limited to binding and maintaining with adequate shelf space. Archiving e-journals needs substantial investment in infrastructure and maintenance. Assuming that a major University or research library subscribes to about 500 journals, on a 5-year plan basis, electronic archiving would require investment on the

infrastructure of the following kind, which can be estimated at around Rs. 50-60 lakhs at present costs, with additional refreshing cost of about Rs. 15-20 lakhs once in three or five years.

- Server hardware and software
- Storage of approximately one Tera Bytes (1,000gb) and back-up facility
- Archive management and search software
- Refreshing the data to new technology and formats (once in 3 or 5 years)

This excludes the annual cost of creating and updating bibliographic database, linking them to archived article, and associated hardware-software maintenance.

5.7 Third-Party Archiving

Electronic archiving is a big cost and an entirely new type of serious responsibility. Its functions are similar to data warehousing. If the publishers can develop an institutional model and legal framework to guarantee perpetual Internet access to the subscribed journals for every subscriber, the libraries need not archive. However, the need for aggregating the subscribed journals and providing a common access interface for all the journals subscribed is a prompting enough compulsion to think of independent local archiving. The geo-political factors, the frequent corporate changes at publishing organisations in terms of mergers, acquisitions and closures, and the changes in the structure and ownership of journal become other compelling factors for the library to think of independent local archiving.

Apart from the high cost of infrastructure and maintenance, archiving will be a substantially repetitive cost for each library in a community. If we were to address university libraries as a community, a simple research could possibly confirm that at least 25% of the titles are widely duplicated among 75% of the universities. This leads to the feasibility of third party local archiving as means for sharing the cost. The third-party organisation could be an independent corporate body, which has legal and institutional framework to support the activity to ensure and insure perpetual access to the archive to participating libraries. Alternatively, it could be a co-operative task and cost sharing activity among the libraries in a community who can assign the responsibility to one of its members.

6.0 PRICING AND BUSINESS MODELS

The publishing, distribution, access and archiving activities of e-journal is a completely IT-enabled activity involving two independent and yet integrated tasks – (1) content creation and development; (2) e-commerce. Because of its very nature of attracting value addition opportunities through IT, different business models have emerged. These include:

- Publishers Model
- Aggregators Model
- Subscription Agency Model
- Models emerging through library co-operatives and Consortia

6.1 Publishers Model

For publishers, e-journal is a technological evolution from print. They will naturally expect their revenue stream to continue and increase. Scholarly and research journals always depended on subscription revenues, as advertisement revenues were not feasible due to low circulation pattern. The circulation revenue largely came from the institutions, which often subsidized individuals and members (in case of Professional Society journals). There are no indications that as of now, Internet would change this pattern for research journals. Hence, the publishers have largely continued the pricing models of print journals and with policies leading to stricter enforcement of copyright compliances. The pricing model that have emerged are:

- Free subscription to e-journal against print subscription
- Additional 10-25% (or more) of print price for print and e-journals
- Plus or minus 10-15% for subscription to e-journal version only

Some publishers for whom revenue is not a consideration and the publishers of a good many popular, trade and industry magazines where revenue comes primarily from advertisements, have offered their e-journal free to all, completely de-linking their e-journals from print model. This practice is more in the direction of trends set by Newspaper publishers. Most publishers are testing waters in Internet stream and are likely to introduce some level of fee in future. Much depends on the maturity of Internet based advertising industry, which is still in transition.

6.2 Aggregators Model

This model is sphere-headed by the bibliographic database producers and vendors who ventured into building full-text databases during early 80s. A database producer of journal literature always focussed on aggregating literature to provide subject focus cutting across the boundaries of journals, and also to create a tool for retrospective access to print journal archive. These database producers were the first and the earliest to use IT and go electronic. Some of them have successfully applied their database models to aggregate e-journals also. However, unlike with bibliographic records where the database producer owned the database, the e-journal will have to be licensed from the primary journal publisher, which has made the aggregation model for journals much different from their earlier business model used for bibliographic databases. The major players in this game today are companies and organisations like Bell&Howell Information and Learning (formerly UMI), ADONIS, and Ovid.

An aggregator licenses the rights from a set of publishers and aggregates them into a common database. His bibliographic database with additional functionalities like table of contents, tools for generating current awareness acts as the interface for delivering e-journals to libraries. Two pricing models have emerged by aggregators.

1. Publisher's Price, Plus

In this model, the aggregator offers the e-journal at publisher's price plus additional charges varying from 10-50% or more. The aggregator offers the subscriber the choice

of selection of journals. Ovid and ADONIS fall into this category. Ovid charges as much as 30-60% over the publisher's price. Ovid also offers electronic-only and electronic—plus-print price option. However, they will not handle the print journal subscription but limit themselves to e-journal only. ADONIS delivers the journal on CD-ROM as a local solution for access within in the library's Intranet. Ovid offers both Internet and local solution models. Both offer the software for local archiving, with an additional technology fee for the software

2. Less than Publisher's Price.

Bhel&Howell Information and Learning (BHIL) and IEEE offer this kind of pricing model. BHIL's PQD (ProQuest Direct) offers access to over 3,000 plus e-journals in different subject collections. Their PQD's database collection of over 6,000 journals acts as an access and search interface for these 3,000 plus journals. The only limitation of this model is that the library will have to subscribe to all the e-journals offered in a specific subject collection. However, a substantially lowered pricing brings down the cost per journal to a uniform level and far below publisher's price. For example, the ProQuest Medical Library (PML) from BHIL offers around 220 e-journals. The cost per journal works out to around US\$60 per journal. If one were to subscribe to all these journals at publisher's price, it might cost, on the average, more than US\$200 per journal. www.bhellhowell.infolearning.com

6.3 Subscription Agency Models

Traditionally subscription agencies focussed on the commerce side of the journal business and the database producers focussed on the content side of the business. With Internet triggering opportunity for e-commerce and the journal delivery going electronic, Subscription agencies have a unique opportunity to combine e-commerce and e-journal into an effective new business model. Some of the leading names like Swets, RoweCom (Information Quest) and Blackwell have effectively combined e-journal delivery with e-commerce through their gateways. They are emerging to act as:

1. E-commerce gateway for subscription handling, a traditional role up-graded to Internet based model.
2. Interface gateway for linking to publisher's e-journal sites through a common password to all the journals a library subscribes through the agency
3. Bibliographic database for several journals, which acts as access interface to the library for the journals they subscribe, and a search and document delivery interface for several thousand journals.
4. Third-party archive for libraries desiring to maintain a remote archive for all the journals they subscribe.

6.4 Models emerging through Library Co-operatives and Consortia

As a cost reduction process to manage tight budgets, libraries always chose co-operative acquisition and resource sharing as their favorite models. Various models are emerging as a result of this effort. Two interesting models that have emerged are:

1. OCLC which has been a pioneer in the application of IT for library networking to promote resource sharing with due respect to copyright complications offers e-journal access to over 300 journals, with a bias to social sciences. OCLC's model is similar to Ovid model but is priced almost at publisher's price level, making it the most cost-effective model. But, OCLC does not offer local solution.
2. HighWire Press (<http://highwire.standard.edu>) was a consortium originally promoted by Stanford group of libraries. It has developed an e-journal archives and access interface for over 100+ science journals. Its search engine and access interface, is one of the best in features and functionalities offered. It fully uses the capabilities and advantage of web technology. The pricing model works out fairly economical, often less than the print journal price. Highwire is willing to partner with various organizations to create e-journal content, particularly to support scholarly societies and university presses. (2)

Several publishers have come forward to encourage libraries to develop their own consortium to share e-journals, each with his own set of policies and pricing models. In this consortium model, the publishers will treat all the e-journals subscribed by consortium members as one composite collection. Consortium members are allowed to access the entire collection irrespective of how many of those journals are subscribed by each library. A major limitation enforced by the publishers is that the participating libraries should maintain their print renewals at the previous year's level.

7. CONCLUSION

E-journal revolution has set in without doubt. Both the compulsions and advantages of the emerging worldwide digital library scenario and the imperatives of Internet economy are unlikely to leave the libraries with any choice. Managing the complexities and decision choices thrown up by the new paradigms caused by e-journals, particularly the archiving and copyright issues, will prove to be the major challenge to libraries, publishers and all other involved players.

8. REFERENCES

1. Butler, Declan. The writing is on the web for science journals in print. *Nature*. No. 397, p195-200, 1999.
2. Arnold, Stephen E. The scholarly hothouse: Electronic STM journals. *Database*. V22, No.1. p27-33. Feb/Mar 1999.