

# A model for economic management of electronic resources in research libraries and information centres

Saumen Adhikari

**Abstract.** Management of electronic resources within the budget is a major challenge for research libraries and Information Centres. As the need of different types of electronic resources and cost of resources, both are growing proportionately, research libraries are struggling to manage the situation in the era of multidisciplinary research. Again, publishers are business minded they are charging libraries on the basis of per paper download cost. As a solution this model tries to control the downloading of research papers judiciously based on artificial intelligence.

**Key words:** Electronic resources, Expert system, Download cost of electronic resources

## 1. Introduction

With the advent of the internet, various electronic journals and online databases; the volume of information available ranging across all interests has been exploded. Libraries and information centres are struggling to develop their collections because of the limited budget. Further with the progress of multidisciplinary research, libraries need various types of journals of different subjects. Again the cost of electronic resources has been increasing every year. In the developing country like India, where all research libraries are facing difficulties to procure their required electronic resources. Publishers charge on the basis of number of downloads of research papers. For bigger institutes number of research scholars are more and number of downloads shall be high. So they have to pay more for the same resource compared to smaller institute. Again, it is found that for a particular journal all the papers are not downloaded. Only few limited papers are getting multiple and cumulative downloads. Then the question arises why library should pay so much for repetitive

downloads. This model tries to find out a mechanism to relieve research libraries from making payment for the repetitive download of research papers available in various online journals.

### **1.1 Objectives**

1. To do judicious utilization of the library budget and fund management.
2. To enrich library resources by providing scope to procure more electronic resources with limited fund.
3. To encourage researchers to for multidisciplinary research by providing more electronic resources of different subjects.

### **2. Electronic Resources usage study:**

What are Electronic Resources (e-resources)? As per UNIVERSITY OF TEXAS AT EL PASO, “an electronic resource is any information source that the library provides access to an electronic format”[1]. In simple words electronic resources are documentes in electronic version. The Library provides online or offline access to this information. These documents may be journal, book, database, thesis, archive, magazine, etc. Library and information professionals have been carried out several studies to analyze the e-resource usage patterns and its management in various libraries. Professionals are also worried about e-resources organization and it proper dissemination and systematic access. In this regard, some works may be mentioned like - Jotwani[2] studied on the trends in acquisition and usages of e-resources in IIT libraries. Alison and others [3] analyzed the factors affecting usage of electronic information in Universities in Uganda. Anbu K and others [4] talked about the flow of e-resource management. Gowda and Shivalingaiah[5] focused on the attitude of research scholar towards usages of e-resources in Karnataka University. Millawithanachchi [6] showed the picture of electronic resource usages in University of Colombo. Again, Seetharama [7] conducted study about collection development and management of electronic resources. Manjunatha and Shivalingaiah [8] did research on resource sharing among the academic libraries. Singh and Veralakshmi [9] took the modern concept like cloud computing for the sharing of electronic resources. Nyamboga [10] discussed about the development of electronic resources in the information centres. Sreekumar [11] developed

a system of e-resource management. Ram and Rao [12] provided metadata description for integration of resources. Chandel and Saikia [13] examined and explained the challenges and opportunities of electronic resources. Bhatia [14] showed interest in the usage of e-resources in Degree College. Lal [15] worked on the consortia based electronic information sharing among the biotechnology institutes. Thanuskodi and Ravi [16] made a study on the use of resources at Manonmaniam Sundaranar University. Kaur and Verma [17] analyzed the use of e-resources in Thapar University.

These research works represent that library and information science professionals always have been thinking about the better management and dissemination of e-resources. This model gives emphasis on optimum management and utilization of electronic resources.

### **2.1 Utilization of Electronic Resources and download cost:**

The majority of researchers of the present era is interested in multidisciplinary areas. These multidisciplinary areas are like application of chemistry in medical sciences, the application of physics for developing medical instrument, application of computer science in physics, chemistry, biotechnology, like simulation technology, application of chemistry in biology etc. In the era of collaborative research people are working in a group. Senior researcher has a group of some junior fellow scientists of different subjects like chemistry, biology, computer sciences, physics, biotechnology, etc. Therefore, research libraries are no longer confined with only one or two subjects like physics or chemistry. And to satisfy the information thirst of researchers, libraries have been procuring e-resources of various diversified subjects. As a result nowadays research libraries are struggling to fulfill the boundary less or seamless need of electronic resources with their limited budget. The price of journals has been increasing every year. For developing countries, currency conversion rate is also a reason for increase of price. Again, same journal is having different price for different institutes. In this regard the publishers' clarification is, as different institutes are having different number of research paper downloads of the same journal their usage are different. They fix the journal access price on the basis of usages; means research paper downloads. Again multidisciplinary research has been increasing day by day. There is amalgamation of subjects like Biology, Chemistry, Medicine, Physics, etc. Now research libraries need journals of

various subjects like Physics, Chemistry, Biology, Medicine, etc. But there are not so adequate fund in the Indian research libraries to afford so many journals of different subjects.

Again, it is found that out of total research paper downloads, considerable number of popular papers are repetitive downloads; rather it is better to say cumulative in nature. Even the same person downloads same paper repetitively as and when needed instead of keeping the paper with him. Now the question arises why should a library pay repetitively for cumulative downloads of the same paper. In this model a solution to this problem has been thought about and presented.

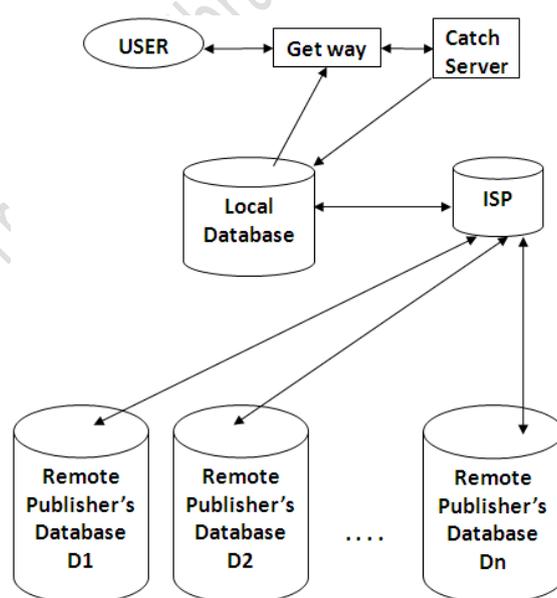
### **3. Methodology:**

This model has been developed based on the concept of artificial intelligence. The way the human brain learns and stores information in the brain means database the model follows that. Human brain stores information in his database (neurons) since childhood. Every time he faces any new situation he stores that information in his brain. Later on, while facing the similar kind of situation he retrieves that information from his brain and responds. Following that here the links of the papers and their number of hits (by user) will be continuously sorted and updated in logical table and stored. There is a catch server, which is having a separate logical table for different journals. In the link of papers of a journal, the initial portion of the strings is same and only paper numbers are different in the link string of different papers. Therefore, catch server is not accepting all requests of the LAN (Local Area Network) rather when it is getting specified string of different journals; it only catches those requests ignoring other web page requests in the internet. The moment the catchy server gets request for any paper, it will consult the journal tables in the database. For the first time paper will be downloaded from the source publisher's server. After that it will be saved in the library's local server. Next time the local server will provide the paper and corresponding hit number of the paper will be increased. One hit means one research paper is downloaded by any user. Next time if anyone downloads the same paper its hit counter will becomes two. For any journal table, papers are sorted on the basis of the hit number. As

popular papers are having repetitive downloads, this sorting mechanism reduces the search time and the most popular papers shall come up near the top of the table.

#### 4. Architecture of the Model:

The library has a catchy server in the institute LAN. One logical table is maintained for each journal in the local database. It is found that for a journal, all papers' links, are having a string whose initial portion is the same only paper number varies for different papers. Moment any user hits a research paper of any journal the server goes to search the available table in the local database as per the link string of the paper. It will search the paper in the respective table. For the first time it downloads the paper from the remote publisher's site and keeps a copy in the local server. It assigns the hit counter as 1 for the first time. Next time when the cache server receives the request for the same paper, first it searches the respective table, if match found it takes the paper from the local server and updates the respective hit counter for that paper. The data flow datagram is given below.



Data flow datagram

Now the question arises; in any institute a good number of users are always browsing in the campus LAN. And Internet Service Provider (ISP) of that research institute is always receiving a huge number of requests from the users end. How to control so many requests; it will definitely have an impact on the speed of internet and download.

The solution is that the cache server does not catch all requests. It only catches the requests where it finds the string (web link) of different journals. On the basis of link string it goes to search the respective table. Again, in a particular table; paper links are sorted on the basis of hit counter number. This sorting method has been pulling up the higher heights (research paper having higher hit) at the top region. Therefore, popular papers are located at the beginning; means top of a table. For any library most of the user hits the popular papers repetitively. Naturally, research papers which are having cumulative download are downloading faster. In this way the model tries to maintain the speed of the internet in the Library LAN.

The model is an application of artificial intelligence where the system has been learning and every time updating the counter number / hit number of each popular research papers on repetitive manners. After two to three months of learning, the system is expected as learned system or expert system. Although the learning procedure is a lifelong process. It will go on and with time, system will be much matured and intelligent enough. Means papers are sorted (popular papers are located at the top region) in all the tables in the local server. Therefore the library is having a local database where most of the important papers of accessed journals are arranged at the top.

#### **5. Limitation of the Model:**

There are two limitations of this model. One is the internet and download speed of the library LAN and another is the copyright issue. The problem of internet speed has been discussed already. The copyright problem arises as research papers are downloaded and stored in the local server and next time system is providing papers from that local server, it may be treated as a case of torrent. Which may be considered as infringement of copyright. But in defense the argument is that, as library has been subscribing the electronic journals from the publishers for researchers of that institute, therefore any research library is allowed to use the papers repetitively within the institute LAN for academic purpose, and

libraries are not going to make money by reusing these papers. Moreover the model is not like a torrent and access of the local server is not open in the internet. The research papers are kept in the local server only for the use of library users within the institute LAN. So there is no violation of copyright. The model is a systematic access mechanism to get research libraries rid of repetitive charging for the same paper.

## 6. Experimental study:

For execution one catch server having configuration, 1 x Quad-core Xeon server processor 2.4 GHz, Cache 12 MB, RAM 8 GB, has been used. The DBMS: PostgreSQL is used at the back end and JSP (Java Server Programming) is used at the front end. Tomcat is working as a web server. An interface has been built up using JSP to browse the internet through the said model.

A prototype test has been conducted for two journals. The system is providing satisfactory performances. There are some glitches, but required customizations are incorporated as per the need of the users.

Two tables mentioned below are illustrating how logical tables are maintained in the local database. First table is for journal A (say). Here LA1 is the actual web link of a research paper belongs to journal A. The physical address of that paper in the local server is A1. 260 is the number of hit counter received by that paper. The same way other papers are placed on the table. Papers are sorted in the descending order of their hit counter. Similarly, another table is shown for the journal B (say).

Table: Journal A

Links	Local Address of paper	Hit Counter Number (Sorted in Descending Order)
LA1	A1	260
LA2	A2	225
...	...	....
LAn	An	1

Table: Journal B

Links	Local Address of paper	Hit Counter Number (Sorted in Descending Order)
LB1	B1	746
LB2	B2	408
...	...	...
LBn	Bn	1

## 7. Conclusion:

Cost effective management of electronic resources of research libraries is a crucial issue for the library professionals. Need and demand of researchers for various types of e-resources have been growing up every year. The research libraries have to make proper plans for judicious and economic utilization of research paper downloads. The model is an initiative in that context. This is an application of Artificial Intelligence where we have used the concept of repetitive updating of database of the local server for quick searching of papers. Further changes to different modules of the model will make the system robust and scalable in due course of time.

## About Author

Saumen Adhikari

S.N.Bose National Centre for Basic Sciences

Dept. of Science and Technology, Govt. of India

Block-JD, Sector-III, Salt Lake, Kolkata - 700098

E-mail: saumen1111@gmail.com, Ph : 9433580990

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