

Usage and Impact of Science Direct Material Science Package in a Material Science Library

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ABSTRACT

Defence Materials Stores and Research and Development Establishment (DMSRDE), Kanpur is working in the field of nonmetallic materials. This paper tries to evaluate the usage statistics of Science direct material science package of M/s Elsevier in terms of number of downloads of full text articles available to users of DMSRDE. Usage data of science direct material science package from 2005 to 2015 is analysed to assess the usability of journals in terms of highly utilised or non-utilised journals, average cost per article, and the impact of the online availability of journal articles on the library services. The study reveals that only 12 per cent of the highly used titles of package accounts for 65-66 per cent usage. The cost per article study supports package subscription over individually selected highly used titles.

Keywords: E-resources; usage analysis; science direct services; cost analysis

1. INTRODUCTION

Technical information centre's or libraries are considered the heart of any research institutions. As the research activities are the basis for the progress of any country and primary means of getting latest research information is through scientific and technical journals, so the libraries are spending the huge portion of their budget in subscribing journals. After realising the importance of e-journals and to keep pace with the growing literature requirements of users, libraries have now started providing access to e-journals along with print journals. Libraries don't just subscribe the e-resources but also ensure that users get the basic infrastructure, browsing facilities with greater bandwidth and training to avail the facilities offered to them. Technical Information Centre of Defence Materials Stores and Research and Development Establishment is presently having approximately 22000 books, 18000 bound scientific and technical periodicals; 5000 specification, NTIS reports and standards. It is also having access to various online journals through DRDO E-Journal Consortium. National Knowledge Network and Internet Centre has also been set-up where users have been provided 15-20 computers with internet connectivity of 100 mbps and thus serves as a central hub for accessing online journals and NPTEL lectures.

2. LITERATURE REVIEW

There is a plenty of literature available on usage analysis and impact of electronic journals in academic and research libraries, which can be clustered into three categories. First category contains articles related to use and user behaviour of

electronic journals, Second category covers literature related to usage analysis of electronic journals available through consortium and the third category contains articles analysing subscription of full package versus individually selected journals from package based on journal and number of full text article downloads. Though this paper is centered on third category but we have included articles relevant to our study in all the categories.

Davis and Solla¹ established a relationship between journal and number of article downloads. Their study exemplifies that for ACS titles, the vast majority of users download few articles and consult few journals, also a small number of heavy users can have an extremely large effect on the number of total downloads. And lastly, the relationship between journals consulted and article downloads is quadratic, meaning that users that rely on more titles tend to download many more articles than expected. Botero², *et al.* analysed the comparative findings of two studies undertaken at the University of Florida Libraries comparing online journal usage statistics derived from COUNTER-compliant publishers Their evaluation were intended as tools for determining trends in the costs and use of online journals at the University of Florida. They also explored the relationship between the large publisher online journal packages and online journal usage, and the effects of big deal packages on library budgets. One significant finding of their study was that the relative cost-effectiveness of the electronic journal packages being received through the big deal, especially when these packages are measured by the number of full-text downloads compared to the cost of articles supplied by document delivery services at HSCL. Susheela³ pursued her study to emphasise the necessity of evaluating the library resources in terms of their quality, cost benefit

and usefulness. She concluded that usage statistics certainly supports in the complex decision making activity of serials management in university libraries. Bansode⁴ studied the use and impact of e-journals on the users of University of Pune, Pune to find out the preferred format of use of e-journals and whether their library satisfies the information needs of its users. They concluded from their study that majority of users prefer electronic journals compared to print journals and they found positive response from the users for e journals as they are really helpful in searching the appropriate references. Nicholas⁵, *et al.* highlighted the importance of log usage analysis to determine the use and information seeking behaviour of the e-resources and summarises that logs provide a sound indicator of use and information seeking behaviour albeit in respect to just a part of the information seeking journey. But also emphasise that in today's parlance the digital evaluation methods are just not effective, economical or practical. And task of filtering the unwanted data has become very complex.

Davis⁶ analysed the annual e journal usage data for the North East Research Library (NERL) consortium 2000 and 2001 for the Academic Press IDEAL aggregate package. Their study patterns indicated that a small number of journals formed the majority of total use. Titles not subscribed in print received about ten times less use than locally subscribed titles. Cluster analysis revealed three distinct groups of institutions based on use of the journal package: large research institutions, medical institutions, and smaller liberal arts colleges and polytechnic institutes. Student enrolment is a good predictor of total usage, with medical institutions being an exception. He recommended that institutions consider their consortia membership and organise themselves into groups of homogenous institutions with similar missions. Moorthy and Pant⁷ evaluated the use of electronic resources in DRDO Institutes with the help of analytical study of usage of DRDO E-Journal Consortium for the period 2009-2011 for 8 publishers. The study revealed that usage is highest among large DRDO units and in those units that carry our research in basic sciences. The labs dealing in areas like training, high altitude agriculture, psychology, certification, bio-energy, recruitment of personnel etc. use the electronic resources less frequently.

For analysing the big deal versus individual selected journal titles Singh and Murthy⁸ studied the use of Elsevier's Science Direct at IIT Roorkee to explain whether big deal mode is the right approach for consortia subscription or not. They studied the 1486 number of titles for analysing the usage of science direct at IIT Roorkee which was based on one year data of 2003 and found that very small fraction of the titles available are being heavily used and there is a very large portion which either not being used at all or being used rarely. The concentration of the requests around a limited number of titles clearly shows that the core collection is very much alive and active. If IITR subscribe to only 17(1.14 per cent of the total available) titles than its 25 per cent requirement can be met. Subscription to 66 (4.4 per cent of the total available titles) alone can meet 50 per cent requirement and subscription of 177 titles (only about 12 per cent of the total) can meet its 75 per cent requirement. Thus 88 per cent of the titles are being subscribed to meet 25 per cent of the total requirement. This

data clearly specifies that the big deal mode of subscription is not at all in the favour of the consortia. Schopfel and Leduc⁹ evaluated the usage statistics to compare it with the two modes of subscription, individually selected journals vs packages (big deals). They found that individual subscriptions to journals are more selective than big deals, and tend towards a traditional retail model. Unlike subscriptions through packages, usage and individual subscriptions can be related by a similar inclination. Singh¹⁰, *et al.* analysed the usage, cost and return on investment (ROI) of e-resources specially the Science Direct online database at Banaras Hindu University library system. BHU library subscribes to 13 subject collections out of 24 subject database provided by science direct. Usage data of 5 years (2009-2014) for full text downloads and 3 years (2012-2014) for cost analysis and ROI taken from science Direct for analysis. They found that though the number of download shows continuous increase in consecutive years, the cost per download varies according to subscription prices and conversion rates from USD to INR. They concluded that 13 subject collections subscribed by BHU library is quite useful and used extensively by its users to support its continuity in future.

Singh¹¹ compared the full text download statistics of springer journals for the 5 year period (2007 -2011) in an academic library to identify the most used and least used titles and to establish mathematical relation between the number of titles and number of article download known as principle of constant averages. His analysis showed that the average download in each group remains more or less constant which he termed as principle of constant averages and represented mathematically as : if the download data in a scientific and technical institution is arranged in different groups such that highest download (H) in group one has single digit download ($\log H < 1.0$), group two has double digit download ($\log(H) = 1.0 - < 2.0$, and so on than for every calendar year D/N is equal to constant (where D = number of downloads in a group and N = number of journals in that group). The analysis revealed that out of 2500 titles subscribed only about 125 (only 5 per cent) are heavily used which can be considered for subscription. He also stated that careful analysis of usage data can give remarkable tool for helping librarians.

Though vast research is available for analysing the usage and user behaviour of electronic journals and consortium based statistical usage analysis, the literature on analysing usage and cost effectiveness of package subscription versus individually selected title is very few. Most of the articles in this category recommends procuring individual titles over package subscription, but this paper put an effort to present the cost effectiveness of package subscription over selected journal titles from package.

3. OBJECTIVE OF THE STUDY

The study confine only to science direct material science package (SDMSP) on the basis of usage analysis in this article. The procurement of SDMSP had been started as an outcome of an urge by our scientific community to have a quick access to journals specifically devoted to materials science stream to aid in the current research projects. In 2005, SDMSP covered 121

titles from M/s Elsevier are being subscribed for fulfilling the needs of our scientific community. Gradually the number of titles increased from 121 to 160 titles. Though not covering the whole gamut of journals required for research in non-metallic materials, most of the research requirement of our scientists gets fulfilled through SDMSP. The study has been carried out keeping in mind the following objectives to assess the efficacy of the service provided to our patrons:

- i. Features and services of SDMSP along with the number of journals available in terms of paid/open access and complimentary.
- ii. Usability of journals in terms of number of downloads from 2005-2015 and file type preference of accessing the database. Number of downloads is actually the number of full-text articles downloaded from publisher website.
- iii. Most heavily used and non-utilised/less utilised journals under the SDMSP package.
- iv. Cost per article based on the number of downloads from 2005 to 2012.
- v. Impact of SDMSP on the library services.

4. METHODOLOGY

Elsevier science direct has a separate usage report web interface through which they provide COUNTER Compliant reports that can be sorted, printed, visualised and exported in excel, CSV or PDF format. Hence, the usage reports for subscribed and complimentary titles from 2005-2015 were obtained from science direct usage report portal¹². The data was then arranged to get information under appropriate head. Sorting, Tabulation and graphical tools have been applied to analyse the data. It is also to be noted here that presently our laboratory is having online access to more than 200 titles under material science subject collection against subscription of 160 titles. Access to remaining titles comes under complimentary and open access category. For our study purpose we have taken 160 core titles of material science package for the sake of convenience and uniformity of available titles in all years.

5.1 Science Direct

Science Direct is a leading full-text scientific database in the sciences, technical and medical arena and a part of Elsevier which publishes over 2,500 peer reviewed journals as well as books and secondary databases. There are 24 subject groups under four major subject categories i.e. physical science and engineering, life sciences, health sciences and social sciences and humanities. Materials Science subject category comes under physical science and engineering group along with other subjects. The platform offers sophisticated search and retrieval functionality that enables the user to maximise the effectiveness of their knowledge discovery process.

5.2 Usage Analysis of e-Journals

The basic tool to measure the usage of online journal is its usage statistics as it provides the evidence of use by our user community in terms of number of downloads of the journal articles. We have taken the usage data of 11 years from 2005-

2015 for analysing the usability of SDMSP. In 2013-2014 the subscription of SDMSP had not been materialised. The usage shown in 2013 and 2014 is actually the usage of archives, open access and complimentary titles available within that time period. Figure 1 shows the number of downloads from 2005 - 2015

It is clearly evident from the Fig. 1 that out of total downloads the maximum usage was made in 2009 and minimum articles were downloaded in 2014 by our scientists. The figure also depicts that usage in 2006, 2013 and 2014 is below 3000 which is very low as compared to usage of rest of the years. The Fig. 1 also reveal that most preferred format of download is pdf over HTML as we can see in all the years from 2005 - 2015 most downloads were in PDF format when compared to HTML format. The leading reason behind the fact may be the on screen visual appearance of pdf documents is the same as the printed version.

5.3 Analysis of Journal Titles

To analyse the trend of usage of journal titles we have divided the 160 titles on the basis of number of full text downloads into three groups viz Group A (0-100), Group B (101-1000) and Group C (more than 1000) as shown in the Table 1. Group A consists of 81 titles each of which is having number of downloads between range 0-100, with 2346 total downloads having 3.48 per cent usage, Group B consists of 60 titles with 20911 downloads and group C contains 19 titles with maximum 44088 full text downloads. It is worthy to note that the number of titles contributing to maximum usage is 65.47 per cent for group C is only 19 and vice versa.

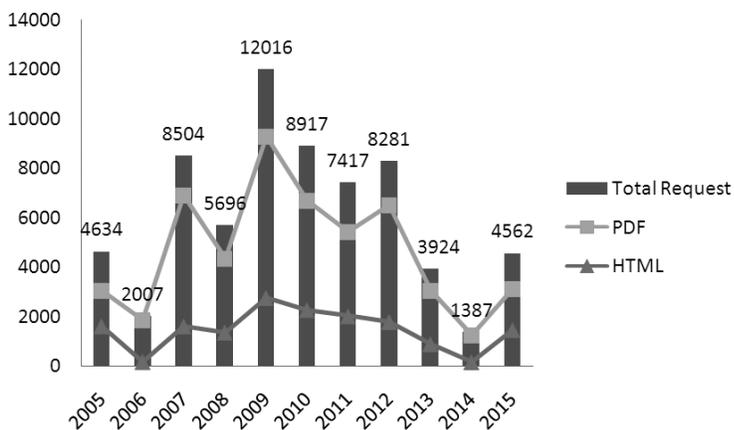


Figure 1. Year wise usage and file type preference of SDMSP from 2005-2015.

Table 1. Group wise distribution of journal titles based on number of full text downloads

Groups	Range (number of downloads)	Titles accessed	Total downloads	Per cent
Group A	0-100	81	2346	3.48
Group B	101-1000	60	20911	31.05
Group C	More than 1000	19	44088	65.47
Total		160	67345	100

5.3.1 Journal Titles in Group A

Only 129 articles have been downloaded from 32 titles in sub group 0-10 which means on an average each titles has approximately only 4 hits in the span of 11 years and contributing only 0.19 per cent of the total usage of the package. We can see the decreasing trend in number of titles accessed while moving down the column of sub groups and an increasing trend in number of full text downloaded except for sub group 61-70 and 91-100. The percentage of total usage in terms of number of full text downloads is just 3.48 per cent from the titles covering more than 50 per cent of the titles available in the SDMSP strike off -presentation of Table 2.

Table 2. Data of number of titles accessed and number of downloads in Group A

Full text downloads	Titles covered	Total downloads	Per cent
0-10	32	129	0.19
11-20	10	143	0.21
21-30	7	181	0.27
31-40	6	223	0.33
41-50	7	321	0.48
51-60	6	337	0.50
61-70	3	194	0.29
71-80	4	291	0.43
81-90	4	337	0.50
91-100	2	190	0.28
Total	81	2346	3.48

5.3.2 Titles in Group B

Group B ranges from 101-1000 consisting of 60 titles having 20911 number of downloads and constitute 31.05 per cent usage of the SDMSP from 2005-2015. The numbers of titles comprise almost 40 per cent of the titles available in the package however the usage is not adequate even from this group of package. Maximum usage in this group is 5.19 per cent with 14 titles in range 201-300 with 3496 downloads. The minimum usage i.e 923 in the group is from sub group 900-1000, but on the other way it is the maximum usage as the number of hits comes from only one journal title and single journal is contributing to 1.37 per cent usage of the package Table 3.

5.3.3 Titles in Group C

Group C has titles that have more than 1000 downloads with maximum usage of 65 per cent and minimum number of titles i.e only 19 titles which accounts for 44088 downloads. The data of this group is just opposite with data of group A with minimum usage and maximum titles. The 19 titles constitute only 11-12 per cent of the titles available in the package and are considered the core journal titles that have been read or downloaded extensively by our scientific fraternity. The detail of the individual journal titles with their respective number of downloads is shown in Fig. 2.

Table 3. Data of number of titles accessed and number of downloads in Group B

Full text downloads	Titles covered	Total downloads	Per cent
101-200	19	2796	4.15
201-300	14	3496	5.19
301-400	9	3062	4.55
401-500	6	2679	3.98
501-600	3	1682	2.50
601-700	2	1349	2.00
701-800	2	1500	2.23
801-900	4	3424	5.08
900-1000	1	923	1.37
Total	60	20911	31.05

Table 4. Data of number of titles accessed and number of downloads in Group C

Full text downloads	Titles covered	Total downloads	Per cent
1001-2000	11	14285	21.21
2001-3000	3	6402	9.51
3001-4000	2	7657	11.37
4001-5000	2	8721	12.95
5001-6000	0	0	0.00
6001-7000	0	0	0.00
7001-8000	1	7023	10.43
0	19	44088	65.47

It is evident from the figure that Polymer is the highly utilised journal among other journals is Polymer with 7023 hits occupying 10.43 per cent of the total usage of the package journals. Similarly Carbon and European Polymer Journal are having 4667 and 4054 number of downloads respectively and constitutes 12.95 per cent usage of the package journals. The maximum usage in Group C is 21.21 per cent which comes from 11 journal titles having 14285 number of downloads. Though this group contains the titles which gives the maximum usage of the package but usage may be further enhanced by conducting orientation programmes by library and making users aware about the alerts services provided by personalised access options by just registering with the website like saved search alerts, topic alerts and journal alert for publication of new issue.

5.4 Analysis of Cost per Article of the Package Journals

The average cost per article is calculated on the basis of number of downloads and subscription fee paid during 2005 to 2012. 2013 to 2015 are excluded from this study as in 2013-14 the package was not subscribed and all the online journals along with consortia journals are subscribed through a nodal agency; DESIDOC, Delhi.

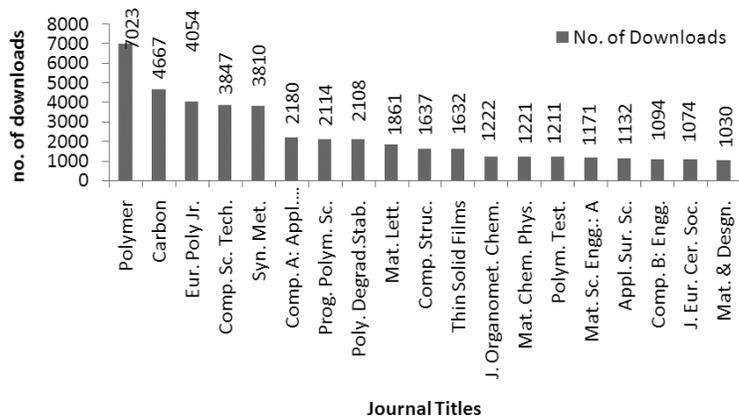


Figure 2. Usage of 19 titles having more than 1000 downloads.

The Table 5 clearly indicates that the minimum cost per article is reported in 2009 (INR 142.39) when the usage is maximum and maximum cost per article is reported in 2006 when the usage is minimum. We have not observed any trend in cost/article as the cost per article depends on the subscription cost along with the number of downloads in a particular year. The average cost per article in all the years comes to around INR 228/-. When calculated in US\$ it will cost maximum \$3.30, which is quite less when compared to pay per download option offered by the website. At the time of study the cost of downloading a single article from any science direct journal is US\$ 31.50 per article¹³. Hence it is clear that pay per download is an expensive option for our library as it may cost 10 times more than the average cost of single article. It is also worth mentioning that the reason for choosing package subscription is first our library is getting the science direct material science package on highly discounted price, secondly the publisher is offering access to 10 years back files of the subscribed titles and thirdly the package contains around 50-60 complimentary titles.

5.5 Impact of Package on Library Services

- i. Among other material science DRDO labs, the Science Direct Material Science Package has been subscribed only in our laboratory, thus literature requirements of other DRDO labs are also being fulfilled through inter library loan services. So we can say that Inter library loan has increased to a great extent while users requirement of photocopying has decreased.
- ii. DMSRDE Technical Information centre is having a central national knowledge network and internet centre and approximately 400 users are visiting library every month for accessing the online-resources available to them. Though the frequency of visit to library has increased but the focus is being shifted from print to online-resources. As earlier users tend to visit library for reading and reference

purposes but now most of the literature requirement of our patrons gets fulfilled through this package as our lab is working primarily in materials science stream.

- iii. Library has initiated a literature search service for its scientists and provides latest relevant articles of interest based on the keyword provided by them.
- iv. The role of library has changed from providing the placed based services to access based services. Now users prefer getting their required information in digitised form on their own desktop and library tries to make available the requisite material through library portal and E-mails etc. with minimal loss of time.

6. CONCLUSIONS

After analysing the reports we can conclude that usage of nearly 50 per cent of the journals titles are negligible especially the 81 titles in group A. Out of which 32 titles are having nil or 0-10 number of downloads in a large span of 11 years so they can be considered as nil used titles. Usage of titles falling in Group B is also not very significant and contributes only 31 per cent usage of the package in the 11 years span. There is a common trend in every group that as the range of number of downloads increases the number of journal titles start declining. Consequently, the maximum usage centered on only 19 journal titles of group C. Thus if we procure only 19 titles 65 per cent of user request can be satisfied. But this is only one side of the coin as the prices of the journals is reaching the sky and the subscription price of 19 journals when calculated individually costs more than the cost of the package having 121 titles. The subject packages are offered on discounted price of approximately 90 per cent on their list price by the publisher. Secondly we can opt for pay per view option which is also a costly affair as average cost per article analysed in section 4.4 is INR 228/- (US \$3.35) as compared to US \$31.50 (INR 2142.00) for each article. Considering the above facts we can say that purchasing the whole package is more suitable for our laboratory rather than to purchase highly utilised titles individually. The added advantage is getting 10 years archival access free with the subscription. Library can opt for procurement of some highly used journal titles individually if in future, the subscription of the package may not be continued due to any inevitable circumstance or unreasonable or irrational price hike by the publisher. The libraries always prefer to have a complete set of journals titles owned by them because there is a drawback with online procurement that the moment we stop subscribing the package for some or the other reason, we will have nothing for perpetual access on our end neither the access to the subscribed journal titles nor any of the archives. The access will be available only for those titles whose print is also being subscribed. The publishers justify their decision by mentioning that the user get access to the content only by

Table 5. Year wise distribution of cost per article

Year	2005	2006	2007	2008	2009	2010	2011	2012	Total
Downloads	4634	2007	8504	5696	12016	8917	7417	8281	57472
Price (in lakh)	10.52	12.52	13.67	15.22	17.11	19.38	20.34	22.37	131.13
Price per article (in INR)	227.02	623.82	160.75	267.21	142.39	217.34	274.23	270.14	228.16

paying 10 per cent of the cost so they cannot give the access to the content everlastingly.

There are many pricing options available with the publisher, librarians should judiciously choose the option that is economically feasible for their institution. The emphasis should be on uninterrupted supply and post termination access of subscribed titles for paid period of subscription. Librarians should give proper training and educate their users for using the online-resources and encourage them for maximum utilisation of the subscribed resources.

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