The use of scholarly electronic journals at the Indian Institute of Science: a case study in India

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Abstract
Purpose – The purpose of this paper is to investigate the use of scholarly electronic journals at the Indian Institute of Science.
Design/methodology/approach – The paper examines the methodology and results from a questionnaire-based survey of networked electronic services in India at the Indian Institute of Science (IISc) libraries, serving a variety of disciplines. A random sample of the main cohort was selected and, during five months from January 2004 until May 2004, 700 copies of the questionnaire were distributed among 40 departments of IISc; 397 completed and valid questionnaires (56.7 per cent) were received.
Findings – The results showed a growing interest in electronic journals among the users at IISc. Electronic journals were mostly used for research needs and PDF was the most preferred format. The fact that users have free access to electronic journals at all hours from their own computers seems to be the most appealing feature.
Research limitations/implications – There are many factors that may affect the use of scholarly electronic journals. An attempt is made in this study to see how these resources are being used in a multi-disciplinary institute in India. Limiting its focus to one institute, this paper provides useful empirical evidence for library staff and the research community.
Practical implications – The results of the study will be useful for library staff at IISc and similar institutes in India.
Originality/value – The paper provides original data from Indian end users regarding their use of scholarly electronic journals.

Keywords Electronic journals, User studies, India

Paper type Research paper

Introduction
Scholarly electronic journals are part of both scientific publishing and an emerging communications and publishing environment via the internet. There are many factors that may affect the use of scholarly electronic journals. An attempt is made in this study to see how these resources are being used in a multi-disciplinary institute in India. It should be noted that “electronic journal” in this study refers to “scholarly electronic journals”.

Literature survey
User and usage studies of electronic journals appeared in the literature in the late 1990s, when a large number of electronic journals had become widely available. These studies were mostly carried out among the academic staff of institutes and colleges, who were the most frequent users of scholarly journals (Diedrichs, 2001; Holmquist, 1997; Woodward et al., 1998; Lenares, 1999; Brown, 1999; Baldwin and Pullinger, 2000; Electronic Journals Survey, 2000; Wiley and Chrzastowski, 2002; Tenopir and King, 2002; Conti et al., 2003; De Groot and Dorsch, 2003; Bonthron et al., 2003).

In 1999, research was carried out at the Max Planck Society in Germany. The results of this survey showed a significantly high acceptance of electronic journals and an unwillingness to return to print versions only. Elsevier journals were most used, but the number of electronic journals offered by Elsevier was also the highest offered by one publisher. The researchers also rated the advantages and disadvantages of electronic journals related to various aspects. The advantages included:
• direct accessibility from researchers’ desktops;
• downloading (or printing out) of articles directly;
• currency; and
• full-text retrieval possibilities.

Disadvantages included:
• the lack of long-term access and incomplete volumes;
• network dependency;
• reading from a monitor;
• loss of certain attributes of the paper version;

The current issue and full text archive of this journal is available at www.emeraldinsight.com/0264-1615.htm

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- quality of graphics; and
- lack of citation status and standards (Rusch-Feja and Siebeky, 1999).

It should be noted that the advantages and disadvantages of electronic journals used in the present study are mostly extracted from the above study in Germany.

Another study at the Norris Medical Library at the University of Southern California compared the usage of a matched set of biomedical literature available to users in print and on the web. During the six-month study period, there were approximately 28,000 electronic viewings of full-text articles from the study subset, compared to only 1,800 uses of the corresponding print volumes. The results further revealed a remarkably similar usage curve in the print and electronic data, with just 20 per cent of titles accounting for nearly 60 per cent of usage in both formats (Morse and Clintworth, 2000).

The librarians Clajus and Maier from the University and State Library in Köln carried out a survey among academic staff and found that 16 per cent of respondents did not want to renounce the print version of the journal under any circumstances (Clajus and Maier, 2001). The biggest advantages of the new service were full-text access from their own desktop (49 per cent) and the better currency of the electronic journal over print (Clajus and Maier, 2001).

Another usage study was conducted at Stanford University in 2001 by interview. The project was conducted from November 2000 to March 2001 by researchers at the Institute for the Future. The result showed that the most significant current source of value from e-journals was in scholars’ ability to search them, and that online searching emphasises the article as a relevant container of knowledge rather than the journal itself. In addition, there was not a single pattern of usage that predominated for e-journals, and scholars used them for convenience (Stanford E-Journal User Study, 2001).

A study by De Groote and Dorsch (2001) at the University of Illinois reported that print journal usage had decreased significantly since the introduction of online journals. This decrease occurred regardless of whether a journal was available only in print or both online and in print. Interlibrary loan requests had also significantly decreased since the introduction of online journals. The decrease in use of the print collection suggested that many patrons preferred to access journals online (De Groote and Dorsch, 2001).

In 2002, another user study was carried out, of scientists at the Rudjer Boskovic Institute (RBI) in Zagreb (Pazur, 2002). The results showed a high acceptance and use of electronic journals. The RBI respondents stressed availability before the print version as the most important advantage of electronic journals, and the most important disadvantage to be slow downloads. Very few respondents thought that electronic journals had no disadvantages at all. Most of the respondents preferred the print version in the situation where both were available, but many used both versions equally – 32 per cent and 33 per cent (Pazur, 2002).

A study by Obst (2003) showed that print journal usage decreased by 22.3 per cent in the first year and by 30.2 per cent in the second year after the introduction of online journals. Journals published both in print and online lost 30.4 per cent of their print usage within two years. Two clearly distinguishable groupings emerged: while for Academic Press and Elsevier e-journal usage exceeded print usage by a factor of three or four, the e-journals of Blackwell, HighWire and Springer were used on average 14.6 times as frequently as the corresponding print journals. Print titles not available online suffered a greater decline in usage compared with print/online journals (Obst, 2003).

In 2004 in the UK, a project designed to test a hypothesis that learning can be enhanced by promoting the use of e-journals was conducted by the Business School at University College Worcester (UCW). Analysis of the results indicated that effective collaboration between academic and library staff, the timely embedding of e-journals into the learning process and associating them with the assessment process can significantly enhance the learning of students. The data indicated an encouraging increase in journal usage for assignment research (Colvin and Keene, 2004).

The results of a study at the University of Tennessee Health Science Center showed that the medical faculty read a great deal, especially compared to scientists. The most frequently reported purpose of reading was to support their primary research – 30 per cent of reading. The majority of reading came from recently published articles and mostly from personal subscriptions. The medical faculty continued to rely on print journals (about 70 per cent of readings) versus electronic journals. Medical faculty read more articles than others and needed information digested and verified to save them time. Convenience and currency were highly valued attributes (Tenopir et al., 2004).

Literature studies show that in many studies researchers made a comparison between the usage of print and electronic journals; however, the present study investigates the use of electronic-only journals available in a particular institute.

The research studies described in the paper also demonstrate that the use of electronic journals has increased steadily since 1996, and they have been accepted well among users. The present study attempts to discover the acceptance of electronic journals in an Indian institution.

It is interesting to note that the reading pattern of journals is changing. Tenopir and King have undertaken many studies on the reading pattern of scholarly journals and published many papers and a substantial book. They believe that while evidence suggests that the amount of reading and the time spent reading have been relatively stable over the past 20 years to 2000 (but see the discussion and conclusion for change post-2000), there have been some changes in the ways in which scientists identify the articles they read, and there are appreciable differences in the sources of these articles (Tenopir and King, 2000). Previous studies of scientists’ reading habits had found that scientists in all disciplines read and valued peer-reviewed journal articles, but there are considerable differences in the amount that they read and whether they preferred print or electronic sources (Kling and McKim, 1997). Physicists, for example, are high users of e-print services, and read more articles per year on average than engineers, but fewer than chemists. Medical faculty with PhD degrees on average prefer electronic sources more often than medical faculty with MD degrees. Scientists who work in academia generally read more than those in corporations or government laboratories (Tenopir and King, 2002).
Tenopir (2005) points out:

My research on faculty reading patterns with Donald W. King shows that medical faculty read two to three times as many journal articles on average than humanities or engineering faculty and a bit more than science or social science faculty. These measures of reading have held true over three decades, indicating that they relate to the nature of research in each discipline, not to the value of the reading by faculty. Humanities faculty relies on other sources such as books and primary materials, so while each journal reading may be valuable, there will not be as many. Engineers read many specifications and reports in addition to journal articles.

A recent study by Liu (2005) showed that a screen-based reading behaviour is emerging for reading electronic documents. This behaviour is characterised by more time spent browsing and scanning, keyword spotting, one-time reading, non-linear reading, and reading more selectively, while less time is spent on in-depth reading and concentrated reading. Annotating and highlighting while reading is a common activity in the printed environment. However, this “traditional” pattern has not yet migrated to the digital environment when people read electronic documents (Liu, 2005). The reading patterns of electronic journals are considered in the present study, although they are not the only focus.

Earlier studies on reading behavior (e.g. Brown, 1999; Woodward et al., 1998) have shown that the users prefer print media for reading over electronic media, while recent studies reflect an acceptance of reading on monitors (e.g. Liu, 2005). The preference of print and electronic media is also studied in the present survey at IISc.

It should be noted that although the review of the literature shows an increase in the use of electronic journals along with a decrease in the use of print collections, more recent studies reveal that an increase in the use of older material is occurring as a result of increased visibility/accessibility of older material in the digital environment (Nicholas et al., 2005; Odlyzko, 2000). The study of Nicholas et al. (2005) study was performed using transaction log analysis, which is a recent method to trace journal usage in the digital environment. Deep log analysis (DLA) is a methodology developed by the Centre for Information Behaviour and the Evaluation of Research (CIBER) team at UCL (University College London). A recent study using deep log analysis showed that for different kinds of articles viewed, people who only viewed a table of contents page were far more likely to be current awareness “checkers”, as nearly half their views related to the current period, while those who viewed a journal issue and also went on to view an article or abstract were more likely to view older articles (Huntington et al., 2006).

Finally, there were many similar results in the studies reviewed in this paper; however, we should keep in mind that differences in the direction of effects between different studies can be attributed to different sampling methods or to the methodology adopted.

**Objective of the study**

This study was carried out to see how scholarly electronic journals are being used at a multi-disciplinary institute in India. It aimed to identify users’ opinions of different features of electronic journals, their awareness of the electronic journals service, their use of different publishers, the purpose of use, the components of use, preferred formats and more.

**Methodology**

In usage surveys, data are often obtained by using questionnaires. It should be noted that there are basically four methods of data gathering for profiling electronic journal use:

1. questionnaire;
2. interview;
3. transaction log; and
4. citation study.

Each method has its unique strengths and weaknesses. Data are often obtained by using a questionnaire; these data are standardized for easy comparison. Data gathering by questionnaire is a popular method and is easily understood.

However, much time has to be spent in designing and piloting the questionnaire. Analysis of the results, even with the aid of an appropriate computer package, is also time-consuming.

The questionnaire method was used for the collection of usage data in the present study (see the Appendix). The respondents for the questionnaire were drawn from the Indian Institute of Science (IISc) located in Bangalore, India. Major reasons for choosing IISc were:

- Access to significant number of electronic journals from distinguished publishers.
- IISc is a multi-disciplinary institute providing coverage of different subject areas.
- IISc has a significant number of users of electronic journals.

IISc is an institute of higher learning and is one of the oldest centres of its kind in India, and has a high international standing in the academic world. Internet facilities are available in all departments and researchers have 24-hour access to 6,000 electronic journals. There are few other institutions in India which have access to such a significant number of scholarly electronic journals.

Keeping in mind the objective of collecting usage data from different disciplines/subject areas, the study distributed questionnaires to the faculty and students of all departments at the IISc in two stages:

1. a pilot study; and
2. the full study.

The pilot study distributed 50 copies of the questionnaire to 12 departments of IISc in November 2003. This helped to design the questionnaire for the full study. This initial study helped to identify the major publishers whose journals were actually being used at IISc. The pilot study also helped to eliminate ambiguity in some questions and to fine-tune the questionnaire.

A sample for the main study was selected at random from January to May 2004. Five hundred copies of the questionnaire were distributed on different days among 40 departments of the IISc. Users went to the central library of the IISc, the J.R.D. Tata Memorial Library, in order to use library resources. Therefore, 200 more questionnaires were also distributed randomly to these users during the same period. This made it possible to generalise the result of the study to the entire IISc.

A total of 397 completed and valid questionnaires (56.7 per cent) were received. The total staff and students comprise 450
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academic staff, 1,215 research staff and 480 postgraduate students, as well as an unknown number of guest users who comprised 18 per cent of the sample. Table I shows the response rates from groups of users at the IISc.

Principal component analysis (PCA) was used for statistical data analysis. PCA is a statistical data analysis technique used to reduce the dimensionality of multivariate data. According to Smith (2002):

PCA reduces data dimensionality by performing a covariance analysis between factors. Covariance is always measured between two factors. So with three factors, covariance is measured between factor x and y, y and z, and x and z. When more than 2 factors are involved, covariance values can be placed into a matrix.

When the analysis finishes, the principal components analysis window appears, displaying each component as a line in graph mode. The significance of each component is represented by the color of its graph line, as defined by the colour bar. After PCA analysis, the browser displays a scores plot in which the first and second principal components (representing the largest fraction of the overall variability) are plotted on the vertical and horizontal axes, respectively. Components that exhibit high levels of the first principal component and low levels of the second principal component are displayed in the lower right corner of the plot, and components exhibiting equal levels of the two components lie along the diagonal.

Data analysis

Awareness of electronic journal service
In response to the first question, “Are you aware of the availability of electronic/online journals at your institute?”, 97.7 per cent (388 out of 397) responded positively and 2.2 per cent negatively (9 out of 397). These nine respondents did not answer the remaining questions. So, analysis of usage was carried out on the 388 remaining questionnaires.

Use of publishers (Question 2)
The users were asked about their use of different publishers (see questionnaire in the Appendix). Data regarding preference of publishers of electronic journals is summarized and ranked in Table II based on percentage of use at the IISc.

Electronic journals from Elsevier were being used most by the IISc respondents, with 63.9 per cent of the total usage, and Sage Publications recorded the lowest usage rate with a mere 2.5 per cent. The literature study also showed that Elsevier journals were most used at the Max Planck Society in Germany (Rusch-Feja and Siebeky, 1999).

It is not surprising that the largest publisher of electronic journals (i.e. Elsevier, with 1,349 journals, as opposed to 436

Table I Ranked number of responses by status of users at the IISc

<table>
<thead>
<tr>
<th>SN</th>
<th>Status of respondents</th>
<th>Number of responses</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Research students (MPhil, PhD)</td>
<td>210</td>
<td>52.89</td>
</tr>
<tr>
<td>2</td>
<td>Postgraduate students (MSc, ME, MBA, MA)</td>
<td>94</td>
<td>23.67</td>
</tr>
<tr>
<td>3</td>
<td>Guest users</td>
<td>55</td>
<td>13.85</td>
</tr>
<tr>
<td>4</td>
<td>Research staff</td>
<td>28</td>
<td>7.05</td>
</tr>
<tr>
<td>5</td>
<td>Academic staff</td>
<td>10</td>
<td>2.51</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>397</td>
<td>100</td>
</tr>
</tbody>
</table>

from Springer-Verlag, 300 from Wiley and 120 from IEEE) was found to be the most preferred publisher in this study. It should also be noted that Academic Press merged with Elsevier in January 2003. Elsevier topping the list is expected in view of its dominant position both in terms of absolute number of journals as well as the broad coverage of subject areas which reflected the concerns of researchers in this study.

Purpose of use (Question 5)
The opinion of different categories of respondents – namely faculty, research staff, research scholars and students – with regard to the use of electronic journals were collected on a five-point scale. PCA was also carried out on the data in order to obtain a clear idea of the order of preference of use purposes. By comparing the scores plot and the correlation loading plot, it is clear that electronic journals are most used for “research needs”, often used for “education”, sometimes used for “current information”, and least used for “recreational” and ‘win award” (see Figure 1).

Components of electronic journals (Question 7)
The use of different aspects of the e-journals was evaluated. These were:

- table of contents;
- abstracts;
- full text;
- article references; and
- alerting services.

The results of the PCA are given in Figure 2.

The Score plot and the correlation loading plot of Figure 2 indicate that electronic journals are mostly used for accessing
the “full text” of research papers and often used for “journals abstract”, sometimes for “article references”, and least for “alerting services”.

**Preferred format of electronic journals (Question 6)**
The format of electronic journals is considered to be one of the many parameters that affects their use. Figure 3 presents the scores plot and correlation loading plot of the PCA on this data.

Figure 3 shows that the PDF format is the “most” and “sometimes” preferred choice of electronic journal, the HTML format is “often” used, and that the MS Word, LaTeX, ASCII and PostScript formats are the “least” desired. This may be because most of the electronic journals were easily available in PDF or HTML.

It seems that PDF and HTML are the two most preferred formats with publishers, so users of electronic journals have to accept these two formats. In addition, reader software for the PDF format and browser software for the HTML format are free. When free software is available, generally users are not ready to pay money for other formats. PDF uses less computer memory and the look of the original article is maintained; HTML is also platform-independent, and perhaps this is the reason for users preferring it.

**Frequency of use and amount of time spent on reading e-journals (Questions 10 and 11)**
The respondents were asked about frequency of use and the time they spent reading electronic journals. Table III shows the amount of time spent on online and offline reading electronic journals and the frequency of their use (figure inside tables refer to the number of users).

In order to test whether the amount of time spent on online/offline reading has any association with the frequency of using electronic journals, the $\chi^2$ test of independence was carried out. The results clearly showed that there is a significant association between the time spent on reading online/offline and frequency of use of electronic journals.

**Frequency of use and number of articles read (Questions 8 and 11)**
This study tested whether the number of articles read is also a function of frequency of use. Table IV shows the distribution of articles read over various usage frequencies.

The $\chi^2$ test carried out on Table IV reveals that there is an association between the number of articles read and the frequency of use of electronic journals. Those who use electronic journals daily tend to read more articles than those who use them bi-weekly and weekly.
Status of respondents and frequency of use
(Introduction and Question 8)
The status of respondents might have an influence on the frequency of use, and the data is summarised in Table V. The total number of answers is 343, not 397, because 54 respondents did not respond to this question.

To see whether there was indeed an association between frequency of use and status of respondents, the $\chi^2$ test was carried out on Table V. The result showed that there is a significant association between the frequency of use and the status of respondents. This means research staff, research and postgraduate students are using electronic journals daily, but not academic staff and guest users. This may be because research staff and research and postgraduate students are involved in research every day so they need to be up to date with currently published material. It seems that “providing up to date information” is the most attractive feature of electronic journals for users at the IISc. The low usage of electronic journals by academic staff has already been reported in the literature (Lenares, 1999; Bonthron, 2002).

Importance of electronic journals and their use by respondents (Question 16)
The following question was asked: “Do you agree with this statement: Online/electronic journals are one of the most important parts of scientific communication?”. Table VI shows the results. Of 397 respondents, 366 (92.2 per cent) responded positively. The result demonstrates the strong and predominant role of electronic journals in scientific communication. Table VI shows that 98.1 per cent of those who use electronic journals responded positively, which strongly underlines the conclusion that “Online/electronic journals are one of the most important parts of scientific communication”.

Monitor versus print-out reading (Question 12)
Users were also asked about reading on a monitor compared to reading a print-out. Table VII and Figure 4 show the results. As shown in Figure 4, the preference from respondents is almost equally distributed: 25.3 per cent of respondents always read on a monitor and 26.8 per cent always read print-outs. Also, 26.8 per cent often read on a monitor, while 26.8 per cent of respondents often read print-outs. These percentages suggest that there is an even balance between the media preference. However, a surprisingly high number were happy to read on screen.

Accessibility and availability of electronic journals (Question 13)
The respondents were asked to rank the accessibility and availability of electronic journals on a four-point scale (see questionnaire in the Appendix). PCA was carried out on these
data to identify the classification of availability and accessibility with respect to the scaling. Figure 5 gives the scores plot and correlation loading plot of the PCA.

From Figure 5 it is seen that the respondents strongly agreed that electronic journals were “available 24 hours”, they had “free access” and they also had “desktop availability”. They also agreed that the availability of electronic journals “depends on the network”. They strongly disagreed that they “need special equipment and training”.

It seems that one of the most appealing features of electronic journals is availability at any time. The majority of
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Table VI Importance of e-journals and use

<table>
<thead>
<tr>
<th>Importance of e-journals</th>
<th>Use of e-journals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Yes</td>
<td>362 (98.1)</td>
</tr>
<tr>
<td>No</td>
<td>4 (1.08)</td>
</tr>
</tbody>
</table>

Note: Figures in parentheses are percentages

Table VII Monitor versus print-out reading

<table>
<thead>
<tr>
<th>Type of reading</th>
<th>Always</th>
<th>Often</th>
<th>Usually</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read on monitor</td>
<td>83 (25.3)</td>
<td>88 (26.8)</td>
<td>66 (20.12)</td>
<td>84 (25.6)</td>
<td>7 (2.13)</td>
</tr>
<tr>
<td>Read print-out</td>
<td>90 (26.86)</td>
<td>90 (26.86)</td>
<td>31 (9.25)</td>
<td>111 (33.13)</td>
<td>13 (3.88)</td>
</tr>
</tbody>
</table>

Note: Figures in parentheses are percentages

Figure 4 Monitor versus print-out reading

users agreed that electronic journals are available at the IISc at any time, free of charge.

General features of electronic journals (Question 14)
The respondents were asked to scale the general feature of electronic journals on a four-point scale. PCA was carried out to see the classification of these features with respect to the opinion of the respondents. Figure 6 gives the score plot and correlation loading plot, from which it is easy to identify the classification.

It can be seen from Figure 6 that the respondents “strongly agree” that the advantages of e-journals are their “up to date information”, “search capabilities” and “download possibilities”; they “agree” that the advantages are “hypertext links” and “retrieval possibilities”. It seems that the most interesting general feature of electronic journals for users at the IISc is to “provide up to date information”, and this feature leads users toward using electronic journals. This result confirms the results of the earlier study at the Max Planck Society (Rusch-Feja and Siebeky, 1999).

Top used journals (Question 4)
The respondents were also asked to list the titles of journals that they use regularly. Based on the titles listed, Nature, Science and Proceedings of the National Academy of Sciences (PNAS) are the most popular research journals. Further analysis on these top 30 journals was carried out by the current author and published in Libri (Galyani Moghaddam, 2006).

Discussion and conclusion
The results of the survey reflect a growing interest in electronic journals among users at the IISc. Similar results have been reported in the literature (e.g. Rusch-Feja and Siebeky, 1999; Lenares, 1999; Pazur, 2002; Colvin and Keene, 2004). The literature review presented in this paper mostly refers to research carried out in the West. The current study confirms those results by finding that electronic journals are well accepted in a developing country such as India when they are made available to users.

The analysis of publishers showed that while Elsevier electronic journals (63.9 per cent) are most popular among users at the IISc, Sage Publications journals ranked lowest (56.7 per cent). The other publishers in decreasing order of popularity were:
• Wiley (38.0 per cent);
• Springer-Verlag (34.7 per cent);
• IEEE (30.0 per cent);
• American Chemical Society (23.4 per cent); and
• Cambridge University Press (16.8 per cent).

This high use of Elsevier journals has already been reported in Obst’s (2003) study and that of Rusch-Feja and Siebeky (1999). Convenience and accessibility are the two most important issues considered by users in using electronic journals of a particular publisher; perhaps these are the reasons for low usage of the Sage Publications at this institute. As mentioned earlier, one possible reason for Elsevier’s domination is their high number of scientific journals. Merging with Academic Press in 2003 increased its number of electronic journals still further; at the time of writing, more mergers with other publishers are being proposed. While the business of publishing scholarly journals is already dominated by US- and Europe-based publishers, these mergers concentrate even more power in fewer hands in scientific publishing. In another study by the current author (Galyani Moghaddam, 2007), a comparison was made between for-profit/commercial publishers and not-for-profit publishers by the price of electronic journals and interesting results were found. More usage studies of electronic journals by publisher (especially among different disciplines) would be beneficial to librarians.

Although Elsevier is the most used publisher at the IISc, further analysis of the top 30 journals used at the IISc showed that two-thirds belong to non-profit/society publishers and one-third to for-profit/commercial publishers (Galyani Moghaddam, 2006).

Electronic journals are mostly used for “research needs”, followed by “education” and “current information”. As expected they are least used for “recreational purposes” and “winning awards”. This result confirms the results of Tenopir et al.’s (2004) study. The results of the present study also clearly showed that there is a significant association between the time spent on reading online/offline and the frequency of use of electronic journals. This result confirms the results of a recent study by King et al. (2006). They found that readers who take the time to download articles are more likely to read
most of the text than only part of it. As mentioned above in the literature review, the pattern of reading by users is changing in the digital environment toward less concentrated reading, but the average amount of reading is increasing. A study by King et al. (2003) revealed that 25-year trends of reading by university scientists show substantial increases in the average amount of reading. Scientists appear to be more advanced in their use of electronic journals than other faculty, but changes are taking place within all faculty disciplines (King et al., 2003).

This study has shown that PDF is the most preferred format for electronic journals. HTML, MS Word, LaTeX, ASCII and PostScript formats are next in that order of preference. It should be noted here that the PDF and HTML formats are the most common formats in which the full texts are available. It appears that users were also accepting these formats as their choices.

The study of media preference (reading on the monitor/reading print-out) suggests that there is an even balance between media preferences. Earlier studies found that users prefer to read print-outs than read on monitors (e.g. Woodward et al., 1998; Rusch-Feja and Siebeky, 1999; Brown, 1999; Pazur, 2002). The results of the present study show some changes in this trend. This result confirms more recent studies, such as that of Liu (2005). His study showed that a screen-based reading behaviour is emerging for reading electronic documents. This screen-based reading behaviour is characterized by more time spent on browsing and scanning, keyword spotting, one-time reading, non-linear reading and reading more selectively, while less time is spent on in-depth reading and concentrated reading (Liu, 2005); this screen-based reading behaviour seems also to be happening at the IISc.

The fact that users have free access to electronic journals at any time from their own computers seems to be the most appealing feature. The same result was reported by Clajus and Maier (2001) and Rusch-Feja and Siebeky (1999). Clajus and Maier (2001) reported that the biggest advantage of the new service was full-text access from the user’s own desktop (49 per cent), and the fact that the electronic journal is available before the print version.

Pazur’s (2002) study ad also revealed that respondents at the Rudjer Boskovic Institute in Zagreb stressed availability before the print version as the most important advantage of electronic journals. The fact that the electronic journal is available before the print version is an important advantage of electronic journals in developing countries such as India. Considering the fact that the leading publishers of scholarly electronic journals are located in the USA and Europe, and the print version of electronic journals arrives late in India,
this feature of electronic journals became very attractive for users at the IISc. It should be noted here that a large number of electronic journals are being made available through consortia. India is providing access to electronic journals through consortia especially for research institutions such as the IISc.

In addition, it is found from this study that the journals *Nature*, *Science* and *Proceedings of the National Academy of Sciences* are the most popular research journals. This result is similar to the study of Rusch-Feja and Siebeky (1999). Because of these similarities a comparison was made between the results in a separate paper (Galyani Moghaddam, 2006).

The result of this study in general suggests that the library network with the availability of significant numbers of electronic journals at the IISc has been successful. The results suggest that 24-hour free access to electronic resources at the user's desktop leads to increased acceptance and use of scholarly electronic journals. This service needs to be maintained and continued in future at the IISc. This successful service can be used as a model for other institutions in India as well as other developing countries.

**References**


Appendix

Figure A1 The questionnaire

QUESTIONNAIRE

BACKGROUN INFORMATION

Name:  Sex: Female ( ) Male ( )

Department:
Status: (Tick One) ( ) Academic staff ( ) Research staff ( ) Research students (M.Phil, PhD, M.Sc, ME, MBA, MA) ( ) Other (please specify)

1. Are you aware of the availability of electronic/online journals at your institute?
   Yes ( ) No ( )

2. Do you use electronic/online journals? Yes ( ) No ( )
   If yes, please indicate from which publishers (Tick as many as applicable). If the publisher is not included below please mention it.

---|-----------------------------|----------------------------|
| American Chemical Society   | IEEE (Ins of Electrical & Elec.) |
| AIP (American Ins of Physics) | IOP (UK) (Ins of Physics) |
| Am. Society for Microbiology | ASBMB (Am. Soc. for Biochemistry & Molecular Biology) |
| APS (American Physical Socil) | MCB Uni. Press (Emerald) |
| ASCE (Am. Soc of Civil Eng.) | MIT Press |
| Blackwell Publishing         | Oxford University Press |
| Cambridge University Press   | Sage Publications |
| John Wiley & Sons, Inc       | Taylor & Francis, Ltd. |

3. Mention which type of subscription you are using.
   Personal Subscription ( ) Library-based Subscription ( )

4. List the titles of electronic/online journals that you use?
   1.
   2.
   3.
   4.
   5.

(continued)
Figure A1

5. For what purposes do you use electronic/online journals?

<table>
<thead>
<tr>
<th>Purpose of Use</th>
<th>Most</th>
<th>Often</th>
<th>Sometimes</th>
<th>Somewhat</th>
<th>Least</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Needs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Achievement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recreational</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Win Award</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Which format of electronic/online journals do you use?

<table>
<thead>
<tr>
<th>Type of Format</th>
<th>Most</th>
<th>Often</th>
<th>Sometimes</th>
<th>Somewhat</th>
<th>Least</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HTML</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGML</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASCII</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS Word</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PostScript</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LaTeX</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Which component of electronic/online journals do you use?

<table>
<thead>
<tr>
<th>Component of Online Journals</th>
<th>Most</th>
<th>Often</th>
<th>Sometimes</th>
<th>Somewhat</th>
<th>Least</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table of Contents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Journal Abstracts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Text</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Article References</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alerting Services</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. On average how often do you access online journals?

( ) Daily  ( ) Bimonthly
( ) Biweekly ( ) Monthly
( ) Weekly  

(continued)
9. On average how long does it take to access or download online articles?

( ) Less than 10 min. ( ) 30-40 min.
( ) 10-20 min. ( ) 40-50 min.
( ) 20-30 min. ( ) More than 50 min.

10. On average how much time do you spend weekly on reading online journals?
(Please tick appropriate box).

<table>
<thead>
<tr>
<th>Online reading</th>
<th>Off Line Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 30 minutes</td>
<td>Up to 60 min.</td>
</tr>
<tr>
<td>30-60 min.</td>
<td>60-120 min.</td>
</tr>
<tr>
<td>60-90 min.</td>
<td>120-180 min.</td>
</tr>
<tr>
<td>90-120 min.</td>
<td>Above 180 min.</td>
</tr>
<tr>
<td>More than 120 min.</td>
<td></td>
</tr>
</tbody>
</table>

11. How many articles do you read in a week?

( ) Less than 5 ( ) 10-15
( ) 5-10 ( ) More than 15

12. How do you read online journals?

<table>
<thead>
<tr>
<th>Types</th>
<th>Always</th>
<th>Often</th>
<th>Usually</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read on a Monitor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Read Print out</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13. The following statements are about the accessibility and availability of electronic online journals. Please indicate how strongly you agree or disagree with each statement.

<table>
<thead>
<tr>
<th>Online Journals Accessibility and Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statement</td>
</tr>
<tr>
<td>24 HRS Available</td>
</tr>
<tr>
<td>Desktop Availability</td>
</tr>
<tr>
<td>Free Access</td>
</tr>
<tr>
<td>Depend on Network</td>
</tr>
<tr>
<td>Needs Special Equipment</td>
</tr>
<tr>
<td>Require Training</td>
</tr>
</tbody>
</table>

(continued)
Figure A1

14. The following statements are about electronic/online journals general features. Please indicate how strongly you agree or disagree with each statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Agree Strongly</th>
<th>Agree Somewhat</th>
<th>Disagree Somewhat</th>
<th>Disagree Strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up-to-date Information</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Search Capabilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Download Possibilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Text Retrieval</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retrieval Possibilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertext Links</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Link to Related Items</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connect People</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15. How strongly do you agree or disagree with the following statements which describe electronic/online journal browsing features?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Agree Strongly</th>
<th>Agree Somewhat</th>
<th>Disagree Somewhat</th>
<th>Disagree Strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contain Multimedia Information</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contents Easy to Understand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>User-Friendly Interface</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading on Monitor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of Standardized Formats</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Poor Graphic Quality</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

16. Do you agree with this statement “Online/Electronic journals are one of the most important parts of scientific communication?”

Yes ( ) No ( )

Thank you very much for your cooperation in completing this questionnaire. I would like to remind you once again to please return it to the office at your Department. If you have any additional remarks about your e-journal usage, or comments on the questionnaire, please write here.

**Corresponding author**

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g_galyani@yahoo.com

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