Scatter of Journals and Literature Obsolescence Reflected in Document Delivery Requests

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ABSTRACT

This paper investigates the scatter of journals and literature obsolescence reflected in more than 137,000 document delivery requests submitted to a national document delivery service. The paper first summarizes the major findings of the study with regards to the performance of the service. It then identifies the “core” journals from which article requests were satisfied and addresses the following research questions: 1) Does the distribution of (core) journals conform to the Bradford’s Law of Scattering? 2) Is there a relationship between usage of journals and impact factors, journals with high impact factors being used more often than the rest? 3) What is the median age of use (half-life) of requested articles in general? 4) Do requested articles that appear in core journals get obsolete more slowly? 5) Is there a relationship between obsolescence and journal impact factors, journals with high impact factors being obsolete more slowly? Based on the analysis of findings, we found that the distribution of highly- and moderately-used journal titles conform to the Bradford’s Law. The median age of use was 8 years for all requested articles. Ninety percent of the articles requested were 21 years of age or younger. Articles that appeared in 168 core journal titles seem to get obsolete slightly more slowly than those of all titles. We observed no statistically significant correlations between the frequency of journal use and ISI journal impact factors, and between the frequency of journal use and ISI-cited half-lives for the most heavily used 168 core journal titles. No statistically significant relationship was found between median age of use and journal impact factors, either. There was a weak negative correlation between ISI journal impact factors and cited half-lives of 168 core journals, and a weak correlation between ISI citation half-lives and use half-lives of core journals. Findings of the current study are discussed along with those of other studies.

1. Introduction

Millions of articles get published in scientific and scholarly journals every year. Scientists and researchers make use of those articles to carry out their studies. Yet, even large libraries with considerable collection development budgets cannot subscribe to all scientific journals needed by their users. Requests that cannot be fulfilled using in-house resources of a library need to be satisfied through interlibrary borrowing and document delivery services. Large scale document delivery services are offered by libraries such as the British Library Document Supply Centre (BLDSC) and by commercial companies.

Collection development policies of libraries in the past have usually been shaped by in-house use of journals. Libraries would track in-house use and try to identify most frequently used journal titles. Journal titles used most often through document delivery services would also be recorded. Such journal titles would then become prime candidates for subscription in the following years. The “access vs. ownership” approach is now changing the premise of collection development policies. More and more libraries tend to subscribe to “core journals” only, while satisfying the need for less frequently requested titles through interlibrary borrowing and document delivery services. This is reflected in the service trends observed in member libraries of Association of Research Libraries (ARL): the number of interlibrary borrowing transactions has almost doubled (97%) between 1991 and 2000 (Kyrillidou & Young, 2001). Moreover, documents are increasingly being delivered electronically to the user’s desktop or personal digital assistant (PDA) as part of personalized information services offered by libraries in cooperation with publishers (Tonta, 2003). The trend towards electronic document delivery is also having an impact on commercial companies and institutions providing traditional document delivery services. For instance, the British Library (BL) recently signed an agreement with Elsevier Science and Adobe to provide print-quality copies of journal articles from over 1700 key Elsevier titles delivered to users’ desktops (British Library, 2002).
2. Literature Review

Several researchers carried out studies on collection development policies based on document delivery requests. For instance, Cooper and McGregor (1994) studied more than 48,000 journal article photocopy requests submitted to the information services unit of a biotechnology firm between 1987-1989 with a view to find out the unit cost per use, the most frequently requested journal titles as well as the age of requested articles. They provided a detailed review of previous research on reference, citation and use studies along with those that investigated the relationship between use and citation data that are regularly published in *Journal Citation Reports* of the Institute forScientific Information (ISI). Based on findings, the library cancelled 45% of its subscriptions. Despite this, the number of photocopies increased. Half the photocopy requests were for articles that appeared in only 36 of the 1673 journals used in the study. Cooper and McGregor also found that (a) the median age of use was just over one year, and more than 42% of all articles were photocopied in the same year as they were published; (b) there was a negative random agreement between ISI impact factors and the rankings based on use data; yet researchers advised that local use data should be preferred over citation data for collection management purposes; and (c) the cost per use for most heavily photocopied journals were modest (between 0.30 and 3.40USD) whereas the cost per use for less frequently used journals were quite high: only 260 journals of a total of 1673 journals owned by the company had a cost-per-use ratio of less than 35USD.

Van Borm, Corthouts and Philips (2000) studied the performance of the Belgian document ordering and delivery system (Impala) using a number of measures and indicators such as the number of requests received and satisfied, success rate, response times and cost. They analyzed seven years’ (1992-1998) worth of interlibrary loan and document delivery data for articles and books. Some 140,000 requests were received in 1998. Requests were primarily for journal articles. Standard cost of supplying an article or book was about 5 Euros. Some 37% of requests were fulfilled after one day, 73% after 2-3 days and 94% after 5-10 days. The overall success rate was 89% in 1998, which fares well with other similar services in the US and Europe.

Wiley and Chrzastowski (2002) also reviewed more than 105,000 document delivery requests for journal articles submitted to the Illinois Consortium Libraries (comprising 26 libraries) in 1999/2000. Some 60,000 requests came from Illinois researchers. Almost 13,000 journal titles (44% of all requests) were used only once while a very few titles (3.4% of all titles) were used more than 20 times. They found that 470 core journals satisfied over 20,000 requests from Illinois researchers (one-third of all Illinois requests) and that “the majority of transactions for the most highly requested titles were from the more current years” (p. 29).

The relationship between frequency of use and journal impact factors, between frequency of use and obsolescence (half-life) rates, and between journal impact factors and half-lives have been studied in the past by a number of researchers (see, for example, Tsay, 1999a, 1999b; Moed, Van Leeuwen & Reedijk, 1998; Cooper & McGregor, 1994; Glänzel & Schoepflin, 1994; Line, 1978; Line & Sandison, 1974). The impact factor is defined as “the ratio of the number of citations which a journal receives in the course of a given year to the number of articles published by that journal within the two preceding calendar years” (Rousseau, 1988, p. 249). Rousseau (2002) discussed in detail how journal impact factors are calculated and used in evaluation studies. The term “obsolescence” is defined as “the time during which one-half of the currently active literature was published” (Line, 1970, p. 46). Line and Sandison (1974), Gappen and Milner (1981) and Line (1993) reviewed the literature on obsolescence. Some studied frequency of use as reflected in ISI citation data while others did by gathering data on in-library use of, or document delivery requests satisfied from, journal titles. Glänzel and Schoepflin (1994, cited in Moed et al., 1998, p. 391) concluded that ageing and impact factor may be considered as almost independent phenomena. Based on 15 years’ worth of citation data for more than 3000 journals covered by Science Citation Index (SCI), Moed et al. (1998) found that correlations between impact factors and ageing characteristics were rather weak and that ageing characteristics were primarily specific to the individual journal rather than to the subfield.

Tsay (1999a, 1999b) studied the in-library use of journal titles in a hospital library and found that the peak in-library use was at age one while the maximum citation was at age three. Based on the same in-library use statistics, the mean use half-life for 835 journal titles was 3.43 years while the mean citation half-life was 6.28 years and the difference was statistically significant. No correlation was found between use and citation age distributions. Earlier, Scales (1976) compared the list of
journal titles ranked by the frequency of use with the list of same journals, ranked by citation counts, and found that the rank order correlation was low between the two. She concluded that “journal citation rankings are not good indicators of actual use, and as such do not constitute valid guides for journal selection” (p. 23). More recently, Cooper and McGregor (1994) reached a similar conclusion when they found no correlation between obsolescence measured by photocopy demand for journal titles in a biotechnology library and obsolescence measured by citation frequency. They suggested that “median citation age data based on citations was not a reliable predictor of the use of current journals” (p.403).

This paper investigates the document delivery requests for journal articles submitted to the document delivery unit of the Turkish Academic Network and Information Center (TANIC). After a brief overview of TANIC’s document delivery services, methodology and findings of the study are summarized along with discussion, conclusions and recommendations.

3. The Turkish Academic Network and Information Center

The Turkish Academic Network and Information Center (TANIC) was founded in June 1, 1996 in Ankara by the Turkish Scientific and Technical Research Center (TÜBİTAK). In addition to setting up the national academic network, TANIC is also responsible for developing a “vision” of electronic library to satisfy the information needs of academia and for setting up the organizational structure to implement and maintain this vision. As most Turkish university libraries are not well-stocked, TANIC also maintains a rich serials collection (about 10,000 titles) with more than 20 years of backruns inherited from the Higher Education Council Documentation Center. Individual users as well as libraries in need of document delivery services send requests to TANIC. TANIC in return tries to fulfill a request from its own collection first. If not successful, the request is forwarded to other libraries taking part in what is called “Cooperative Document Delivery System” established and run by TANIC. In 1998 and 1999, TANIC satisfied about half of all document delivery requests from its own collection. After the introduction of the cooperative system, the fulfillment rate improved to 63% in 2000 and 66% in 2001 (TÜBİTAK, 2000, 2002a, 2002b). TANIC’s document delivery system has been automated since June 26, 2000.

4. Methodology

The following research questions were addressed:

1) Does the distribution of (core) journals conform to the Bradford’s Law of Scattering?
2) Is there a relationship between the usage of journals and their impact factors, journals with high impact factors being used more often than the rest?
3) What is the median age of use (half-life) of requested articles in general?
4) Do requested articles that appear in core journals get obsolete more slowly?
5) Is there a relationship between obsolescence and journal impact factors, journals with high impact factors being obsolete more slowly?

These research questions have been addressed in the past with a view to developing collection management policies in libraries. Decisions on retention of heavily used materials, deselection, discarding and relegation of less-used or older materials to off-site storage areas were meant to be based on the answers to such questions (e.g., Line, 1970, 1978; Line & Sandison, 1974; Tsay, 1999a, 1999b; Cooper & McGregor, 1994). Bradford’s Law of Scattering “describes how the literature on a particular subject is scattered or distributed in the journals” (Garfield, 1980, p. 476). Originally formulated in 1934, the Bradford Law states that “if scientific journals are arranged in order of decreasing productivity of articles on a given subject, they may be divided into a nucleus of periodicals more particularly devoted to the subject and several groups or zones containing the same number of articles as the nucleus...” (Bradford, 1934; as cited in Hertzel, 1987, p. 175). Garfield thinks that the Bradford Law “derives its universality from the basic unity of science—that is, that every scientific field is related, however remotely, to every other field.” He interprets it as follows: “If you want to compile a bibliography on any subject, you will find that there is always a small group of core journals that account for a substantial percentage
of the articles on that subject or discipline. Then there is second larger group of journals that account for another third while a much larger group of journals picks up the last third” (Garfield, 1980, p. 477). “Expressed this way, Bradford’s Law of Scattering can properly be regarded as a law of diminishing returns with respect to the number of titles held in a given subject area” (Buckland, 1983, p.167). Later, Trueswell’s 80/20 rule drew attention to the same phenomenon when it was shown that roughly 80% of the books circulated in a library accounted for the 20% of the collection (Trueswell, 1969).

The Bradford Law proved useful, inter alia, to describe the distribution of in-library use of articles in core journals as well. Journal citation data and impact factors indicating the importance or prestigiosity of scientific journals were usually taken as a basis for comparison. It was thought that journals with high impact factors would be used more heavily in libraries. If this assumption proved to be valid, then relatively fewer number of core journals would satisfy proportionally large number of information needs. However, studies showed that journals with high impact factors do not necessarily get used more often. Usually, no discernable relationship was found between impact factors and the frequency of in-library use of articles appeared in those journals.

Similarly, it was observed that current literature gets cited more often in scientific journal articles. As articles get aged, they get fewer and fewer citations, although the median age of cited articles (obsolescence) varies by scientific fields and by type of material. This can also be “regarded as a law of diminishing returns with respect to the length of time material is retained in a library’s collections” (Buckland, 1983, p.167). No meaningful correlation was detected between obsolescence measured by citation frequency of articles and obsolescence measured by the frequency of in-library use of those articles, either. Yet, age remains to be an important criterion in collection management decisions.

The possible relationship between scattering and obsolescence was studied in the past. It was pointed out that “[i]t would be of considerable theoretical interest if a relationship could be established and much data collection could be avoided if one could be deduced from the other” and that the Bradford Law and obsolescence can be used together to decide “how large library collections should be” (Buckland, 1972, p. 242). Yet, a study carried out in a university library did not produce conclusive results.

Although the issues of scattering and obsolescence were studied in the past in regard to citation analysis, impact factors and in-library use of journals in a given subject or a specific collection, very few studies have been carried out on the applicability of these two laws in document delivery services. Usually, interlibrary loan (ILL) or document delivery requests get satisfied from larger, more interdisciplinary and thus less homogenous library collections. It would be worthwhile to study if scattering and aging of literature apply equally well in the context of document delivery requests that were satisfied from the relatively rich and varied journal collection of a national document delivery service. As mentioned earlier, no correlation was found between impact factors and in-library use of journals, and between median age of use as measured by citation studies and that as measured by the frequency of in-library use of journals. It would be interesting to test if the lack of relationship also holds for the frequency of use of journals for document delivery purposes.

5. Data Sources

A total of 137,692 document delivery requests were submitted to TANIC between June 26, 2000 and June 30, 2002. The raw data on document delivery requests as well as their outcome (satisfied or not satisfied, supplying libraries, reasons for failure, etc.) were obtained from TANIC in electronic form. The whole data file was divided into two subfiles, each containing roughly one year’s worth of data. The first one contained 57,802 requests (submitted between June 26, 2000 and June 30, 2001) while the second contained 79,890 requests (submitted between July 1, 2001 and June 30, 2002). Then, requests in each file were compared in regards to, among others, satisfaction rate, core journals, distribution of requests to journal titles, obsolescence, and impact factors.

1 The grand total was 138,141. Some 449 document delivery requests (or 0.3%) for books, standards and patents were excluded.
2 For convenience, data containing the first set will be labeled “2000” and the second set “2001”.

5
Findings were analyzed under two subheadings: (1) Evaluation of TANIC’s document delivery services; and (2) Journal usage patterns (scatter and age of use of journal titles). Discussion and conclusions follow the findings.

6. Findings

6.1 Evaluation of TANIC’s Document Delivery Service

TANIC served a total of 4185 unique customers in two years. They submitted a total of 137,692 document delivery requests in two years. Average number of requests per month for two years was 5756. Average number of requests increased 38% from the first year to the second (from 4833 to 6679). The number of requests exhibited some periodicity: they were usually below averages during the months of July, August, September and February as university students and faculty (who are the major clientele of the service) placed fewer requests during those months because of summer and spring breaks (Fig. 1).

Sixty-seven percent (92,574) of those requests were satisfied. Fulfillment rate has slightly improved (from 65% to 69%) between 2000 and 2001. The distribution of supplying libraries is given in Table 1. As table 1 indicates, TANIC supplied almost three quarters (73%) of all requests. The rest were supplied by Hacettepe University (10%), Middle East Technical University (METU) (8%), and Gazi University (7%) libraries, and the British Library Document Supply Centre (2%). It is interesting to note that the percentage of requests that TANIC supplied from its electronic journals collection has almost tripled (from 3% to 8%) in two years.

Almost three quarters (73%) of requests came from academic users. Researchers from public and private institutions submitted equal amount of requests (5% each). The affiliations of users for the rest (17%) of the requests were not given. As most requests came from the academia, universities were among the top users of the TANIC’s document delivery service. For instance,
requests from users based in Istanbul University constitute 13% of all requests coming from academic sector (Selçuk and Marmara came next with 6% and 4%, respectively).

In a similar study based on two months’ worth of data (October-November 2000), the unit cost per use of journal titles for document delivery purposes (i.e., excluding in-house use) at TANIC was calculated. Direct and indirect labor costs, amortization costs of building and equipment, maintenance costs, expenses for telecommunication and stationery were taken into account in the calculation. The unit cost per use for document delivery purposes was found as about 4USD (Ünal, 2002, p. 105). Given the fact that journal titles at TANIC are also used in-house, this figure is comparable to the findings of similar studies that we cited earlier (e.g., Cooper & McGregor, 1994; Van Borm et al., 2000). It should be noted that unit cost per use for highly used core journal titles is much lower than that for less frequently used ones.

6.2 Journal Usage Patterns

A total of 91,314 document delivery requests fulfilled were satisfied from 5521 different journal titles.3 The cumulative usage of all journal titles is given in Fig. 2. As can be seen from figure 2, highly used journal titles satisfied majority of document delivery requests whereas overwhelming majority of titles were used very infrequently. For instance, 168 core journals (a mere 3.0% of all journal titles) satisfied one-third of all fulfilled requests. Furthermore, a total of 354 journals (6.4% of all journal titles) satisfied half while 667 titles (12.1%) did almost two-thirds of all fulfilled requests. Some 1519 journals (%27.5 of all titles) were used only once, satisfying only 1.7% of all document delivery requests. Data on journals and document delivery requests also conform to Trueswell’s 80/20 rule in that 80.3% of the total number of document delivery requests accounted for only 21.4% of all journals (Trueswell, 1969).

Journal titles that appeared in both 2000 and 2001 lists were compared to see if highly used titles overlap. A total of 3904 journal titles satisfied all requests in 2000 while 4608 titles were used for the requests in 2001. As all requests for both 2000 and 2001 were met by a total of 5521 unique journal titles, it appears that 2991 journal titles were commonly used to satisfy requests in both

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3 The discrepancy between total requests fulfilled as given in Table 1 (92,574 ) and that of 91,314 is due to the lack of journal data for 1260 article requests.
years. This represents a 54% overlap between the two lists of journal titles, which is similar to the overlap rates (52%) obtained in the Illinois Interlibrary Loan Assessment Project for two different journal lists used in 1995 and 1999 (Wiley & Chrzastowski, 2002).

A similar overlap study for only core journal titles of both 2000 and 2001 was carried out separately. Of the 3904 titles, 159 highly-used core journal titles satisfied one-third of all requests in 2000. The number of core journal titles that satisfied one-third of all requests in 2001 was 163 (out of 4608). Some 118 journal titles appeared in both 2000 and 2001 core journal title lists. The overlap between the two highly-requested journal titles (72%) was much higher than the general overlap (54%) for two lists of all journal titles. Moreover, the correlation between the number of article requests (frequency of use) satisfied from a given journal and its being listed among highly-requested journal titles in both years was statistically significant (Pearson’s $r = .474$, $p < .01$). The rank order correlation between the 2000 and 2001 journal lists was also statistically significant (Spearman’s $R = .473$, $p < .01$). In other words, a significant percentage of document delivery requests was filled consistently through the same or highly-overlapping set of core journal titles.

A test was conducted to see if the Bradford law holds for more than 137,000 document delivery requests submitted to TANIC. The total number of journal titles (5521) were divided into three equal regions on the basis of total requests that journal titles in each region satisfied (in our case, one-third of all requests for each region). Table 2 below gives the number of journal titles and approximate percentages of transactions satisfied. As we indicated earlier, 168 core journals satisfied one-third of all requests whereas 667 titles (499 plus 168) satisfied two-thirds of all requests. The great majority of journal titles (4854 titles or 88% of all titles) satisfied only one-third of all requests. We found that the frequencies of use of journal titles in the first two regions (highly- and moderately-used titles) conform to the frequencies that are expected according to the Bradford’s Law of Scattering. Yet, the frequencies of use for less frequently-used journal titles seem to be higher than expected, which may be due to the fact that large numbers of transactions tend to produce what is called a “comet tail” (Garfield, 1980, p.6). This reinforces the fact that core journal titles consistently satisfy significant amount of document delivery requests as is to be expected, whereas most journal titles are rarely used.

<table>
<thead>
<tr>
<th>Region</th>
<th># of journal titles</th>
<th># of requests</th>
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<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>1</td>
<td>168</td>
<td>3.0</td>
</tr>
<tr>
<td>2</td>
<td>499</td>
<td>9.1</td>
</tr>
<tr>
<td>3</td>
<td>4854</td>
<td>87.9</td>
</tr>
<tr>
<td>Total</td>
<td>5521</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The mean and median impact factors of 168 highly-used journal titles were 3.588 and 2.489, respectively. No statistically significant relationship was found between the usage of 168 core journals and their journal impact factors (Pearson’s $r = .074$, $p = .34$). The mean and median impact factors of 159 and 163 highly-used journal titles that appeared in 2000 and 2001 lists, respectively, were similar to those of 168 journals. The overlapping set of 118 core journal titles that appeared in both lists had slightly higher mean and median impact factors (3.95 and 2.714, respectively). No statistically significant correlation was observed between the frequency of use and journal impact factors for 159 and 163 journal titles, either ($r = .050$, $p = .61$; $r = .062$, $p = .53$). This suggests that journal impact factors cannot be used as an indicator to predict the frequency of local use of journal titles for document delivery purposes, which confirms findings of previous studies that we reported earlier.

As journal articles get aged, they get requested or cited less frequently. This is known as “obsolescence”. “Median use age of a journal is a measure of the age at which half the journal’s usage has taken place” (Cooper & McGregor, 1994, p. 402). To measure the obsolescence rate of all the requested articles (fulfilled and not fulfilled), they were ranked by publication year and the median age was found as 8 years (see Fig. 3). In other words, half the requests were made to

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4 Obtained by summing 3904 and 4608 and subtracting the result (8512) from 5521.
5 However, only 1% of all requests were made to articles that appeared in 2002, as the data collection period ended in mid-2002. Thus, median age can be taken as 7 years. Similarly, one year can be subtracted from 30%, 70% and 90% obsolescence rates.
articles that were 8 years old or younger. Almost 30% of all requests were made to articles that appeared within the last 4 years, 70% within the last 11 years and 90% within the last 21 years. Journal articles that appeared in 2000 (i.e., 3 years old) received the peak use with 11% of the total requests. As is to be expected, requests to older journal articles gradually declined (Fig. 4). A similar trend was also observed in article requests from core journal titles in Wiley and Chrzastowski's study (2002, fig. 4, p. 30).

![Distribution of requests by publication year](image)

**Fig. 3. Cumulative demand (as percentage) met by publication year**

![Age distribution of all journal articles: 2002-1900 (not all years shown)](image)

**Fig. 4. Age distribution of all journal articles: 2002-1900 (not all years shown)**

A total of 11 most heavily used journal titles satisfied 4.4% of all document delivery requests. The number of requests for those titles along with their median age, 90% obsolescence, and journal impact factors and cited half-lives taken from ISI's *Journal Citation Reports* (2001) are given in Table 3. It is interesting to note that such relatively inexpensive medical journals as the *Lancet* and the *New England Journal of Medicine* (NEJM) were among the most frequently requested journals. The fact that such popular journals as *Nature*, *Science*, and *NEJM* get requested heavily for interlibrary loans and photocopying has also been observed in the past (see, for example, Scales, 1976, table 2, p. 19, and Cooper & McGregor, 1994, table 3, p. 401).
Table 3. The most frequently used 11 journal titles to fulfill document delivery requests at TANIC (2000-2002)

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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CLINICAL ORTHOPAEDICS AND RELATED RESEARCH</td>
<td>433</td>
<td>0.5</td>
<td>14</td>
<td>24</td>
<td>1.166</td>
<td>&gt;10</td>
</tr>
<tr>
<td>PLASTIC AND RECONSTRUCTIVE SURGERY</td>
<td>415</td>
<td>0.5</td>
<td>10</td>
<td>28</td>
<td>1.436</td>
<td>9.3</td>
</tr>
<tr>
<td>LANCET</td>
<td>407</td>
<td>0.4</td>
<td>9</td>
<td>25</td>
<td>13.251</td>
<td>7.0</td>
</tr>
<tr>
<td>JOURNAL OF FOOD PROTECTION</td>
<td>406</td>
<td>0.4</td>
<td>8</td>
<td>20</td>
<td>1.808</td>
<td>6.5</td>
</tr>
<tr>
<td>JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY</td>
<td>386</td>
<td>0.4</td>
<td>6</td>
<td>17</td>
<td>1.576</td>
<td>6.4</td>
</tr>
<tr>
<td>APPLIED AND ENVIRONMENTAL MICROBIOLOGY</td>
<td>362</td>
<td>0.4</td>
<td>13</td>
<td>21</td>
<td>3.688</td>
<td>6.7</td>
</tr>
<tr>
<td>NEW ENGLAND JOURNAL OF MEDICINE</td>
<td>352</td>
<td>0.4</td>
<td>9</td>
<td>21</td>
<td>29.065</td>
<td>7.2</td>
</tr>
<tr>
<td>SPINE</td>
<td>324</td>
<td>0.4</td>
<td>6</td>
<td>14</td>
<td>1.853</td>
<td>7.5</td>
</tr>
<tr>
<td>JOURNAL OF TRAUMA</td>
<td>316</td>
<td>0.3</td>
<td>6</td>
<td>16</td>
<td>3.190</td>
<td>8.3</td>
</tr>
<tr>
<td>JOURNAL OF UROLOGY</td>
<td>316</td>
<td>0.3</td>
<td>8</td>
<td>20</td>
<td>1.531</td>
<td>7.1</td>
</tr>
<tr>
<td>JOURNAL OF RHEUMATOLOGY</td>
<td>309</td>
<td>0.3</td>
<td>4</td>
<td>15</td>
<td>2.591</td>
<td>6.4</td>
</tr>
<tr>
<td><strong>Total/Average</strong></td>
<td><strong>4026</strong></td>
<td><strong>4.4</strong></td>
<td><strong>8.4</strong></td>
<td><strong>20.1</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The median use ages for the most heavily used 11 titles ranged between 4 years (Journal of Rheumatology) and 14 years (Clinical Orthopaedics and Related Research), the average median age being 8.4 years. The average was almost the same as that for all titles (8 years). Ninety percent obsolescence rates ranged between 14 years (Spine) and 28 years (Plastic and Reconstructive Surgery), the average being 20.1 years (as opposed to 21 years for all journals).

The median use ages for 168 core journal titles ranged between 3 years (Journal of Clinical Psychiatry) and 20 years (Journal of the American Chemical Society), the average being 9 years, which was slightly longer than that for all titles (8 years). The average ninety percent obsolescence rate for 168 core journal titles was 20 years, which is slightly shorter than that for all years (21).

In the current study, the mean usage half-life of 168 core journals was 8.6 years. The mean citation half-life of 168 core journals was found as 7.5 years, about half a year less than that for all requested articles. We found a weak (negative) correlation between impact factors and cited half-lives (as reported in SCI Journal Citation Reports-2001) of 168 core journal titles (Pearson’s $r = -.214, p < .01$). There was no correlation between the frequency of use (measured by the number of document delivery requests) and cited half-life of 168 core journals (Pearson’s $r = .141, p = .069$), suggesting that cited-half life figures as reported in SCI JCR are not good indicators to predict the level of document delivery demand for journal titles. No correlation was found, either, between the median age of use for the most heavily used journal titles and journal impact factors (Pearson’s $r = .114, p = .14$). Core journal titles with higher impact factors do not necessarily have older median age compared to those with lower impact factors. There was a weak correlation between citation half-lives and usage half-lives of core journals and it was statistically significant (Pearson’s $r = .279, p < .01$). This weak positive agreement between the two suggests that journals with higher citation half-lives tend to get requested over longer periods of time.

7. Discussion

We found that article requests to journals exhibited Bradfordian distributions for all journal titles (i.e., requests placed in both 2000 and 2001). The distribution of requests placed to journals in 2000 and 2001 separately also showed similar characteristics. Some 168 core journal titles (3.0% of all titles) satisfied one-third of all requests while 159 and 163 heavily-used titles fulfilled one-third of requests placed in 2000 and 2001, respectively. The overlap between heavily-used titles in both years was 72%, suggesting that the same set of core journal titles consistently satisfy significant

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6 It should be noted, though, that SCI records the cited half-lives that are 10 years or longer as greater than or equal to 10 years. There were 28 out of 168 journal titles as such. It is likely that the real mean cited half-life is somewhat higher than what we reported here (7.5 years).
percentage of document delivery requests. The overwhelming majority of journal titles (4854 or 88%) were used rather infrequently, satisfying one-third of all requests only. The general pattern of use of journal titles in this study was similar to the findings obtained in previous studies of in-library use (see, for example, Cooper & McGregor, 1994, p. 396ff for comparison). Half the photocopy requests were satisfied by 36 core journals in a biotechnology firm library (Cooper & McGregor, 1994). Some 470 core journals satisfied one-third of all document delivery requests received by the 26-member Illinois Libraries Consortium whereas approximately 13,000 journal titles (44% of all titles) were used only once (Wiley & Chrzastowski, 2002). Compared to findings of in-library use studies, the number of core journal titles satisfying a significant percentage of document delivery requests in our study was relatively higher, as was in Wiley and Chrzastowski’s study (2002). This may be due to the fact that users would first check their own libraries for the availability of journal titles before they submit their requests to a national or state-wide document delivery system as a last resort.

No correlation was found between journal impact factors and the frequency of use measured by the number of document delivery requests. This confirms the findings of previous studies to a certain extent. Cooper and McGregor (1994) found a negative random agreement between ISI impact factors and use data while Scales (1976) found a low correlation between the two. This suggests that journals with high impact factors are not necessarily used more often than the rest and that ISI impact factors cannot be used as a reliable indicator to predict the frequency of local use of journal titles for document delivery purposes.

The median age of use in our study was 8 years for all journals and 9 years for 168 core journals. Requested articles that appeared in core journals seem to get obsolete in a slightly longer period of time. No correlation was found between median use age and impact factors of core journals. Journal articles of 3 years of age received the highest percentage of requests (11%) in our study while the demand for older articles gradually declined. This is echoed in Price’s principle which states that “use will be relatively low for very recent publications, but will increase dramatically for those which are a few years old before falling into the expected exponential decay curve” (cited in Tsay, 1999a, p. 549-550).

The median age of use of 8 years and the peak use of 3 years that we obtained in the current study are relatively higher than those reported in other studies. For instance, Cooper and McGregor (1994) found the median age of usage just over one year while Tsay (1999b) reported 3.4 years. Some 42% of articles were xeroxed in the same year in Cooper and McGregor’s study. Tsay’s finding was similar: the peak in-library use of journal articles was at age one. Wiley and Chrzastowski (2002) found that most current years of journals received the majority of requests. The difference may be attributed to a number of reasons. First, as indicated earlier, our data was based on document delivery requests while Cooper and McGregor’s and Tsay’s data was based on in-library use of a biotechnology company and an hospital library, respectively. The demand for in-library use of articles by local users may be more immediate whereas document delivery requests used in our study came from off-site users. Second, as alluded earlier, off-site users request articles from TANIC after they exhausted local resources that were available to them and failed to satisfy their needs. Third, a national document delivery system would receive article requests on all subjects whereas in-library use of journals in an hospital and a biotechnology firm should primarily concentrate on respective subjects. Findings of various studies consistently confirm the fact that that literature in medical and technical fields gets aged faster compared to social sciences and humanities.

The mean half-life for core journals based on use data was 8.6 years. The mean half-life based on citation data was 7.5 years. Use data based on document delivery requests and citation data based on ISI cited half-life statistics of core journals were weakly correlated. This may be interpreted as core journals with higher citation half-lives getting aged more slowly, although the test statistic explains only a small percentage of the variance. Hence, the relationship between half-life based on use and citation data should be tested on all journal titles to reach a more meaningful conclusion. Cooper and McGregor (1994) found no correlation between use and ageing.

While we found the mean use half-life (8.6 years) slightly longer than the mean citation half-life (7.5 years) for 168 core journals, Tsay (1999b) obtained the opposite: she found the mean use half-life for 835 journals as 3.4 years which was significantly shorter than the mean citation half-life of 6.3 years. It is likely that core journals differ from all journal titles with respect to their use and citation ages. Or, the nature of in-library use of journals by local users may be different from off-site use of journals by the clientele of a national document delivery service.
Cited half-life figures of core journals based on ISI data cannot be used to predict the potential level of use of those titles as there was no correlation between the two. A weak (negative) random agreement was observed between cited-half lives and impact factors of core journal titles. Again, the test statistic explains only a small percentage of variance observed in cited half-lives of journals and their corresponding levels of use. That no strong correlation was found in this study between use and ageing, and between ageing and impact factors confirms the findings of earlier studies (e.g., Cooper & McGregor, 1994; Glänzel & Schoepflin, 1994; Moed et al., 1998). As Line (1974) pointed out some years ago, age seems to be a rather poor criterion to predict future use of journals. Moreover, findings of previous studies and that of our own further reinforce Line’s hypothesis that “[n]o measure of journal use other than one derived from local-use study is of any significant practical value to libraries” (Line, 1978, p. 313 cited in Cooper & McGregor, 1994, p. 402).

8. Conclusions

We reported the preliminary findings of a study on scatter of journals and obsolescence based on data obtained from a national document delivery service. The distribution of article requests to journal titles confirmed the findings of earlier studies: heavily used core journal titles satisfied large numbers of document delivery requests while large numbers of infrequently used titles satisfied relatively fewer numbers of requests. Half the requests were made to articles of 8 years of age or younger. It takes slightly longer for core journal titles to get obsolete. The frequency of journal use for document delivery purposes was not related with ISI journal impact factors or citation half-lives, although a weak negative correlation was found between impact factors and citation half-lives.

Median use age of journals was not related with impact factors, either. A weak correlation was observed between citation half-life and use half-life of journals.

Findings obtained in this study have some policy implications for library administrators and collection managers in general, and for the Turkish Academic Network and Information Center (TANIC) in particular.

The Bradford Law applies equally well to journals used for document delivery purposes. A journal collection comprising a couple of hundred core titles seems to be enough to satisfy the majority of document delivery requests while a little over 1000 titles can cater for 80% of the total demand.

Median age as measured by the frequency of use of journals for document delivery services is longer compared to that of in-library use. While median age for in-library use ranged between one and four years in specific libraries, it was much higher (8 years) in the current study. Core journal titles age more slowly. This indicates that libraries providing document delivery services on a national scale are well-advised to keep longer runs of their periodical collections including the core titles. This may well be due to the fact that a national document delivery service usually caters for a large group of users from various scientific disciplines with a wide variety of information needs.

Our findings also indicate that journal impact factors cannot be used solely to select the core journal titles as journals with high impact factors do not necessarily satisfy higher number of document delivery requests. The average citation half-life of core journal titles being shorter than that of use half-life shows that use tends to outlive citation. Yet, the relationship between the two is inconclusive as the correlation was weak and that conflicting findings were obtained in other studies.

The weak correlation between impact factors and citation half-lives show that one cannot easily be “deduced from the other.” Moreover, median age of use of journals for document delivery purposes does not correlate with impact factors, either. As neither the median use age nor citation half-lives of journals correlate with impact factors, this can be taken as an indication of impact factors and half-lives measuring different things.

The Bradfordian distribution of journal titles satisfying document delivery requests and median use age of journals have some consequences for TANIC as well. As we pointed out earlier, TANIC’s fulfillment rate was 67%. Although not reported in this paper, journal titles that received the remaining –albeit unfulfilled- 33% of the document delivery requests also exhibited a Bradfordian distribution. In other words, TANIC can easily improve its success rate by providing access to core journal titles that it did not own but has nevertheless received large numbers of requests for them. The methods by which access to those titles may vary. TANIC can subscribe to highly requested journal titles, including back runs of limited number of journal titles. Or it can
purchase access to their electronic versions, if available, starting from the most important ones (Davis, 2002).

TANIC can also develop collection management policies for infrequently used or non-used journal titles. Currently, TANIC has subscription or license to some 10,000 journal titles (including electronic ones). They are used both in the library and for document delivery services. If findings of other in-library use studies are to be used, one can safely predict that journal titles used within the library should also exhibit a Bradfordian distribution. That is to say, significant numbers of those titles in the library do not get used at all at any given year. Journal titles that have consistently been used infrequently or have not been utilized at all can be prime candidates for cancellation. Occasional requests to such infrequently used journal titles can perhaps be satisfied through electronic journal services on a "pay-per-view" basis. As median use age of TANIC journals is longer than those recorded in other studies, collection managers should be more conservative in making decisions about journal titles to be discontinued. A "break-even" analysis can be carried out to determine which printed journal titles should be discontinued and which titles should be considered for pay-per-view. It should be noted that the viability of housing printed materials in the virtual age has been questioned: “Does it actually matter very much what is discarded if it can be quickly and cheaply obtained from elsewhere? Does even cheapness matter very much, since occasional access is cheaper than holding materials locally, except when uses exceed some seven or eight a year for the average book or twenty or more for the average serial?” (Line, 1993, p. 678).

TANIC has not only secured access to electronic versions of thousands of scientific journals in recent years but also licensed archival copies of certain electronic journals (e.g., Elsevier). (It also acts as a local mirror site for certain bibliographic databases such as Web of Science.) This means that TANIC has access to both printed and electronic copies of increasingly more journal titles. The demand for printed titles of TANIC—and hence the demand for physical space to house them—will gradually decline as more electronic journals are added to the collection. It will be much cheaper to use electronic copies directly for document delivery purposes. Moreover, the use of print journals and document delivery services will decrease due to the availability of electronic journals as users prefer to get access to journals online (De Groote & Dorsch, 2001). In fact, the number of monthly document delivery requests submitted to TANIC has already decreased in the first half of 2003, although it remains to be seen if this is the beginning of a new trend. The reason behind this decrease may well be the increase in the number of university libraries getting access to full-text electronic journals through consortial agreements in the last couple of years (Tonta & Ünal, 2003).

In conclusion, then, TANIC should review its collection management policies, procedures and practices with regards to selection, deselection, retention and housing of its journals and be ready for a gradual and complete transformation of its services in the very near future.

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10. References


