Journal of Advances and Scholarly Researches in Allied Education

Vol. V, Issue X, April-2013, ISSN 2230-7540

APPLICATION OF BRADFORD'S LAW TO CITATION DATA OF HISTORY DOCTORAL DISSERTATIONS ACCEPTED BY KURUKSHETRA UNIVERSITY: AN ANALYTICAL APPROACH

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Application of Bradford's Law to Citation Data of History Doctoral Dissertations Accepted by Kurukshetra University: An Analytical Approach

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Abstract – The applicability of the two vital formulations (verbal and graphical) of Bradford's Law of scattering were tested. The study has shown that the verbal formulation of the present study was closer to the graphical formulation.

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1. INTRODUCTION

An insufficient budget and inadequate space are the two serious problems which the libraries are confronting presently. About the paucity of funds, Sengupta and others have observed that libraries get less than 15 percent of the parent body's total budget and the rate of increase of the average annual production cost of publications ranges from 12 to 15 percent, which is far more than the average 3 percent annual increase granted to the library budget by the administration. The problem of inadequate funds thus getting more serious year after year.

In view of such problems as : the publication of large number of journals, provision of insufficient budget, world-wide inflation, and the lack of adequate space in the libraries, it is worthwhile to evaluate the Journals for their quality. It is necessary because the libraries today cannot afford to procure even a small fraction of the total number of Journals available in a particular field.

There has been no universal tool for determining the quality of the Journals. However, the application of bibliometric technique in identifying the most used Journals in any field of knowledge is now-a-days a well established and reliable practice. Most used means most important journals. Citation count of a journal usually considered to be a fair index of the scientific significance of the material it publishes in the field under investigation. Citation frequency, as such, reflects the relative importance in the terms of the use made of the journals. Citation count of journals help in assessing the relative merit the highly important journals in a given specialization for deciding what journals to get and for how long to keep them. The direct citation method, originally devised by Garfield, has been used in this study.

2. SCOPE OF THE PRESENT STUDY

The scope of this study is limited to 30 doctoral theses submitted to the Department of History under Kurukshetra University during the year 1998-2007. The study treats references as items and journals as source. This study makes an attempt to test the distribution of references among journals in terms of Bradford's Law.

3. OBJECTIVES OF THE STUDY

The main objectives of the present investigation are:

1. To identify the network of journals for communication in history.

2. To test the appropriateness of verbal and graphical formulation of Bradford's Law.

3. To examine the relative performance of the two formulations Viz. verbal and graphical of the Bradford's Law based on bibliographical data for selecting the core journals.

4. METHODOLOGY

In this study, a total of 60 periodicals containing 534 references collected from 20 doctoral theses were arranged in order of their number of frequencies shared (i.e. in their descending order of productivity). Bradford's Law of scattering was applied to test the appropriateness of both verbal and graphical formulations. The purpose of this investigation is two fold. First the study serves as a test of the two formulations of Bradford's Law, verbal and graphical; to determine which one better fits citation data to the Social Science journals. Leimkuhler's formulas are used.

5. CORE JOURNALS

Core journals may be defined as the minimum number of periodicals which are very useful to effect optimum bibliographical control of important scientific research contributions in a particular subject, out of the total number of primary journals available on that particular subject. As the term core journals is as relative terms in a general way core journals may also be defined as those journals which provide useful information for the broad research community and also easily accessible in libraries. To determine core journals for all the subjects a rank frequency distribution of all journals articles were undertaken. The titles of the journals have been recorded against each journal article in the work sheet. The distribution was ranked in order of journals that most frequently cited.

6. ANALYSIS OF DATA

TABLE 6.1 : RANKING OF JOURNALS

Sr. No	Rank No	Title of Journal	No of Citations	Percentage of Citations	Cumulative Citations	Cumulative Percentage
1	2	3	4	5	6	7
1	1	Indian Antiquary	50	9.36	50	9.36
2	2	Indian Historical Quarterly	33	6.18	83	15.54
3	3	Indian Quarterly	32	5.99	115	21.54
4	4	Indian Archives	26	4.87	141	26.40
5	5	Journal of Indian History	24	4.49	165	30.90
6	6	Journal of the Royal Asiatic Society Bombay	23	4.31	188	35.21
7	7	Indian Historical Review	22	4.12	210	39.33
8	8	Social Scientist	20	3.75	230	43.07
9	9	Kurukshetra University Research Journal*	18	3.37	248	46.44
10	10	Journal of the royal Asiatic Society of Great Britain and Ireland	17	3.18	265	49.63
11	11	Indian Archaeology Review	16	3.00	281	52.62
12	12	Quarterly Review of Historical Studies	15	2.81	296	55.43
13	13	India Economic and Social History Review*	14	2.62	310	58.05
14	14	Journal of American Oriental Society	13	2.43	323	60.49
15	15	Journal of Economical and social History	12	2.25	335	62.73
16	16	Medieval India Quarterly	11	2.06	346	64.79
17	17	Annals of the Bhandarkar Oriental Research Institute Poona	9	1.69	355	66.48
18	18	Bulletin of the Deccan College Research Institute	8	1.50	363	67.98
19	18	Itihas (Indian Council of Historical Research)	8	1.50	371	69.48
20	18	Journal of Oriental Research	8	1.50	379	70.97
21	18	Journal of Regional Studies	8	1.50	387	72.47
22	18	Punjab Past and Present*	8	1.50	395	73.97
23	18	Quarterly Journal of Mystic Society	8	1.50	403	75.47
24	19	Journal of Contemporary History	7	1.31	410	76.78
25	19	Journal of Economic History	7	1.31	417	78.09
26	19	Journal of Modern History	7	1.31	424	79.40
27	19	Journal of South Asia	7	1.31	431	80.71
28	19	Journal of World History	7	1.31	438	82.02
29	19	Modern Asian Studies*	7	1.31	445	83.33
30	20	Annals of the Bhandarkar Oriental Research Institute	6	1.12	451	84.46
31	20	Bulletin of the Institute of Traditional Culture	6	1.12	457	85.58
32	20	Bulletin of the Philosophical society of Culture	6	1.12	463	86.70
33	20	South Asian Review	6	1.12	469	87.83
34	20	Survey of British Common Wealth affairs	6	1.12	475	88.95
35	21	Journal of Asiatic society of Bengal, Calcutta	5	0.94	480	89.89
36	21	Journal of Peasant Studies	5	0.94	485	90.82
37	21	Journal of the Numismatic Society of India	5	0.94	490	91.76
38	21	Journal of Aligarh Historical Research Institute	5	0.94	495	92.70
39	21	Punjab Journal of Politics	5	0.94	500	93.63
40	21	Social Action	5	0.94	505	94.57
41	----	Other (20) Journals	29	5.43	534	100.00.
		Total	**534**	**100.00**		

Table 6.1 gives a rank list of periodicals in History. Among the 60 periodicals cited it is noted that only eleven periodicals account for more than 52.62% of the citations and therefore they may be considered as core periodicals.

Among them, the first three most frequently cited periodicals are 'Indian Antiquary' (9.36%), 'Indian Historical Quarterly' (6.18%) and 'Indian Quarterly' (5.99%).

It is surprising to note that, the analysis of the ranked list reveals that a large number of citations are from the Indian Journals. There are as many as 60 journals cited in the theses. Kurukshetra University is receiving 16 journals and from these journals only 3 journals are cited (* indicate that the Journal is subscribed by the University Library). Interestingly only 2 out of 3 journals cited face in the ranking list.

Implications: The implication of the observed citation pattern is that there is a need for re-examination of the use of the periodicals in History, at the Kurukshetra University Library, and more stress should be given to Indian periodicals.

7. APPLICATION OF BRADFORD'S LAW TO CITATION DATA

The current revolution in computer-aided, micro-analytic techniques of information retrieval is largely justified by earlier studies of literature used in scientific research. These studies showed that a researcher's interest was widely scattered among titles and was much more extensive than the coverage provided by existing bibliographic reviews. The important measures of scatter used in empirical studies is 'Title dispersion', which is defined as the degree to which the useful literatures of a given subject area is scattered through a number of different books and journals.

Of particular interest is the work of Bradford. He studied the title dispersion of useful papers in two areas: applied geophysics and lubrication by arranging the source titles in order of productivity and then dividing them into three approximately equal groups. Bradford concluded that the ratio of the titles in successive zones followed a common pattern, and proposed the following "Law of Scattering".

"If scientific journals are arranged in order of decreasing productivity of articles on given subject, they may be divided into a number of periodicals more particularly devoted to the subject and several groups of zones containing the same number of articles as the nucleus where the number of periodicals in the nucleus and succeeding zones will be 1 : a^2 ……….".In other words, only a small number of journals will be needed to supply the nucleus of paper on a given topic, assuming that the topic is a narrow scientific subject. Beyond the nucleus or first zone however, the number of journals required to produce the same number of paper increases dramatically. For example, if two journals supply 300 articles on a topic, then four additional journals will be needed to supply the next 300 articles, and sixteen journals the next 300 journals.

In comparing cumulative periodicals with the cumulative references they yield, Bradford proposed a linear logarithmic approximation. Vickery shows that Bradford's law is independent of the number of zones chosen, although this value affects the value of the ratio multiplier.

A more revealing analysis of title dispersion can be made by first serving the mathematical formula for the distribution of references in an ordered collection of titles, which is implicit in Bradford's Law. This formula, or model, makes it possible to use standard statistical methods for summarizing empirical data and making tests of hypothesis.

Bradford did not conclude his study by simply stating his law verbally, but instead went on to express graphically using experimental data, not noting himself that the graphical expression was not mathematically identical to the verbal formulation. He plotted R (n) (Cumulative total of relevant papers) against log (n) (natural logarithm of the total of productive journals) and found that the data revealed an elongated 'S' shaped curve. Part one of the curve, the initial concave portion, represents the higher density of the nuclear zone, part two the linear portion of the curve when data are plotted on a semi log scale, is equivalent to the Zipf distribution, hence the commonly used expression is the Bradford-Zipf Distribution, part three often called the "Groos Droop" shows the departure from linearity for higher values of n, the reason which is not yet fully understood. Brookes thought that the droop was observed when there were omissions from the relevant literature.

In the years following the publication of Bradford's Law, papers by eminent researchers such as Vickery, Brookes, and Leimkuhler contributed to a partial understanding of the Bradford distribution-partially because these contributors did not interpret the law in mathematically identical terms. Vickery extended the verbal formulation to show that it applied to any number of zones of equal yield, not to only the three zones that Bradford had used for his data. Later Leimkuhler expressed the verbal formulation mathematically as is shown in the equation.

$R(n) - j \log (n/t+1) \ (n>n_m)$ ………….. (1)

Where

R (n) = Cumulative total of relevant papers found in the first n journals when all periodicals are ranked 1, 2, 3 ……….n in order of decreasing productivity:

N = Cumulative number of journals producing R (n) relevant papers:

j and t = Constants defined in terms of other variables, and

n_m = the value of n beyond which the curve becomes linear.

Brookes in a study expressed the formula for the graphical version of Bradford's law beyond the nuclear zone and for N log as is shown in equation (2).

$R(n) = N \log (n/s) \ (n>n_m)$ ……………. (2)

Where

N = total number of journals estimated to contain articles relevant to the subject of the search, and

s = a constant calculated using experimental data.

Vickery in his paper noted that the verbal and graphical formulations were not mathematically identical. Once the disparity between the two formulations was recognized, the questions arise concerning which of the two was more practical to apply to empirical data. Wilkison devised a comparative test between the two formulations utilizing the same bibliographic data for four different subjects Instead it utilized simple formulas for calculating N (the estimated total number of journals containing articles relevant to the subject of the search) and R (N) (the estimated total number of papers produced by N) only 'P' (number of journals) and 'S' (the corresponding cumulative number of papers) had to be known in order to apply the formulas. Both p and s were obtained from a plot of the empirical data on semi log paper. Although the value of p could be chosen anywhere in the linear portion of the curve, the point at which the initial concave portion of the curve turned into a linear region (n= m) was arbitrarily chosen to be equal to p and was used in determining the corresponding value of s. By identifying on the plot 2s papers, the corresponding number of journals required to supply 2s, called q, was ascertained. The values obtained for s, p, and q, were then used to calculate N and R (N) for both the verbal and graphical expressions of Bradford's Law. Wilkinson's test revealed that, for the data she considered the graphical rather than the verbal formulation was more consistent with the practical situation.

Verbal Formulation

$$N = \frac{a}{\text{Log } a} - \frac{p}{a-1} \quad (3)$$

Where

$$a = \frac{q-p}{p}$$

$$R(N) = \frac{a}{\log a} \times \log\left[\frac{a}{\log a} - \frac{(a-1)}{p}\right] \quad (4)$$

Graphical Formulation:

$$N = \frac{s}{\text{Log } \beta} \quad (5)$$

Where

$$\beta = \frac{q}{p}$$

$$R(N) = \frac{s}{\log \beta} \times \log\left[\frac{s}{\log \beta} - \frac{\beta}{p}\right] \quad (5)$$

TABLE 7.1 : CITATION DATA FOR HISTORY JOURNALS THEORETICAL AND OBSERVED VALUE

X	Theoretical Value $\hat{F}(X)$	Observed Value F(X)	$(F(X) - \hat{F}(X))^2 / \hat{F}(X)$
1	2	3	4
0.0167	0.1281	0.0936	0.0093
0.0333	0.2151	0.1554	0.0166
0.0500	0.2817	0.2154	0.0156
0.0667	0.3355	0.2640	0.0152
0.0833	0.3803	0.3090	0.0134
0.1000	0.4191	0.3521	0.0107
0.1167	0.4532	0.3933	0.0079
0.1333	0.4834	0.4307	0.0058
0.1500	0.5108	0.4644	0.0042
0.1667	0.5358	0.4963	0.0029
0.1833	0.5586	0.5262	0.0019
0.2000	0.5798	0.5543	0.0011
0.2167	0.5995	0.5805	0.0006
0.2333	0.6178	0.6049	0.0003
0.2500	0.6350	0.6273	0.0001
0.2667	0.6513	0.6479	0.0000
0.2833	0.6666	0.6648	0.0000
0.3000	0.6812	0.6798	0.0000
0.3167	0.6950	0.6948	0.0000
0.3333	0.7081	0.7097	0.0000
0.3500	0.7207	0.7247	0.0000
0.3667	0.7328	0.7397	0.0001
0.3833	0.7443	0.7547	0.0001
0.4000	0.7554	0.7678	0.0002
0.4167	0.7661	0.7809	0.0003
0.4333	0.7763	0.7940	0.0004
0.4500	0.7862	0.8071	0.0006
0.4667	0.7958	0.8202	0.0007
0.4833	0.8050	0.8333	0.0010
0.5000	0.8140	0.8446	0.0012
0.5167	0.8227	0.8558	0.0013
0.5333	0.8310	0.8670	0.0016
0.5500	0.8392	0.8783	0.0018
0.5667	0.8472	0.8895	0.0021
0.5833	0.8549	0.8989	0.0023
0.6000	0.8624	0.9082	0.0024
0.6167	0.8697	0.9176	0.0026
0.6333	0.8768	0.9270	0.0029
0.6500	0.8838	0.9363	0.0031
0.6667	0.8906	0.9457	0.0034
0.6833	0.8972	0.9532	0.0035
0.7000	0.9036	0.9588	0.0034
0.7167	0.9100	0.9625	0.0030

1	2	3	4
0.7333	0.9161	0.9663	0.0027
0.7500	0.9222	0.9700	0.0025
0.7667	0.9281	0.9738	0.0022
0.7833	0.9339	0.9757	0.0019
0.8000	0.9396	0.9775	0.0015
0.8167	0.9452	0.9794	0.0012
0.8333	0.9506	0.9813	0.0010
0.8500	0.9560	0.9831	0.0008
0.8667	0.9612	0.9850	0.0006
0.8833	0.9664	0.9869	0.0004
0.9000	0.9714	0.9888	0.0003
0.9167	0.9764	0.9906	0.0002
0.9333	0.9813	0.9925	0.0001
0.9500	0.9861	0.9944	0.0001
0.9667	0.9908	0.9963	0.0000
0.9833	0.9954	0.9981	0.0000
1.0000	1.0000	1.0000	0.0000

TABLE 7.1.1

Sr. No	X	F(X)
1	2	3
1	0.0167	0.0936
2	0.0333	0.1554
3	0.0500	0.2154
4	0.0667	0.2640
5	0.0833	0.3090
6	0.1000	0.3521
7	0.1167	0.3933
8	0.1333	0.4307
9	0.1500	0.4644
10	0.1667	0.4963
11	0.1833	0.5262
12	0.2000	0.5543
13	0.2167	0.5805
14	0.2333	0.6049
15	0.2500	0.6273
16	0.2667	0.6479
17	0.2833	0.6648
18	0.3000	0.6798
19	0.3167	0.6948
20	0.3333	0.7097
21	0.3500	0.7247
22	0.3667	0.7397
23	0.3833	0.7547
24	0.4000	0.7678
25	0.4167	0.7809
26	0.4333	0.7940
27	0.4500	0.8071
28	0.4667	0.8202
29	0.4833	0.8333
30	0.5000	0.8446
31	0.5167	0.8558
32	0.5333	0.8670
33	0.5500	0.8783
34	0.5667	0.8895
35	0.5833	0.8989
36	0.6000	0.9082
37	0.6167	0.9176
38	0.6333	0.9270
39	0.6500	0.9363
40	0.6667	0.9457
41	0.6833	0.9532
42	0.7000	0.9588
43	0.7167	0.9625
44	0.7333	0.9663
45	0.7500	0.9700

TABLE 7.1.1

Sr. No	X	F(X)
1	2	3
1	0.0167	0.0936
2	0.0333	0.1554
3	0.0500	0.2154
4	0.0667	0.2640
5	0.0833	0.3090
6	0.1000	0.3521
7	0.1167	0.3933
8	0.1333	0.4307
9	0.1500	0.4644
10	0.1667	0.4963
11	0.1833	0.5262
12	0.2000	0.5543
13	0.2167	0.5805
14	0.2333	0.6049
15	0.2500	0.6273
16	0.2667	0.6479
17	0.2833	0.6648
18	0.3000	0.6798
19	0.3167	0.6948
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22	0.3667	0.7397
23	0.3833	0.7547
24	0.4000	0.7678
25	0.4167	0.7809
26	0.4333	0.7940
27	0.4500	0.8071
28	0.4667	0.8202
29	0.4833	0.8333
30	0.5000	0.8446
31	0.5167	0.8558
32	0.5333	0.8670
33	0.5500	0.8783
34	0.5667	0.8895
35	0.5833	0.8989
36	0.6000	0.9082
37	0.6167	0.9176
38	0.6333	0.9270
39	0.6500	0.9363
40	0.6667	0.9457
41	0.6833	0.9532
42	0.7000	0.9588
43	0.7167	0.9625
44	0.7333	0.9663
45	0.7500	0.9700
1	2	3
46	0.7667	0.9738
47	0.7833	0.9757
48	0.8000	0.9775
49	0.8167	0.9794
50	0.8333	0.9813
51	0.8500	0.9831
52	0.8667	0.9850
53	0.8833	0.9869
54	0.9000	0.9888
55	0.9167	0.9906
56	0.9333	0.9925
57	0.9500	0.9944
58	0.9667	0.9963
59	0.9833	0.9981
60	1.0000	1.0000

TABLE 7.1.2

No. of Journals i	f(i)	No of Citations i.f(i)
1	2	3
1	0.0936	0.0936
2	0.0618	0.1236
3	0.0599	0.1797
4	0.0487	0.1948
5	0.0449	0.2245
6	0.0431	0.2586
7	0.0412	0.2884
8	0.0375	0.3000
9	0.0337	0.3033
10	0.0318	0.3180
11	0.0300	0.3300
12	0.0281	0.3372
13	0.0262	0.3406
14	0.0243	0.3402
15	0.0225	0.3375
16	0.0206	0.3296
17	0.0169	0.2873
18	0.0150	0.2700
19	0.0150	0.2850
20	0.0150	0.3000
21	0.0150	0.3150
22	0.0150	0.3300
23	0.0150	0.3450
24	0.0131	0.3144
25	0.0131	0.3275
26	0.0131	0.3406
27	0.0131	0.3537
28	0.0131	0.3668
29	0.0131	0.3799
30	0.0112	0.3360
31	0.0112	0.3472
32	0.0112	0.3584
33	0.0112	0.3696
34	0.0112	0.3808
35	0.0094	0.3290
36	0.0094	0.3384
37	0.0094	0.3478
38	0.0094	0.3572
39	0.0094	0.3666
40	0.0094	0.3760
41	0.0075	0.3075
42	0.0056	0.2352
43	0.0037	0.1591
44	0.0037	0.1628
45	0.0037	0.1665
1	2	3
46	0.0037	0.1702
47	0.0019	0.0893
48	0.0019	0.0912
49	0.0019	0.0931
50	0.0019	0.0950
51	0.0019	0.0969
52	0.0019	0.0988
53	0.0019	0.1007
54	0.0019	0.1026
55	0.0019	0.1045
56	0.0019	0.1064
57	0.0019	0.1083
58	0.0019	0.1102
59	0.0019	0.1121
60	0.0019	0.1140

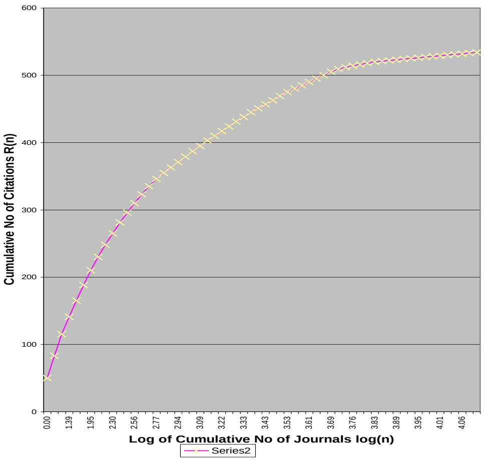

Figure 8.1 : Bradford's -Bibliograph
History - Kurukshetra University

Hypothesis:

HO: Data fits with Bradford's Law of Distribution.

H_1: Data doesn't fit with Bradford's Law of Distribution.

Results: The Bradford's Law as applied to the Data of the History and the relevant statistics were computed using Leimkuhler's equation which is stated as follows:

$$F(x) = \frac{\log(1+\beta x)}{\log(1+\beta)} \qquad 1$$

Where □ is connected with x as follows:

$$x = \frac{1}{\log(1+\beta)} - \frac{1}{\beta}$$

$$\text{Where } x = \frac{1 f(i)}{n} \qquad 2$$

$$x = \frac{15.0462}{60} = 0.2508 \quad \text{(computed from Table 7.1.2)}$$

Using trial and error method and from Equation (2) we find the value of □ = 34.8. For goodness of fit the chi-square test has been applied.

$$\text{The sum of the } \frac{(F(x) - \hat{F}(x))^2}{\hat{F}(x)} = 0.1591 \quad \text{(Computed from Table 7.1)}$$

Where F(x) Observed values and F (x) Theoretical values.

At 5% level of significance for n = 60 the table value of $x^2_{0.05}$ for 59 df is 76.778.

Therefore calculated $x^2 < x^2_{0.05}$

Hence we may accept the hypothesis i.e., the data fits well with Bradford's Law of distribution. Fig. 7.1 provides a curve which categorically establishes the validity of Bradford's empirical law of Bibliometrics. The curve has been drawn by taking journals and cumulative citations as abscissa and ordinate respectively. Data for plotting this curve is based on information furnished in Table 8.9.

8. LIBRARY ACQUISITION POLICY BASED ON BRADFORD'S LAW:

Goffman and Morries found that the distributions of both circulating periodicals and their users in a medical library seemed to obey Bradford's Law. Much of the untidiness mentioned by Brookes is attributed to the lack of methods for determining the minimum size or lower limits of a useful library collection, using Bradford's law; they have suggested a method for establishing such lower limits for the purpose of maintaining a dynamic library collection.

Broadford's law, although an interesting phenomenon, was of little practical use (because of zoning only and the absence of a mathematical equation). It was shown, however that there is a numerical nucleus in the sense of Broadford. That is, a core of journals can be separated from the top of an ordered list of periodicals dealing with a given subject who represents the most significant information sources for that field. This numerical nucleus, moreover, does not necessarily consist of only the most productive periodical, but may contain any number of journals depending on the extent of dispersion of the subject's literature among the various periodicals. Thus it is possible to set lower bounds on the number of journals which must be contained in a collection devoted to a given subject.

8.1 NUCLEUS OF JOURNALS

Brookes has also pointed out that Bradford's law can be expected to arise when selection is made of items, charcterised by some common for an equal period and subject to the "success-breeds-success" mechanism. Hence, Broadford's law should apply to the use of periodicals in a library as well as to the dispersion of articles among journals. These are both acquisitions processes, namely process of obtaining relevant item by means of selection.

8.2 ACQUISITION POLICY

Taking in to consideration that journal circulation obeys Bradford's law; the following acquisition policy can be derived. In doing so it is important to base the selection of journals on expected future demand –

1. First establish the numerical nucleus and its successive zones of periodicals circulating at various successive time intervals. The length of these intervals will vary from library to library with the density of use. Some libraries may complete the nucleus each month,

others every three months, and so forth. This is necessary because the nucleus may vary with time as a result of change in users or user interest.

2. On the basis of these observations, establish the rate of change of circulation for each periodical circulating in the library.

3. On the basis of these rates of change, establish by any appropriate means of extrapolation the expected circulation at some appropriate future date, say a year in advance.

4. The expected numerical nucleus should then belong to the numerical collection in the library's inventory at that point in time.

As a safety factor it may be good policy for the library not to delete a given journal from its collection until its predicted decline in circulation is verified by fact.

8.3. NUCLEUS OF USERS

If the budget allows, it may be in the library's interest to include those periodicals which are of greatest interest to its best customers, provided they do not already appear in the nuclear nucleus of circulating journals.

The successive zones of users borrowing about the same number of journals formed a geometric series. We can thus:

1. Establish the numerical nucleus of users of the library.

2. Determine the areas of interest of the members of this nucleus, in terms of, for example, Social Science Citation Index. For Social Science Research Scholars, this can be done by selecting the headings of S.S.C.I. under which their most recent publications have been indexed. For social science research scholars, teachers and students, this may be done by interest profiles.

3. Establish the numerical nucleus for each subject heading represented by the user nucleus. This is done by applying Bradford's Law to the distribution of articles among journals under each of the subject headings.

4. The totality of such numerical nucleus should then be added to the numerical nucleus of circulating journals for the library's numerical collection.

The expected numerical nucleus of users as well as the expected numerical nucleus of the subject areas of their interest at some appropriate future date can be established by extrapolation, and in this way the library can be in a position to anticipate future demand. In this case it may be a good policy to include new titles in the collection on the basis of these predictions.

CONCLUSION

The evidence of the application of Bradford's law of Scattering clearly supports a positive response in the present study. On the basis of present studies observations it is suggested that further studies may be conducted to test the applicability of Bradford's law for the literature in other disciplines**.**

REFERENCES

1. SENGUPTA (IN), GHOSH (BN) and SENGUPTA (KN). Role of bibliometry in journal selection and library management. IASLIC Bulletin. 25, 2; 1980; 87-92.

2. GARFIELD (Eugene). Citation indexes for science. Science. 122; 1955; 108-11.

3. VICKERY (BC). Bradfrod's Law of Scattering. Journal of Documentation. 4, 3; 1948; 198-203.

4. ZIPF (GK). Human behaviour and the principle of least effort. 1949. Addison-Wesley; Cambridge.

5. GROSS (OV). Bradford's Law and the Kelvan-Atherton Data. American Documentation. 18; 1967; 46.

6. BROOKES (BC). Derivation and application of the Bradford Zipf distribution. Journal of Documentation. 24, 4; 1968; 247-265.

7. VICKERY (BC). Op. Cit. No. 3.

8. LEIM KUHLER (FF). The Bradford distribution. Journal of Documentation. 23; 1967; 197-2007.

9. BROOKES (BC). Op. Cit. No. 6.

10. WILKINSON (FA). The ambiguity of Bradford's Law. Journal of Documentation. 28; 1972; 122-130.

11. GOFFMAN (William) and MORRIS (Thomas G). Bradford's Law and library acquisitions. Nature. 260; 1970; 922-93.

12. BROOKES (BC). Growth, utility and obsolescence of Scientific periodical Literature. Journal of Documentation. 26; 1970; 283-294.

13. BROOKES (BC). Op. Cit., No. 12.