



APPLICATION OF BRADFORD'S LAW OF SCATTERING TO HOME SCIENCE LITERATURE: A STUDY OF DOCTORAL THESES CITATIONS

Dr Sanjay Wagh¹, Dr Nilesh Gawande² & Dr (Ms) Rasika R. Wadalkar³

¹Librarian, Sant Gadge Maharaj Mahavidyalay, Walgaon, Maharashtra

²Principal, Late B S Arts, N G Science & A G Commerce College, Sakharkherda

³Research Scholar

Abstract

The study cover 05 Ph.D. theses of Home Science submitted to MAU, Parbhani. The study was carried out to examine the applicability of Bradford's Law of Scattering. From the study it is found that Indian Journal of Nutrition and Digest is the most cited journal with 12.94% citations. Bradford's Law fits to present study and the applicability of Leimkuhler model was also tested with the present data.

Introduction

Journals are the one of the most important information source in any subject field. However, the large number of journals and their subscription cost make it difficult for libraries to subscribe all required journals. Citation analysis is one of the useful tool in the hands of librarian to identified the core journals in particular subject. In fact citation study is one of the effective method to understand the information requirement of users.

The present study is based on application of Bradford's law of scattering to the journal citations appended in theses in the subject Home Science submitted to Marathwada Agricultural University, Parbhani.

Review of Literature

Number of studies have been undertaken to test the Bradford's Law of Scattering. Vickery¹ (1948) conducted study on Bradford's law to analyzed periodical references. Patra S. K., Bhattacharya P. and Verma N².(2006) in their "Bibliometric study of literature on bibliometrics identify core journals. Devi B.M. and Sankar V.S.J³.(2014) in their study analyzes the citations

of doctoral dissertations in commerce awarded by University of Kerala (During 2001 to 2010). Study reveals that Bradford's law did not find fit with commerce literature. Singh K P and Bebi⁴ (2014) analyzed the citations of Ph.D. theses of Social Sciences Submitted in University of Delhi. The Study revealed that journals are the most preferred cited source and the Bradford's Law fits to present study. There are number of studies carried out on Bradford's Law Of Scattering. Banateppanavar K P D and Vindya A D⁵ (2015) in their citation study of Free- e- journal "Collection Building" found that journals are the most preferred source of information used by researchers and Bradford's Law of Scattering was applied.

Objectives of the Study

- 1) To study distribution of citations by type of document.
- 2) To prepare a ranked list of most cited journals by the Home Science scholars.
- 3) To test the Bradford's Law of scattering.

Methodology

05 Ph.D. Theses of Home Science submitted to MAU, Parbhani during 2003 to 2012 were selected as a source of data. 823 citations were found in these 05 theses. Each citation was noted down on a data sheet. MS-Excel was used for data entry. As per objective of study the citations were analyzed and presented in the form of tables.

Form wise Distribution of Citations

Information published in different form like Journals, Books, Theses, Reports, Conference papers etc. Form wise distribution of citations has been done in order to know the most dominant form in which the information is cited.

This study will be helpful for information scientists as well researchers, to know the most dominant form of information.

Table no.-1 present the data about different information sources used by the researcher in the field of Home Science during 2003-2012.

Table No.- 1: Form wise Distribution of Citations

Sr. No.	Source Of Documents	No. of Citations	Percentage	Cumulative Citations	Cumulative Percentage
1	Journals	564	68.53	564	68.53
2	Reports	70	8.51	634	77.04
3	Books	58	7.05	692	84.09
4	Conference Papers	42	5.10	734	89.19
5	Theses	30	3.65	764	92.84
6	Websites	12	1.46	776	94.30
7	Other	47	5.70	823	100.00
Total		823	100.00	823	100.00

Data presented in above table shows that out of total 823 citations, maximum i.e. 564(68.53%) citations are from journals, followed by reports 70(8.51%), books 58(7.05%), conference papers 42(5.10%), theses 30(3.65%), websites 12(1.46%) whereas 47(5.40%) citation are of different information sources such as patent,

standards, newspapers etc. and these sources are grouped in other category.

So, this indicates that journals are most preferred source of information among research scholars of Home Science.

Country wise Distribution of Citations

Data presented in table no.- 2 shows the country wise distribution of citations

Table No.- 2 : Country wise Distribution of Citations

Sr. No.	Country	No. of Citations	Percentage	Cumulative Citations	Cumulative Percentage
1	India	550	66.83	550	66.83
2	U.S.A.	165	20.05	715	86.88
3	U.K.	56	6.80	771	93.68
4	China	24	2.92	795	96.60
5	Italy	14	1.70	809	98.30
6	Japan	8	0.97	817	99.27
7	Pakistan	6	0.73	823	100.00
Total		823	100.00	823	100.00

From the above table it is observed that research scholars in the subject Home Science cite the document published from seven countries. Data presented in above table shows that documents published from India has got the maximum citations i.e. 550 .Out of total citation,66.83% citations are of Indian documents followed by documents published

from USA received the second highest preference with 20.05% citations.

The analysis reveals that the scholars depend mostly on literature published form India and USA.

Authorship Pattern of Journal Citations

Authorship has been analyzed to determine the percentage of single, two, three,

four and above authors. Following table shows the authorship pattern of the journal citations, according to the number of authors.

Table No.- 3 : Authorship Pattern of Journal Citations

Sr. No.	No. of Author	Citations	Percentage	Cumulative Citations	Cumulative Percentage
1	1	105	18.62	105	18.62
2	2	168	29.79	273	48.40
3	3	137	24.29	410	72.70
4	4	76	13.48	486	86.17
5	5	46	8.16	532	94.33
6	6	32	5.67	564	100.00
Total		564	100.00	564.00	100.00

It is observed from the analysis of citations by authorship pattern that the highest number of citations is from two authors. Out of 564 total journal citation 168 citations are of two authors and the percentage is 29.79%.

Out of total 564 citations, 105 citations are from single author with percentage 18.62% and 137 citations are from three authors with percentage 24.29%. Further 76(13.48%), 46(8.16%) and 32(5.67%) citations are of four, five and six author papers respectively.

Hence from the study it can be said that in the subject Home Science trend toward joint authorship found.

This reflects the degree of prevalence of multiple authored publications in Home Science, which reflects higher level of collaboration.

Ranking of Journals

In the present study ranking of the journals has been prepared on the basis of total citation frequency received by each journal. The titles have been arranged in decreasing order of the number of citations. Ranked list of journals is given in the table no. 4 with their rank, number of citations and origin of journal.

Table No.- 4 : Ranking of Cited Journals

Sr. No.	Rank	Name of Journal	Country	No. of Citations	Cumulative Citations	Percentage	Cumulative Percentage
1	1	Indian Journal of Nutrition and Digest	India	73	73	12.94	12.94
2	2	Journal of Food Science and Technology	India	56	129	9.93	22.87
3	3	Journal of Applied physiology	India	20	149	3.55	26.42
4	4	Applied Ergonomics Journal	India	17	166	3.01	29.43
5	5	Journal of Ethnopharmacology	India	12	178	2.13	31.56
6	6	Dharwad, Karnataka Journal (UAD)	India	10	188	1.77	33.33
7	6	International Sunflower Journal	U.S.A.	10	198	1.77	35.11
8	6	International Journal of Industrial Ergonomics	U.S.A.	10	208	1.77	36.88
9	6	Indian Journal of Experimental biology	India	10	218	1.77	38.65
10	6	Phytotherapy Research Journal	India	10	228	1.77	40.43
11	7	Journal of Nutritional Medicine	India	9	237	1.60	42.02

12	7	International Journal of Crude Drug Research	India	9	246	1.60	43.62	
13	8	Beverage and Food World Journal	India	8	254	1.42	45.04	
14	8	Acta Oncol Journal	India	8	262	1.42	46.45	
15	8	The American Journal of clinical Nutrients	U.S.A.	8	270	1.42	47.87	
16	8	Natural Product Sciences,	India	8	278	1.42	49.29	
17	8	Journal Research of Indian Medical	India	8	286	1.42	50.71	
18	8	Journal of Nutritional Medicine	India	8	294	1.42	52.13	
19	8	Journal of Managerial Psychology	India	8	302	1.42	53.55	
20	9	Journal of Maharashtra Agriculture University	India	7	309	1.24	54.79	
21	9	Journal of Food Science and Technology	India	7	316	1.24	56.03	
22	10	Journal of Biology Control	U.S.A.	6	322	1.06	57.09	
23	10	Indian journal of Psychology	India	6	328	1.06	58.16	
24	10	Fitoterapia Journal Elsevier	U.S.A.	6	334	1.06	59.22	
25	10	Journal of Child Development	U.K.	6	340	1.06	60.28	
26	11	Shanghai Traditional Chinese Medical Science Journal	China	5	345	0.89	61.17	
27	11	Plant Food Fpr Human Nutrition	India	5	350	0.89	62.06	
28	11	Karnataka Journal of Agricultural science	India	5	355	0.89	62.94	
29	12	Journal of Food Science and Technology	U.S.A.	4	359	0.71	63.65	
30	12	Journal of clinical Psychiatry monograph Series	U.S.A.	4	363	0.71	64.36	
31	12	Journal of Child and Adolescent Psychiatry and mental Health	India	4	367	0.71	65.07	
32	13	13 journals each having three citation	.	39	406	6.92	71.99	
33	14	28 Other journals each having two citation		56	462	9.93	81.91	
34	15	102 Other journals each having only one citation		102	564	18.09	100.00	
Total					564	564	100	100.00

From the analysis of data presented in above table it is revealed that “Indian Journal of Nutrition and Digest” is highly cited journal with 73(12.94%) citations. “Journal of Food Science and Technology” has got the second rank with 56(9.93%) citations.

Further rank list of journal indicates that research scholars of Home Science cite 564 research articles from 174 journals. Out of these 174 journals first 6 journals contribute 188(33.33%) citations and these 06 journals are the core journals in the subject Home Science.

Application of Bradford’s Law of Scattering:

Bradford’s Law of Scattering is used to determine the number of core journals in any

given field. It states that “journals in a given field can be divided into three zones, containing the same number of citations, a core zone containing the same number of citations but a greater number of journals and zone 2 containing the same number of citations, but still greater number of journals”. The mathematical relationship of the number of journals in the core zone to the zone first is a constant ‘n’ and to the second zone the relationship is ‘n²’. Bradford expressed this relationship as; 1: n: n² for verifying the Bradford’ law, the 174 journals and 564 citations in the subject Home Science were divided in three zones as shown in the table no. 4A

Table No.- 4A : Scattering of Journals and Citations over Bradford's Zone

Sr. No.	Zones	No. of Journals	No. of Citations
1.	Core zone	6	188
2.	Zone 1	28	188
3.	Zone 2	140	188
Total		174	564

$$6 : 28 : 140 :: 1 : n : n^2$$

Here 6 represent the number of periodicals in the nucleus and $n = 4.67$ is a multiplier.

$$\text{Therefore, } 1 \times 6 : 4.67 \times 6 : 4.67^2 \times 6 \times 1.07$$

$$6 : 28 : 140$$

Bradford's law of Scattering should be $1 : 4.67 : 4.67^2 = 1 : n : n^2$

But in present analysis Bradford's law is in following form

$1 : 4.67 : (4.67)^2 \times 1.07$ is not equal to $1 : n : n^2$ but it is almost equal to Bradford's law.

$$\text{Percentage of error} = \frac{174.02 - 174}{174 \times 100} = 0.01$$

Here the percentage of error is negligible. It is also observed that, the number of journals contributing citations to each zone increases by a multiplier of 4.67. So it can be said that the distribution in present study follow Bradford's law for more confirmation of this law we can apply one more law i.e. Leimkuhler model.

Application of Leimkuhler model :

For application of Bradford's law, the citations distribution was divided in three zones (p). Bradford assumes that there should be minimum three zones, here also 'p' is assumed to be 3. Then by using the mathematical formula, the value of the Bradford's multiplier 'k' is calculated as

$$k = (e^y \times y_m)^{1/p}$$

Where $e^y = 1.781$ Eulers number

y_m = first rank Journal citations

$p = p$ is number of zone.

Table No.- 4B : Using Leimkuhler Model, Bradford's Zone and Number of Journals

Sr. No.	Zones	No. of Journals	No. of Citations
1.	Core zone	6	188
2.	Zone 1	28	188
3.	Zone 2	140	188
Total		174	564

$$k = (1.781 \times 73)^{1/3}$$

$$= (130.013)^{1/3}$$

$$= 5.065$$

$$y_o = \frac{A}{p}$$

Where y_o = No of citations in each zone.

A = No. of Citations

$$y_o = \frac{564}{3} = 188$$

The nucleus zone r_0 can be defined as:

$$r_0 = \frac{T(k-1)}{(k^p - 1)}$$

$$\square r_0 = \frac{174(5.065 - 1)}{(128.94)}$$

$$= \frac{174 \times 4.065}{128.94}$$

$$= \frac{707.31}{128.94}$$

$$= 5.48$$

Different Bradford's zone can be obtained using the value of k and r_0 .

$$\text{Nucleus zone } r_0 = r_0 \times 1 = 5.48$$

$$\text{First zone } r_1 = r_0 \times k = 5.48 \times$$

$$5.065 = 27.76$$

$$\text{Second zone } r_2 = r_0 \times k^2 = 5.48 \times$$

$$5.065 \times 5.065 = 140.58$$

$$5.48 : 27.76 : 140.58$$

$$\text{Percentage of error} = \frac{174 - 173.82}{174 \times 100} = 0.103$$

The Bradford groups thus formed were shown in the table no. 4B

Here the percentage of error is very much negligible. It was observed that, the number of Journals contributing citation to each zone is increased by multiplier of 5.065. The data of zonal analysis also shows that there is exact $1/3^{\text{rd}}$ of total citations in each zone. Journal in nucleus zone are highly productive and productivity of journals decreases in next subsequent zones.

This theoretical presentation of Bradford's law proves that Bradford's law of Scattering is valid in present study.

Graphical Formulation:

Bradford's Bibliograph for present study have been plotted taking the cumulative number of citations on the Y-axis and cumulative number of journal titles on the X-axis. From the figure no. 1 it is found that data in present study have an initial raising curve and followed by linearity. From the figure it is also confirms that Bradford's law of Scattering is valid for the present study.

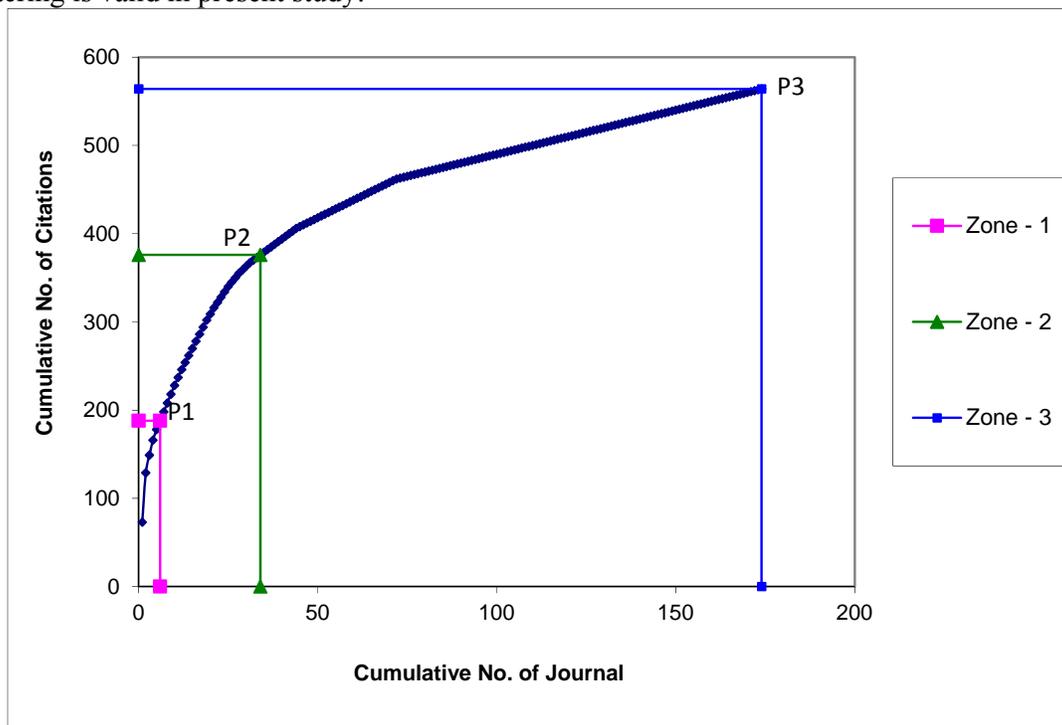


Figure No.- 1 : Bradford's Bibliograph

Conclusion

The study revealed that journals are preferred source of information with 68.53% citations, further country wise distribution of citations indicates that information sources published from India received highest i.e. 66.83% citations followed by documents published from USA. It indicates that information sources published from India in the subject Home Science is worthwhile.

The rank list of journals in the subject Home Science indicates that 564 citations were scattered in 174 journal titles. It is evident from rank list that out of these 174 journals 1^{st} 06 journals contribute 188 (33.33%) citations i.e. $1/3^{\text{rd}}$ citations and these 06 journals are core journals in the subject Home Science.

To test the Bradford's Law, 174 journals and 568 citations were divided in three zones of

equal number of citations. After dividing citations in three zones the number journals in each zones is in the ratio of "6:28:140". Hence it is evident from analysis of data that dispersion of journal titles in Home Science is follows Bradford's Law. The Method Based on the Leimkuhler model was used for the verification of Bradford's Law. From the study it is found that Law is valid for the data set.

References

1. Vickery, B.C.(1948).Bradford's law of scattering *.Journal of Documentation* .4(3),198-203
2. Patra, S.K. ,Bhattacharya, P. and Verma, N. (2006). Bibliometric study of literature on Bibliometric *.DESIDOC Bulletin of Information Technology*.26(1).

3. Devi,B.M. and Sankar, V.S.J.(2014). Information use pattern of researchers in commerce: A citation analysis of doctoral dissertations. *Library Philosophy and Practice*.0-1,1-35
4. Singh, K.P. and Bebi. (2014).Application of Bradford's law on journal citations : A study of Ph.D. theses in social sciences of University of Delhi.*Annals of Library and Information Studies*. 61(2),112-120.
5. Banateppanavar, K .P. D. and Vindya, A. D. (2015). Bradford's zone to LIS publications published in collection building journal from 2009 to 2012: A citation study.*Collection Building* ,34(2),65.
6. Wadalkar, Rasika .(2016). Citation analysis of Ph.D. theses submitted it Marathwada Agricultural University Parbhani during 2003 to 2012 . Ph.D. thesis ,SBBAU,Amravati