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Application of Bradford's Law of Scattering to the Discipline of Law: Analysis of Doctoral Theses Citations Submitted by Universities in India

by

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ABSTRACT

This study mainly examines the applicability and appropriateness of Bradford's Law of Scattering to the literature of law. It also ranks the most cited law journals by the research scholars. This study covers citation of journals provided by the law research scholars in their Doctoral Theses submitted to various universities in India, which are available at Shodhganga is the digital repository of Indian electronic theses and dissertations. This study examines 773 journals, containing 3187 citations collected from 252 doctoral theses. Rank list was prepared to identify the core journals in law. Top most preferred journals among the law research scholars are, American Journal of International Law (USA) with 5.24% of citation, followed by the Journal of Indian Law Institute (India) with 3.79% of citation and International and Comparative Law Quarterly (UK) with 2.66% of citation. Bradford's distribution pattern is not applicable with journal distribution pattern of law theses. Applicability of Bradford's law of scattering was tested with verbal, graphical and Leimkuhler model. The law found applicable with the value of multiplier $k = 6.67$.

Keywords: Bradford's law of scattering, core law journals, law literature, journal citations, journal ranking, law journals, Leimkuhler model, citation analysis.

1. INTRODUCTION

Revolution in information and communication technology has resulted in changing the landscape of legal literature, emerging new fields of law, reporting channels, media and finding tools and search aids. This leads to an ever growing increase in the corpus of the legal literature. Law journals are inevitable in legal literature. Jurists, law professionals, Legal research scholar mostly use the law reports because it contains judicial opinions that are legally binding under the rule of *stare devises*. Articles in legal journals also form a source of reference to legal practitioner, students, and to judges and may provide information on subjects which are too new or too specialized. Articles will be a continuous source of reference over a longer period than other materials. Articles in legal journals have also been accepted by judges on several occasions because of their accuracy. In the fields of law there are a good number of journals published by commercial organizations, academic and professional bodies.

Generally legal journals are categorized as:

1. Academic journals : which will covers articles only
2. Law Reports: which will cover only the full text of case laws
3. Hybrid: This cover both articles and case laws. Some among them also cover statutory materials such as acts, amendments, rules, etc
4. Legislative materials: This includes acts, rules, notifications etc.

The 21st century moved forward, the difficulty of providing access to all of the intellectual materials necessary to sustain a vibrant law library become increasingly clear. The scope of legal publishing exploded and law libraries were expected to keep carried with all contemporary development within a limited funds. In this circumstance, bibliometric approaches that examine the citations found in dissertations and journal articles will help the librarian to identify the core journals, to understand the information use pattern of researcher, and to determine the information behavior of researchers. Hence this study focuses on identifying the core law journals by applying the Bradford's law of scattering in the disciplines of Law.

2. LITERATURE REVIEW

There are various aspects of literature available for Bradford's law analysis of scattering. Since its proclamation the law analyzed, retested, redefined, interpreted, compared, proposed and contributed various models for scattering. It created corpus of

literature. There are two approaches; verbal and graphical have been recognized in analyzing the law. Some of the notable analyses of verbal formulation of the law are propounded by Leimkuhler, Goffman and Warren. The graphical representation of the law is analyzed by Kendall, Cole and Brooks. There are enormous literatures available on application of Bradford's law of scattering. Noteworthy studies are by Sengupta who prepared rank list of journals in the fields of medicine, biochemistry, physiology, microbiology, pharmacology, Maheswarapa and Prakash (1982) tested Bradford's law on botanical literature. ArjunLal and Panda tested the applicability of two approaches of Bradford's law of scattering on the data collected from 20 doctoral theses submitted to the Regendra Agricultural University, Bihar in the subject of plant pathology during 1980 - 1993. Pillai (2007) studied Bradford's Law on 11412 citations appeared in 71 doctoral theses awarded by Indian Institute of Science during 1999-2003. Dhanamjaya, Talawar. Mulla and Chowdappa (2011) analyzed 17151 citations in 137 doctoral theses in engineering and technology awarded in universities of Karnataka during 1961 to 2008. Joginder Singh Burman, Sheela (2011) prepared rank list of journals by analyzing 3052 citations from 33 dissertations available in Campus Law Centre Library, University of Delhi.

The above studies confirm the applicability of Bradford's law of scattering in different disciplines. This study tries to fill up the gap in literature in analyzing Bradford's law of scattering in the discipline of law.

3. OBJECTIVES

This study mainly aims to examine the appropriateness of Bradford's law of scattering in law journals available in the Ph.D dissertations.

The objectives of the study are,

1. To analyze the core journals referenced in the Ph.D. dissertations by Indian researchers;
2. To rank the cited journal and to check appropriateness of Bradford's Law of Scattering;
3. To study the phenomenon of scattering for citation data;
4. To study the chronological distribution of citations;
5. To find out most cited law journals in India.

4. SCOPE AND LIMITATION

The research was carried out on data available at Shodhganga database retrieved by the keywords law and legal studies. This study is limited to the doctoral theses submitted during the year 2010 – 2015 to Shodhganga database. It includes citation of journals referred in the doctoral theses and excludes other forms of citations such as books, newspaper, magazines etc. It also excludes chapter citations and case law citations appended in the Ph. D dissertations.

5. METHODOLOGY

The present study is confined to the analysis of citations referred in the Ph.D theses accepted in the field of Law and Legal Studies for the award of doctoral degree by various Universities in India available in the public domain of Shodhganga database. The keywords law and legal studies were used to retrieve the relevant reference list of doctoral theses.

Source of data for this study is imported as Portable Document Format (PDF) file from the database of Shodhganga. Totally 281 doctoral theses were imported. 29 theses were excluded from the study due to technical problem occurred during downloading the data and language of theses. 18613 citations collected from 252 theses were converted from pdf to MS Excel file format for analyzing the data. Out of 18613 citations 3187 citations were journal articles and the remaining 15426 citations were removed from the database. Each record was checked for consistency, redundancy. Totally 914 journal titles were derived from 252 theses. The journal titles rendered in citations was checked for accuracy and completeness. It is observed that most of the researchers used abbreviation in rendering the journal titles and it is also observed that there is frequent change in titles of Law journals.

Blue book of abbreviation of legal journals and OCLC World Cat were utilized to check the uniformity in rendering of journal title, and to obtain first level of bibliography and subject coverage of the journals. 141 titles of the journals were eliminated from the study due to inaccurate and incomplete titles of the journals.

Generally, a legal research involves the analysis and / or interpretation of various Codes, Acts, Rules etc, and their implementation in the society. These constitute legal sources of research study which have a primary authority of law. However, there are certain legal sources which have a secondary authority of law. They include journals, reports, treaties, encyclopedia, dictionaries, commentaries and press release etc.

6. DATA ANALYSIS AND INTERPRETATION

Table - 1. Chronological Distribution of Ph.D Awarded

Sl. no	Year	No. of Ph.D awarded
1	1965 - 1975	1
2	1975 - 1985	8
3	1985 - 1995	14
4	1995 - 2005	44
5	2005 - 2015	185
Total		252

The table 1 depicts the chronological distribution of Ph.D awarded by Indian Universities. It is observed that the number of Ph.D awarded is highest during the period 2005 – 2015.

**Table - 2
Citation Counts of the Legal Sources (Bibliographical Form)**

Sl. no	Forms	Citation Counts	Cumulative No, of Citations	% of Citation	Cumulative % of Citations	Rank
1.	Books	8813	8813	46.49%	46.49%	1
2.	Journals	3187	12000	18.63%	65.12%	2
3.	Online Sources	2471	14471	13.03%	78.15%	3
4.	Reports	1113	15584	5.87%	84.03%	4
5.	Treaties	683	16267	3.60%	87.63%	5
6.	Press Release	576	16843	3.04%	90.67%	6
7.	Assembly Resolution & Debates	309	17152	1.63%	92.30%	7
8.	Statues	213	17365	1.12%	93.42%	8
9.	Acts & Manuals	210	17575	1.11%	94.53%	9
10.	Conference	173	17748	0.91%	95.44%	10
11.	Magazines	164	17912	0.87%	96.31%	11
12.	Circulars & Resolutions	143	18055	0.75%	97.06%	12
13.	Reference Sources	100	18155	0.53%	97.59%	13
14.	Judicial Decisions	100	18255	0.53%	98.11%	14

15.	Other Languages	71	18326	0.37%	98.49%	15
16.	Other Documents (Policy Statement, Plan Doc)	63	18389	0.33%	98.82%	16
17.	Standards & Technical paper	59	18448	0.31%	99.13%	17
18.	Unpublished Theses	47	18495	0.25%	99.38%	18
19.	Working Papers	19	18514	0.10%	99.48%	19
20.	Interviews	14	18528	0.07%	99.55%	20
21.	Occasional Papers	12	18540	0.06%	99.62%	21
22.	Inaugural Address	11	18551	0.06%	99.68%	22
23.	Archival Sources	11	18562	0.06%	99.73%	22
24.	Editorial Comments	9	18571	0.05%	99.78%	23
25.	Unpublished Manuscripts	8	18579	0.04%	99.82%	24
26.	Official Records	8	18587	0.04%	99.87%	24
27.	Letters	6	18593	0.03%	99.90%	25
28.	Pamphlets	6	18599	0.03%	99.93%	25
29.	MI Dissertations	3	18602	0.02%	99.95%	26
30.	Briefs	3	18605	0.02%	99.96%	26
31.	Reviews	3	18608	0.02%	99.98%	26
32.	Manuscripts	2	18610	0.01%	99.99%	27
33.	Statements	1	18611	0.01%	99.99%	28
34.	Newsletter	1	18612	0.01%	100.00%	28
35.	CBS News	1	18613	0.01%	100.00%	28
Total		18613		100.00%		

Table 2 displays the bibliographical form of documents found in the citation. It is evident that Books (8813) are the most preferred medium of all the forms followed by Journals (3187), Online sources (2491) and reports (1113).

Table 3. Contribution of Universities to the Shodhganga Database

S. No	Universities	No of theses
1	Aligarh Muslim University	48
2	University of Burden	42
3	University of Mysore	39
4	Maharshi Dayanad University	16

5	Cochin University of Science and Technology	14
6	Kurushetra University	12
7	Dr. Hari Singh GourVishwavidhyalay	8
8	Punjabi University	8
9	Five Universities produced 6 theses	30
10	Two Universities produced 5 theses	10
11	Three Universities produced 4 theses	12
12	One University produced 3 theses	3
13	Two Universities produced 2 theses	4
14	Universities produced one thesis	6
Total		252

The values enumerated in the table 3 describe about the theses submitted by the Universities in the subject of Law and Legal Studies to the Shodhganga database. Aligarh Muslim University, University of Burden and University of Mysore contribute 45, 42 and 39 theses respectively to the Shodhganga.

Descriptive statistics such as citation counts, percentile was used to analysis the subject area of citing documents, rant list of journals. Verbal and graphical formulations of Bradford's law of scattering was employed to examine its appropriateness in law. Leimkuhier model also used to find out the core journals in law.

Bradford's law of scattering: Bradford first formulated his law in 1934. It was published in his first book entitled "Documentation" in the year 1948 and received wide attention. According to him "if scientific periodicals 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 maintaining the same number of articles as the nucleus where the number of periodicals in the nucleus and the succeeding zones will be as 1: n: n²where n is the multiplier." This is also known as Bradford's verbal expression of law of scattering.

Bradford also plotted graphs of the cumulative number of source items (R) versus the logarithms of the cumulative number of journals (log n). The resulting graph is called as "Bradford Bibliograph." Thus Bradford's law of scattering consists of verbal formulation of theoretical speculation; and the graphical representation by

plotting empirical data. Bradford's verbal formulation is not mathematically identical with the graphical representation.

Bradford Scattering Phenomenon:Based on the graphical formulation, scattering phenomenon was derived as, $F(X) = a + b \log x$, where $F(X)$ is the cumulative number of citations contained in the first X or first Zone. x is the most productive journals, "a" and "b" are constants.

Bradford law of scattering has great significance to librarians, information professionals, administrators and policy makers in collection development particularly selection of sources of information to purchase or subscribe and materials to weed out. This helps to achieve maximum utilization of limited resources allocation to the libraries. A rank list of journals cited by research scholars in their Ph.D theses was prepared and Journals were arranged in their decreasing order of citation count. Totally 38 rank was awarded to the journals. The total number of journals observed in the present study was 773 and the number of citations to journals was 3187. It is observed from the annexure 1 that the first 10 journals in the rank list contribute more than 25% of total journal citations. The first 49 journals in the rank list contribute 50 % of total journal citations. These 49 journals can be considered as mostly cited journals by the researchers. It is also obvious from the table that 75% of total citations are contributed by the first 188 journals. The remaining 25% of citation are scattered among the 585 journals.

Table 4. Rank List of Top 20 Journals in Law

Rank	Title of The Journal	Country	Citations	Cumulative no of citation	% of Citations	Cumulative % of Citations
1	American Journal of International Law	USA	167	167	5.24%	5.24%
2	Journal o Indian Law Institute	INDIA	121	288	3.80%	9.04%
3	International And Comparative Law Quarterly	UK	85	373	2.67%	11.70%
4	AIR	INDIA	77	450	2.42%	14.12%
5	Indian Bar Review (P) Journal of Bar Council Of India	INDIA	74	524	2.32%	16.44%
6	Economic And Political Weekly	INDIA	64	588	2.01%	18.45%

7	Cochin University Law Review (CULR)	INDIA	55	643	1.73%	20.18%
7	Supreme Court Cases	INDIA	55	698	1.73%	21.90%
8	Criminal Law Journal	INDIA	53	751	1.66%	23.56%
9	Indian Journal of International Law	INDIA	40	791	1.26%	24.82%
10	Harvard Law Review	USA	39	830	1.22%	26.04%
11	Modern Law Review	UK	36	866	1.13%	27.17%
12	British Year Book of International Law	UK	35	901	1.10%	28.27%
13	Human Rights Quarterly	USA	33	934	1.04%	29.31%
13	Yale Law Journal	USA	33	967	1.04%	30.34%
14	Indian Journal of Marketing	INDIA	30	997	0.94%	31.28%
15	Journal of Intellectual Property Rights	INDIA	28	1025	0.88%	32.16%
16	American Journal of Comparative Law,	USA	26	1051	0.82%	32.98%
16	Supreme Court Journal	INDIA	26	1077	0.82%	33.79%
17	Company Law Journal	INDIA	24	1101	0.75%	34.55%
17	European Intellectual Property Review	UK	24	1125	0.75%	35.30%
17	Law Quarterly Review	UK	24	1149	0.75%	36.05%
17	New Law Journal	UK	24	1173	0.75%	36.81%
18	California Law Review	USA	23	1196	0.72%	37.53%
18	Indian Journal of Criminology	INDIA	23	1219	0.72%	38.25%
19	Harvard International Law Journal	USA	21	1240	0.66%	38.91%
19	Journal of Marriage And Family	USA	21	1261	0.66%	39.57%
19	Nyaya Deep	INDIA	21	1282	0.66%	40.23%
20	Consumer Protection And Trade Practices Journal	INDIA	19	1301	0.60%	40.82%

Table 4 illustrate the rank list of top 20 journals. It is evident from the table that American Journal of International Law was the most cited and ranked first with citation counts of 167 and 5.24%. Journal of Indian Law Institute occupied 2nd rank with 121 citation counts followed by International and Comparative Law Quarterly with 85 citation counts. The least cited was consumer Protection and Trade Practices Journal ranked 20th with 19 citation count.

These top 20 journals contribute more than 40% of total journal citations in Law. From the above table the 7th rank was shared by 2 journals. The 16th, 17th, 18th and 19th rank also shared by 2, 4, 2, and 3 journals respectively.

It is surprising to have the most cited journals published from USA, India, and UK. Among top 20 journals India contributes more than 50% of citations, USA and UK contributes 28 and 21 percentage of citations respectively. It shows that research scholars in Law mainly depend upon literature published from India, USA and U.K. for their information requirements.

Productivity of Journals in Law: The productivity of journals in Law is measured by dividing the total number of citations into four equal categories.

Table 5: Range of Citations of Law Journals:

Range of Citations	Number of journals covered	Number of Citations	Cumulative no of Citations	% of Journals	Average Productivity of Journals
1 – 25	10	791	791	1.30	79.1
26 – 50	40	823	1614	5.17	20.57
51 – 75	147	806	2420	19.01	5.48
76 – 100	576	767	3187	74.51	1.33
Total	773	3187		99.99	4.12

Table 5 depicts the ranges of citations of law journals. It is clear found that Law the first 25% of citations are covered by the first 10 journals with an average productivity of 79.1 citations per journal which have high productivity. The second, third and fourth group of citations are covered by 40,147, and 576 journals respectively. This trend shows the decreasing productivity of cited journals in Law.

Chronological Distribution of Journal Citations: Table 3 reveals that maximum number of citations (55.53%) is cited during the year 1990 to 2009, followed by the period 1970 - 1989 accounting for 823 (25.82%) citations. The other period groupings are in decreasing trend. This clearly shows that the Law researchers are in need of recent information for their research work. Very small percent of references are cited which are published about a century ago.

Table 6 Chronological Distribution of Journal Citations:

Year	No of Citations	Cumulative no of Citations	% of Citation	Cumulative % of citation
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1600 – 1700	2	3	0.06	0.09
1800 – 1899	8	10	0.25	0.31
1900 – 1929	38	48	1.19	1.50
1930 – 1949	75	123	2.35	3.85
1950 – 1969	343	466	10.76	14.62
1970 – 1989	823	1289	25.82	40.44
1990 – 2009	1770	3059	55.53	95.98
2009 - 2013	79	3138	2.47	98.469
Year not mentioned	49	3187	1.53	100
Total	3187		100	

Appropriateness of Bradford's Law of Scattering:

Verbal Formulation: Rank list of law journals was prepared to check the appropriateness of the law. The journals were arranged and ranked according to decreasing frequency of citation counts. Annexure 1 depicts the rank list of journals arranged according to the decreasing order of citation counts along with their cumulative number of citations, percentage of journals. 773 journals were divided into three zones. The Bradford's multiplier factor was arrived at by dividing journals of a zone by its preceding zone. Bradford's multiplier was expressed as the ratio of the number of journals in any group to the number of journals in any immediately preceding. $1: n: n^2$. The scattering of journals and corresponding number of citations in the three zones along with the value of Bradford multipliers are shown in Table 7.

Table 7. Scattering of journals and citations over Bradford Zone

Zone	No of citations	No of Journals	% of Journals	Cumulative No. of Citations	Cumulative No. of Journals
1	1025	17	2.19	1025	17
2	1133	107	13.84	2158	124
3	1029	649	83.94	3187	773
Total	3187	773			

Thus, the ratios of journals contributing approximately the same number of articles in the core group and succeeding zones = 17: 107: 649. The Bradford's multiplier factor (BMF) was arrived at by dividing number of journal titles of a zone by its preceding zone.

$$BMF=(107/17) + (649/107)/2 = 6.29+6.06/2 = 12.35/2= 6.17$$

Thus 1: n: n²= 17: 17X6.17: 17X (6.17)² = 17: 105.05: 17X38.06 = **17: 105.05: 647.17**

The basis for choosing the three zones was to minimize the percentage error in distribution of citation count. The percentage of error was calculated as

$$(17+ (17X6.17) + (17X 6.17^2) - (17+107+649)) = (17+104.89+647.17)-(773) = (769 - 773) = -3.93. \text{ Thus the ratio } 17:107: 649 \text{ does not fit into the Bradford's distribution.}$$

Leimkuhler model: Leimkuhler developed a model based on Bradford's verbal formulation as: $R(r) = a \log(1+br)$ Where $R(r)$ is the cumulative number of articles contributed by journals ranked 1 through r , a and b are parameters. Egghe explains that

$$a = \frac{y_0}{\log k} \text{ and } b = \frac{k-1}{r_0} \text{ and } k \text{ is the Bradford multiplier factor calculated as } k = (e^g \times Y_m)^{1/P}$$

Where e^g is Euler's number having 1.781

y_m is the number of citations of rank one journal. In this study $y_m = 167$.

P is the Bradford groups or number of zone = 3

$$\text{Thus } k = (1.781 \times 167)^{1/3} = (297.427)^{1/3} = 6.67 = k = 6.67$$

$$Y_0 = \frac{A}{P} \text{ where } A \text{ denotes the total number of citations. } A = 3187$$

Where P denotes number of zones. $P = 3$

$$Y_0 = 1062.33$$

r_0 = number of journals in the nucleus of Bradford. It is calculated as follows,

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

Where T stands for Total number of Journals = 773

$$r_0 = \frac{773(6.67-1)}{(6.67)^3-1} = \frac{773(5.67)}{296.74-1} = \frac{4382.91}{295.74} = 14.82 = r_0 = 14.82$$

$$a = \frac{y_0}{\log k} = \frac{1062.33}{0.824125834} = 1289.04 ; b = \frac{k-1}{r_0} = \frac{6.67-1}{14.82} = \frac{5.67}{14.82} = 0.38$$

Different Bradford zone can be obtained used the value of k and r_0 .

$$\text{Thus } r_0 : r_0 \times k : r_0 \times k^2 = 1 : n : n^2$$

$$\text{Nucleus zone } r_0 = r_0 \times 1 = 14.82 \times 1 = 14.82$$

$$\text{Nucleus zone } r_1 = r_0 \times k = 14.82 \times 6.67 = 98.85$$

$$\text{Nucleus zone } r_2 = r_0 \times k^2 = 14.82 \times (6.67)^2 = 14.82 \times 44.48 = 659.32$$

$$14.82 : 98.84 : 659.32$$

Percentage of error is $\frac{14.82+98.85+659.32-773}{773} \times 100 = \frac{772.98-773}{773} \times 100 \frac{0.02}{773} \times 100 = 0.002$

The percentage error is negligible. The number of journals in the nucleus is 14.82 and the mean value of the Bradford multiplier is 6.67. The application of Leimkuhler model to the data set proves that the Bradford law fits very well with the multiplier of 6.67.

Table 8. Zonal analysis with the multiplier of 6.67

Rank	No. Jls	Cum. No. of Jls	No. Cits	Cum. of Cits	Log of Cum. no of jls	% of Cits	% of Cum. of Cits	% of Tot Jls	Zones
1	1	1	167	167	0	5.24	5.24	0.12	
2	1	2	121	288	0.30	3.79	9.03	0.12	
3	1	3	85	373	0.47	2.66	11.70	0.12	
4	1	4	77	450	0.60	2.41	14.11	0.12	
5	1	5	74	524	0.69	2.32	16.44	0.12	
6	1	6	64	588	0.77	2.00	18.44	0.12	
7	2	8	110	698	0.90	3.45	21.90	0.25	
8	1	9	53	751	0.95	1.66	23.56	0.12	
9	1	10	40	791	1	1.25	24.81	0.12	
10	1	11	39	830	1.04	1.22	26.04	0.12	
11	1	12	36	866	1.07	1.12	27.17	0.12	
12	1	13	35	901	1.11	1.09	28.27	0.12	
13	2	15	66	967	1.17	2.07	30.34	0.25	
	15		967		10.12				Zone 1
14	1	16	30	997	1.20	0.94	31.28	0.12	
15	1	17	28	1025	1.23	0.87	32.16	0.12	
16	2	19	52	1077	1.27	1.63	33.79	0.25	
17	4	23	96	1173	1.36	3.01	36.80	0.51	
18	2	25	46	1219	1.39	1.44	38.24	0.25	
19	3	28	63	1282	1.44	1.97	40.22	0.38	
20	1	29	19	1301	1.46	0.59	40.82	0.12	
21	3	32	54	1355	1.50	1.69	42.51	0.38	
22	1	33	17	1372	1.51	0.53	43.04	0.12	
23	3	36	48	1420	1.55	1.50	44.55	0.38	
24	4	40	60	1480	1.60	1.88	46.43	0.51	

25	4	44	56	1536	1.64	1.75	48.19	0.51	
26	6	50	78	1614	1.69	2.44	50.64	0.77	
27	6	56	72	1686	1.74	2.25	52.90	0.77	
28	2	58	22	1708	1.768	0.69	53.59	0.25	
29	7	65	70	1778	1.81	2.19	55.78	0.90	
30	6	71	54	1832	1.85	1.69	57.48	0.77	
31	8	79	64	1896	1.89	2.00	59.49	1.03	
32	11	90	77	1973	1.95	2.41	61.90	1.42	
33	15	105	90	2063	2.02	2.82	64.73	1.94	
34	19	124	95	2158	2.09	2.98	67.71	2.45	
	109		1191		34.04				Zone 2
35	43	167	172	2330	2.22	5.39	73.10	5.56	
36	59	226	177	2507	2.35	5.55	78.66	7.63	
37	133	359	266	2773	2.55	8.34	87.00	17.20	
38	414	773	414	3187	2.88	12.99	100	53.55	
	649		1029		10.02				Zone 3

Table 9 .

Leimkuhler model: Scattering of journals and citations over Bradford Zone

Zone	No of citations	No of Journals	% of Journals	Cumulative No. of Citations	Cumulative No. of Journals
1	967	15	1.94	967	15
2	1191	109	14.10	2158	124
3	1029	649	83.95	3187	773
Total	3187	773			

It is perceived that the number of journals contributing citations to each zone increases by a multiplier of 6.67. The data of the zonal analysis shows that the first zone containing 15 journals contributed 967 citations are the most productive journals in law with 1.94% of total cited journals, the 109 journals of the second zone produced 1191 citations sharing 14.10% of total journals and the 649 journals of the third zone produced 1029 citations sharing 83.95% of total journals. Each zone has approximately one-third of the total citations.

Graphical Formulation: The graphical formulation of the Bradford's law of scattering has been applied to the literature of Law. Table 3 represents Bradford Bibliograph. To testify the applicability of Bradford's law of scattering, a graph plotted

with horizontal x axis represents the logarithmic of cumulative number of journals, and the vertical y axis represents cumulative number of citations. It is apparently known from the figure 1 that a rapid rise of exponential curve indicates very less number of journals cited highly and becomes linear curve followed by droop towards tails shows that maximum number of journals cited very less.

Table 10. Bradford Bibliography

No. of Journals	Cumulative No. of Journals	No. of citations	Cumulative no of Citations	Log of Cumulative no of journals
1	1	167	167	0
1	2	121	288	0.30
1	3	85	373	0.47
1	4	77	450	0.60
1	5	74	524	0.69
1	6	64	588	0.77
2	8	110	698	0.90
1	9	53	751	0.95
1	10	40	791	1
1	11	39	830	1.04
1	12	36	866	1.07
1	13	35	901	1.11
2	15	66	967	1.17
1	16	30	997	1.20
1	17	28	1025	1.23
2	19	52	1077	1.27
4	23	96	1173	1.36
2	25	46	1219	1.39
3	28	63	1282	1.44
1	29	19	1301	1.46
3	32	54	1355	1.50
1	33	17	1372	1.51
3	36	48	1420	1.55
4	40	60	1480	1.60
4	44	56	1536	1.64
6	50	78	1614	1.69
6	56	72	1686	1.74

2	58	22	1708	1.76
7	65	70	1778	1.81
6	71	54	1832	1.85
8	79	64	1896	1.89
11	90	77	1973	1.95
15	105	90	2063	2.02
19	124	95	2158	2.09
43	167	172	2330	2.22
59	226	177	2507	2.35
133	359	266	2773	2.55
414	773	414	3187	2.88
773		3187		

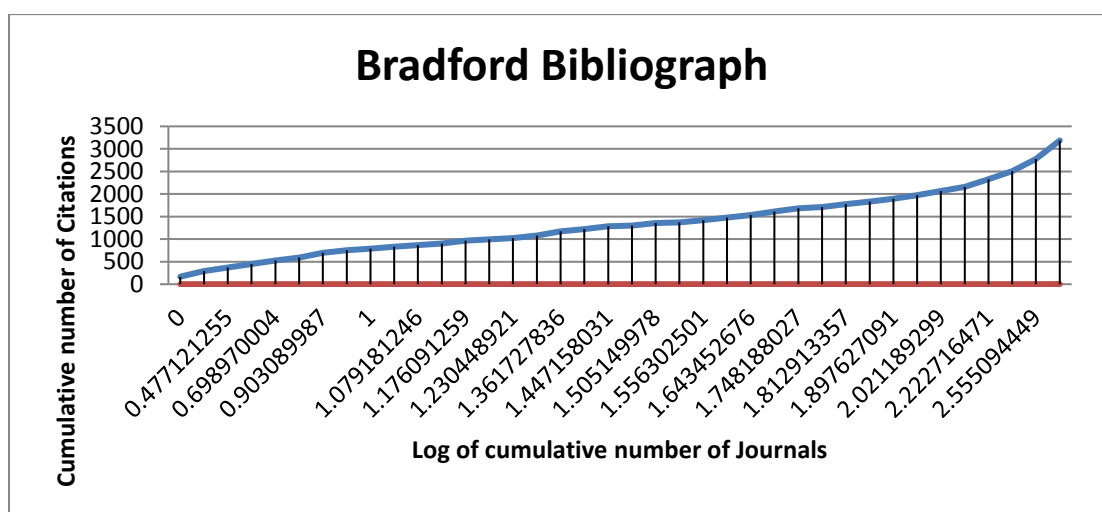


Figure 1: Graphical Formulation of Bradford Law of Scattering

7. DISCUSSIONS AND CONCLUSION

This study reveals that some of the law research scholars lack uniformity and consistency in rendering citations. There was no standard abbreviation followed in rendering journal titles. The verbal formulation of Bradford's law of scattering was tested by dividing the total number of journal citation into three zones. The law journal distribution revealed the ratio as 17:107:649. The ratio indicates that the number of journal titles in each zone was not increasing geometrically. The verbal formulation is inappropriate with the journal titles in Law. Leimkuhler model is then applied for the verification of Bradford's law of scattering. It is found that law fits the journal distribution, as the percentage of error is most negligible (0.002%). The rank list of journals revealed that the most cited journal was American Journal of

International Law (USA) with 5.24% of citation, followed by the Journal of Indian Law Institute (India) with 3.79% of citation and International and Comparative Law Quarterly (UK) with 2.66% of citation. The rank list of journals shows that among 773 journals cited only 25 journals accounted for more than 75% (79.1) of the citations and therefore they may be considered as core journals. It may be observed that journals published 333 years ago had been cited by law researchers. It is also observed that law researcher cited more than 20% of non-law journal in their studies.

The quality of this kind of research is mainly depending on the accuracy and correctness of the citations provided by the research scholars in their doctoral dissertations. This study focuses on appropriateness of Bradford's Law of Scattering in the discipline of Law. It helps the law librarian to identify the core law journals, and also about the scattering phenomena of legal literatures in law journals. A complete bibliometric study needs to be conducted in the discipline of Law to determine the information use pattern of law researcher and to trace the trend of research more accurately.

References

- Arjun, Lal & Panda, Krishna C. (1999) Bradford's law and its application to bibliographical of Plant Pathology dissertations: An analytical approach. *Library Science: with a Slant to Documentation Information Studies*, 36(3), 193-206.
- Asha, Rani (2014), Citation analysis of management Doctoral Dissertations submitted to the Universities of Haryana, Punjab & Himachal Pradesh, Ph.D thesis, Kurukshetra University.
- Bradford, S.C. (2011) Documentation. (Crosby Lockwood and Sons: London), 1948.
- Dhanamjaya, Talawar, Mulla and Chowdappa, Visibility of Reference Patterns in the Doctoral Theses of Engineering and Technology: A Citation Analysis Study. *PEARL-A Journal of Library and Information Science*, 5(2), 59-70.
- <http://shodhganga.inflibnet.ac.in>
- <http://lib.law.washington.edu/cilp/abbrev.html>
- Joginder Singh Burman, and Sheela M, (2011) Citation analysis of dissertations of law submitted to University of Delhi. *Library Philosophy and Practice*. available at <http://unllib.unl.edu/LPP/>

- Maheswarappa BS and Prakash BP. (1982) Literature use pattern by the researchers in the field of botany: A citation study of doctoral theses. *Journal of Library and Information Science*, 7 (1), 15-32.
- Pillai, K. G. S. (2007), Journal citations in Physics doctoral dissertations of Indian Institute of Science. *Annals of Library and Information Studies*, 54 (4), 177-184.
- Ravichandra Rao, I.K. (1998) An analysis of Bradford multipliers and a model to explain law of scattering. *Scientometrics*, 41(1-2), 93-100.
- Sengupta, I N, (1973) Choosing Physiology Periodicals: A recent study of the growth of its literature. *Annals of Library Science and Documentation*. 20 39-57.
- Sengupta, I N, (1972) Impact of Scientific serials on the advancement of Medical knowledge: An objective method of analysis, *International Library Review*.4 169-195.
- Sengupta, I N, (1974) Choosing of Microbiology Periodicals: Study of the growth of literature in the field. *Annals of Library Science and Documentation*. 1 11
- Sudhier Pillai, K.G., (2010) Application of Bradford's Law of Scattering to the Physics Literature: A Study of Doctoral Theses Citations at the Indian Institute of Science. 30 (2,) 3-14.

www.commonlii.org/in/journals/NLUDLRS/2011/11.pdf