

APPLICATION OF BRADFORD'S LAW OF SCATTERING TO THE LITERATURE OF LIBRARY & INFORMATION SCIENCE: A STUDY OF DOCTORAL THESES CITATIONS SUBMITTED TO THE UNIVERSITIES OF MAHARASHTRA

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ABSTRACT

Application of Bradford's Law of Scattering is one of the bibliometric law, which is used most commonly in bibliometric research. The paper gives a review of the contribution in Library & Information Science & theoretical aspects of the law. A study carried out on the data of journals cited by Ph.D. research scholars at the universities in Maharashtra for their doctoral research. To examine the applicability of Bradford's Law of Scattering, study include 798 periodical containing 5467 references collected form 138 theses during the period 1982-2010. Rank list was prepared and Annals of Library Science and Documentation took top place with 207 citations followed by College and Research Libraries with 184 , and Herold of Library Science with 160 citations were the most preferred journals. Applicability of Bradford's Law in various method was tested.

KEYWORDS:

Bradford's law of scattering, Bradford's multiplier

1. INTRODUCTION

The scientific information comes through number of publications such as periodicals, journals, thesis etc. Among various sources, journal is one of the valuable primary source of information. Importance of journal literature as a source of nascent information, which covers new researchable information and ideas .Information contained in the journal is usually published therefore it is an published primary source which provides new ideas, concept formula and new research results. Journal may cover the depth information on micro thoughts, comparison of subjects, depth study of subjects or new developments in subjects etc.

In the subject of any disciplines there are some journals which are frequently referred by the researchers because of the close relation between the subject of the journals and the areas of the research work. These highly cited journals are listed as core journals of the particular subject. The rising prices of periodicals, declining credit of Indian currency abroad and waning funds of the libraries

have posed a great threat to the librarian to procure all the published materials in the field which has become possible with the help of bibliometrics.

The concept of core journals was first coined by S.C. Bradford in 1934 which is popularly known by Bradford Law of Scattering. Bradford law of scattering describes how the literature on a particular subject is scattered or distributed in the journals. The law is based on an investigation performed in 1933 by L. Jones in the Science Museum Library, London. It was first reported in 1934 in the Journal "Engineering" by Bradford and subsequently in book entitled "Documentation" by the same author in 1948. Bradford formulated his law as follows.

"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 articles as the nucleus, when the number of periodicals in the nucleus and succeeding zones will be as $1: n: n^2$, where 'n' is a multiplier."

2. OBJECTIVES OF THE STUDY

The main objectives of the study were:

- (i) To prepare a rank list of most cited journals by the doctoral researchers in Library and Information Science of Maharashtra.
- (ii) To study the phenomenon of scattering for citation data.
- (iii) To test the appropriateness of verbal and graphical formulation of Bradford's Law of Scattering.

3. METHODOLOGY

A total of 798 journals containing 5467 references collected from 138 doctoral theses submitted to Universities in Maharashtra State, India were arranged in descending order of productivity. the study treated references as items and journals as sources. The verbal formulation was tested by three separate parameters for carrying the different number of periodicals, while for testing the appropriateness of graphical formulation, the natural log value of the cumulative number of journals was calculated for plotting the graph.

3.1 Bradford's Law of Scattering

Bradford's Law of Scattering describes a quantitative relation between journals and the papers published in these. S.C. Bradford's, Chief Librarian at the London Science Museum, made statistical analysis of two geophysics bibliographies, the Current Bibliography of Applied Geophysics (1928-1931) and the Quarterly Bibliography of Lubrication (1931-1933). He tested the journals containing references to these fields in their descending order of productivity and then divided the articles into three approximately equal zones. He termed the first one as the nuclear zone, which is highly productive; the second zone moderately productive zone; and the third as low productive zone. Bradford discovered regularity in calculating the number of titles in each of the three zones. On the basis of the observations, Bradford concluded that the ratio of the titles of journals in successive zones followed a common pattern Bradford's verbal formulation stated 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 articles as the nucleus, when the number of periodicals in the nucleus and succeeding zones will be as $1: n: n^2$, where 'n' is a multiplier.

Based on Bradford's observations, Brookes suggested the following linear relation to describe the scattering phenomenon as:

$$F(X) = a + b \log x$$

Where $F(X)$ is the cumulative number of references contained in the first x most productive journals, and a and b are constants. This is the most widely used formulation of Bradford's Law.

Vickery extended the verbal formulation to shows that it can be applied to any number of zones of equal yield. Leimkuhler issued the following simple function for Bradford's distribution, which was named after him:

$$R(r) = a \log(1 + br)$$

Where $R(r)$ is the cumulative number of articles contributed by journals ranked 1 through r , and a and b are parameters.

Similarly, Brooke's derivation for journal productivity takes the form

$$R(r) = a \log\left(\frac{b}{r}\right)$$

Further, Wilkinson noticed that the formulae provided by Leimkuhler and Brookes did not really describe the same phenomenon. Starting from the late 1960s, several mathematical formulations, models, and syntheses of previous statements related to Bradford's Law have been put forth, but very little agreement exists about which model is the best. Brookes expression of the Bradford's distribution has however gained wide acceptance.

3.2 Theoretical Aspects of Bradford's Law:

Bradford's Law Scattering describes a quantitative relationship between journals and the papers they publish. It explains that, only a small number of core journals will supply the nucleus of papers on a given topic which accounts for a substantial percentage (1/3) of the articles, to be followed by a second larger group of journals that accounts for another third, while a much larger group of journals picked up the last third.

There are two most widely recognised formulations of the so called Bradford's Law: the verbal formulation which is derived from the verbal statement of Bradford's Conclusion, and the graphical formulation, which is an empirical expression derived from the graphical survey of a distribution of periodicals.

Bradford's did not give a mathematical model for his law. Models were suggested later by Brookes, Vickery and Leimkuhler. Several authors, while explaining the scattering of articles in journals, have formulated many different models of Bradford's Law. Leimkuhler developed a model based on Bradford's verbal formulation as:

$$R(r) = a \log(1 + br) \quad (1)$$

$$r = 1, 2, 3, \dots$$

While explaining Leimkuhler's Law, Egghe Shows that

$$a = \frac{Y_0}{\log k} \quad (2)$$

$$b = \frac{k-1}{r_0} \quad (3)$$

where, r_0 is the number of sources in the first Bradford's group, Y_0 is the number of items in every Bradford group (all these group of item being of equal sizes). and k is the Bradford multiplier.

$R(r)$ is the cumulative number items produced by the sources of rank 1,2,3..... r and a and b are constants appearing in the law of Leimkuhler. In forming Bradford groups, it is shown that the number of groups p is a parameter that can be chosen freely.

Eggle has shown the mathematical formula for calculating the Bradford Multiplier k as

$$k = (e^y y_m)^{\frac{1}{p}} \quad \dots \quad (4)$$

Where g is Euler's number

$$(e^g = 1.781)$$

If the sources are ranked in decreasing order of productivity, then y_m is the number of items in the most productivity sources.

Then y_m and r_0 are :

$$y_0 = y_m^2 \log k \quad \dots \quad (5)$$

and

$$r_0 = (k-1) y_m \quad \dots \quad (6)$$

Once p is chosen, the value of k can be calculated by using

$$k = (1.781 y_m)^{\frac{1}{p}} \quad \dots \quad (7)$$

$$\text{and } Y_0 = \frac{A}{P}$$

where A denotes the total number of articles

Let denote the total number of journals in Bradford group, there are $r_0 k^{i-1}$ sources ($i = 1, 2, 3, \dots, p$)

$$T = r_0 + r_0 k + r_0 k^2 + \dots + r_0 k^{p-2} \quad \dots \quad (8)$$

$$\text{So, } r_0 = \frac{T}{1} + k + k^2 + \dots + k^{p-1} = T \frac{(k-1)}{(k^p - 1)} \quad \dots \quad (9)$$

Since A and T are known from the data set r_0 and y_0 are calculated, once p is calculated by the formula (7)

Gupta and Suresh Kumar have given the theoretical aspects of Bradford's Law and studied its applicability using the above method. According to Brooke's to test the conformity of Bradford's Law, one should meet the following three implicit conditions:

- (i) In dividing the journals into zones, the number of articles in each zone must remain constant.
- (ii) The Bradford multiplier k must be > 1 .
- (iii) The Bradford multiplier must remain approximately constant.

4. ANALYSIS & INTERPRETATION

4.1 Ranking Of Journals

Core journals ranking studies are usually made to help in the selection of journals and assessing the importance of one or more journals in a particular subject field. the journals are arranged in their respective descending order of frequency. The journal contributing the largest number of articles is ranked as number one, next is ranked two and so on.

Rank list of Journals was prepared in Table 1 total 62 ranks were awarded. Among these 'Annals of Library Science and Documentation' have first rank with 207 citations and followed by 'College and Research Library' with 184 citations, 'Herald of Library Science' occupied third rank with 160 citations, 'ILA Bulletin' with 158 citations took place fourth rank and fifth rank have taken place by 'Journal of Documentation' with 152 citations and so on. The compiled ranked list of journals can be utilized by librarians and research workers to select the journals of greater importance and productivity in the particular discipline and thereby overcome the

budgetary constraint which is posing serious threat to librarians. The journals are arranged in terms of number of citations received by each individual journal and hence the highest rank will be occupied by journal with maximum number of citations to be credit followed by other journals. The total number of journals observed in the present study were 798 and number of citations to journals comes to 5467.

The Nine journals in the ranked list contributed to more than 25 percent of the total citations. The first thirty two journals contributed to 50 percent of the total journal literature. The first one hundred and nine journals contributed to 75 percent of the total journal citations.

Out of first nine journals which contributed more than 25 percent 5 journals were of Indian origin, 3 were found of United States of America origin and 1 journal published from U.K. This indicates that scholars in the discipline mainly depend upon literature published from India, USA and U.K. for their information requirements.

The country wise distribution of journals which were cited in the discipline of Library and Information Science and its sub – discipline also shows the ratio of Indian and foreign journals. The ratio of Indian and foreign journals was 1:3.38.

The percentage of citations contributed by 182 Indian journals is 22.80 where as percentage of citations contributed by 616 foreign journals were 77.20.

The ranked list of ten Indian and foreign core journals shows that Annals of Library Science and Documentation and College and Research Libraries are the top Indian and foreign journals respectively. The findings related to top most Indian journals confirm to the findings of the earlier study by Mahapatra (1994) and V.V. Suryanarayana (2008).

Table No. 1
Ranking of Journal

Sr. No.	Rank	Name of Journal	Frequency
1	1	Annals of Library Science and Documentation (India)	207
2	2	College and Research Libraries (USA)	184
3	3	Herold of Library Science (India)	160
4	4	ILA Bulletin (India)	158
5	5	Journal of Documentation (UK)	152
6	6	Library Trends (USA)	149
7	7	IASLIC Bulletin (India)	148
8	8	University News (India)	120
9	9	Library Resources and Technical Services (USA)	101
10	10	Journal of American Society for Information Science (USA)	96
11	11	Library Quarterly (USA)	95
12	12	Journal of Library and Information Science (India)	75
13	13	Cataloguing and Classification Quarterly (UK)	67
14	13	DESIDOC Bulletin of IT (India)	67
15	14	Library Herold (India)	65
16	15	Library Journal (USA)	64
17	16	Bulletin of Medical Library Association (UK)	63
18	17	Library Science with Slant to Documentation and Information Studies (India)	62
19	18	Library Management (USA)	60
20	19	Information processing and management (USA)	58
21	20	IAALD Quarterly (S. Africa)	57
22	21	Library Science with Slant to Documentation (India)	56
23	22	Library Review	55
24	23	Special Libraries	54
25	24	Granthaparivaar(India)	53
26	25	SRELS Journal of Information Management (India)	52
27	26	Journal of Academic Librarianship	50
28	27	Program (UK)	43
29	27	Library Hi Tech	43
30	28	IFLA Journal	41
31	29	Serials Librarian	40

32	30	Libri	38
33	30	Scientometrics (Netherland)	38
34	31	Journal of Information Science	33
35	31	LARR	33
36	32	Journal of Library Administration	32
37	33	Annals of Library and Information Studies (India)	31
38	33	Interlending and Document Supply	31
39	34	Journal of the American Society for Information Science and Technology (USA)	30
40	35	Electronic Library	29
41	35	Resource Sharing and Information Networks	29
42	36	Collection Management	28
43	36	Lucknow Librarian (India)	28
44	36	Journal of Librarianship	28
45	36	Indian Journal of Information Library and Society(IJILIS) (India)	28
46	36	Library and Information Science Research	28
47	37	Library Science	27
48	37	Serials Review	27
49	37	World Patent Information (USA)	27
50	38	American Documentation (USA)	26
51	39	Information Research	25
52	39	International Library Review	25
53	40	Indian Librarian (India)	24
54	40	Information Technology and Libraries	24
55	40	Science	24
56	40	Unesco Bulletin for Libraries (France)	24
57	40	Annual review of information science and technology	24
58	41	CLIS Observer (India)	23
59	42	Knowledge Organization	22
60	43	International Information and Library Review	21
61	43	Research Quarterly	21
62	44	American Libraries (USA)	19
63	45	Communications of the ACM	18
64	46	Learned and Publishing	17
65	47	Bookbird	16
66	47	Harvard Business Review (UK)	16
67	47	International Cataloguing and Bibliographic Control	16
68	47	International Library Movement	16
69	47	Sahitya Sahakar (India)	16

70	47	Social Welfare (India)	16
71	47	Library Acquisitions:practice and theory	16
72	48	International Classification (USA)	15
73	48	International Journal for Human Computer Studies	15
74	48	Machine Translation	15
75	48	Science and Technology Libraries	15
76	48	International Forum on Information and Documentation	15
77	49	Information storage and retrieval	14
78	49	OCLC Systems and Services	14
79	50	Computers in Libraries	13
80	50	Eastern Libraian	13
81	50	Granthana (India)	13
82	50	International Journal on Grey Literature	13
83	50	Wachanalaya (India)	13
84	50	Collection Building	13
85	51	New Library World	12
86	51	Online Information Review	12
87	51	Yojana (India)	12
88	51	Canadian Library Journal (Canada)	12
89	51	Reference Service Review	12
90	52	Library Software Review	11
91	52	Information today and tommorow	11
92	53	Australian Library Journal (Australia)	10
93	53	Drexel Library Quarterly	10
94	53	International library review	10
95	53	JASIS	10
96	53	Journal of Information Processing and Management	10
97	53	Library Administration and Management	10
98	53	Library Association Record	10
99	53	Online	10
100	53	Reference Librarian	10
101	53	Technical Services Quarterly	10
102	53	Wilson Library Bulletin	10
103	53	Journal of Education Media and Library Science	10
104	54	Catalogue and Index	9
105	54	International Information Communication and Education	9
106	54	Journal of Internet Cataloguing	9
107	54	Journal of Medical Library Association	9
108	54	Nature	9

109	54	Searcher	9
110	54	The Electronic Library	9
111	54	Asian Libraries	9
112	54	Information Development	9
113	54	Information Services and Use	9
114	55	Daedalus	8
115	55	Granthapal (India)	8
116	55	Information Today	8
117	55	Journal of Digital Information	8
118	55	Journal of Education for Library and Information Science	8
119	55	Technicalities	8
120	55	INICAE	8
121	55	Health Information and Libraries Journal	8
122	55	Medical Reference Services Quarterly	8
123	55	South African Journal of Library and Information (South Africa)	8
124	55	College and research libraries News	8
125	55	Electronics:Information and Planning	8
126	56	Computers In Libraries	7
127	56	Granthagar (India)	7
128	56	Journal of the ACM	7
129	56	Law Library Journal	7
130	56	Library Collections,Acquisitions and Technical Services	7
131	56	Malaysian Journal of Library and Information Science (Malesiya)	7
132	56	Portal:Libraries and the Academy	7
133	56	Timeless Fellowship	7
134	56	IEEE Transaction on Engineering Management	7
135	57	Database	6
136	57	Indian Sugar	6
137	57	Information Storage and Retrieval	6
138	57	Information World Review	6
139	57	International Cataloguing	6
140	57	Journal of Higher Education (India)	6
141	57	Journal of the Medical Library Association (UK)	6
142	57	Public Library Journal	6
143	57	The Gilbane Report	6
144	57	IEEE Intelligent System	6
145	57	ALA Bulletin (USA)	6
146	57	Australian Academic and Research Libraries	6

		(Australia)	
147	57	Health Library Review	6
148	57	Journal of the China Society for Scientific and Technical Information (China)	6
149	57	School Library Media Quarterly	6
150	58	Advances In Librarianship	5
151	58	Advances in Library Resource Sharing	5
152	58	American Archivist (USA)	5
153	58	Aslib Information	5
154	58	Bulletin of Library and Information Science	5
155	58	D-Lib Magazine	5
156	58	Iatul Quarterly	5
157	58	IEEE Computer	5
158	58	Information Studies	5
159	58	Journal of College and University Libraries	5
160	58	Journal of Library Automation	5
161	58	Libra	5
162	58	Librarian Career Development	5
163	58	Library Research	5
164	58	Library Technology Reports	5
165	58	Scientific American (USA)	5
166	58	Audiovisual Librarian	5
167	58	Biometrics	5
168	58	Vine	5
169	59	Astronomy and Astrophysics Supplement	4
170	59	Blind Welfare	4
171	59	Canadian Journal of Information and Library Science (Canada)	4
172	59	CD-ROM Librarian	4
173	59	Current Science	4
174	59	Education for Information	4
175	59	Educational Technology and Society	4
176	59	Indian Journal of Library and Information Science (India)	4
177	59	Information Systems Management	4
178	59	Journal of Advanced Nursing	4
179	59	Journal of Indian Society of Soil Science(India)	4
180	59	Journal of Information, Communication and Library Science	4
181	59	Kurukshetra (India)	4
182	59	Library Information Update	4
183	59	Managing Information	4

184	59	MIS Quarterly	4
185	59	Modern Librarian	4
186	59	New Review of Children's Literature and Librarianship	4
187	59	Online Review	4
188	59	Pharmaceutical Library Bulletin	4
189	59	Samikshak(India)	4
190	59	Caps Librarian	4
191	59	Journal of Communication	4
192	59	Health Informatics	4
193	59	Kniznice a Informacie	4
194	59	Internet Research	4
195	59	Journal of Japan Medical Library Association(Japan)	4
196	60	Academic Medicine	3
197	60	Academy of Management Journal	3
198	60	ACM	3
199	60	Advances in Librarianship	3
200	60	American Librarian (USA)	3
201	60	Annual Journal of Comparative Librarianship	3
202	60	Art Libraries Journal	3
203	60	Bulletin of the Library Association of China (China)	3
204	60	Cataloguing Australia (Australia)	3
205	60	Computer Networks and ISDN Systems	3
206	60	Computers and Graphics	3
207	60	Cultural Forum	3
208	60	Electronic Information and planning	3
209	60	Electronic Library and Information System	3
210	60	Illinois Libraries	3
211	60	ILM	3
212	60	Indexer	3
213	60	Indian Bar Review (India)	3
214	60	Indian Journal of Information Libraries and Documentation (India)	3
215	60	Indian Management (India)	3
216	60	Information Management and Technology	3
217	60	Information Outlook	3
218	60	International Journal of Medical Information	3
219	60	Internet Reference Services Quarterly	3
220	60	Journal of Business and Finance Librarianship	3
221	60	Journal of Library History	3

222	60	Journal of patent Office Technical Society	3
223	60	Journal of Personality and Social Psychology	3
224	60	Journal of Washington Academy of Sciences (USA)	3
225	60	Kekal Abadi (Saudi Arab)	3
226	60	Krishi Vidyapeeth Varta (India)	3
227	60	Library and Information Research News	3
228	60	Library Miscellany	3
229	60	Library News	3
230	60	LIBRESLibrary and Information Science Electronic Journal	3
231	60	Netherlands Journal of Agricultural Science (Netherland)	3
232	60	New Frontiers in Education	3
233	60	Pakistan Journal of Library and Information Science (Pakistan)	3
234	60	Payam-e-ketab-khaneh (Pakistan)	3
235	60	Social Science Information Studies	3
236	60	Sociology	3
237	60	Span	3
238	60	The Library Journal	3
239	60	Vachanalaya (India)	3
240	60	Vistas in Astronomy	3
241	60	Administratives Science Quarterly	3
242	60	Bibliothek Scientist	3
243	60	Bulletin of the American Society for Information Sciences (USA)	3
244	60	Catholoc Library World	3
245	60	Journal of Electronic Resources of the Medical Libraries	3
246	60	Journal of Information Communication and Library Science	3
247	60	Konyvtari Figyelo	3
248	60	LASIE	3
249	60	Microcomputers for Information Management	3
250	60	R&D Management	3
251	60	British Journal of Academic Librarianship (UK)	3
252	60	Library Philosophy and Practice	3
253	61	Academy of Management Review	2
254	61	ACM Transactions on Information Systems	2
255	61	African Journal of Library, Archives and Information Science (Africa)	2
256	61	Against the Grain	2

257	61	American Journal of Physical Anthropology (USA)	2
258	61	American Psychology (USA)	2
259	61	Analytical Chemistry	2
260	61	Art Documentation	2
261	61	Assignation	2
262	61	Assistant Librarian	2
263	61	Atlantic Monthly(Netherland)	2
264	61	Austrlian Journal of Soil Research (Australian)	2
265	61	Behavioral and Social Sciences Librarian	2
266	61	Bell System Technology Journal	2
267	61	Bibliotheca Medica Canadiana (Canada)	2
268	61	Bibliothek Fourschung and Praxix	2
269	61	British Library (UK)	2
270	61	British Medical Journal (UK)	2
271	61	Bulletin of the American Astronomical Society	2
272	61	Bulletin of the Indian Institute of History of Medicine (India)	2
273	61	Bulletin of the Japan Academic Librarians Association (Japan)	2
274	61	Business Information Review	2
275	61	Byte	2
276	61	California Librarian (USA)	2
277	61	Canadian Journal of Information Science (Canada)	2
278	61	CERN	2
279	61	Classification Society Bulletin (USA)	2
280	61	Computer Networks	2
281	61	CRUS News	2
282	61	Current science	2
283	61	DyanGangotri (India)	2
284	61	Education Libraries Journal	2
285	61	Educational and Psychological Measurement	2
286	61	Educational Technology	2
287	61	Electronic Publishing	2
288	61	Engineering Education	2
289	61	Expert System for Information Management	2
290	61	Faslname-Ye-Ketab (Pakistan)	2
291	61	Hospitals	2
292	61	Human Resource Management Journal	2
293	61	IEEE Internet Computing (India)	2
294	61	INCAE	2
295	61	Indian Journal of Adult Education (India)	2

296	61	Indian Journal of Social Work (India)	2
297	61	Indian Journal of Technical Education (India)	2
298	61	Indian Library Movement (India)	2
299	61	Industrial and Engineering Chemistry (India)	2
300	61	Industrial and Labour Relations Review (India)	2
301	61	Informatics	2
302	61	Informatika	2
303	61	Information and Management	2
304	61	Information and Software Technology	2
305	61	Information Media and Technology	2
306	61	Information Systems	2
307	61	Information today	2
308	61	INSPEL	2
309	61	International Information and Library Review (USA)	2
310	61	International Journal of Human Resource Management (USA)	2
311	61	International studies	2
312	61	Journal of Agricultural and Food Information	2
313	61	Journal of American Medical Association (USA)	2
314	61	Journal of American Statistical Association (USA)	2
315	61	Journal of Geological Society of India (India)	2
316	61	Journal of Indian Education (India)	2
317	61	Journal of Indian Management (India)	2
318	61	Journal of information science	2
319	61	Journal of Information Service	2
320	61	Journal of Interlibrary Loan, Document Delivery and Information Supply	2
321	61	Journal of Management Information System	2
322	61	Journal of Retailing	2
323	61	Journal of Scholarly Publishing	2
324	61	Journal of the National Integratrd Medical Association Mumbai (India)	2
325	61	Journal of the Society of Archivists	2
326	61	Journal of University Librarians	2
327	61	Knowledge Engineering Review	2
328	61	Liber Quarterly: the journal of European Research (France)	2
329	61	Librarian	2
330	61	Logos (Greek)	2
331	61	MALA Bulletin	2
332	61	Medical Information	2

333	61	Methods Information Medical	2
334	61	Nachrichetan for Dokumentation (France)	2
335	61	New Review of Information Networking	2
336	61	New Scientist	2
337	61	Nigerian Library and Information Review (Nigeria)	2
338	61	Pakistan Library Bulletin (Pakistan)	2
339	61	PNLA Quarterly	2
340	61	Professional Information	2
341	61	Progress in Nuclear Energy	2
342	61	Psychological Reviews	2
343	61	Publishing Weekly	2
344	61	Reference and User Services Quarterly	2
345	61	Reference Quarterly	2
346	61	Research Innovation Report	2
347	61	Research Strategies	2
348	61	Revista AIBDA	2
349	61	RLG DigiNews	2
350	61	Rural Libraries	2
351	61	School & Society	2
352	61	School Libraries in Canada (Canada)	2
353	61	School Library Journal	2
354	61	Science Communication	2
355	61	Social Studies of Science	2
356	61	Sociological Inequity	2
357	61	Sri Lanka Journal of Social Sciences (Srilanka)	2
358	61	Studies in Higher Education	2
359	61	Technological Forecasting and Social Change	2
360	61	The Assistant Librarian	2
361	61	The Association of Information Management	2
362	61	The Indian Journal of Technical Education (Indian)	2
363	61	The Journal of the Indian Library Association (India)	2
364	61	The Journal of the Learning Sciences	2
365	61	UBIS News	2
366	61	UNESCO Journal of Information Science, Libraries and Archives Administration (France)	2
367	61	Yeshwant (India)	2
368	61	African Research and Documentation (Africa)	2
369	61	American Sociological Review (USA)	2
370	61	Applied statistics	2

371	61	C & R L News	2
372	61	Campus-Wide Information System	2
373	61	Ciencia da Informacao	2
374	61	Community and Jubior College Libraries	2
375	61	FID Bulletin	2
376	61	Interlending Review	2
377	61	Journal of Library Archives and Information Science	2
378	61	Journal of Spanish Research of Information Science (Spain)	2
379	61	New England Journal Medicine (UK)	2
380	61	Revista Espanola de Documentation Cientifica (France)	2
381	61	Technical Communication Quarterly	2
382	61	The International Inforamtion and Library Review	2
383	61	The Public Access Computer Systems Review	2
384	61	Dnyangangotri (India)	2
385	61	Indian Journal of Commerce(India)	2
386	61	International Journal of Information Communication and Education	2
387	61	International Journal of Libraryand Information Services	2
388	61	Journal of Education for library and Information Science	2
389	61	Journal of Indian Library Association (India)	2
390	61	Technology and Society	2
391	61	The Library World	2
392	62	A Journal of Documentation Review	1
393	62	A Review	1
394	62	A.B.I. Technik	1
395	62	AAPG Bulletin	1
396	62	AAUP Bulletin	1
397	62	ABO/OLA Bulletin	1
398	62	Academe	1
399	62	Academia Sinica	1
400	62	Academic Librarianship	1
401	62	Academy of Management Executive	1
402	62	ACM Computing Surveys	1
403	62	Action of Libraries	1
404	62	Advanced Management Journal	1
405	62	Advances in Computers	1
406	62	Advances in Library	1

407	62	Advances in Public Access Catalogues	1
408	62	African Journal of Academic Librarianship (Africa)	1
409	62	African Journal of Information Management (Africa)	1
410	62	Al-Khafji Journal (Saudi Arab)	1
411	62	Alexandria (France)	1
412	62	ALIS Bulletin	1
413	62	American Behavioural Scientists (USA)	1
414	62	American Journal of Distance Education (USA)	1
415	62	American journal of Sociology (USA)	1
416	62	American Psychologist (USA)	1
417	62	American Scientific American (USA)	1
418	62	American society for information science (USA)	1
419	62	American Sociologist (USA)	1
420	62	An International Journal (USA)	1
421	62	Ann Fam Med	1
422	62	Annals of International Medical	1
423	62	Annals of Library Science with Slant to Documentation (India)	1
424	62	Annals of the History of Computing	1
425	62	Annual Review of Psychology	1
426	62	Anthropologist	1
427	62	ARBIDO Bulletin	1
428	62	Archivi and Computer	1
429	62	Argus	1
430	62	Ariadne	1
431	62	ARIST	1
432	62	Artificial Intelligence	1
433	62	Artificial Intelligence and Law	1
434	62	Asian Business and Management	1
435	62	Asian Journal of Communication	1
436	62	Association Record	1
437	62	Australian College Libraries (Australia)	1
438	62	Australian Library Review (Australia)	1
439	62	Australian Special Libraries News (Australia)	1
440	62	Australlian Academic and Research Libraries(Australia)	1
441	62	Austrialian Library Journal (Australia)	1
442	62	Automatic Documentation and Mathematical Linguistics	1
443	62	Behaviour and Information Technology	1

444	62	Benchmarking:an international Journal	1
445	62	BHU Department Journal (India)	1
446	62	Biblioteche Oggi	1
447	62	Bibliotekspresen	1
448	62	Bibliotheek en Samenleving	1
449	62	BioBytes	1
450	62	BMC Bioinformatics	1
451	62	Bottom Line	1
452	62	British Journal of Administrative Management (UK)	1
453	62	British Journal of Educational Technology (UK)	1
454	62	British Journal of EducationalPsychology (UK)	1
455	62	British Library Research and Information Report (UK)	1
456	62	Bulletin for Libraries	1
457	62	Bulletin of American Astronomical Society (USA)	1
458	62	Bulletin of the International Association of Agricultural Information Specialists	1
459	62	Bulletin of the National Archives	1
460	62	Bulletin of the New York Academy of Medicine (USA)	1
461	62	Bullettino d' Informazioni	1
462	62	Business Horizons	1
463	62	CAB & Scisearch Database	1
464	62	Canadian Journal of Communication (Canada)	1
465	62	CD-ROM Professional	1
466	62	Ceylon Library Review (Srilanka)	1
467	62	Chronicle of Higher Education	1
468	62	College and Undergraduate Libraries	1
469	62	College and University Media Review	1
470	62	College News	1
471	62	College of Librarianship	1
472	62	Colorado Libraries (USA)	1
473	62	COMLA Bulletin	1
474	62	Computer and Electronics in Agricultural	1
475	62	Computer Application to Society	1
476	62	Computer journal	1
477	62	Computer Society of india	1
478	62	Computer Standards and Interfaces	1
479	62	Computers in Biology and Medicine	1
480	62	Computers in Physics	1
481	62	Computers Today	1

482	62	CRL Observer	1
483	62	Culture of the Internet	1
484	62	Current Contents	1
485	62	Current Studies in Librarianship	1
486	62	Dataquest	1
487	62	Decision Sciences	1
488	62	Decision Support Systems	1
489	62	DecisionSciences Journal og Innovative Education	1
490	62	DELNET Newsletter (India)	1
491	62	Discovery	1
492	62	Distance Education ()India	1
493	62	Documentation et Bibliotheques	1
494	62	Drug Information Journal	1
495	62	E-JASL: the electronic journal of academic and special librarianship	1
496	62	E-media professionals	1
497	62	Economic Challenger	1
498	62	Education for Library and Information Services	1
499	62	Educational Technology Research and Development	1
500	62	Educause Quarterly	1
501	62	Electronic Journals	1
502	62	Electronic Learning	1
503	62	Emergency Management	1
504	62	Engineering	1
505	62	Engineering Review	1
506	62	Ettela Resani	1
507	62	European Journal of Marketing (France)	1
508	62	Ev Bulletin	1
509	62	Feliciter	1
510	62	Gayana Library Association Bulletin (Africa)	1
511	62	Geographical Journal	1
512	62	Ghana Library Journal (Africa)	1
513	62	Globe	1
514	62	Government Publication Review	1
515	62	Harvard Library Bulletin (UK)	1
516	62	High Energy Physics Libraries Webzine	1
517	62	Higher Education (India)	1
518	62	Hind (India)	1
519	62	History and Theory	1
520	62	Horizons in Library and Information Sciences	1
521	62	HRM Review	1

522	62	Human Relations	1
523	62	IBM Journal of research and development (USA)	1
524	62	IBM systems journal (USA)	1
525	62	ICSTI Forum	1
526	62	IEEE transactions on information theory (India)	1
527	62	India Culture and Society (India)	1
528	62	Indian Journal of Physical Anthropology and Human Genetics (India)	1
529	62	Indian Journal of Training and Development (India)	1
530	62	Indian Journals of Information Library and Society (India)	1
531	62	Industrial Management and Data Systems	1
532	62	Industrial Relations	1
533	62	Information Age (India)	1
534	62	Information and Library Manager	1
535	62	Information Cultural Society	1
536	62	Information Journal	1
537	62	Information Management	1
538	62	Information Management and Computer Security	1
539	62	Information Reports and Bibliographies	1
540	62	Information Retrieval and Library Automation	1
541	62	Information Review	1
542	62	Information Specialists	1
543	62	Information Systems Research	1
544	62	Information technology and libraries	1
545	62	Information Technology,learning and Performance Journal	1
546	62	Information technology: A revolutionary change	1
547	62	Information UK Outlooks (UK)	1
548	62	Information world review	1
549	62	Informatologia	1
550	62	Informetrics	1
551	62	Infosystems	1
552	62	Innovation	1
553	62	Interacting with Computer	1
554	62	International Agricultural Development	1
555	62	International Forum on Informatics	1
556	62	International Information Communication	1
557	62	International Journal of Artificial Intelligence in Education	1
558	62	International Journal of Geographical Information	1

Science			
559	62	International Journal of Information Management	1
560	62	International Journal of Information Resources Management	1
561	62	International Journal of Man-Machine Studies	1
562	62	International Journal of Manpower	1
563	62	International Journal of Technical Assessment Health Care	1
564	62	International Journal on Semantic Web and Information Systems	1
565	62	International Journal of Human Resource Management	1
566	62	International Journal of Information and Library Research	1
567	62	International Libraries	1
568	62	International Online Information Meeting	1
569	62	International Sugar Journal	1
570	62	Internet World	1
571	62	Iran Webology (IRAN)	1
572	62	Iranian Journal of Information Science and Technology (IRAN)	1
573	62	ISKO	1
574	62	IT Pro.	1
575	62	J. Washinton Academy of science (USA)	1
576	62	Journal of Adult Education	1
577	62	Journal of Agricultural Library and Information Science	1
578	62	Journal of Association for Computing Machinery	1
579	62	Journal of Business and Economic Studies	1
580	62	Journal of Chemical Information and Computer Sciences	1
581	62	Journal of Clinical Psychology	1
582	62	Journal of Digital Librarianship	1
583	62	Journal of Distance Education	1
584	62	Journal of E-learning and Knowledge Management	1
585	62	Journal of Education and Library Science	1
586	62	Journal of Education for Librarianship	1
587	62	Journal of Educational Multimedia and Hypermedia	1
588	62	Journal of Educational Technology and Society	1
589	62	Journal of End User Computing	1
590	62	Journal of Engineering and Technology Management	1

591	62	Journal of Government Information	1
592	62	Journal of Information Library and Society	1
593	62	Journal of Information Management	1
594	62	Journal of Information Science and Technology Association	1
595	62	Journal of Information Science Principles & Practice	1
596	62	Journal of Information Systems and Management	1
597	62	Journal of Information Today and Tommorow	1
598	62	Journal of Information, Library and Society	1
599	62	Journal of Japan Society of Library and Information Science (Japan)	1
600	62	Journal of Knowledge Management	1
601	62	Journal of Library Development	1
602	62	Journal of Library Science	1
603	62	Journal of Library Science in China (China)	1
604	62	Journal of Management Issues	1
605	62	Journal of Management Studies	1
606	62	Journal of Marketing	1
607	62	Journal of Marketing Research	1
608	62	Journal of Microcomputer Applications	1
609	62	Journal of National Library of Nigeria (Nigeria)	1
610	62	Journal of Organizational and End User Computing	1
611	62	Journal of Reading	1
612	62	Journal of Religious and Theological Information	1
613	62	Journal of Research and Education in Indian Medicine (India)	1
614	62	Journal of Research Communication Studies	1
615	62	Journal of Rural Development	1
616	62	Journal of Social Issues	1
617	62	Journal of Social Sciences	1
618	62	Journal of Soil Science	1
619	62	Journal of Systems Management	1
620	62	Journal of Technical Education	1
621	62	Journal of the American Society for information indexing (USA)	1
622	62	Journal of the Department of Library and Information Science	1
623	62	Journal of the Honk Kong Library Association	1
624	62	Journal of the Indian Association (India)	1
625	62	Journal of the Indian Law Institute (India)	1
626	62	Journal of the National Integrated Medical	1

		Association	
627	62	Journal of the Royal Society of Medicine	1
628	62	Journal of the Royal statistical society	1
629	62	Journal of the University Librarians Association of Sri Lanka (Sri Lanka)	1
630	62	Journal of University Education	1
631	62	Journal of Urban Health	1
632	62	Journal of Visual Impairment and Blindness	1
633	62	Journal of Workplace Learning	1
634	62	Journalism and Mass Communication Quarterly	1
635	62	Journal of the Medical Library Association	1
636	62	Journalogy	1
637	62	Journals of Library and Information Studies	1
638	62	Knowledge	1
639	62	Knowledge Acquisition	1
640	62	Knowledge-Based Systems	1
641	62	Lagos Librarian	1
642	62	Language	1
643	62	Laser Link	1
644	62	Laserdick Professional	1
645	62	Law Librarian (USA)	1
646	62	Legal Information Management	1
647	62	Legal Reference Services	1
648	62	LIBER Bulletin	1
649	62	Libr & Coll Journal	1
650	62	LIBRA	1
651	62	Librarian journal of Department of Library and Information Science	1
652	62	Libraries Alone	1
653	62	Libraries and Culture	1
654	62	Libraries and the Academy	1
655	62	Libraries for Nursing Bulletin	1
656	62	Libraries Journal	1
657	62	Library and Society	1
658	62	Library Computing	1
659	62	Library Consortium Management an Internnatial Journal	1
660	62	Library Manager	1
661	62	Library Micromation News	1
662	62	Library of Congress Information Bulletin (USA)	1
663	62	Libray Journal	1
664	62	Libray Mangement	1

665	62	Lokmitra (India)	1
666	62	Lokrajya (India)	1
667	62	Maharashtra Sahitya Patrika (India)	1
668	62	Management Decision	1
669	62	Management Review	1
670	62	Managing Library Finances	1
671	62	Mangement Science	1
672	62	Marathi Sanshodhan Patrika (India)	1
673	62	Masik Manoranjan (India)	1
674	62	Media Asia	1
675	62	Medical Arh.	1
676	62	Methods of Information in Medicine	1
677	62	Mousaion	1
678	62	National Horizon on Patent Information and Documentation	1
679	62	National Law Schools Journal	1
680	62	Natl.Netw	1
681	62	Nauchno Technicheskays Informatsiya	1
682	62	Nauchnye-Tekhnicheskie Biblioteki	1
683	62	Navyoug (India)	1
684	62	Nebraska Library Association Quarterly	1
685	62	Network information	1
686	62	Neurosurgery	1
687	62	New Review of Academic Librarianship	1
688	62	New Review of Libraries and Lifelong learning	1
689	62	New Zealand Libraries (New Zealand)	1
690	62	Nfd Information:wissenschaft and praxix	1
691	62	Nigerbiblios	1
692	62	Noolagam	1
693	62	Offshore	1
694	62	OLS News	1
695	62	Online Kensaku	1
696	62	Online Libraries and Microcomputers	1
697	62	Open	1
698	62	Organization	1
699	62	Performance Measurement and Metrics	1
700	62	Personnel Administrator	1
701	62	Personnel Management	1
702	62	Personnel review	1
703	62	Perspectives in Information Management	1
704	62	Philosophy of the Social Sciences	1

705	62	Physical Review	1
706	62	PICA Medelingen	1
707	62	Planning Review	1
708	62	Policy Studies Journal	1
709	62	Pravanatha (India)	1
710	62	Public Health	1
711	62	Public Libraries	1
712	62	Public Opinion Quarterly	1
713	62	Qualitative Research	1
714	62	Quarterly Bulletin of the International Association of Agricultural Information Specialists	1
715	62	R.R.E. Journal	1
716	62	Research in Librarianship	1
717	62	Research Library	1
718	62	Research Library News	1
719	62	Research Management Journal	1
720	62	Review of Development Economics	1
721	62	Review of Information Science and Technology	1
722	62	Review of International Documentation	1
723	62	Rilisar Bulletin	1
724	62	RILISAR Bulletin	1
725	62	Riverina Library Review	1
726	62	SAM Advanced Management Journal	1
727	62	Sampada (India)	1
728	62	Saraswati Mandir Smarnika (India)	1
729	62	School Librarian	1
730	62	School Library Media Activities Monthly	1
731	62	Science and Technology News	1
732	62	Science Monthly	1
733	62	Science Progress	1
734	62	Science Studies	1
735	62	Scientific Monthly	1
736	62	Sconul Focus	1
737	62	SCONUL News Letter	1
738	62	Shahitya Sahakar (India)	1
739	62	SIGCHI Bulletin	1
740	62	SLA News	1
741	62	Sloan Management Review	1
742	62	Small Computers in Libraries	1
743	62	Social Forces	1
744	62	Social Science and Medicine	1

745	62	Social Science Information	1
746	62	Sociometry	1
747	62	Software fulfillment News	1
748	62	Software-Practice and Experience	1
749	62	Soil Science	1
750	62	Soil Science Society America Journal (USA)	1
751	62	Soil Survey and land Evaluation	1
752	62	Solaris information communication	1
753	62	South African Journal of Business Management	1
754	62	Standardizing Bibliographical Data (S.Africa)	1
755	62	State Librarian	1
756	62	Strategic Management Journal	1
757	62	Studies in Continuing Education	1
758	62	Studii Ceratari de Documentare si Bibliologie	1
759	62	Studin zur Klassifikation	1
760	62	Suman (India)	1
761	62	Techinicalities	1
762	62	Technical Bulletin	1
763	62	Technical report series	1
764	62	Technology and Learning	1
765	62	Teknisk-Veteskaping Forsking (TVF)	1
766	62	Telematics and Informatics	1
767	62	Tenessee Librarian	1
768	62	The American Prospect (USA)	1
769	62	The Bottom of Line:Managing Library Finances	1
770	62	The British Journal of Administrative Management (UK)	1
771	62	The computer Journal	1
772	62	The Economist	1
773	62	The English Journal (UK)	1
774	62	The Houston Area Research Library Information Networks	1
775	62	The ICFAI Journal of Organizational Behaviour	1
776	62	The Indian Journal of Commerce (India)	1
777	62	The Information Society	1
778	62	The Irish Library (UK)	1
779	62	The Journal of Career Development	1
780	62	The New Review of Information Behaviour Research	1
781	62	The Spectator	1
782	62	Theory of Surgery	1
783	62	Tidskrift for Dokumentation	1

784	62	Tudomanyoses Muszaki Tajekoztatas	1
785	62	Turkish Librarianship (Turky)	1
786	62	UJISLAA	1
787	62	Unabashed Librarian	1
788	62	Urban Academic Librarian	1
789	62	User Education	1
790	62	Vidyasevak (India)	1
791	62	Vividhdnyanvistar (India)	1
792	62	VUJLIS	1
793	62	Webology	1
794	62	Western Association of Map Libraries Information Bulletin	1
795	62	Wilton	1
796	62	World Oil	1
797	62	World Libraries	1
798	62	Zambia Library Association Journal (Africa)	1

4.2 Implementation of Bradford's Law:

To observe the appropriateness of the distribution of journals using the verbal formulation of Bradford Law, the following explanations were made and the results were presented. The first part deals with the verbal formulation of the theory based on data consisting of whole journal references arranged by their decreasing frequency of citations, while the second part examines the graphical representations based on the same data.

4.2.1 Verbal Formulation:

The number of cited journals has been arranged by decreasing number of citations. To test the verbal formulation of Bradford's Law, the rank number of journals, number of citations, cumulative citations were given.

For testing the algebraic interpretation of the law, the 798 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 group. The basis for choosing the three zones was that the percentage error in distribution of citations, among the three zones should be minimum.

The distribution of journals and corresponding number of citations in the three zones along with the value of Bradford multipliers are shown in table no. 4.33.

Table No. 2
Scattering of journals and citations over Bradford Zone

Zones	Number of Journals	Percentage of Journals	Number of citation
1	15	1.88	1844
2	55	6.89	1829

3	728	91.23	1794
Total	798	100	5467

In the present data set it was observed that, 15 journals covered 1844 articles, next 55 journals covered 1829 articles and next 728 journals covered 1794 articles. In other words, one third of the total citations have been covered by each group of the journals.

According to Bradford's, the zones, thus identifies will form an approximately geometric series in the form $1:n:n^2$. But it was found that the relationship of each zone in the present study is 15:55:728. This does not fit into the Bradford's distribution.

Therefore, the following method based on the Leimkuhler model was employed for the verification of Bradford's Law of Scattering.

4.2.2 Application of Leimkuhler Model:

In the present study of Journal Citation, for application of Bradford's Law the citation distribution were divided in three zones ($p=3$ where p denote the Number of Zones) then by using the mathematical formula,

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

$$k = (1.781)^{\frac{1}{p}}$$

The value of Bradford's multiplier k is calculated as follows:

In the present case y_m = number of items in the most productive source = 207 and hence

$$k = (1.781 \times 207)^{\frac{1}{3}} = 7.17$$

$$y_0 = \frac{A}{P}$$

where, A denotes the total number of articles = 5467

and, p denotes the number of zones = 3

$$y_0 = \frac{5467}{3} = 1822.33$$

and r_0 = number of journals in the nucleus of Bradford is calculated as

$$r_0 = \frac{T \cdot (k-1)}{(k^p - 1)} \text{ where } T = \text{Total number of Journals}$$

$$r_0 = \frac{798 \cdot (7.17 - 1)}{(7.17^3 - 1)}$$

$$r_0 = 13.4$$

$$a = \frac{y_0}{\log k}$$

$$\text{Log of } 7.17 = 0.8555$$

$$a = \frac{1822.33}{0.8555}$$

$$a = 2130.13$$

$$b = \frac{k-1}{r_0}$$

$$b = \frac{7.17 - 1}{13.4}$$

$$b = 0.46$$

The findings of the calculations as shown in Table No. 2

Table No.3
Scattering of Journals and Citations over Bradford's Zones

Zone	Number of Journals	% of Journals	Number of Citations
1	13	1.63	1712
2	96	12.03	2338
3	689	86.34	1417
Total	798	100	5467

Table No.3 shows that the number of journals in the nucleus is 13.4 and the mean value of the Bradford multiplier is 7.17. Therefore, the Bradford's distribution is written as:

$$13.4: 13.4 \times 7.17: 13.4 \times (7.17)^2 = 1: n: n^2$$

$$i.e 13.4: 96.078 : 688.87 = 798.348$$

$$\text{Percentage of error} = \frac{798.348 - 798}{798} \times 100 = 0.043 \%$$

Here the percentage error is negligible. It is observed that, the number of journals contributing references to each zone increases by multiplier of 7.17. The data of the zonal analysis shows that the first zone containing 13 journals contributed 1712 citations, 96 journals of second zone produced 2338 and the 689 journals of third zone produced 1417 citations. Here the mean value of the Bradford Multiplier (BM) is large i.e two digits. The larger the Bradford Multiplier, presumably, the higher is the scatter. Although the value of Bradford Multiplier also depends on the size of the data, smaller the data, smaller the value of Bradford Multiplier.

Since the percentage of error is very negligible, the Bradford's law fits very well in this data set. The study identifies 13 journals as the nucleus journals that were most cited by the researcher of Library and Information Science, out of the total of 798 journals, 32.1 percent of the total citations of researchers of Library and Information Science, 96 journals i.e 43.31 percent and the remaining 689 journals i.e 25 percent of total citations appended in journals. The three zones are not exactly the one third of the total citations as proved by Bradford. There is no exact match in the proportion of number of journals and the number of papers of each group.

4.3 Graphical Formulation:

The Graphical formulation is just the experimental verification of the verbal formulation which observes certain regularity in the distribution of scientific publications.

The graph is logarithmic plot of the cumulative number of journals titles on the horizontal axis and the cumulative number of citations on the vertical axis.

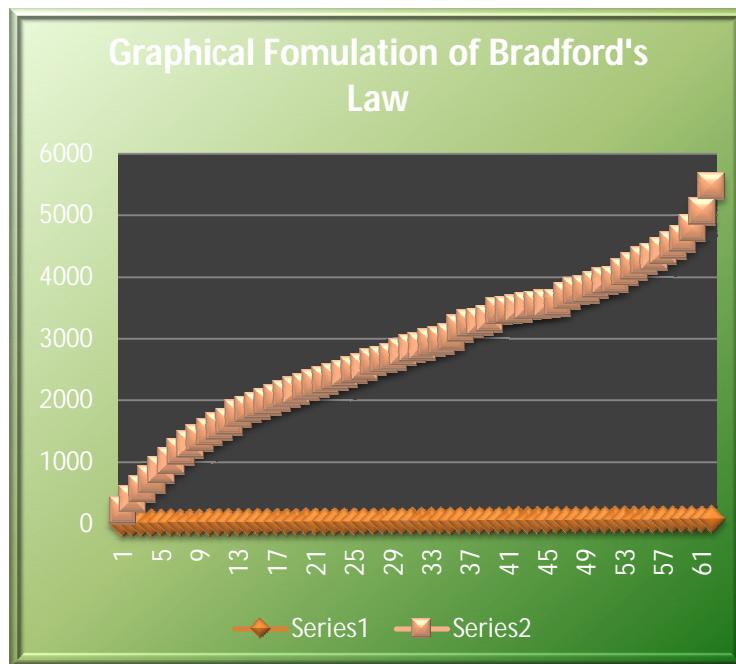


Figure No. 1
Graphical Formulation of Bradford's Law

5. CONCLUSION

The journal distribution pattern Library and Information Science theses does not fit the Bradford's distribution pattern, i.e $1:n:n^2$.

The method developed by Leimkuhler has been utilized in the present study in order to test the application of Bradford's Law of Scattering (Verbal formulation) to the citation data. In the present data set 15 journals covered 1844 articles, next 55 journals covered 1829 articles and next 728 journals covered 1794 articles. In other words, one third of the total citations were covered by each group of the journals.

According to Bradford's, the zones, thus identifies will form an approximately geometric series in the form $1: n: n^2$. But it was found that the relationship of each zone in the present study was 15:55:728. This does not fit into the Bradford's distribution.

Therefore, the method based on the Leimkuhler model is employed for the verification of Bradford's Law of Scattering. When the Leimkuhler model is employed for the verification of Bradford's Law, it was found that the law find valid for the data set. The percentage of error is found to be the most negligible (0.043%). Bradford's Law of Scattering was an area where much work has been done. However, till now, no one has come out with a single model that fits fairly well to most of the data set.

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