

## Bradford's Law in the Field of Psychology Research in India

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**Abstract** - The main objective of this investigation is to know the applicability of Bradford's law in Psychology research in India. A total of global wise 14,30,700 papers has be published and 12,543 (0.88%) with 96,871 published in India than retrieved from the "Web of Science" citation database for a time of twenty years i.e. from 2001 to 2020. The study examined the countries wise research output, communication channels preferred by the researchers, and most productive journals in Psychology literature. The analysis of the study revealed that there is an increasing trend in terms of research productivity during the period. USA 5,11,528 (35.75%) Psychology research publications followed by England with 1,32,460 (9.26%) Germany 96,620 (6.75%), Canada country 75,238 (5.26%), China and Spain both countries 2.49% research paper published and seven and eight stage ranked and India country psychology research papers published with 12,543 (0.88%) eighteenth ranked. The maximum number of research papers are published by Indian Journal of Psychiatry 4,316 (34.49%) and 3,909 (4.04%) citations first ranked followed by Asian Journal of Psychiatry 772 (6.17%) papers, 2,835 citations. The percentage of the error is negative and negligible (-0.00870), therefore the data conforms well fit to Bradford's law zone.

**Keywords:** Psychology, India, Countries, Scientometric, Web of Science (WoS), Bradford's Law, Bradford's Multiplier, Leimkuhler Model

### I. INTRODUCTION

The empirical study of actions and mental processes is known as psychology. The scientific study of the biological basis of actions and mental states is known as biological perspective, and it is closely related to neuroscience. The psychological study of the mind and actions is known as psychology. The term "psychology" is derived from the Greek words "psyche", which means "existence", and "logos", which means "explanation". Psychology is a prominent undergraduate major, a popular topic in the news, and a part of our daily lives.

Bradford's Law of Scattering, coined by "Samuel Clement Bradford in 1934", inspired the idea of core papers. Bradford first noted the increasing scatter of related journal articles on a given subject, and later, in 1948, he summarised his findings by comparing the number of journals in the nuclear or most productive zone to the number of journals in successively less productive zones containing equivalent numbers of papers. Bradford's Law of Scattering is probably the most well-known and well-known of all the bibliometric principles that attempt to explain the

successful functioning of science by mathematical means. Citation analysis is a useful tool for identifying the most important references in a topic, which are listed at the end of each scientific paper. The basic methodology entails the compilation, estimation, and analysis of citations provided in research writing, assisting in the identification of the most important journal of information in the field. The current study examines the research productivity of Psychology in great detail. The study's findings will aid librarians and knowledge scientists in making decisions, preparing, and handling information resources in the field of psychology.

### II. OBJECTIVES OF THE STUDY

1. To the analyzed the most productive countries on Psychology literature.
2. To test the applicability of Bradford's Law.

### III. REVIEW OF LITERATURE

(Kumar, 2014) This paper study on Human-Computer Interaction (HCI) research journals indexed in Science citation index-expanded, total paper 1,37,120 papers published between 1987 and 2011 were used to evaluate two formulations of Bradford's rule, verbal and graphical. The data is divided into five-year blocks so that percentage errors can be compared, and a list of core journals is also prepared for each of the five blocks of the five-year cycle. The presence of a variety of journals and their titles in the core community suggests that the emphasis of HCI study has shifted from one five-year period to the next. In addition, the Leimkuhler model's applicability was checked in the current analysis of human-computer interaction. (Nash-Stewart, Kruesi, & Del Mar, 2012) The aim of this study was to see whether Bradford's law applied to the Cochrane Review-recognized literature on acute otitis media and respiratory illness, two conditions that are reported in a wide range of clinical and health journals. "Bradford's" law was found to be ineffective in estimating the size of the literature on a subject matter based on the number of publications published in core journals. (Venable, Shepherd, Roberts, Taylor, Khan, & Klimo, 2014) William Bradford law was used to determine the core journals of pediatric neurosurgery and a geographic citation density comparison. The regional comparison confirmed a priority for the Journal of Neurosurgery and the Journal of

the Child's Nervous System, but four of the top five journals were regular to each team. When Bradford's law was applied verbally to the North American citation database, a trend of citation density was discovered across the primary three regions.

**IV. METHODOLOGY**

The record was retrieve from the "Web of Science" (WoS) citation database maintained by Clarivate Analytics. Data accessed with the help of an advanced search technique by using the term CU=India AND SU=(Psychology OR Psychiatry OR "Mental illness" OR Mental OR Neurobehavioral OR Psycho diagnostics OR Mental OR Psycho Surgery OR Behavior OR Behaviorism OR Psychoanalyst OR Psychodynamic OR unconscious) Indexes=SCI-EXPANDED, SSCI, CPCI-S, CPCI-SSH, CCR-EXPANDED, IC Time span=2001-2020 total twenty years. A total of 12,543 were downloaded in CSV file format and plain text format for analysis. The data has been analyzed with the help of "HistCite" software and a Microsoft Excel spreadsheet. Tables and graphs have been used to present the data for analysis and discussion.

**V. RESULTS AND DISCUSSION**

*A. Country - wise Top Twenty Distributions of Publications in India*

The global wise total field of Psychology research papers published 14,30,700 during the period of twenty years from 2001 to 2020 and we selected only top 20 countries highly published papers.

TABLE I COUNTRY-WISE GROWTH OF PSYCHOLOGY RESEARCH PUBLICATIONS IN INDIA

Rank	Countries	Papers	%
1	USA	511528	35.75
2	England	132460	9.26
3	Germany	96620	6.75
4	Canada	75238	5.26
5	Australia	64650	4.52
6	Netherlands	49330	3.45
7	China	35583	2.49
8	Spain	35579	2.49
9	Italy	35273	2.47
10	France	32439	2.27
11	Japan	26812	1.87
12	Switzerland	21474	1.50
13	Sweden	17977	1.26
14	Brazil	17695	1.24
15	Belgium	16696	1.17
16	Israel	16663	1.16
17	Scotland	13874	0.97
18	India	12543	0.88
19	South Korea	12293	0.86
20	Others Countries	205973	14.40
Total		1430700	

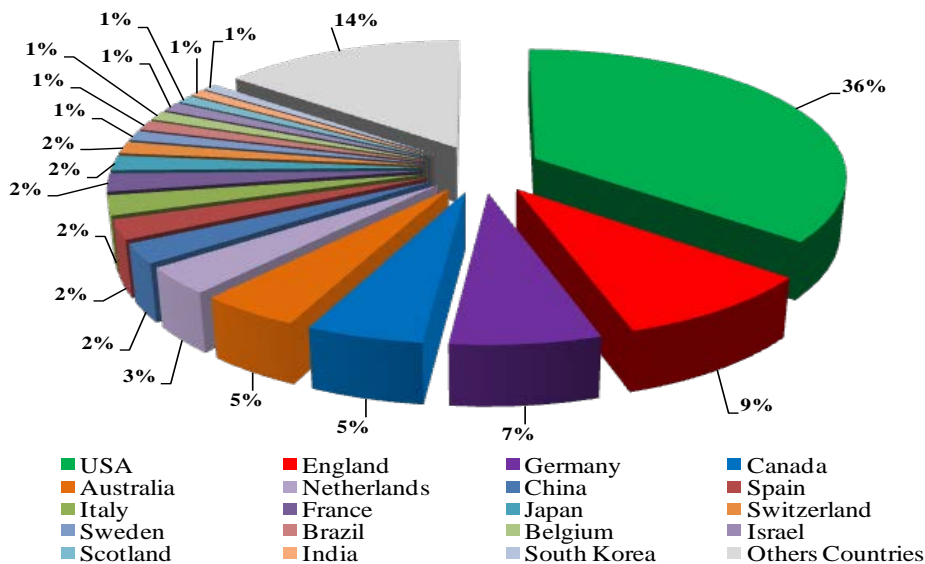


Fig. 1 Country-wise growth of Psychology Research publications in India

Table I and Fig. 1 shows that, high contribution was USA 5,11,528 (35.75%) Psychology research publications first ranked, followed by England with 1,32,460 (9.26%) second ranked, Germany third ranked with 96,620 (6.75%), fourth

ranked by Canada country 75,238 (5.26%). Noticed that China and Spain both countries 2.49% research paper published and seven and eight stage ranked and India country psychology research papers published with 12,543

(0.88%) eighteenth ranked. The other countries remaining papers published lowest numbers below 0.88% of output.

*B. Application of Bradford’s Law Psychology Papers*

The Bradford multiplier was calculated by separating the quantity of journal in a sector by the preceding zone’s number of journals on psychology in India. “The three zones were decided on putting almost one-third of articles in each zone at most possible way so that the percentage of error minimum in the distribution of articles”. Total 12,543 articles with 96,871 citations have been published by 648 journals during the research from 2001 to 2020 in the Psychology subject by Indian researchers and scientist.

In these journals, “Indian Journal of Psychiatry” most the journals record by publishing the highly papers 4,316

(34.49%) and 3,909 (4.04%) citations with Average Citation per Paper 0.91, followed by “Asian Journal of Psychiatry” 772 (6.17%) papers, 2,835 citations with 3.67 ACPP and “International Journal of Psychology” occupied the 3<sup>rd</sup> rank with 498 (3.98%) and 621 (0.27%) citations with ACPP 0.52. The 4<sup>th</sup> rank “European Psychiatry” 193 (1.54%) and 276 (0.28%) with 1.42 ACPP, the 5<sup>th</sup> rank “Bipolar Disorders” with 166 (1.33%) and 523 (0.54%) citations with 3.15 ACPP. Noticed that showing table I journal title “British journal of Psychiatry” only 155 papers published and highly cited total 5,301 with maximum ACPP 34.20 received. The top five ranked journals provided approximately half of all papers to the rankings, while the remaining 643 journals contributed less than 1% of all papers published showing table II and Fig. 3.

TABLE II JOURNALS PSYCHOLOGY PUBLICATIONS IN INDIA

Sl. No.	Journal Name	TP	TP%	TC	TC%	ACPP
1	Indian Journal of Psychiatry	4316	34.49	3909	4.04	0.91
2	Asian Journal of Psychiatry	772	6.17	2835	2.93	3.67
3	International Journal of Psychology	498	3.98	261	0.27	0.52
4	European Psychiatry	193	1.54	276	0.28	1.43
5	Bipolar Disorders	166	1.33	523	0.54	3.15
6	Epilepsy and Behavior	165	1.32	1975	2.04	11.97
7	Journal of Neuropsychiatry and Clinical Neurosciences	156	1.25	766	0.79	4.91
8	British journal of Psychiatry	155	1.24	5301	5.47	34.20
9	Australian and New Zealand Journal of Psychiatry	147	1.17	538	0.56	3.66
10	Psycho-Oncology	144	1.15	162	0.17	1.13
11	International Journal of Social Psychiatry	140	1.12	1525	1.57	10.89
12	Schizophrenia Research	138	1.10	1849	1.91	13.40
13	Aids Care-Psychological and Socio-Medical	129	1.03	1883	1.94	14.60
14	Journal of ECT	125	1.00	1176	1.21	9.41
15	Journal of Clinical Psychiatry	123	0.98	1820	1.88	14.80
16	Frontiers in Psychology	121	0.97	679	0.70	5.61
17	Biological Psychiatry	119	0.95	1214	1.25	10.20
18	Psychiatry Research	119	0.95	1488	1.54	12.50
19	European Neuropsychopharmacology	111	0.89	885	0.91	7.97
20	Journal of Neurology Neurosurgery and Psychiatry	107	0.86	1581	1.63	14.78
21	Schizophrenia Bulletin	104	0.83	500	0.52	4.81
22	International Review of Psychiatry	96	0.77	1162	1.20	12.10
23	Progress in Neuro-psychopharmacology & Biological	85	0.68	2816	2.91	33.13
24	International Journal of Neuropsychopharmacology	82	0.66	314	0.32	3.83
25	International Psychogeriatrics	80	0.64	496	0.51	6.20
26	26 Journals (Publication within the Range of 74-31)	1242	9.93	19263	19.89	15.51
27	597 Journals (Publication within the Range of 30-1)	2880	23.02	41674	43.02	14.47
Total		12513		96871		
“TP-Total Papers, TP%-Total Papers percentage, TC-Total Citation, TC%-Total Citation percentage, ACPP-Average Citation per Paper”						

C. Application of Bradford's Law

Journals can be classified into 3 regions, each one of which produces a similar no. of posts, according to this rule. The number of journals in each field, on the other hand, would rapidly grow. "Then the relation between the zones is  $1: n: n^2$ . Consequently, the relationship between the zones is  $1: n: n^2 \dots$ " (Bradford, 1934) p.86. In the current information set, the number of articles separated into three zones containing equal number of article papers. In 1<sup>st</sup> zone, 1 (0.15%) journals published 4,316 (34.41%) papers, followed by 25 (3.86%) journals contribute 4,149 (33.08%) papers in the 2<sup>nd</sup> zone and 622 (95.99%) journals contribute 4,078

(32.51%) papers in the 3<sup>rd</sup> zone. It can be observe that the three zones are approximately accurately one third of the sum no. of articles showing table III and Fig. 2.

TABLE III BRADFORD ZONE JOURNALS AND CITATIONS

Zone	Journals	Articles	Bradford Multiplier
1	1 (0.15%)	4316 (34.41%)	-
2	25 (3.86%)	4149 (33.08%)	25.00
3	622 (95.99%)	4078 (32.51%)	24.88
Total	648	12543	

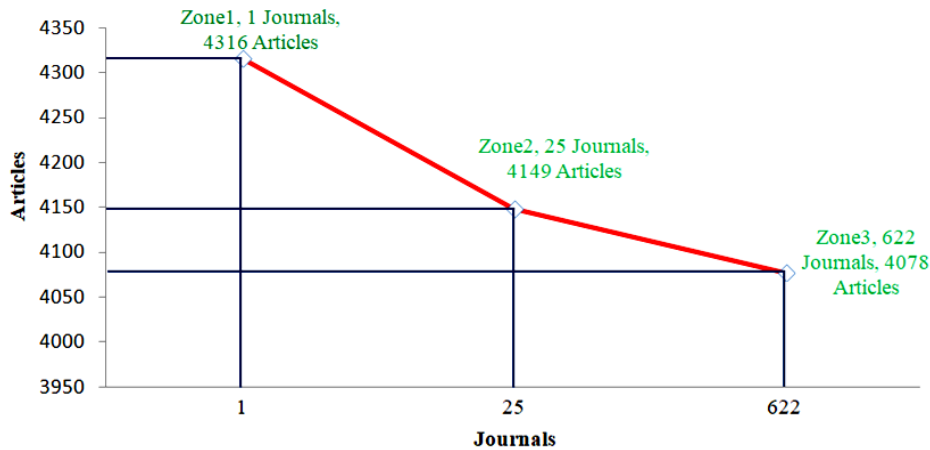


Fig. 2 Scattering of journals in Bradford's law of Psychology research output

The "marked zones are in order in the geometric sequence of  $1: n: n^2$  as given by (Bradford, 1934). We find that the connection of every zone in the present study is"  $1: 24.94: 622$ .

Here, 1 journals found in the nucleus zone and the mean value of Bradford's multiplier is  $n=24.94$ , Therefore,  $1 : (1 \times 24.94) : (1 \times 24.94^2) :: 1 : n : n^2$   
 $1 : 24.94: 622$

$$\% \text{ error} = \frac{647.94-648}{648} \times 100 = -0.00870$$

$$= -0.00870$$

The percentage of the error is negative and negligible (-0.00870), therefore the data conforms well fit to Bradford's law zone.

D. Verification of Bradford Law through 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,

$$k = (e^{\gamma} \times Y_m)^{1/p}$$

Where  $e^{\gamma}$  is Euler's number having value 1.781  
 $Y_m$  is the number of article of rank one article = 4316  
 $p$  is Bradford group or number of zones i.e.  $p=3$

So,

$$k = (1.781 \times 4316)^{1/p}$$

$$k = 19.73$$

"Using  $k$  we can calculate different groups of Bradford's, the core zone  $r_0$  can be defined" as:

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

"Where,  $T$  represents the total number of journals in this study for Brazil", that is, 648.

$$= \frac{648(19.73 - 1)}{(19.73^3 - 1)}$$

$$r_0 = \frac{12140.61}{7685.80} = 1.58$$

$$k = 19.73 \quad r_0 = 1.58$$

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

$$\text{Log of } 19.73 = 1.2951$$

$$a = \frac{1438.66}{1.2951}$$

$$a = 1110.84$$

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

$$b = \frac{19.73-1}{1.58}$$

$$b = 11.85$$

“Different Bradford’s zone can be obtained using the value” of  $k$  and  $r_0$

The  $k$  rate is found out to be 19.73 and  $r_0 = 1.58$

Nucleus zone  $r_0 = r_0 \times 1 = 1.58$

First zone  $r_1 = r_0 \times k = 1.58 \times 19.73 = 31.17$

Second zone  $r_2 = r_0 \times k^2 = 1.58 \times 19.73^2 = 615.25$

It is in the ratio of 1.58: 31.17: 615.25 =648

This “theoretical distribution of Bradford’s law allows examining the exact fit of Bradford’s law with the data

analyzed in the present study”. Using this sharing, you can draw the no. of papers as shown in table IV.

TABLE IV BRADFORD ZONE JOURNALS AND CITATIONS

Zone	Journals	Articles	Bradford Multiplier
1	1.58 (0.24%)	1930 (19.42%)	-
2	31.17 (4.81%)	3940 (39.65%)	19.73
3	615.25 (94.95%)	4068 (40.93%)	19.74
Total	648	9938	

It is experimental in table IV that there are three 1.58 journals in the nuclear zone and they are the most dynamic papers of Psychology that were publications in Indian country and share 1,930 of the total no. of article papers. The next area represented by 31.17 journals distribution 3,940 total papers and the final last zone is by 615.25 journals with distribute 4,068 total articles, therefore, the journal’s data shows the well fit with Bradford’s distribution law.

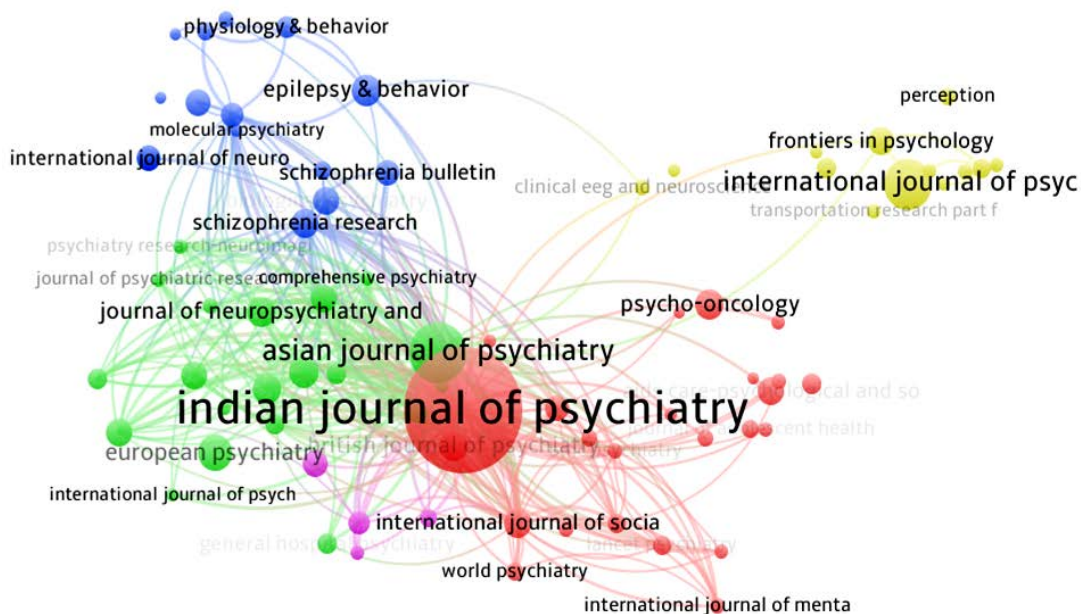


Fig. 3 VOS Viewer of Journals Psychology Publications in India Network Mapping

## VI. CONCLUSION

The result of the study shows that there was a significant research activity in the field of Psychology research. Most of the research publications published is in the research articles from USA country 5,11,528 (35.75%), England with 1,32,460 (9.26%, Germany with 96,620 (6.75%), Canada country 75,238 (5.26%) and India country psychology research papers published with 12,543 (0.88%) eighteenth ranked. Observing that more papers published on Psychiatry subject area journals and study confirms that the journals use pattern of Psychology researchers well fitted into Bradford’s law of scattering (1: 24.94: 622). Finally, it can

be concluded that Psychology is one of the emerging research areas in science.

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