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# Application of Bradford's Law on journal citations: A study of Ph.D. theses in social sciences of University of Delhi

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The study covers 260 Ph.D. theses submitted during 1995-2008 that have a total of 9,997 references scattered in 934 journals. The study found that the journal ***Economic & Political Weekly*** is the most cited journal with 22.8% citations, followed by ***The Punjab Past and Present*** with 1.80% citations. Bradford's law of scattering fits to the present study.

**Keywords:** Bradford's Law of Scattering; Social Science literature; Core journals; Journals citations; University of Delhi

## Introduction

Journals are a key information source to the researchers. However, the large number of journals and their high subscription costs make it difficult for libraries to subscribe all required journals. Citation analysis can be carried out to identify core journals in a field. The ranked list of highly cited journals is a practical tool for a librarian to select the journals of maximum utility. Citation analysis is one of the ways through which one can identify journals most important for the library collection cited by the researchers in their theses.

The present study is based on application of Bradford's law of scattering on the journal citations of theses in social sciences. The concept of core journals is derived from the Bradford's law of scattering.

## Review of literature

A number of studies have been conducted to test the applicability of Bradford's law of scattering. The first notable study on the law was conducted by Vickery (1948) who analyzed periodical references[1]. Patra and Chand in 2005 used Bradford's law to identify core journals of biotechnology in India[2]. Nicolaisen and Hjorland critically reviewed the application of Bradford's law[3]. Hadagali, Kumbar and Benahal[4] analyzed the citations of Ph.D. theses submitted to the Karnataka University, Dharwad, India in the field of Physics during 1992-2006. They have applied Bradford's law of Scattering on the data and found to be fit in their study. Sudhier[5] applied the Bradford's law of scattering on physics doctoral theses at the Indian Institute of Science, Bangaluru and found that Bradford's distribution pattern does not fit to the doctoral theses of the IISc. Kumar and Dora[6] analyzed the doctoral dissertations at IIM, Ahmedabad during the period 2004-2009. The study revealed that journals are the most cited source and the Bradford's law of Scattering was found to be fit to the data. There are many more studies on the application of Bradford's law of Scattering. This paper studies Bradford's law of Scattering on the journal citations of the Ph.D. theses in the field of social sciences, University of Delhi.

## Objectives of the study

1. To list the distribution of citations by type of documents and year;
2. To prepare a ranked list of most cited journals by the Social Sciences researchers;

3. To test the Bradford's Law of scattering.

## Methodology

Two-sixty Ph.D. theses of social sciences submitted to the University of Delhi during 1995-2008 were selected as a source of data. A total of 52,378 citations were found in all 260 theses. In the present study, the main focus is on 9,997 journal articles belonging to 934 journals. Each citation was noted down on a data sheet. Citations were categorized based on the form of information sources i.e. books, journals articles, newspapers, reports, conference proceedings, websites, interviews, theses/dissertations etc. MS-Excel was used for data entry and SPSS software for analysis.

## Analysis

### Document type-wise distribution of citations

Table 1 denotes the distribution of cited literature in different types of documents used by the social sciences researchers.

It is observed from the Table 1 that out of 52,378 citations, books contribute the highest number of citations 29,214 i.e. 55.7%. Journals are the second highest cited documents accounting for 9997 (19.0%) citations and remaining citations are from newspapers, chapters in book, reports etc.

### Country-wise distribution of journal citations

It was found that the 9997 journal citations were from journals published from 31 countries (Table 2).

It is seen from the table that out the total 9997 citations, 5075 (50.7%) citations were from India followed by USA with 2375 (23.8%) citations and UK 1193 (11.9%) citations, The Netherlands with 302 (3.0%) and South Africa with 126 (1.2%) citations. Journals from the other 26 countries have contributed only 926 (9.2%) citations. It indicates more than half of the journals cited by the social sciences researchers are of Indian origin.

### Year-wise break-up of journal citations

Table 3 presents the findings of year-wise break-up of journal citations. The duration of the whole period in the present study is divided into 10 year periods beginning from 1900 to 2008.

Table 3 shows that the maximum number of journal citations cited by the researchers is of the period ranging from 1991-2000 that is 2937 (29.4%),

Table 1—Distribution of citations by document type

| Sl. no. | Document types | No. of citations (%) | Cumulative nos. (%) | Rank |
|---|---|---|---|---|
| 1 | Books | 29214 (55.7) | 29214 (55.7) | 1 |
| 2 | Journal Articles | 9997 (19.0) | 39211 (74.8) | 2 |
| 3 | News Papers | 3452 (6.5) | 42663 (81.4) | 3 |
| 4 | Chapters in Book | 3262 (6.2) | 45925 (87.6) | 4 |
| 5 | Reports (Annual/Technical) | 2397 (4.5) | 48322 (92.2) | 5 |
| 6 | Conference Proceedings | 900 (1.7) | 49222 (93.9) | 6 |
| 7 | Magazines | 711 (1.3) | 49933 (95.3) | 7 |
| 8 | Web Resources | 520 (0.9) | 50453 (96.3) | 8 |
| 9 | Interviews | 394 (0.8) | 50847 (97.0) | 9 |
| 10 | Theses/Dissertations | 374 (0.7) | 51221 (97.7) | 10 |
| 11 | Government Documents/Records | 224 (0.4) | 51445 (98.2) | 11 |
| 12 | Manifestos | 208 (0.4) | 51653 (98.6) | 12 |
| 13 | Conversations/Debates | 121 (0.2) | 51774 (98.8) | 13 |
| 14 | Gazettes | 118 (0.2) | 51892 (99.0) | 14 |
| 15 | Year Books | 105 (0.2) | 51997 (99.2) | 15 |
| 16 | Others | 381 (0.7) | 52378 (100) | |
| | Total | 52, 378 | | |

Table 2—Distribution of citations by country

| Sl. no. | Country | No. of citations (%) | Cumulative nos. (%) | Rank |
|---|---|---|---|---|
| 1 | India | 5075 (50.7) | 5075 (50.7) | 1 |
| 2 | USA | 2375 (23.8) | 7450 (74.5) | 2 |
| 3 | UK | 1193 (11.9) | 8643 (86.4) | 3 |
| 4 | The Netherlands | 302 (3.0) | 8945 (89.4) | 4 |
| 5 | South Africa | 126 (1.2) | 9071 (90.8) | 5 |
| 6 | Others (26 countries) | 926 (9.2) | 9997 (100) | |
| | Total | 9997 | | |

Table 3—Year-wise break-up of journals citations

| Sl. no. | Period of citations | Total no. of citations (%) | Cumulative nos. (%) |
|---|---|---|---|
| 1 | Till 1900 | 20 (0.2) | 20 (0.2) |
| 2 | 1901-1910 | 9 (.09) | 29 (.29) |
| 3 | 1911-1920 | 30 (0.3) | 59 (.59) |
| 4 | 1921-1930 | 24 (0.2) | 83 (.83) |
| 5 | 1931-1940 | 99 (0.9) | 182 (1.9) |
| 6 | 1941-1950 | 48 (0.5) | 230 (2.3) |
| 7 | 1951-1960 | 411 (4.1) | 641 (6.4) |
| 8 | 1961-1970 | 788 (7.8) | 1429 (14.3) |
| 9 | 1971-1980 | 1869 (18.7) | 3298 (32.9) |
| 10 | 1981-1990 | 2883 (28.9) | 6181 (61.8) |
| 11 | 1991-2000 | 2937 (29.4) | 9118 (91.2) |
| 12 | 2001-2008 | 879 (8.8) | 9997 (100) |
| | Total | 9997 | |

followed by the periods 1981-1990 with 2883 (28.9%) citations and from 1971-1980 accounting for 1869 citations (18.7%), 2001-2008 with 879 (8.8%) citations and 1961-1970 with 788 (7.8%) citations. Majority of citations belong to the period 1961-2008.

**Ranked list of cited journals in social sciences**

Journals are essential for research but because of their increasing cost, librarians study their quality, usefulness, and suitability to a particular group of users. The rank list is a practical tool to select the journals of maximum utility in relation to their coverage of new and important literature in a particular subject area. Ranking of the journals has been prepared on the basis of total citation frequency received by each journal. The titles have been arranged in decreasing order of the number of citations (Table 4).

Table 4 depicts that in all, 9,997 citations were scattered in 934 journals, of which the frequency of occurrence is least 30 for 55 journals. *Economic & Political Weekly* from India is the most cited journal accounting for 2276 (22.7%) of the total journal citations. *The Punjab Past and Present* follows next with 180 (1.8%) citations, *The Indian Historical Review* with 158 (1.5%) citations, *Indian Economic & Social History Review* with 143 (1.4%) citations and *Indian Journal of Psychiatry* with 133 (1.3%) citations and so on. It is observed that these five top ranked journals cover about 29% of the total citations and all these five journals are from India. The 55 journals contribute about 59% of the total citations and the other 879 journals contribute about 41% of total citations.

**Bradford Law of Scattering**

Bradford's law of scattering is used to determine the number of core journals in any given field. It states that "journals in a given field can be divided into three zones, containing the same number of articles, a core zone containing the one third of the total

Table 4—Ranked list of cited journals in social sciences

| Sl. no. | Journal | Country | No. of Citations (%) | Cumulative Nos. (%) | Rank |
|---|---|---|---|---|---|
| 1 | *Economic & Political Weekly* | India | 2276 (22.7) | 2276 (22.7) | 1 |
| 2 | *The Punjab Past and Present* | India | 180 (1.8) | 2456 (24.5) | 2 |
| 3 | *The Indian Historical Review* | India | 158 (1.5) | 2614 (26.1) | 3 |
| 4 | *Indian Economic & Social History Review* | India | 143 (1.4) | 2757 (27.5) | 4 |
| 5 | *Indian Journal of Psychiatry* | India | 133 (1.3) | 2890 (28.9) | 5 |
| 6 | *Modern Asian Studies* | UK | 129 (1.2) | 3019 (30.2) | 6 |
| 7 | *Social Sciences & Medicine* | USA | 127 (1.2) | 3146 (31.4) | 7 |
| 8 | *Indian Journal of Agricultural Economics* | India | 124 (1.2) | 3270 (32.7) | 8 |
| 9 | *Geographical Review of India* | India | 123 (1.2) | 3393 (33.9) | 9 |
| 10 | *Social Scientist* | India | 107 (1.0) | 3500 (35.0) | 10 |
| 11 | *Anumukti* | India | 101(1.0) | 3601 (36.0) | 11 |
| 12 | *Journal of Asian Studies* | UK | 99 (0.1) | 3700 (37.0) | 12 |
| 13 | *Foreign Affairs* | USA | 97 (0.9) | 3797 (37.9) | 13 |
| 14 | *Indian Journal of Political Science* | India | 87 (0.8) | 3884 (38.8) | 14 |
| 15 | *Contributions to Indian Sociology* | India | 84 (0.8) | 3968 (39.7) | 15 |
| 16 | *American Economic Review* | USA | 80 (0.8) | 4048 (40.5) | 16 |
| 17 | *Social Sciences Probings* | India | 76 (0.7) | 4124 (41.2) | 17 |
| 18 | *Journal of Finance* | USA | 71 (0.7) | 4195 (41.9) | 18 |
| 19 | *Punjab Journal of Politics* | India | 70 (0.7) | 4265 (42.7) | 19 |
| 20 | *Social Work* | USA | 70 (0.7) | 4335 (43.3) | 19 |
| 21 | *Journal of Development Economics* | The Netherlands | 68 (0.6) | 4403 (44.0) | 20 |
| 22 | *Indian Journal of Social Work* | India | 63 (0.6) | 4466 (44.6) | 21 |
| 23 | *Econometrica* | The Netherlands | 61 (0.6) | 4527 (45.2) | 22 |
| 24 | *Man in India* | India | 60 (0.6) | 4587 (45.8) | 23 |
| 25 | *Land Economics* | USA | 59 (0.5) | 4646 (46.4) | 24 |
| 26 | *International Studies* | USA | 56 (0.5) | 4702 (47.0) | 25 |
| 27 | *Journal of Bihar Research Society* | India | 56 (0.5) | 4758 (47.5) | 25 |
| 28 | *Journal of Political Economy* | USA | 55 (0.5) | 4813 (48.1) | 26 |
| 29 | *Indian Historical Quarterly* | India | 53 (0.5) | 4866 (48.6) | 27 |
| 30 | *Africa Quarterly* | India | 51 (0.5) | 4917 (49.1) | 28 |
| 31 | *African Affairs* | UK | 51 (0.5) | 4968 (49.6) | 28 |
| 32 | *Journal of Monetary Economics* | The Netherlands | 51 (0.5) | 5019 (50.2) | 28 |
| 33 | *Administrative Change* | India | 50 (0.5) | 5069 (50.7) | 29 |
| 34 | *Journal of Peasant Studies* | UK | 49 (0.4) | 5118 (51.2) | 30 |
| 35 | *Vikas Varta* | India | 48 (0.4) | 5166 (51.6) | 31 |
| 36 | *Applied Geography* | USA | 46 (0.4) | 5212 (52.1) | 32 |
| 37 | *Management in Government* | India | 44 (0.4) | 5256 (52.5) | 33 |
| 38 | *Subaltern Studies* | India | 40 (0.4) | 5296 (52.9) | 34 |

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Table 4—Ranked list of cited journals in social sciences

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| | | | | | |
|---|---|---|---|---|---|
| 39 | *American Sociological Review* | USA | 39 (0.3) | 5335 (53.3) | 35 |
| 40 | *Third World Quarterly* | UK | 37 (0.3) | 5372 (53.7) | 36 |
| 41 | *American Journal of Agricultural Economics* | USA | 35 (0.3) | 5407 (54.0) | 37 |
| 42 | *Journal of Marriage and Family* | USA | 35 (0.3) | 5442 (54.4) | 37 |
| 43 | *Annals of the National Association of Geographers* | India | 34 (0.3) | 5476 (54.7) | 38 |
| 44 | *Indian Culture* | India | 34 (0.3) | 5510 (55.1) | 38 |
| 45 | *African Security Review* | South Africa | 33 (0.3) | 5543 (55.4) | 39 |
| 46 | *Journal of Studies on Alcohol* | USA | 33 (0.3) | 5576 (55.7) | 39 |
| 47 | *Review of African Political Economy* | UK | 33 (0.3) | 5609 (56.1) | 39 |
| 48 | *Quarterly Journal of Economics* | UK | 32 (0.3) | 5641 (56.4) | 40 |
| 49 | *Journal of National Institute of Environmental Health Science* | USA | 31 (0.3) | 5672 (56.8) | 41 |
| 50 | *Pacific Affairs* | UK | 31 (0.3) | 5703 (57.0) | 41 |
| 51 | *Population Studies* | UK | 31 (0.3) | 5734 (57.3) | 41 |
| 52 | *The Geographer* | India | 31 (0.3) | 5765 (57.6) | 41 |
| 53 | *Africa Today* | USA | 30 (0.3) | 5795 (57.9) | 42 |
| 54 | *Annals of the Association of American Geographers* | USA | 30 (0.3) | 5825 (58.2) | 42 |
| 55 | *Journal of Royal Anthropological Institute* | UK | 30 (0.3) | 5855 (58.6) | 42 |
| 56 | Others (879 Journals) | | 4142 (41.4) | 9997 (100) | |
| | Total | | 9,997 | | |

citations, zone 1, containing the same number of articles but a greater number of journals, and zone 2, containing the same number of articles, but still greater number of journals". The mathematical relationship of the number of journals in the core zone to the zone first is a constant *n* and to the second zone the relationship is $n^2$. Bradford expressed this relationship as 1: *n*: $n^2$. [7]

The number of the journals in each Bradford's zone can be calculated from multiplier constant k that is called Bradford constant. Using the formulation of Egghe (1986)[8], Egghe (1990)[9], Egghe and Rousseau (1990)[10], and Andres (2009)[11] k can be calculated as follow:

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

Where is Euler's number having value .57772

$Y_m$ is the number of citation of rank one journal

p is Bradford groups or number of zones i.e. p=3

From table 4.110 the number of highest citation is 2276

Hence $Y_m = 2276$

So that

$$k = \left(2.718^{0.57772} \times 2276\right)^{1/3}$$

$$k = \left(1.781 \times 2276\right)^{1/3}$$

$k$=15.944

Using k we can calculate different Bradford groups. The nucleus zone $r_0$ can be defined as:

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

Where, T represents the total number of journal in this study that is 934.

So $$r_0 = \frac{934(15.944 - 1)}{(15.944^3 - 1)}$$

Table 5—Distribution of journals

| Rank | No. of Jour. | Cum. No. of Jour. | No. of Citations | Total No. of Citations | Cum. No. of Citations | Log N | % of Citations | % of Total Journals |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 2276 | 2276 | 2276 | 0.000000000 | 22.77 | 0.11 |
| 2 | 1 | 2 | 180 | 180 | 2456 | 0.693147181 | 24.57 | 0.21 |
| 3 | 1 | 3 | 158 | 158 | 2614 | 1.098612289 | 26.15 | 0.32 |
| 4 | 1 | 4 | 143 | 143 | 2757 | 1.386294361 | 27.58 | 0.43 |
| 5 | 1 | 5 | 133 | 133 | 2890 | 1.609437912 | 28.91 | 0.54 |
| 6 | 1 | 6 | 129 | 129 | 3019 | 1.791759469 | 30.20 | 0.64 |
| 7 | 1 | 7 | 127 | 127 | 3146 | 1.945910149 | 31.47 | 0.75 |
| 8 | 1 | 8 | 124 | 124 | 3270 | 2.079441542 | 32.71 | 0.86 |
| 9 | 1 | 9 | 123 | 123 | 3393 | 2.197224577 | 33.94 | 0.96 |
| 10 | 1 | 10 | 107 | 107 | 3500 | 2.302585093 | 35.01 | 1.07 |
| 11 | 1 | 11 | 101 | 101 | 3601 | 2.397895273 | 36.02 | 1.18 |
| 12 | 1 | 12 | 99 | 99 | 3700 | 2.48490665 | 37.01 | 1.28 |
| 13 | 1 | 13 | 97 | 97 | 3797 | 2.564949357 | 37.98 | 1.39 |
| 14 | 1 | 14 | 87 | 87 | 3884 | 2.63905733 | 38.85 | 1.50 |
| 15 | 1 | 15 | 84 | 84 | 3968 | 2.708050201 | 39.69 | 1.61 |
| 16 | 1 | 16 | 80 | 80 | 4048 | 2.772588722 | 40.49 | 1.71 |
| 17 | 1 | 17 | 76 | 76 | 4124 | 2.833213344 | 41.25 | 1.82 |
| 18 | 1 | 18 | 71 | 71 | 4195 | 2.890371758 | 41.96 | 1.93 |
| 19 | 2 | 20 | 70 | 140 | 4335 | 2.995732274 | 43.36 | 2.14 |
| 20 | 1 | 21 | 68 | 68 | 4403 | 3.044522438 | 44.04 | 2.25 |
| 21 | 1 | 22 | 63 | 63 | 4466 | 3.091042453 | 44.67 | 2.36 |
| 22 | 1 | 23 | 61 | 61 | 4527 | 3.135494216 | 45.28 | 2.46 |
| 23 | 1 | 24 | 60 | 60 | 4587 | 3.17805383 | 45.88 | 2.57 |
| 24 | 1 | 25 | 59 | 59 | 4646 | 3.218875825 | 46.47 | 2.68 |
| 25 | 2 | 27 | 56 | 112 | 4758 | 3.295836866 | 47.59 | 2.89 |
| 26 | 1 | 28 | 55 | 55 | 4813 | 3.33220451 | 48.14 | 3.00 |
| 27 | 1 | 29 | 53 | 53 | 4866 | 3.36729583 | 48.67 | 3.10 |
| 28 | 3 | 32 | 51 | 153 | 5019 | 3.465735903 | 50.21 | 3.43 |
| 29 | 1 | 33 | 50 | 50 | 5069 | 3.496507561 | 50.71 | 3.53 |
| 30 | 1 | 34 | 49 | 49 | 5118 | 3.526360525 | 51.20 | 3.64 |
| 31 | 1 | 35 | 48 | 48 | 5166 | 3.555348061 | 51.68 | 3.75 |
| 32 | 1 | 36 | 46 | 46 | 5212 | 3.583518938 | 52.14 | 3.85 |
| 33 | 1 | 37 | 44 | 44 | 5256 | 3.610917913 | 52.58 | 3.96 |
| 34 | 1 | 38 | 40 | 40 | 5296 | 3.63758616 | 52.98 | 4.07 |
| 35 | 1 | 39 | 39 | 39 | 5335 | 3.663561646 | 53.37 | 4.18 |
| 36 | 1 | 40 | 37 | 37 | 5372 | 3.688879454 | 53.74 | 4.28 |
| 37 | 2 | 42 | 35 | 70 | 5442 | 3.737669618 | 54.44 | 4.50 |
| 38 | 2 | 44 | 34 | 68 | 5510 | 3.784189634 | 55.12 | 4.71 |

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Table 5—Distribution of journals

*—Contd*

| Rank | No. of Jour. | Cum. No. of Jour. | No. of Citations | Total No. of Citations | Cum. No. of Citations | Log N | % of Citations | % of Total Journals |
|---|---|---|---|---|---|---|---|---|
| 39 | 3 | 47 | 33 | 99 | 5609 | 3.850147602 | 56.11 | 5.03 |
| 40 | 1 | 48 | 32 | 32 | 5641 | 3.871201011 | 56.43 | 5.14 |
| 41 | 4 | 52 | 31 | 124 | 5765 | 3.951243719 | 57.67 | 5.57 |
| 42 | 5 | 57 | 30 | 150 | 5915 | 4.043051268 | 59.17 | 6.10 |
| 43 | 5 | 62 | 29 | 145 | 6060 | 4.127134385 | 60.62 | 6.64 |
| 44 | 1 | 63 | 28 | 28 | 6088 | 4.143134726 | 60.90 | 6.75 |
| 45 | 4 | 67 | 27 | 108 | 6196 | 4.204692619 | 61.98 | 7.17 |
| 46 | 2 | 69 | 26 | 52 | 6248 | 4.234106505 | 62.50 | 7.39 |
| 47 | 4 | 73 | 25 | 100 | 6348 | 4.290459441 | 63.50 | 7.82 |
| 48 | 4 | 77 | 24 | 96 | 6444 | 4.343805422 | 64.46 | 8.24 |
| 49 | 5 | 82 | 23 | 115 | 6559 | 4.406719247 | 65.61 | 8.78 |
| 50 | 3 | 85 | 22 | 66 | 6625 | 4.442651256 | 66.27 | 9.10 |
| 51 | 3 | 88 | 21 | 63 | 6688 | 4.477336814 | 66.90 | 9.42 |
| 52 | 11 | 99 | 20 | 220 | 6908 | 4.59511985 | 69.10 | 10.60 |
| 53 | 5 | 104 | 19 | 95 | 7003 | 4.644390899 | 70.05 | 11.13 |
| 54 | 4 | 108 | 18 | 72 | 7075 | 4.682131227 | 70.77 | 11.56 |
| 55 | 2 | 110 | 17 | 34 | 7109 | 4.700480366 | 71.11 | 11.78 |
| 56 | 10 | 120 | 16 | 160 | 7269 | 4.787491743 | 72.71 | 12.85 |
| 57 | 5 | 125 | 15 | 75 | 7344 | 4.828313737 | 73.46 | 13.38 |
| 58 | 10 | 135 | 14 | 140 | 7484 | 4.905274778 | 74.86 | 14.45 |
| 59 | 10 | 145 | 13 | 130 | 7614 | 4.976733742 | 76.16 | 15.52 |
| 60 | 12 | 157 | 12 | 144 | 7758 | 5.056245805 | 77.60 | 16.81 |
| 61 | 14 | 171 | 11 | 154 | 7912 | 5.141663557 | 79.14 | 18.31 |
| 62 | 20 | 191 | 10 | 200 | 8112 | 5.252273428 | 81.14 | 20.45 |
| 63 | 12 | 203 | 9 | 108 | 8220 | 5.313205979 | 82.22 | 21.73 |
| 64 | 14 | 217 | 8 | 112 | 8332 | 5.379897354 | 83.35 | 23.23 |
| 65 | 22 | 239 | 7 | 154 | 8486 | 5.476463552 | 84.89 | 25.59 |
| 66 | 23 | 262 | 6 | 138 | 8624 | 5.568344504 | 86.27 | 28.05 |
| 67 | 37 | 299 | 5 | 185 | 8809 | 5.700443573 | 88.12 | 32.01 |
| 68 | 84 | 383 | 4 | 336 | 9145 | 5.948034989 | 91.48 | 41.01 |
| 69 | 90 | 473 | 3 | 270 | 9415 | 6.159095388 | 94.18 | 50.64 |
| 70 | 121 | 594 | 2 | 242 | 9657 | 6.386879319 | 96.60 | 63.60 |
| 71 | 340 | 934 | 1 | 340 | 9997 | 6.839476438 | 100.00 | 100.00 |

$$r_0 = \frac{934 \times 14.944}{\left(15.944^3 - 1\right)}$$

$$r_0 = \frac{13957.696}{4052.142} = 3.44$$

Different Bradford zone can be obtained using the value of K and $r_0$

Nucleus zone $r_0 = r_0 \times 1 = 3.4446$

First zone $r_1 = r_0 \times k = 3.44 \times 15.944 = 54.911$

Table 6—Bradford's group and their number of journals

| Zones | No. of Journals | No. of Citations | *k* |
|---|---|---|---|
| Core Zone | 04 | 2757 | --- |
| Zone 1 | 55 | 3098 | 15.934 |
| Zone 2 | 875 | 4142 | 15.925 |

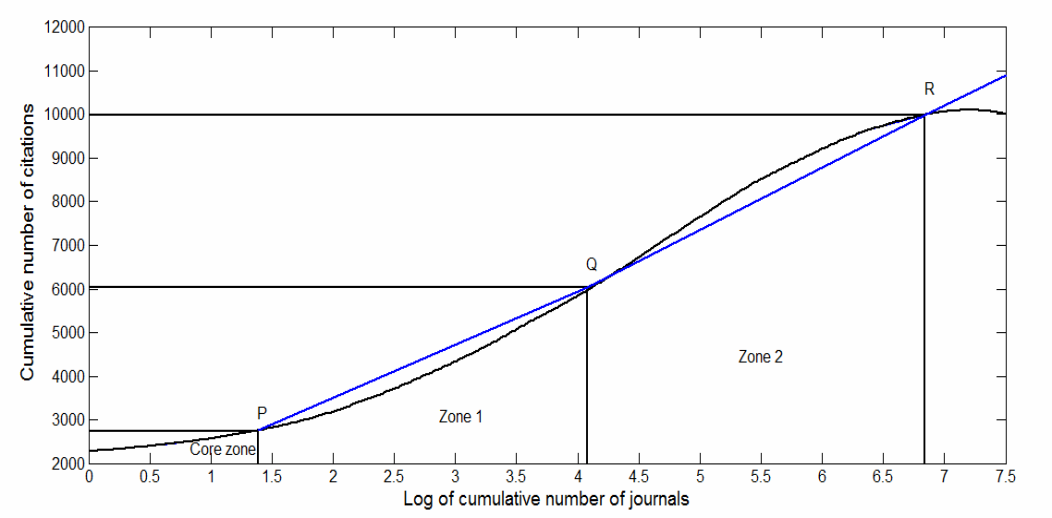


Fig. 1-Bradford's graph

Second zone

$$r_2 = r_0 \times k^2 = 9.611 \times 15.944^2 = 874.486$$

This theoretical distribution of Bradford's law makes it possible to test the exact fit of Bradford's law to the data in the present study. Using this distribution, the number of citations can be drawn, as shown in the Table 6.

Using the exact number of journals from Table 6 the Bradford's constant *k* is 15.93 and 15.92 for Zone 1 and Zone 2 respectively. That is same to the value of *k* calculated from the formula $k = (e \times Y_m)^{1/p}$. This shows that in the present study collected data is fit for three zones of Bradford's distribution. In other words, it is 1: *k*: $k^2$which is a proof of Bradford's law.

Further as per the Bradford's law, graph is plotted of the cumulative number of citations with the log of cumulative number of journals. It can be seen clearly from the Fig. 1 that very less numbers of journals are cited highly and maximum numbers of journals are cited very less.

## Conclusion

The application of Bradford's law of scattering helps in deriving the list of core journals in a given field. Now in a situation, where information is exponentially growing in the form of books, journals and other documents, cost is also increasing accordingly especially of foreign publications and limited budget of a library does not allowed a librarian to purchase all kind of documents. For this bibliometric methods are playing a crucial role, in which Bradford's law of scattering is one through which a list of core journals can be prepared according to that librarian will select those journals which are found to be greater importance or core journals by applying the Bradford's law on the data. Bradford's law of scattering found to be fit to the present data of study. Hence, the present study, which is based on the journal citations of Ph.D. theses in social sciences submitted to Delhi University, will definitely help the librarian to select the core journals in social sciences by using the list of core journals prepared by the authors by applied Bradford's law of scattering.

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