CITATION ANALYSIS OF ECONOMICS PH.D. THESES OF DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY AURANGABAD: A SCIENTOMETRIC STUDY

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The main purpose of this paper is to analyze the citations of Economics Ph.D. theses of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad for the applicability of Bradford's Law of Scattering and Leimkuhler model. The data has been taken from Citations of Ph.D. theses of Economics subject from 1967 to 2017. During the period of the study a total of 30,611 citations were received from 319 Ph.D. theses. Out of 30611 citations 7750 citations are Journal citations. A ranked list of journals has been prepared and it is found that 'Economic and Political Weekly' was the most productive journal which has published 1076(13.88%) total articles. Accordingly the relationship between the zones, the data does not fit Bradford's law of scattering mathematically but verbally it fits into it. The Leimkuhler model is tested and found that the data does not fits in the present data set for Bradford multiplier k=12.42.

Keywords: Bradford's Law, Leimkuhler model, Citation, Economics, Ph.D. theses, Scientometric.

INTRODUCTION

Scientometrics is the branch of science of science. Scientometric methods include statistical and thesaurus methods, and indicators as to the number of citation, terms etc. It involves quantitative studies of scientific activity, including among others' publication and so overlaps bibliometrics to some extent. Scientometric studies help to analyze various aspects of journal articles or citations such as; degree of collaboration, average author per paper, productivity per paper, year wise productivity, authorship pattern, relative growth rate of publication, etc. (Kothari and Gage, 2016).

Citation analysis is a very effective technique for analyzing the library records to decide the actual need of the document. Citation analysis helps to evaluate and interpret citations received in articles, or research document by the authors. This method entails the analysis of the bibliographical

references that is usually appended in every research document (Kumar et al., 2013).

CITATION ANALYSIS

Paul and Roy (1983) defined citation analysis as, "Citation is one branch of bibliometrics where the unit of analysis is a document that is being cited as a bibliographic reference or as a footnote in a citing document". Martyn (1976) has rightly defined citation analysis as, "The analysis of citations or references or both which form part of the scholarly apparatus of primary communications. The technique is used for putting items of references in some kind of rank or order, whether they are journals of authors cited".

REVIEW OF LITERATURE

Chaturbhuj and Batcha (2020) studied Application of Bradford's law of scattering and leimkuhler model on fluid mechanics literature published during 2001-2019. The author used different parameters including domestic collaborative index, international collaborative index, bradford's law of scattering, year wise distribution, country wise distribution, ranking of authors, most preferred journals by authors, and application of Egghe's Leimkuhler model etc. Bradford's law of scattering applied on cited journals and each zone covers one third of articles. In the study, Leimkuhler model was employed for verification of Bradford's law. Borthakur (2020) studied citation analysis of theses and dissertations in chemistry submitted to the central library, Dibrugarh University, Assam (2015-2019). For the study 21 theses and 07

dissertations of chemistry were chosen as a sample from 2015-2019 in which 5145 citations were appended. The result revealed that, the collaborative research is prevailing in the field of chemistry. It is also found that journal contributes the highest number of citations, etc. Deka and Das (2020) has done a Citation Analysis of Doctoral Theses submitted to the Department of Library and Information Science, Gauhati University (2011-2017). The author analyzed 3684 citations retrieved from 30 theses. The author found that journals are the most preferable source material. *DESIDOC Journal of Library and Information Technology* was on top rank with 72 citations. The half-life of literature is found approximately as 12 years etc.

Gadhvi et al. (2020) evaluated Citation Patterns followed in Research Papers of the *DESIDOC Journal of Library & Information Technology*. A total of 6914 citations appeared in 399 papers published in DESIDOC Journal of Library & Information Technology from 2012 to 2018. The authors analysed volume wise analyses of citations per article, authorship patterns, forms of literature, chronological analysis of citations and a ranked list of top 25 cited library science journals in the paper. The study found that the highest (51.59%) number of citations were single authored, 6.72% citations were from books and 55.07% citations were from journals. Gupta B. M. was the most cited author of *DESIDOC Journal of Library & Information Technology* during the period of the study. Amsaveni (2016) conducted a study on the assessment of Bradford Law's of Scattering to Neural Network Literature through Bibliometric Study. The author used the

Bradford law of Scattering, for verification of Bradford's Law he used leimkuhler model. Sudhier (2010) in his study used the Bradford's law of scattering to the citation of doctoral theses of physics literature. In the study Leimkuhler model has used for testing the applicability of Bradford's law of scattering in given subject. Wardikar and Choukande (2013) conducted a study on citations of Doctoral Theses literature of Library & Information Science with the application of Bradford's law of scattering and Leimkuhler model.

Wagh et al. (2018) analyzed the citations of doctoral theses of home science literature. The study reveals that the Bradford's Law of scattering fits to the study and the applicability of Leimkuhler model also tested in the study. Paliwal (2016) analyzed 3827 citations of 177 research papers of Annals of Library and Information Studies journal during 2009 to 2013. The Bradford's law as well as the Leimkuhler model both were used in the study. The analysis of the study found that both the laws were valid for the data set. But, in the present study Bradford's law of scattering does not fits in the present data set. Zavery (2013) studies on Citation pattern in Ph.D. Theses in Library and Information Science at S.N.D.T. Women's University, Mumbai during 1996-2012. A total of 1789 citations were identified during the period of the study. The finding of the study reveals that there were 17 types of documents cited by the scholars. Journal articles were the most preferred sources of citations, single authored articles were cited the most. The researchers have cited more foreign publications as compared to Indian resources, etc.

OBJECTIVES OF THE STUDY

The main objectives of the study are to:

1. find out the types (form wise) of cited documents.

2. prepare a rank list of most cited journal by the Economics researchers of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.

3. identify the core journals in Economics subject of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.

4. test the appropriateness of verbal and graphical formulation of Bradford's law of scattering.

METHODOLOGY

Economics is one of the oldest departments in Social Science faculty of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad established in 1958. After the establishment of department the first Ph.D. was awarded in 1967. Citation analysis studies of Ph.D. theses help to find out the most cited or usable document in the subject. The present study citation analysis of Ph.D. theses of economics subject help researchers to select highly cited documents for their research as well as it helps to librarian for collection development.

A total of 30,611 citations of 319 Ph.D. theses of Economics Subject of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad during 1967 to 2017 were selected as a source of data. Out of 30,611 citations 7750 citations are journal citations. These 7750 journals have been analyzed to test the Bradford laws to see the patterns of publication in these journals. As per the objective of the study the citations were

analyzed and presented in the form of tables and figures. MS-Excel was used for data entry.

Year wise Distribution of the theses

During 1967-2017 a total of 319 theses were accepted by Dr. Babasaheb Ambedkar Marathwada University, Aurangabad in Economics. It is observed form the table 1 that the researchers of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad submitted 319 theses in Economics from 1967 to 2017, and all 319 (100%) of the theses were available for the study, It can also observed that, the majority of the theses were submitted in the year 2011 that is 30.

Table 1: Theses in Economics

Sl. No.	Year	Theses Available	Sl. No.	Year	Theses Available
1	1967	1	21	1998	3
2	1972	1	22	1999	12
3	1976	1	23	2000	6
4	1977	1	24	2001	2
5	1980	2	25	2002	15
6	1981	1	26	2003	3
7	1982	1	27	2004	8
8	1984	2	28	2005	9
9	1985	5	29	2006	11
10	1987	3	30	2007	8
11	1988	1	31	2008	14
12	1989	5	32	2009	24
13	1990	6	33	2010	19
14	1991	3	34	2011	30
15	1992	7	35	2012	18
16	1993	9	36	2013	18
17	1994	1	37	2014	9
18	1995	4	38	2015	27
19	1996	3	39	2016	20
20	1997	4	40	2017	2
Total					**319**

Form wise distribution of cited literature

The distribution of cited literature among different forms in Economics is presented in table 2. A total number of 30,611 citations of 319 Ph.D. theses are distributed in different sources as shown in table 2. It is observed from the table 2 that, the frequency distribution of different forms of literature used by researchers in Economics. It was found that the Books contributed the maximum number of citations, accounted 13237 (43.24%) of the total citations. This indicates that Books are the most preferred form of literature used by the researchers in Economics. Journals are the second most cited form of literature accounted 7750 (25.32%) of the total citations, followed by Reports with 5593 (18.27%) citations and etc.

Table 2: Form wise distribution of cited literature in Economics

Sl. No.	Name of Document	Total Citation	Percentage
1	Books	13237	43.24
2	Journals	7750	25.32
3	Reports	5593	18.27
4	Website	1156	3.78
5	Thesis	889	2.90
6	News Paper	845	2.76
7	Conference	487	1.59
8	Encyclopedia	131	0.43
9	Gazetteer	98	0.32
10	Hand Book	82	0.27
11	Act.	60	0.20
12	Year Book	54	0.18
13	Digest	40	0.13
14	Manual	20	0.07
15	Directory	17	0.06
16	Workshop	13	0.04
17	Monograph	11	0.04
18	Dictionary	11	0.04
19	News Latter	7	0.02
20	Others	110	0.36
Total		**30611**	**100.00**

Ranking of Journals

Out of 30,611 citations of 319 Ph.D. theses 7750 citations are Journal citations. The ranking of journals is shown in the table 3.

There are total 2093 journals which are cited by the researchers in Economics during the period of the study. The journal of *Economic and Political Weekly* is cited by the maximum number of researchers in Economics with 1076 (13.88%) total citations, *Indian Journal of Agricultural Economics* comes to next in citation by the researchers with 789 (10.18%) citations, followed by *Yojana* with 287 (3.70%) citations, *Agriculture Situation in India* with 216 (2.79%) citations, *Kurukshetra* with 163 (2.10%) citations respectively.

Bradford's Law of Scattering

In the present set of data the numbers of journals have been arranged in order of decreasing productivity of articles. They were divided in a nucleus of 3 equal zones. Numbers of articles in each zone were more or less equal.

The total numbers of journal articles were grouped into 3 equal zones producing similar number of articles, i.e. 2583 articles in each zone. It was observed that, 6 core journals grouped in zone 1 published 2583 articles accounting for one third of the total output. Similarly, the second zone

Table 3: Ranking of Journals in Economics

Sl. No.	Name of Journal	Total Citations	Percentage (%)
1	Economic and Political Weekly	1076	13.88
2	Indian Journal of Agricultural Economics	789	10.18
3	Yojana	287	3.70
4	Agriculture Situation in India	216	2.79
5	Kurukshetra	163	2.10
6	Indian Co-operative Review	153	1.97
7	Lokrajya	150	1.94
8	Arthsanvad	158	2.04
9	Southern Economist	108	1.39
10	The Maharashtra Co-operative Quarterly	101	1.30
11	Agricultural Marketing	97	1.25
12	Urban Ink magazine	64	0.83
13	Shetkari Masik	58	0.75
14	Maharashtra sinchan vikas	56	0.72
15	The Indian Journal of Labour Economics	51	0.66
16	Minority Commerce Weekly	50	0.65
17	Arthbodha Patrika	49	0.63
18	Indian Dairyman	45	0.58
19	RBI Bulletine	44	0.57
20	Social Welfare Journal	43	0.55
21	Khadi Gramodyog the journal of Rural Economy	42	0.54
22	Artha Vijnana	41	0.53
23	The Co-operator	40	0.52
24	Journal of Maharashtra Agricultural Universities	40	0.52
25	Samaj Prabodhan Patrika	39	0.50
26	American Economic Review	39	0.50
27	Co-operative perspective	36	0.46
28	Baliraja Masik	35	0.45
29	Journal of Rural Development	31	0.40
30	Indian Economic Journal	30	0.39
Truncated….			

comprises of 119 journals with 2583 articles and 1968 journals with 2584 articles grouped in third zone. Accordingly, the relationship in the zone will be 6: 119: 1968. Even though data does not fit Bradford's law of scattering mathematically but verbally it fits into it. The 6 journals coming under first zone are core journals.

Table 4: Bradford's Law of Scattering in Economics

Zone	No. of Articles	No. of Journal
I	2583	6
II	2583	119
III	2584	1968
Total	**7750**	**2093**

The Bradford's algebraic interpretation of the law is 1: n: n². The connection of each zone in this study is 6: 119: 1968. Here, 6 is the number of journals in the nucleus zone and mean Bradford's multiplier is the 19.83.

Hence,
1x6: 6x19.83: 6x(19.83)² x0.83
6: 118.98: 1958.28> 2083.26

Percentage of Error = $\frac{2083.26-2093}{2093} \times 100$

$= -9.74/2093 = -0.0046536073$

$= -0.0046536073 \times 100$

$= \mathbf{-0.46}$

Here the percentage of error is negligible. It is also observed that the number of journals contributing citations to each zone increases by a multiplier of 19.83. So it can be said that the distribution in the present study follows Bradford's law, for more confirmation of this law we can apply one more law i.e. Leimkuhler model.

Application of Leimkuhler model

In the present study, Bradford's law as well as Leimkuhler models both are tested to verity the scattering of literature in Economics. The Leimkuhler model helps to test whether the Bradford's law fits or not fits in the present data set as well as its helps to identify the core journals which is highly used by the researchers in the economics subject of Dr. BAMU, Aurangabad. Leimkuhler has developed a model based on Bradford's verbal formulation as shown below:

For application of Bradford's law, the citation distribution was divided in three equal zones (p). Bradford assumes that there should be minimum three equal zones, here also 'p' is to be 3. Then by using the mathematical formula for calculating the Bradford's multiplier 'k' as; (Wagh, et al., 2018; Paliwal, 2016; Amsaveni, 2016).

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

Where $e^y = 1.781$

P is Bradford number of zones = 3

Y_m is the number of citation of rank first journal

$= 1076$

$k = (1.781 \times 1076)^{1/3} = (1916.356)^{1/3}$

$\mathbf{k = 12.42}$

$y_o = A/P$

Where y_o = No. of citation/articles in each zone.

A = No. of citation/articles

$y_o = 7750/3 = \mathbf{2583.33}$

The nucleus zone r_o can be defined as:

$r_o = T(k-1)/(k^p-1)$

$r_o = 2093(12.42-1)/(12.42^3-1)$

$= 2093(12.42-1)/(1915.86-1)$

$= 2093 \times (11.42)/(1914.86)$

$= 23902.06/1914.86$

$\mathbf{r_o = 12.48}$

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

Nucleus zone = r_o = r_ox1 = 12.48x1 = **12.48**

First zone = r_1 = $r_o$xk = 12.48x12.42 = **155.0016**

Second zone = r_2 = $r_o$xk^2 = 12.48x(12.42)^2

$$= \textbf{1925.12}$$

Table 5: Using Leimkuhler Model, Bradford's Zone and Number of Journals

Zone	No. of Articles	No. of Journal
I	2583	6
II	2583	119
III	2584	1968
Total	**7750**	**2093**

Hence,

1: k: k^2 = 12.48: 12.48x12.42: 12.48x (12.42)^2

$$= 12.48: 155.0016: 1925.12 = \textbf{2092.60}$$

Percentage of error = 2092.60-2093/2093x100

$$= \textbf{-0.019}$$

Hence, it can be noted from the above calculations that the nucleus zone is having 12.48, the first zone is having 155.0016 and the last zone is having 1925.12. i.e., from the table 3 one can find it as 6, 119 and 1968 respectively. Therefore, the Bradford's law of scattering does not fits in the present data set for Bradford multiplier k=12.42.

CONCLUSION

Bradford's law of scattering helps to find out the most cited journal in the respected subject. The present study attempted to apply the Bradford's law of scattering to the citation of economics Ph.D. theses from 1967 to 2017. During the period of the study a total of 30,611 citations retrieved, out of these 30,611 citations 7750 citations are journal citations. In economics subject of Dr. BAMU, *Economic and Political Weekly* was the most cited journal by researchers. 6 core journals grouped in 1 zone, published 2583 articles accounting for one third of the total output. The journal distribution pattern of citation of economics Ph.D. theses data does not fit Bradford's law of scattering mathematically but verbally it fits into it. In the study, Leimkuhler model is applied to verify the Bradfrod's law of scattering. It is found that the percentage of error is very negligible but according to the Bradford's zone and Leimkuhler calculation Bradford's law of scattering does not fits in the present data set for Bradford multiplier k=12.42.

Citation analysis is one of the best methods to list the most used resources by the users. The present study helps researchers to carry out research in similar fields as well as it will help Dr. BAMU Library to plan for effective collection development in Economics Subject. The study show that six journals coming in the first zone that is core zone, this six journals mostly used by the researchers in their research. It helps to select and subscribe the high cited journals in the economics subject.

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