

## APPLICABILITY OF BRADFORD'S LAW ON ANTHROPOLOGICAL JOURNALS

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Anthropology is the study of Human being. The present bibliometric study has been conducted on the Ph.D. theses of Anthropology awarded by the Vidyasagar University during the period 1989-2015. Total number of theses is 22 and total number of citations is 3012. The researchers have cited different types of documents like journals, conference proceedings, books, reports, etc. The study has been carried out on the 1911 citations, found in the Anthropology journals. It has been found that Bradford's Law of productivity is not applicable on the present collected data. After applying Leimkuhler Model on Bradford's data, the error has been reduced. *Annals of Human Biology* is the most popular journal in Anthropology. Most of the journals which are cited by the researchers of anthropology are in English language and have been published in USA. Elsevier is the most prominent publisher in the field of Anthropology. In anthropology most of the researches are conducted on Physical and Cultural Anthropology. Research conducted in Vidyasagar University on other sub disciplines like Prehistory, Linguistics are negligible.

**Keyword:** Bibliometrics; Bradford's Law; Leimkuhler Model; Anthropology

### INTRODUCTION

Bibliometrics is commonly defined as statistical analysis of written publications, such as books or articles. Bibliometric methods are frequently used in the field of Library and Information Science. For instance, bibliometric techniques are used to provide quantitative analysis of academic literature. Citation analysis and content analysis are generally used as bibliometric methods. Many researchers use bibliometric methods for various purposes, e.g. to explore the productivity in relation to institutions, scientists, countries, languages or forms of publications etc. The term bibliometrics was coined by Alan Pritchard in a paper published in 1969, titled *Statistical Bibliography*. He defined the term as "the application of mathematics and statistical methods to books and other media of communication". Although citation analysis is not new, for Science Citation Index began its publication in 1961. However, before computers were used for calculations and analysis, it used to be done manually and hence was time-consuming. Automated algorithms are making it much more useful, versatile, and widespread. This led to the creation of the new field of computational bibliometrics. The first such algorithm for automated citation extraction and indexing was conducted by Cite Seer. Google's Page Rank is based on the principle of citation analysis. Patent citation maps are also based upon citation analysis.

Anthropology is the study of what makes us human. Anthropologists take a broad approach to understand many different aspects of the human experience, which we call as holism. They consider the past, through archaeology, to see how human groups lived hundreds or thousands of years ago and what was important to

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them. The Vidyasagar University was founded by the promulgation of an Act, called Vidyasagar University Act, 1981.

The SCImago Journal & Country Rank is a publicly available portal that includes the journals and country scientific indicators developed from the information contained in the Scopus database (Elsevier B.V.). These indicators can be used to assess and analyze scientific domains. Journals can be compared or analysed separately. Country rankings may also be compared or analysed separately. Journals can be grouped by subject area (27 major thematic areas), subject category (313 specific subject categories) or by country. Citation data is drawn from over 21,500 titles from more than 5,000 international publishers and country performance metrics from 239 countries worldwide. The SJCR allows you also to embed significant journal metrics into your web as a clickable image widget. This platform takes its name from the SCImago Journal Rank (SJR) indicator (PDF), developed by SCImago from the widely known algorithm Google PageRank™. This indicator shows the visibility of the journals contained in the Scopus® database since 1996.

### OBJECTIVES

- To study whether Bradford's Law is applicable in the field of anthropology.
- To show whether Leimkuhler model is applicable in the field of anthropology.
- To identify core journals in the field of anthropology
- To show country wise distribution of cited journals
- To find out language coverage of cited journals.
- To show publisher wise distribution of journals
- To find out subject coverage of cited journals.

### SCOPE AND METHODOLOGY

The present study based on the citations cited in the theses, awarded by the department of anthropology of Vidyasagar University during the period of 1989 to 2015. Total 22 theses have been awarded since 2015 carrying 3012 citations. For the present study, journal citations numbering 1911,

have been extracted. The citations have come from 483 journals only. These 483 journals and its 1911 citations are plotted into an excel sheet and arranged according to the requirements of the present study. Detail Information about each journal has been taken from The SCImago Journal & Country Rank.

### REVIEW OF RELATED LITERATURE

Similar studies have been conducted by different scientists. Gupta [1] found that out of 610 authors 320 authors (52.2) contributed only one paper each. Each of the remaining 290 authors have produced more than one paper, probably in more than one research area.

Arvinda and Reddy [2] have shown that journal articles of Archaeological Anthropology were scattered in 82 periodicals. However most of the research (51.82%) is published in seven periodicals. *The American Antiquity* gets first rank for publishing most of the research work.

Sharada and Sharma [3] analysed that even among articles published in one of the 'Indian Languages', Indian authors give lesser number of citations as compared to foreign authors. The variability as represented by the standard deviation is less for 'Indian Linguistic' than for 'Language' for both 'Sociolinguistics' and 'Grammar' indicating that 'Indian Linguistic' is constant in giving limited number of citations as compared to 'language'. Mahapatra [4] in her study noticed that highly cited books belonged to different authors of foreign countries. This indicates that perhaps other than Ranganathan books published by other Indian authors are not so well recognized among the fellow workers.

Schneider and Borlund [5] has done a theoretical study on the application of bibliometric techniques in the preparation of a thesaurus. They concluded that methods of bibliometrics are not completely automatic methods of thesaurus construction, they rather show a semi-automatic approach.

Gumpenberger, Wieland and Gorraiz [6] tried to understand the bibliometric practices, followed in the University of Vienna at the Department of Bibliometrics. They said that bibliometrics is an important tool for the decision making regarding collection development for any librarian/administrator in any institution.

**DATA ANALYSIS AND REPRESENTATION****Table 1: Application of Bradford's Law in Anthropology**

Rank	NJ	NCJ	NC	TNC	NCC	LOG(n)	PC	PCNJ
1	1	1	95	95	95	0	4.97	0.21
2	1	2	73	73	168	0.3	3.82	0.41
3	1	3	68	68	236	0.47	3.56	0.62
4	1	4	57	57	293	0.6	2.98	0.83
5	1	5	55	55	348	0.69	2.88	1.04
6	1	6	46	46	394	0.77	2.41	1.24
7	1	7	39	39	433	0.84	2.04	1.45
8	1	8	38	38	471	0.9	1.99	1.66
9	1	9	36	36	507	0.95	1.88	1.86
10	1	10	33	33	540	1	1.73	2.07
11	1	11	29	29	569	1.04	1.52	2.28
12	1	12	28	28	597	1.07	1.47	2.48
13	1	13	27	27	624	1.11	1.41	2.69
14	1	14	26	26	650	1.14	1.36	2.90
15	1	15	21	21	671	1.17	1.10	3.11
16	2	17	19	38	709	1.23	0.99	3.52
17	2	19	17	34	743	1.27	0.89	3.93
18	1	20	16	16	759	1.3	0.84	4.14
19	2	22	15	30	789	1.34	0.78	4.55
20	2	24	14	28	817	1.38	0.73	4.97
21	4	28	13	52	869	1.44	0.68	5.80
22	2	30	12	24	893	1.47	0.63	6.21
23	3	33	11	33	926	1.51	0.58	6.83
24	6	39	10	60	986	1.59	0.52	8.07
25	3	42	9	27	1013	1.62	0.47	8.70
26	9	51	8	72	1085	1.7	0.42	10.56
27	6	57	7	42	1127	1.75	0.37	11.80
28	13	70	6	78	1205	1.84	0.31	14.49
29	7	77	5	35	1240	1.88	0.26	15.94
30	24	101	4	96	1336	2	0.21	20.91
31	39	140	3	117	1453	2.33	0.16	28.99
32	115	255	2	230	1683	2.4	0.10	52.80
33	228	483	1	228	1911	2.68	0.05	100.00
<b>Total</b>	<b>483</b>			<b>1911</b>	<b>1911</b>		<b>0.00</b>	<b>100.00</b>

*NJ* = Number of journals, *NCJ* = Cumulative number of journal, *NC* = number of citation, *TNC* = total number of citation, *NCC* = cumulative number of citation, *LOG (N)* = log of cumulative number of journals, *PC* = percentage of citation, *PCNJ* = percentage of cumulative number of journal.

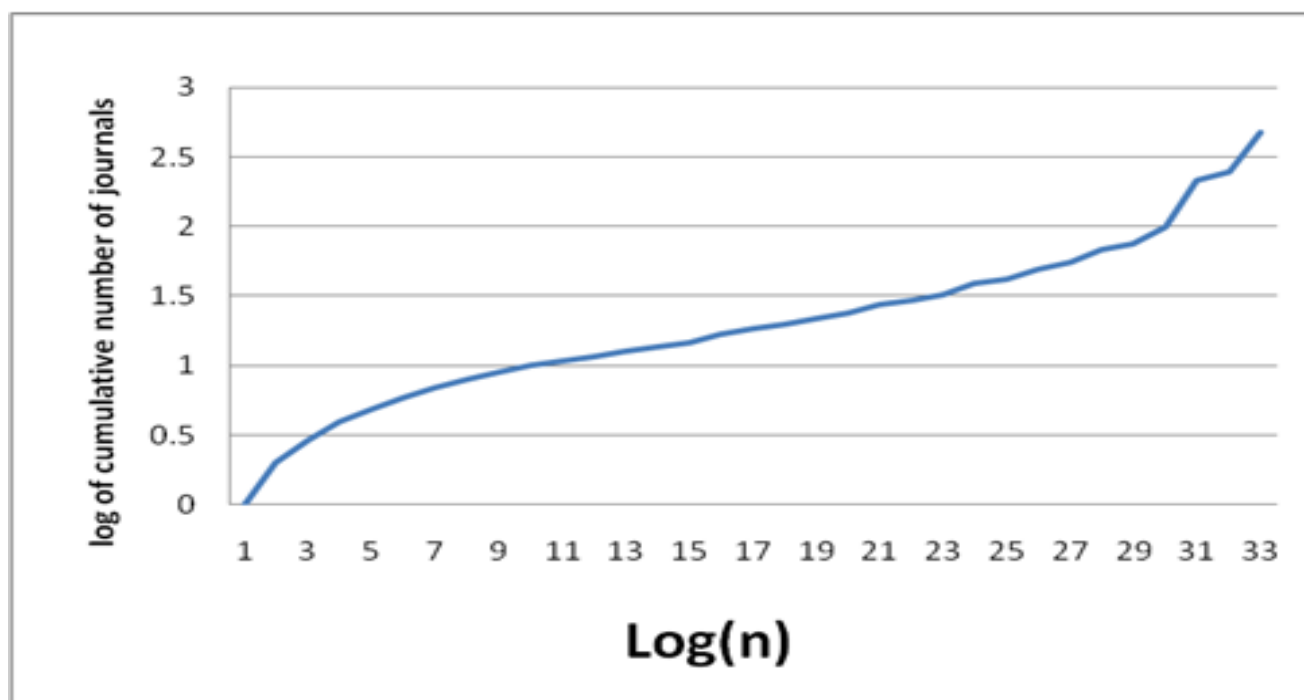


Figure 1: Log of cumulative number of journals

Table 2: Bradford's zone

Bradford's Zone	No. of Journals	% of Journals	No of Journal Citations	% of Citations	Bradford's Multiplier(K)
1	13	2.69	624	32.65	
2	64	13.25	616	32.23	4.92
3	406	84.05	671	35.11	6.34
<b>Total</b>	<b>483</b>	<b>100</b>	<b>1911</b>	<b>100</b>	

In present study, in zone 1, 13 journals covered 624 articles, whereas in zone 2, 64 journals covered 616 articles and in zone 3, 406 journals covered 671 articles. Each zone thus covers one-third of the total articles. According to Bradford's Law of journal productivity in each zone there is a geometric series in the form of: -

$$1: n: n^2.$$

In the present study  $13:64:406 = 13:13 \times 4.92:13 \times 4.92^2$

Where  $n = 4.92$

$$= 13 + 63.96 + 314.68 = 391.68$$

Here

Now the mean value of Bradford's multiplier is 8.09

Therefore  $13:13 \times 8.09:13 \times 8.09^2$

$$= 968.99$$

$$\text{Percentage of error} = (969 - 483) \times 100 / 483 = 100.62$$

#### Applicability of Leimkuhler Model:

In 1967 Leimkuhler, in 1968 Brookes and in 1990 Egghe did experiment on Bradford's law.

Method of Egghe is based on equation of Leimkuhler:

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

$R(r)$  = cumulative number of articles contributed by journals of rank 1, 2, 3, ..... r

$r_0$  = journals in Bradford's first zone

$y_0$  = articles in each Bradford zone

$k$  = multiplier of Bradford

$y_m$  = amount of articles in the mostly cited journal (rank 1)

$a$  and  $b$  = constant, appears in Leimkuhler's formula

$p$  = Bradford's group number

for the explanation of Leimkuhler's law, Egghe said that  $a = y_0/\log k$ , and  $b = k-1/r_0$

Egghe gave a formula to identify the Bradford multiplier  $k$  as

$K = (e^g \cdot y_m)^{1/p}$ , Where  $g$  is Euler's number ( $e^g = 1.781$ );

$Y_0 = y_m^2 \log k$  and  $r_0 = (k-1)y_m$

Group's number  $p$ , a factor have chosen freely, calculation of  $K$  is done by the formula

$K = (1.781 \cdot y_m)^{1/p}$ .

and  $y_0 = A/p$ , where,  $a$  indicated the total amount of articles

$r_0 = T(k-1)/(k^p - 1)$ , where  $T$  indicates total amount of journals.

$A$  and  $T$  can take from the data set  $r_0$  and  $y_0$  will calculate when  $p$  will calculate from the formula

$K = (1.781 \cdot y_m)^{1/p}$

To calculate  $r_1, r_2, r_3, \dots$  one uses the accurate value for  $r_0$  and, with rounding off,

That of  $k$

$r_0 \times 1 = r_0$ ;  $r_0 \times k = r_1$ ;  $r_0 \times k^2 = r_2$ ;  $r_0 \times k^3 = r_3$

By applying the above mentioned formula the values of each variable have been calculated below

$K = (1.781 \cdot y_m)^{1/p} = (1.781 \cdot 95)^{1/3} = (169.195)^{1/3} = 5.52$

$y_0 = 1911/3 = 637$

$r_0 = T(k-1)/(k^p - 1)$

$= 483(5.52-1)/(5.52^3 - 1) = 13.05 = 20$

$a = y_0/\log k = 637/\log 5.52 = 858$ , and

$b = k-1/r_0 = 5.52-1/20 = 5.54$

The findings of the calculations have been shown in the table. It shows that the several journals in the nucleus is 13 and 5.52 is the mean value of the Bradford multiplier.

**Table 3: Bradford's Zones**

Zones	No of Journals	% of Journals	No. of Citations	% of Citations	K
1	13	4.13	624	37.36	....
2	71.76	22.83	482	20.51	5.52
3	396	873.02	805	42.12	
<b>Total</b>	<b>480.76</b>	<b>100</b>	<b>1911</b>	<b>100</b>	

From the above table it is found that  $13:13 \cdot 5.52:13 \cdot 5.52^2 = 480.76 > 483$

Then percentage of error =  $(483-480) \cdot 100/480 = 0.625$

The error is negligible. So we can say that the Bradford's law of journals' productivity is hereby proved. But in the three zones, the number of journals are not increasing geometrically as stated by Bradford's law.

**Table 4: Top 20 Journals Cited by the Researchers of Anthropology**

S. No	Rank of Journals	Name of the Journals	Frequency	Country	Publisher	Citation	% of Citation
1	1	Annals of Human Biology	Quarterly	England	Tylor And Francis	95	4.97
2	2	Indian Paediatrics	Monthly	India	Indian Academy of Pediatrics	73	3.82
3	3	Man in India	Quarterly	India	Serials Publication	68	3.56
4	4	European Journal of Clinical Nutrition	Monthly	Germany	Nature Publishing Group	57	2.98
5	5	American Journal of Clinical Nutrition	Monthly	USA	American Society for Nutrition	55	2.88
6	6	American Journal of Physical Anthropology	Monthly	USA	American Physiological Society	46	2.41
7	7	Human Biology	Monthly	USA	Wayne State University Press	39	2.04
8	8	Anthropologist	Monthly	India	Kamla-Raj Enterprises	38	1.99
9	9	Eastern Anthropologist	Quarterly	India	Ethnographic and Folk Culture Society	36	1.88
10	10	Journal of Indian Anthropological Society	Quarterly	India	Indian Anthropological Society	33	1.73
11	11	Anthropologischer Anzeiger	Quarterly	Germany	Schweizerbart Science Publishers	29	1.52
12	12	Annual Human Genetics	Bimonthly	USA	Wiley Online Library	28	1.47
13	13	Lancet	Weekly	USA	Elsevier	27	1.41
14	14	zeitschrift für morphologie und anthropologie	Quarterly	Germany	E.Schweizerbart'sche Verlagsbuchhandlung	26	1.36
15	15	International Journal of Obesity Related Metabolic Disorder	Monthly	England	International Association for the Study of Obesity.	21	1.10
16	16	Bulletin of Anthropological Survey Of India	Monthly	India	Anthropological Survey of India	19	0.99
17	17	Economic and Political Weekly	Weekly	India	Sameeksha Trust	19	0.99
18	18	British Medical Journal	Weekly	United Kingdom	British Medical Association	17	0.89
19	18	Paediatrics	Monthly	USA	American Academy of Pediatrics	17	0.89
20	19	Journal of Bio Social Science	Monthly	USA	Cambridge core	16	0.84
21	20	American Journal of Human Genetics	Monthly	USA	Elsevier	15	0.78
22	20	Nature	Weekly	United Kingdom	Nature Publishing Group	15	0.78
		<b>Total Journal 483</b>				<b>Total Citation 1911</b>	



Table 4 shows that among all the journals of Anthropology, Annals of Human Biology, a Physical Anthropology journal, has been cited maximum times i.e. 95 times, which is 4.97% of total citation. Next Indian Paediatrics has been cited 73 times i.e. 3.82 % of total citations. Third most popular journal is Man in India cited 68 times, forming 3.56 % of total citations. In this way European Journal of Clinical Nutrition was cited 57 times (2.89%), followed by American Journal of Clinical Nutrition, 55 times (2.88%); American Journal of Physical Anthropology 46 times (2.41); Human Biology 39 times (2.04%) etc.

**Table 5: Country Wise Distribution of Cited Journals**

S. No	Name of the Country	Number of Journals Cited	%
1	USA	167	34.58
2	India	105	21.74
3	Unite kingdom	78	16.15
4	Japan	18	3.73
5	England	16	3.31
7	Switzerland	13	2.69
6	Germany	11	2.28
8	China	9	1.86
9	Italy	6	1.24
10	Netherland	6	1.24
11	Australia	5	1.04
12	Argentina	3	0.62
13	Bangladesh	3	0.62
14	France	3	0.62
15	Ireland	3	0.62
16	Malaysia	3	0.62
17	Nigeria	3	0.62
19	Croatia	2	0.41
20	Pakistan	2	0.41
21	Poland	2	0.41
22	South Korea	2	0.41
23	Turkey	2	0.41
24	Africa	1	0.21
25	Basel	1	0.21
26	Edinburgh	1	0.21
27	Egypt	1	0.21
28	Netherland	1	0.21
29	Greece	1	0.21
30	Iran	1	0.21
31	Kuwait	1	0.21

32	Mexico	1	0.21
33	Nepal	1	0.21
34	Paris	1	0.21
35	Peru	1	0.21
36	Rome	1	0.21
37	Siberia	1	0.21
38	Singapore	1	0.21
39	Slovakia	1	0.21
40	Saudi Arab	1	0.21
41	South Africa	1	0.21
42	Spain	1	0.21
43	Thailand	1	0.21

Table 5 shows that 167 journals from United States of America, that is 34.58% of total citation, have been cited by the researchers of Vidyasagar University. This is followed by 105 journals from India, forming 21.74% of total citation, 78 journals (16.15%) from United Kingdom etc.

**Table 6: Language Wise Distribution of Cited Journals**

S. No	Language	Number of Journals	%
1	English	463	95.86
2	Japanese	5	1.04
3	Germany	3	0.62
4	Spanish	3	0.62
5	Hindi	2	0.41
6	Multi Lingual	2	0.41
7	Chinese	1	0.21
8	English and French	1	0.21
9	English and Japanese	1	0.21
10	French	1	0.21
11	Italian	1	0.21
	<b>Total</b>	<b>483</b>	<b>100</b>

Table 6 reveals the Language wise distribution of cited journals. The largest number of journals and their articles has been written in English Language. The total number of cited journals in this language is 463 i.e. 95.86% of the total number of journals. This is followed by 5 journals (1.04%) in Japanese language and those in German language (3 journals, 0.62%), Spanish language (3 journals, 0.62%) etc.

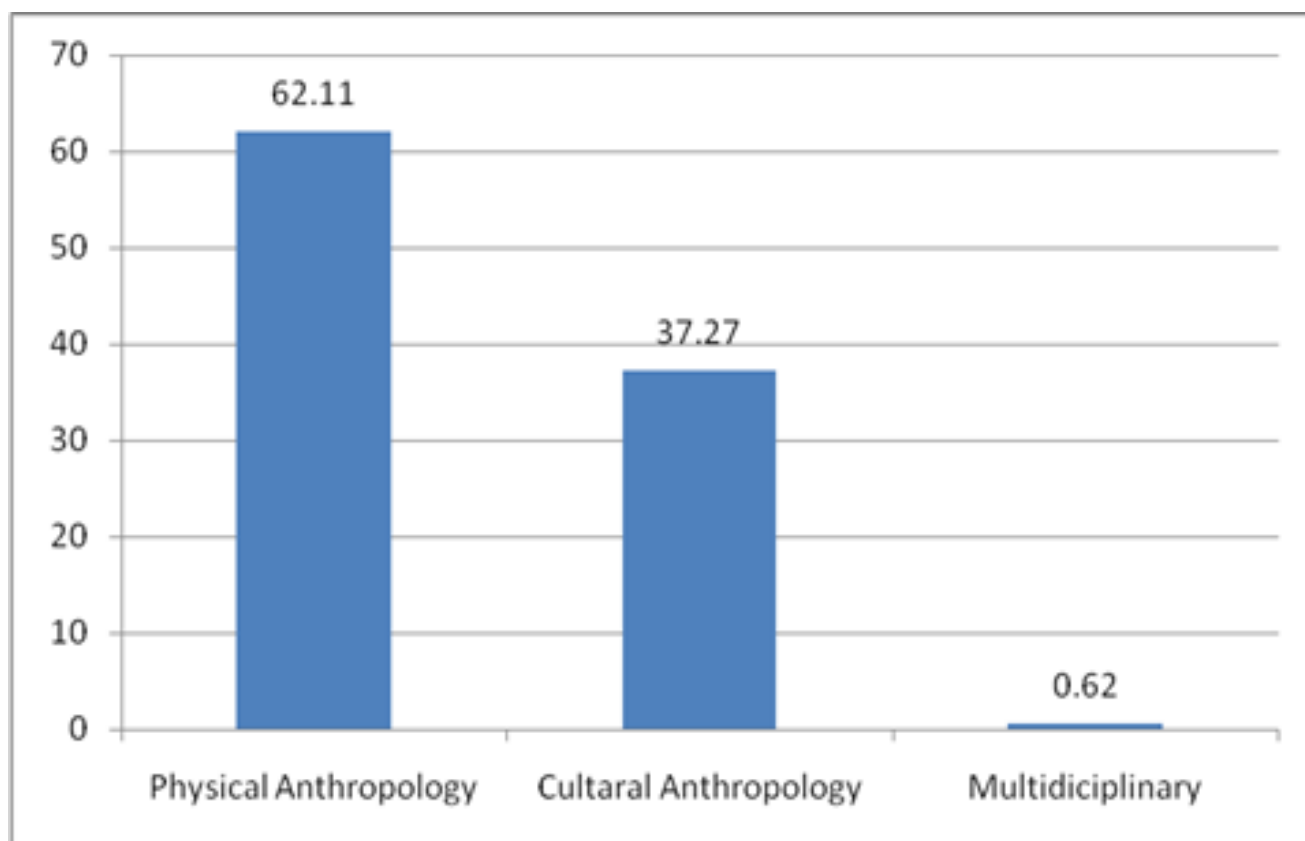
**Table 7: Publisher Wise Distribution of Cited Journals**

S. No	Name of the Publisher	No. of Journal Published	%
1	Elsevier	42	8.70
2	Wily	24	4.97
3	Oxford University Press	15	3.11
4	Springer	15	3.11
5	Taylor and Francis	10	2.07
6	Blackwell Publishing Inc.	7	1.45
7	Lippincott Williams & Wilkins Ltd.	7	1.45
8	Nature publishing group	7	1.45
9	Sage	7	1.45
10	Biomed Central	5	1.04
11	Cambridge Core	5	1.04
12	Karger Publication	5	1.04
13	Serials Publication	5	1.04
14	Tailor and Francis	5	1.04
15	American Medical Association	4	0.83
16	Annual Reviews	4	0.83
17	Indian Academy of Science	4	0.83
18	World Health Organization	4	0.83
19	American Society for Nutrition	3	0.62
20	BMJ Group	3	0.62
21	British Medical Association	3	0.62
22	Indian Society of Coastal Agricultural Research	3	0.62
23	Japan Society of Physiological Anthropology	3	0.62
24	Kamala Raj Enterprises	3	0.62
25	Rutledge	3	0.62
26	Royal Anthropological Institute	3	0.62
27	University of Chicago Press	3	0.62
28	W. B. Saunders Co., Ltd.	3	0.62
29	Publishers published two or less than two journals	284	58.80
	<b>Total</b>	<b>483</b>	<b>100.00</b>

Table 7 shows that 42 journals (8.70%) have been published by Elsevier, followed by Wily 24(4.97%), Oxford University Press & Springer, 15 (3.11%) etc. On the other hand

number of publishers, who have published two or less than two journals are 284 in number forming 58.805% of total citation.





**Figure 2: Subject Wise Distribution of Cited Journals**

Fig 2 reveals that Anthropology researchers of Vidyasagar University have cited most of the journals of Physical Anthropology. The number of journals of Physical Anthropology is 300, which constitute 62.11% of total cited journals. This is followed by 180 Cultural Anthropological journals which form 37.27 % of total cited journals. Citations of multidisciplinary journals such as prehistory, geography, linguistics, are very less in number i.e. 3 forming 0.62% of total cited journals.

### FINDINGS

- The study shows that Bradford's Law of journals' productivity is not applicable in the field of Anthropology as the number of journals in each zone does not increase geometrically.
- Leimkuhler Model when applied on Bradford's Law, has reduced the error of Bradford's Data.
- Annals of Human Biology is found to be the most productive journal in Anthropology. Indian Pediatrics is an also very important journal in the field of Anthropology.

- Researchers of Vidyasagar University have cited largest number of journals published from USA.
- Elsevier, Wiley, Oxford University Press are the most popular publishers of anthropological journals.
- Physical Anthropology is most productive research area, followed by Cultural Anthropology.

### CONCLUSION

The study reveals that foreign journals are mostly consulted by the researchers in Anthropology. The Indian Anthropological journals have also been consulted by the researchers of Vidyasagar University, where most of the research in Vidyasagar University is being conducted in Physical Anthropology. Research in Prehistory, Linguistics is really in bad position. Necessary steps to increase research in these two neglected fields may be taken up.

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