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LIBRARY AND INFORMATION SCIENCE LITERATURE AND LOTKA' S LAW

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ABSTRACT

Attempts to test the validity of Lotka's law in the domain of library and information science(LIS) taking the annual name index of Library and Information Science Abstracts (LISA) 1992, and annual author index of LISA 1993 as the base, which included 7101 and 7591 abstracts of articles contributed respectively by 8284 and 7664 authors. Lotka's law is found to be applicable with the value of n as 3.23 in the first case and 3.1 in the second case. It is concluded that the value of n is found to be higher in LIS compared to exact sciences because the number of authors contributing two or more articles are less in this field.

Keywords : Lotka's law; Library and information science literature; Author productivity; Bibliometrics.

INTRODUCTION

In many instances in our life we find that there is a close link between *less* and *more*. In the academic sphere we find that fewer students pass with very high percentage of marks. In the arena of sports it is seen that fewer football players score more goals, fewer cricketers score more runs, fewer bowlers take more wickets, and so on. In the field of medicine, fewer diseases take more lives. The rule applies in the case of cities too - fewer cities are metropolis or mega-cities harbouring millions of people whereas smaller cities are more in number with fewer number of people. The field of economics is also of no exception, where a very small number of people hold major share of the wealth, whereas billions in the world are practically destitutes.

As can be expected the rule applies to the sphere of library and information science as well. It is but a common experience that the maximum number of contributions are accounted for by a few authors. In 1926, Alfred J. Lotka, a statistician of the Metropolitan Life Insurance Company, became engrossed with the idea of determining, 'if possible, the part which men of different calibre contribute to the progress of science'. For this purpose, he used the index of *Chemical Abstracts* for

the years 1907-1916 and developed a listing of A and B names [i.e. the names starting with the letters A and B] and the corresponding number of papers each author produced. The same procedure was applied to Auerbach's *Geschichtstafeln der Physik* till the year 1900 using complete coverage (Lotka, 1926). The results obtained show surprising regularity which allowed Lotka to derive the equation., $x^n y = c$ where x stands for the number of contributions, y for the number of authors, and c is constant (Lotka,1926). From these studies he found out the value of n as 2. This finding finally became known as Lotka's law or the inverse square law of scientific productivity. The study stimulated a number of investigations giving rise to not only new findings but also controversies.

Lotka's study was related to the field of science, where the number of contributors in most fields is found to be high, and the rate of growth of the field in terms of the number of items published in a year is generally found to be high compared to other fields of knowledge. The studies conducted by others taking various fields of science also corroborated Lotka's finding and the value of n was found to be around 2. For example, Gupta (1987) found the value of n as 1.9 (for all authors), 1.8 (for the first author), 2.2 (for single author), and 2.4 (for the co-author) when analysing the Nigerian entomological literature published between 1900 to 1973. While studying the author productivity in the field of geophysics, Gupta (1992) found the value of n as 2.1. Analysing 498 research articles published in the *Journal of Oilseeds Research* published between 1984 and 1992 Kalyane and Sen (1995) found the value of n as 2.07. However, De Oliveira (1983) after analysing the literature on jackfruit published between 1950 and 1981 found that the Lotka's law did not hold true in this case because the number of researchers in the field was small. Conducting further studies De Oliveira (1984) realized that the application of Lotka's law would prove to be rather difficult in the realm of social sciences. Gupta's (1989) study with psychological literature of Africa for the period 1966 to1975 showed the validity of Lotka's law with a much higher value of n as 2.8.

OBJECTIVE

Library and information science is not an exact science like physics or chemistry. In this field the number of contributors are less, and the growth of literature is also not as high as it is found in many branches of the exact sciences. Lotka conducted his study with the author indexes of *Chemical Abstracts* for the years 1907 to 1916. The volume of literature produced and the growth rate of the subject during that period can be seen from Table 1. The growth during the period 1907 and 1915 was normal which became stunted during 1915 to 1920 because of World War I. Table 2 depicts the scenario of library and information science (LIS) literature as they appeared in *LISA(Library and Information Science Abstracts)* during the period 1984 to 1993. Here we have taken the same span

Table 1: Chemical Literature 1907-20

Year	No. of Abstracts & Citations
1907	11,847
1915	18,981
1920	19,326

Table 2: Library & Information Science Literature Between 1984 - 1993

Year	No, of Abstracts & Citations
1984	6993
1985	6507
1986	6476
1987	6435
1988	6498
1989	6488
1990	8141
1991	7015
1992	7101
1993	7591

of years as did Lotka. From Table 2 it appears that there was a slump during 1985 to 1989. There is no reason to believe that the production of LIS literature went down during those years. The coverage of articles from various periodicals by *LISA* in many cases is very erratic (Sen, 1996) and this may have resulted in the haphazard productivity scenario.The productivity of LIS literature during 1983 to 1992 is about one-half of that of the chemical literature during 1907-1916. Hence, it was thought that the authors' productivity might follow Lotka's law and the study was undertaken.

METHODOLOGY

In the field of library and information science, *LISA* is found to be more comprehensive than other abstracting and indexing services in the field. Hence, this abstracting service was chosen for our study. Till 1992 the name index of *LISA* included personal authors, corporate authors, etc. For this study only personal authors were considered. The annual name index of 1992 and annual author index of 1993 were chosen for the study as it included 8284 and 7664 personal authors respectively. The number of authors contributing one, two, or more articles each were counted manually, and the results tabulated (Table 3A and 3B).

To find out the value of n, the study started with the premise of n = 2. The values obtained were widely different from the real values (Tables 3A and 3B). As the calculated values were much

higher than the real values, the calculations were carried out with the increased values of n. In order to save time and shorten the procedure, the study determined the value of n that matches with the number of authors who have contributed two papers each using the following formula.

$$x^n y = c. \qquad \text{(eqn. 1)}$$

Putting the value of x = 1, and y = 7229, (*vide* Table 3A), the calculation obtained was;

$$1^n.7229 = C$$
$$\Rightarrow 7229 = C$$

Putting the value of x = 2, and y = 771, and C = 7229, the calculation obtained was;

$$2^n.771 = 7229$$
$$\Rightarrow 2^n = 7229/771$$
$$\Rightarrow n\log 2 = \log 9.376$$
$$\Rightarrow n(0.301) = 0.972$$
$$\Rightarrow n = 0.972/0.301$$
$$\Rightarrow n = 3.23$$

Using the value of n = 3.23, the number of authors contributed three, four, or five articles each were computed (Table 3A). Similarly, the same procedure was adopted for the 1993 data and the value of n was found to be 3.00. With the value of n = 3, the calculated values of authors contributing three or more articles were found to be different from the observed values. However, with the value of n = 3.1, the observed and calculated values were found to be very close (Table 3B).

Table 3A: Author Productivity based on *LISA* 1992 Data

No.of Articles (x)	No. of Authors (observed) (y)	No. of Authors with n=2	No. of Authors n=3.23
1	7229	7229	7229
2	771	1807	770
3	198	803	207
4	50	452	82
5	36	289	40

Table 3B: Author Productivity based on *LISA* 1993 Data

No. of Articles (x)	No. of Authors (observed) (y)	No of Authors n=2	No of Authors n=3.1
1	6473	6473	6473
2	810	1618	755
3	210	240	215
4	67	101	88
5	41	52	44

RESULTS AND CONCLUSION

Tables 3A and 3B indicated that the number of authors obtained with the value of n = 2 is widely different from the real values. However, with the value of n = 3.23 in the first case and n = 3.1 in the second case, the calculated values are found to be very close to the real values. Hence, the study concludes that Lotka's law is applicable in the field of library and information science with much higher values when compared to the exact sciences. This is because the number of authors contributing 2 or more articles are less in this particular field compared to a scientific field where the number of such authors would have approximated the figures given in column 3 in Tables 3A and 3B.

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