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Application of Lotka's Law to the Library and Information Science Literature: A Study of Doctoral Theses Citations at the Universities in Maharashtra

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ABSTRACT

Attempts to test the validity of Lotka's Law of author productivity in the domain of Library and Information Science. To examine the applicability of Lotka's Law of Scattering, study include 798 periodical containing 5467 references collected form 138 theses during the period 1982-2010.Lotka's Law is found to be applicable with the value of n as 2.993

Keywords: Lotka's Law, Library and Information Science Literature, Author productivity.

Introduction:

Lotka's law of scientific productivity describes the frequency of publication by authors in any field. Formulated by Alfred J. Lotka in 1926, it is also known as the inverse square law or inverse exponential law, and is used to determine the most prolific authors within a discipline. It usually proves that there are only a few authors who contribute to a field as a publication increases in quantity.

Lotka was a mathematician. While working at the Statistical Bureau of the Metropolitan Life Insurance Company, he started counting the names of authors and compared them to the number of publications in *Chemical Abstracts* between 1907 and 1916. From this he devised the

formula $\mathbf{x^n y = c}$ "where: x is the number of publications, y is the portion of authors making x contributions each; n and c are constants depending on the specific field (n ≈ 2)"

Lotka's law has been highly applicable to various areas of publication but especially in determining "patterns of productivity among chemists". It has been debated whether it is applicable to librarianship, but is known to be useful in the area of collection development and information retrieval.

Objectives of the Study:

The main objectives of the study were:

1) To distribute the number of papers according to authors.

2) To study the phenomenon of Author Productivity.

3)To test the appropriateness of verbal and graphical formulation of Lotka'sLaw of Scattering.

Methodology:

A study included total of 5668 articles contributed by 4071 authors, The verbal formulation was tested by calculating the values of c and n, compare them to observed and calculated values. While for testing the appropriateness of graphical formulation, The graph is logarithmic plot of the cumulative number of papers on the horizontal axis and the number of authors on the vertical axis.

Implementation of Lotka's Law:

In the present study demonstrates how simply the value of c and n pertaining to the equation of Lotka's Law can be calculated. The value of 'n' obtained according to the method describes in the research article written by Sen, B.K.(2010). The method is much simpler compared to Pao's method.

The simplest equation to represent Lotka's Law is

$X^nY = C \quad OR \quad Y = \frac{C}{X^n}$ ---------- (1)

where: x is the number of publications, y is the portion of authors making x contributions each; n and c are constants depending on the specific field (n ≈ 2).

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Determination of the value of 'c':

The value of 'c' determined by using the data of table no.1.

Table No. 1

Distribution of the Number of Papers According to Authors

Number of Papers (x)	Number of Authors (y)
01	3353
02	421
03	125
04	63
05	34
06	28
07	15
08	04
09	05
10	06
11	04
12	05
13	01
14	02
16	01
17	01
25	02
38	01

Putting the values of x = 1 & y = 3353 in equation 1, the calculation was obtained,

1^n x 3353 = c

c = 3353

Putting the values of x = 2 , y = 421 & c = 3353 in equation (1),

$2^n X\ 421 = 3353$

$$2^n = \frac{3353}{421}$$

$2^n = 7.9619$

$nlog\ 2 = log\ 7.9619$

$n(0.301) = 0.9010$

$$n = \frac{0.9010}{0.301}$$

$$n = 2.993$$

Using the value of n, the number of authors contributed 3, 4, 5 …. 38 articles each were computed by following method.

$$c = \frac{y}{x^n}$$

$$logc = log\left(\frac{y}{x^n}\right)$$

$$logc = logy - logx^n$$

$$logc = log\ 3353 - log 2^{2.993}$$

$$logc = 3.5254 - 2.993.log1$$

$$logc = 3.5254 - 2.993\ X\ 0$$

$$logc = 3.5254$$

Taking antilog

$$antilog(logc) = antilog\ 3.5254$$

$$= 3353$$

According to above method all the values of authors contribution were computed by taking(n = 2.993)& (n = 2 according to A.J.Lotka) and shown in table no.2

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Table No. 2

Author Scientific Productivity

No. of Articles (x)	No. of Authors (observed) (y)	No. of Authors with n = 2.993	No. of Authors with n = 2
01	3353	3353	3353
02	421	421	838
03	125	125	372
04	63	63	209
05	34	17	134
06	28	16	93
07	15	10	68
08	04	06	52
09	05	05	41
10	06	03	33
11	04	03	27
12	05	02	23
13	01	01	20
14	02	02	17
16	01	13	13
17	01	16	11
25	02	01	05
38	01	01	02

It may be observed from table no.4.26 the values of 'y' were quite close to the actual observed values when calculated with n=2.993. On the other hand the values of 'y' calculated with n=2, were far away from the actual values.

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Graphical Formulation:

The Graphical formulation is just the experimental verification of the verbal formulation which observes certain regularity in the distribution of scientific publications.

The graph is logarithmic plot of the cumulative number of papers on the horizontal axis and the number of authors on the vertical axis.

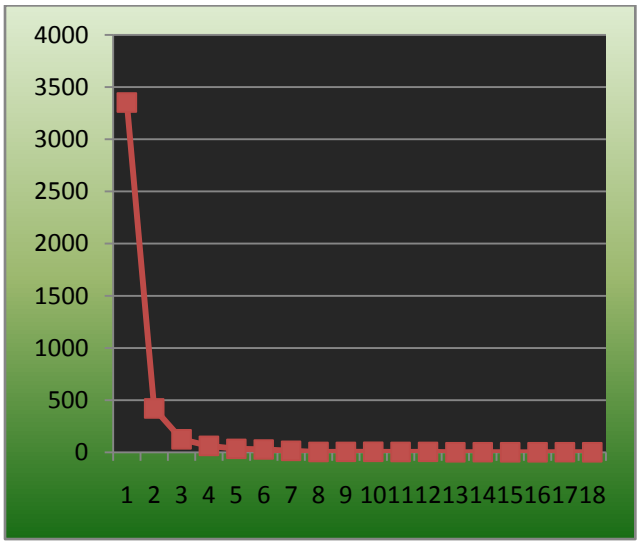

Figure No. 1

Author Scientific Productivity

Results and Conclusion:

Table no.2 indicated that the number of authors obtained with the value of n=2 is widely different from the observed values. However, with the value n= 2.993 the calculated values are found to be very close to real values. Hence the study concludes that Lotka's is applicable in the field of library and information science.

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