P: ISSN No. 0976-8602 RNI No.UPENG/2012/42622 VOL.-V, ISSUE-II, April-2016
E: ISSN No. 2349-9443 Asian Resonance

Author Productivity Applying Lotka's Law

Madhuri Gautam
Resarch Scholar
Deptt.of Library & Information Science,
Pt. R.S.University,
Raipur

Maya Verma
Professor & Head
Deptt.of Library & Information Science,
Pt. R.S.University,
Raipur

Abstract

Library and Information Science Abstract (LISA) 2001 to 2014 as the base, which included 11176 abstracts of articles contributed 8462 authors. Lotka's law could apply in its original form as inverse square law in all the cases but a not fit was found in fourteen cases with different value of n. It is concluded that the value of n is found to be lower in Information Technology because the number of authors contributing two or more articles are less & higher in this fields.

Keywords : Author Productivity, Scientometics, Lotka's Law, Information Technology.

Introduction

In 1926, Alfred J. Lotka's, a statistician of the metropolitan Life Insurance Company, Become engrossed with the idea of determining, "If possible, The part which men of different caliber contribute to the progress of Science." For this purpose has used the index of Chemical Abstracts for the year 1907 -1916 and developed a listing of A and B names[i.e.the names starting with the letters A and B]and 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 .

Objective of the Study

Library and information science is not an exact science like physics and 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. Table no.1 depicts the scenario of information technology (IT) literature as they appeared in LISA (Library and Information Science Abstract) during the period 2001 to 2014.Table no .1 it appears that there was a slump during the year 2001,2010 and 2011.There is no reason to believe that the production of IT literature went down during those years. The coverage of articles from various periodicals by LISA in many cases. Hence, it was thought that the author's productivity might follow Lotka's law and the study was undertaken.

Review of Literature

Sudhier, K.G. Pillai (2013) in this paper had discussed the analyze Lotka's law and pattern of author productivity in the area of physics research. A total of 1665 personal authors were identified and 3367 authors were identified by using 'Complete Count'.K-S statistical test and Chi Square test were applied to verify the applicability of Lotka's law in the approaches.

Shukla ,M.C.,et.al.(2001) attempted to the apply Bradford law of scattering and Lotka's law of productivity to bio-energy literature to verify in the law holds good for ten abstracting services .

Gupta, D.K. (1989) in this paper had discussed the application aspect of Lotka's to the psychological literature of Africa for the period 1966-1975.Lotka's law did not apply to the data in its original form as inverse square but in its generalized form with the value of ɑ equal to 2.8.Chi square and K-S statistical tests were applied to test the applicability of Lotka's law.

Gupta, D.K. (1987) a bibliography of entomological research in Nigeria, 1900-1973 totally 1720 publication was analyzed to study the author productivity pattern and to test the applicability of Lotka's law for the

obtained distribution. Lotka's law in its original form as inverse square law does not apply to any of the four data set.

Table No.1: Information Technology Literature between 2001-2014

Year	No.of Articles
2001	353
2002	1019
2003	835
2004	883
2005	1066
2006	1112
2007	845
2008	740
2009	804
2010	631
2011	623
2012	863
2013	683
2014	719

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. The Number of authors contributing one, two, three, four or more articles each was counted manually and the results tabulated.

The find out the Value of n, the study started with the premise of n=2. The Value obtained was widely different from the real Values. (Table 2A & 2N) As the calculated value were much lower than the real Value. The calculations were carried out with the decreased Value of n. In order to save time and shorten the procedure, the study determine the value of n that matches with the number of authors who have contributed Fourteen papers each using the following formula.

$X^n Y = C$ (equation 1)

Putting the value of X=1 and Y = 187 (Vide Table 2A), the calculation obtained was;

$1^n . 187 = C$

$187 = C$

Putting the Value of X=2 and Y=107, and C=187, the Calculation obtained was

$2^n = 107 = 187$

$2^n = 187/107$

$n \log 2 = \log 1.747$

$n (0.301) = 0.2422$

$n = \frac{0.2422}{0.301}$

$n = 0.80543$

Using the value of n = 0.80543, the number of authorscontributed three, four, or five authors each were computed (Table – 2A) Similarity. The same procedure was adopted for the 2002 to 2014 data and the value of n was found to be 0.05645 (2002), 0.8083 (2003), 0.0679 (2004), 0.585 (2005), -1.6005 (2006), -0.234 (2007), -0.0581 (2008), 1.29019 (2009), 0.926 (2010), 1.02046 (2011), 1.23704 (2012), 1.30256 (2013), and -1.6454 (2014). The calculated value of authors contributing three or more articles were found to be different from the observed values with the value of n=0.05645 the observed and calculated value were found to be different (Table 2B to 2N)

Table 2 A: Author Productivity based on LISA
2001 data n= 0.80543

No. of Articles (X)	No. of Author Conserved (Y)	No. of Authors with n = 2	No. of Authors n = 0.80543
1	187	187	187
2	107	47	107
3	34	21	77.1889
4	0	12	61.2246
5	11	07	51.1531

Table 2 B: Author Productivity based on LISA
2002 data n = 0.05645

No. of Articles (X)	No. of Author Conserved (Y)	No. of Authors with n = 2	No. of Authors n = 0.05645
1	417	417	417
2	401	107	401
3	147	46	391.927
4	0	26	385.614
5	24	17	380.787

Table 2 C: Author Productivity based on LISA
2003 data n = 0.8083

No. of Articles (X)	No. of Author Conserved (Y)	No. of Authors with n = 2	No. of Authors n = 0.8083
1	231	231	231
2	373	58	404.521
3	138	26	561.409
4	0	14	561.409
5	5	9	848.408

Table 2 D: Author Productivity based on LISA
2004 data n = 0.0679

No. of Articles (X)	No. of Author Conserved (Y)	No. of Authors with n = 2	No. of Authors n = 0.0679
1	353	353	353
2	370	88	370
3	127	39	380.321
4	0	22	38.819
5	15	14	393.736

Table 2 E: Author Productivity based on LISA
2005 data n = 0.585

No. of Articles (X)	No. of Author Conserved (Y)	No. of Authors with n = 2	No. of Authors n = 0.585
1	336	336	336
2	504	84	504
3	146	37	638.407
4	03	21	756
5	77	13	861.411

Table 2 F : Author Productivity based on LISA
2006 data n = -1.6005

No. of Articles (X)	No. of Author Conserved (Y)	No. of Authors with n = 2	No. of Authors n = -1.6005
1	185	185	185
2	561	46	561
3	215	21	1073.48
4	01	12	1701.19
5	144	07	2431.4

Table 2 G: Author Productivity based on LISA
2007 data n = - 0.234

No. of Articles (X)	No. of Author Conserved (Y)	No. of Authors with n = 2	No. of Authors n = -0.234
1	301	301	301
2	354	75	354
3	131	33	389.23
4	00	19	416.332
5	50	12	438.647

Table 2 H: Author Productivity based on LISA
2008 data n = - 0.0581

No. of Articles (X)	No. of Author Conserved (Y)	No. of Authors with n = 2	No. of Authors n = -0.0581
1	292	292	292
2	304	73	304
3	104	32	311.247
4	36	18	316.493
5	00	12	320.623

Table 2 I: Author Productivity based on LISA
2009 data n = 1.29019

No. of Articles (X)	No. of Author Conserved (Y)	No. of Authors with n = 2	No. of Authors n = 1.29019
1	472	472	472
2	193	118	193
3	89	52	114.384
4	29	30	78.9174
5	17	19	59.1753

Table 2 J: Author Productivity based on LISA
2010 data n = 0.926

No. of Articles (X)	No. of Author Conserved (Y)	No. of Authors with n = 2	No. of Authors n = 0.926
1	342	343	343
2	180	86	180
3	73	38	123.655
4	25	21	94.7368
5	10	14	77.0514

Table 2 K: Author Productivity based on LISA
2011 data n = 1.02046

No. of Articles (X)	No. of Author Conserved (Y)	No. of Authors with n = 2	No. of Authors n = 1.02046
1	284	284	284
2	140	71	140
3	110	32	92.5621
4	65	18	9.0141
5	16	11	54.9597

Table 2 L: Author Productivity based on LISA
2012 data n = 1.23704

No. of Articles (X)	No. of Author Conserved (Y)	No. of Authors with n = 2	No. of Authors n = 1.23704
1	429	429	429
2	182	107	182
3	143	48	110.215
4	60	27	77.2121
5	43	17	58.5874

Table 2 M: Author Productivity based on LISA
2013 data n = 1.30256

No. of Articles (X)	No. of Author Conserved (Y)	No. of Authors with n = 2	No. of Authors n = 0.926
1	370	370	370
2	150	93	150
3	56	41	88.4548
4	49	23	60.8108
5	23	15	45.4726

Table 2 N: Author Productivity based on LISA
2014 data n = -1.6454

No. of Articles (X)	No. of Author Conserved (Y)	No. of Authors with n = 2	No. of Authors n = -1.6454
1	109	109	109
2	341	27	341
3	181	12	664.0512
4	52	07	1066.8
5	30	04	1540.08

Result & Conclusion

Tables 2A to 2N indicated that the number of authors abstained with the value of n = 2 is widely different from the real value however with the value of n = 0.80543 in the first case, n = 0.05645 in the second case, n = 0.8083 in the third case, n = 0.0679 in the fourth case, n =0.585 in the fifth case, n = -1.6005 in the sixth case, n = -0.234 in the seventh case, n = -0.0581, in the eight case, n = 1.29019, in ninth case , n = 0.926 in the tenth case n = 1.02046 in the eleventh case, n = 1.23704 in the twelfths case ,n =1.30256 in the thirteenth case and n= -1.6454 in the fourteenth case the calculates value are found to be very different to the real Values. Hence the Study concludes that Lotka's Law is applicable in the field of

Information Technology with much low values. This is because the Number of authors contributing 2 or more articles is high in this particular field.

References

1. Lotka, A.J. (1926) Statistics – The frequency distribution of scientific productivity. Journal of the Washington Academy of Science, 16:317-25.
2. Gupta, D.K. (1987) Lotka law and productivity pattern of entomological research in Nigeria for the period 1900-1973. Scientometrics, 1291, P.33-46.
3. Sen, B.K. Etal (1961): Library and Information Science Literature and Lotka's law. Malaysian Journal of Library & Information Science Vol. I, no. 2, P.89-93.
4. Gupta, D.K.(1989) Lotka's law and its application to author's productivity distribution in psychological Literature of Africa for the period 1966-1975. Herald of Library Science. Vol 28, no. 1-2 P. 11-21.
5. Shukla, M.C. (2001) Application of Bradford and Lotka's Distribution to Bio-Energy Literature: A study Based on ten Abstracting Services. Annals of Library & Information Studies .Vol48.4P.149-156.
6. Sudhier, K.C.Pillai (2013) Lotka's law and pattern of Author Productivity in the Area of Physics Research .DESIDOC journal of Library & Information Technology .Vol.33.P.457-464.