Edulib 13(2) (2023) 119-126

EDULIB

Journal of Library and Information Science

Journal homepage: http://ejournal.upi.edu/index.php/edulib/index

Bibliometric Study: Writer's Productivity According to Lotka's Law in the Edulib Journal Publication Year 2011 – 2021

Agus Wahyudi, Jusa Junaedi*

Center for School/Madrasah and College Library Development, Deputy for Library Resource Development, National Library, Indonesia

*Correspondence: E-mail: nuguswah@gmail.com

ABSTRACT

This research is a bibliometric study using Lotka's Law. Lotka's Law describes the frequency of publications by authors in a particular field. According to Lotka, there is an inverse relationship between the number of articles written and the number of authors who write articles, namely the more articles written, the fewer authors write them. This research aims to determine the pattern of writer productivity according to Lotka's law in the Edulib journal. The object of this research is articles in the Edulib journal with a publication period of 2011-2021. The data collection method in this research was carried out by documentation and then tabulated in table format using MS Excel. Article obtained from the page https://ejournal.upi.edu/index.php/edulib/issue/archive. The articles collected were 166 articles written by 206 different authors. In this research, the "Straight Count" technique was used, namely only the main author or first author was counted. Because there are 79 authors as second authors, the number of authors calculated is 127. The calculation results show that the parameter value n is 2.6895 and C is 0.7985. This means that in 2011-2021 the number of authors who contributed one article was 79.85% of the total number of authors. The results of this research also show that the largest number of author collaborations is five authors in producing one article. The author listed as the first author who was most productive in producing articles was Doddy Rusmono with a contribution of 6 articles.

ARTICLE INFO

Article History:
Submitted/Received 05 May 2023
First Revised 10 Jun 2023
Accepted 15 Oct 2023
First Available online 24 Oct 2023
Publication Date 01 Nov 2023

Keyword:
Bibliometric,
Lotka's Law,
Author productivity

1. INTRODUCTION

The term Bibliometrics was first proposed by Alan Pritchard (1969) in his article entitled Statistical Bibliography Or Bibliometrics? In his writing, Pritchard explained that the term first used was Statistical Bibliography by E. Wyndham Hulme in 1922, then in 1969 Pritchard proposed that the term be changed to Bibliometrics for better and more accurate reasons. According to Pritchard, Bibliometrics or bibliometrics is the application of mathematical and statistical methods to measure quantitative and qualitative changes in book collections and other media.

One form of bibliometric study is the study of the productivity of authors/writers/researchers on certain scientific subjects or scientific journals. According to Lotka (1926) in Wahyudi (2015), writer productivity is the number of written works produced by an individual on a certain subject and published in scientific journals on the subject concerned within a certain period of time. Writer productivity is also called scientific productivity. Diodato (1994), defines scientific productivity as the amount of research produced by scientists. Scientific productivity in various fields of science can be measured through the number of scientific publications. Rahayu and Rachmawati (2015) stated that the productivity of researchers/authors is a comparison between the number of articles/research which is the output and the number of researchers/authors which in this case is the input or resources used. In other words, author productivity is the number of works/articles produced by a researcher/author.

The study of authorship productivity uses the basis of Lotka's Law. Lotka's Law describes the frequency of publications by authors in a particular field. Lotka's law is the conclusion of the research of a statistician named Alfred J. Lotka. In 1926, Lotka conducted research on the productivity of authors in producing scientific works in the fields of chemistry and physics. The scientific works studied by Lotka were those contained in Chemical Abstract (published from 1907 to 1916) and Auerbach's Geschictstafeln der Physik (published from 1900). The name of the author studied is only the main author or first author. From the results of his research, data was obtained for 6,891 authors in Chemical Abstract and 1,325 authors in Auerbach's Geschictstafeln der Physik. The article resulting from Lotka's research entitled The Frequency distribution of scientific productivity was published in the Journal of the Washington Academy of Science where the research conclusion reads:

> *"In the cases examined it is found that the number of persons making 2 contribution is about one-fourth of those making one; the number making n contributions is about 1/n^2 of those making one; and the proportion, of all contributors, that make a single contribution, is about 60%" (Askew, 2008).*

According to Lotka, there is an inverse relationship between the number of articles written and the number of authors who write articles, namely the more articles written, the fewer authors write them (Wahyudi, 2015). The conclusion of Lotka's research results was then known in 1949 as Lotka's Law regarding author productivity. Lotka concluded that of all the authors in a particular field who made a single contribution about 60% and the number of authors who contributed n was about 1/n2 of those who contributed one. This means that of all writers in a particular field, as many as 60% only make one publication, 15% of writers (1/22 x 60) make two publications, 7% of writers (1/32 x 60) make three publications, and so on (Zabed & Anisur, 2009). The results of Lotka's research conclusions in the equation are as follows:

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

DOI: https://doi.org/10.17509/edulib.v13i2.56710
p- ISSN 2776-608X e- ISSN 2776-5970

Explanation:
y_x = number of authors with x articles
c = 1,2,3,..., k (constant)
x = number of articles contributed by individual authors
n = exponent

In the following period, the research methodology on author productivity which was based on Lotka's Law experienced developments, including in the form of techniques for calculating author participation in an article. According to Diodato (1994) there are three ways that can be used to calculate author participation, namely: (i) Adjusted count. The value distribution calculation is done by dividing each article by the number of authors. So, each author gets the same share of the article; (ii) Complete count. The calculation is carried out in a way that each author gets a score of 1 (full) for each article, even if the article was written by more than one author. The contribution of each author is acknowledged and valued equally; (iii) Straight count. In this technique, only the first/art/main author gets marks. This calculation technique was carried out by Lotka.

Several studies related to testing Lotka Law include research conducted by Iftinan, et al. (2019) with the title Application of Lotka Law in the Journal of Social and Political Sciences (JSP) Gadjah Mada University. The results of this research are the productivity patterns of authors in the Journal of Social and Political Sciences (JSP) Gadjah Mada University in accordance with Lotka Law. Another research was conducted by Febriyanti (2020) with the title Bibliometrics: Analysis of Lotka's Law Testing on Author Productivity Patterns and Analysis of Zipt's Law Testing on Article Abstracts in the Field of Biology Education where the results of the research showed that the author's productivity pattern complies with Lotka's Law.

The increasing development of Lotka Law testing in various scientific disciplines encourages writers to do the same in articles published in the Edulib journal for the 2011-2021 publication period. The Edulib journal of library and information science was first published in 2011 by the Library and Information Science Study Program at the Indonesian University of Education. This journal, which has ISSN 2089-6549 (print) and ISSN 2528-2182 (online), has been published twice every year since 2012. This research aims to determine the pattern of writer productivity according to Lotka's law in Edulib journal articles for the 2011-2021 publication period.

2. METHODS

The object of this research is articles in the Edulib journal for the 2011-2021 publication period. The population of this research is articles published in the Edulib journal for the 2011-2021 period. In this study all members of the population were used as samples. Data collection in this research was carried out by means of documentation, namely collecting digital document data via the page https://ejournal.upi.edu/index.php/edulib/issue/archive. The collected articles were then tabulated in table format using MS Excel. The data variables required are the publication period (volume, number and year), article title, number of authors, and author's name.

DOI: https://doi.org/10.17509/edulib.v13i2.56710
p- ISSN 2528-1410 e- ISSN 2527-8045

Table 1. Article Data Tabulation

No	Volume	Title	Number of Authors	Author 1	Author 2	Author 3
1	xxx	xxx	xxx	xxx	xxx	xxx

Data Analysis

To determine the pattern of author productivity using Lotka's Law with the following stages: (i) Determine the value of the author's participation using the Straight count technique.; (ii) Determine the estimated values for the Lotka postulate parameters (parameters n and C). (iii) Calculate the theoretical distribution of Lotka's law. The equation used is $y_x = \frac{c}{x^n}$

3. RESULTS AND DISCUSSION

Authorship Patterns

In the 2011-2021 publication period, 21 Edulib journal numbers are available on the page https://ejournal.perpusnas.go.id/md/issue/archive. In 2011 the Edulib journal only published 1 number and in the following year it consistently published 2 numbers with the number of articles per number between 6 – 8. The distribution of the number of articles and authors can be seen in Figure 1

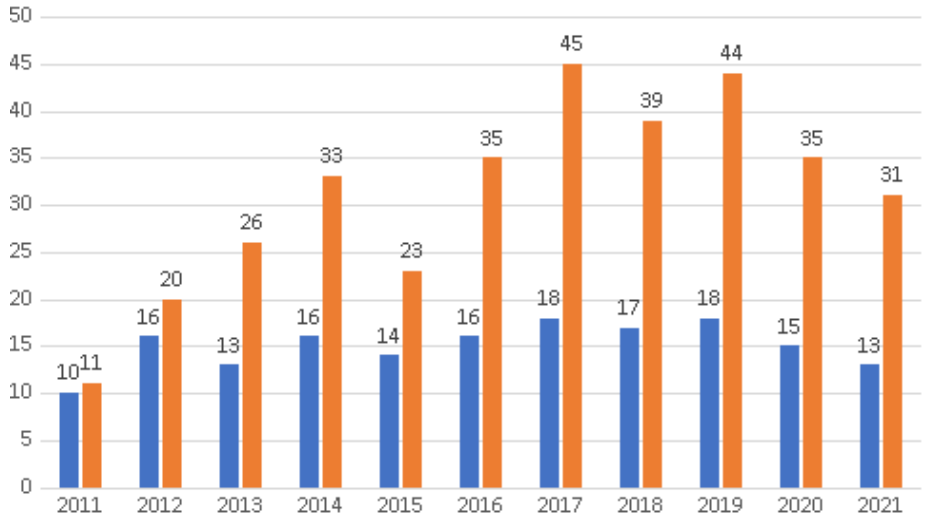

Figure 1. Distribution of the number of articles and authors per year

Of the 166 articles written by 342 authors, there are 206 different author names. The research results showed that 117 (70.48%) of the 166 articles were written collaboratively (see Table 2). There are two articles produced by the collaboration of five authors. The most articles produced by a single author in 2011 were 9 out of 10 articles and in 2012 there were 12 out of 16 articles.

Table 2. Author Collaboration

Number of Authors	Number of Articles
5	2
4	6
3	41

DOI: https://doi.org/10.17509/edulib.v13i2.56710
p- ISSN 2776-608X e- ISSN 2776-5970

Number of Authors	Number of Articles
2	68
1	49
Total	166

Testing Lotka's Law
Calculation of Parameter Values n and C

In this research, recognition of author participation is based on the Straight Count technique, which only counts the first author. Of the 206 authors with different names, there were 79 authors as second authors. So the number of authors calculated is 127. To calculate the parameter values n and C, several stages are required, namely:

Recap the number of authors based on the number of articles produced over a period of 11 years. In Table 3 you can see the number of authors who produced n articles.

Table 3. Recapitulation of Number of Authors and Articles Produced

Number of articles (x)	Number of Authors (y)	x.y
6	1	6
5	1	5
4	3	12
3	2	6
2	17	34
1	103	103
Total	127	166

From the table above, it is known that the range of articles produced by the author over a period of 11 years is in the range of 1-6 articles.

Developing data from Table 3 into 6 columns (see Table 4)

Table 4. Calculations to estimate the parameters of Lotka's postulate

Number of articles (x)	Number of Authors (y)	X=log x	Y=log y	XY	X^2
1	103	0	2.0128	0	0
2	17	0.301	1.2304	0.37035	0.090601
3	2	0.4771	0.301	0.143607	0.227624
4	3	0.6021	0.4771	0.287262	0.362524
5	1	0.699	0	0	0.488601
6	1	0.7782	0	0	0.605595
Total	127	2.8574	4.0213	0.801219	1.774946

Determine the value of parameter n with the formula:

$$b = \frac{\sum_{N_1}^{i=1} X_i Y_i - N_1 \overline{XY}}{\sum_{N_1}^{i=1} X_i^2 - N_1 \overline{X}^2} \text{Where } b = -n$$

DOI: https://doi.org/10.17509/edulib.v13i2.56710
p- ISSN 2528-1410 e- ISSN 2527-8045

The values contained in Table 4 are then entered into the equation.

$$b = \frac{0,801219(6 \times 0,476233x0,670217)}{13,49213(15 \times 0,86427^2)}$$
$$b = -2,6895$$

Because $b = -n$, so $n = -(-2,6895) = 2,6895$

Determine the value of parameter C with the formula:

$$c = \frac{1}{\sum \frac{1}{x^n}}$$

Table 5. Calculations to estimate parameter C

Number of articles (x)	x^n	$1/x^n$
1	1,0000	1,0000
2	6,4509	0,1550
3	19,1963	0,0521
4	41,6141	0,0240
5	75,8368	0,0132
6	123,8334	0,0081
	S(1/xn)	1,2524

With an n value of 2.6895, the results obtained are

$$c = \frac{1}{1,2524} = 0,7985$$

From the calculation results, the parameter value n is 2.6895 and C is 0.7985. So the equation for the pattern of writer productivity in the Edulib journal for 2011-2021 is obtained $Y_x.x^{2,6895} == 0,7985$ This means that the number of authors who contributed 1 article is around 79.85% of the total authors who contributed articles to the Edulib journal over a period of 11 years.

Table 6. The author's % calculation is the result of observations and Lotka's law

Number of articles per author (x)	Number of Authors Observation result (y)	% author of the results Observation (y/Σy*100%)	x^n	C	% estimation author (Y_x = C/x^n) (Lotka's Law)
1	103	81,10236	1,0000	0,7985	79,85000
2	17	13,38583	6,4509	0,7985	12,37812
3	2	1,57480	19,1963	0,7985	4,15966
4	3	2,36220	41,6141	0,7985	1,91882
5	1	0,78740	75,8368	0,7985	1,05292
6	1	0,78740	123,8334	0,7985	0,64482
	127	100			100

A comparison between the writer's productivity pattern in the Edulib journal as a result of observations and the writer's productivity pattern according to Lotka's law can be seen in

DOI: https://doi.org/10.17509/edulib.v13i2.56710
p- ISSN 2776-608X e- ISSN 2776-5970

Table 6 and Figure 2. From this graph, it can be seen that there is no significant difference between the writer's productivity pattern based on observation results and the writer's productivity pattern based on Lotka's law.

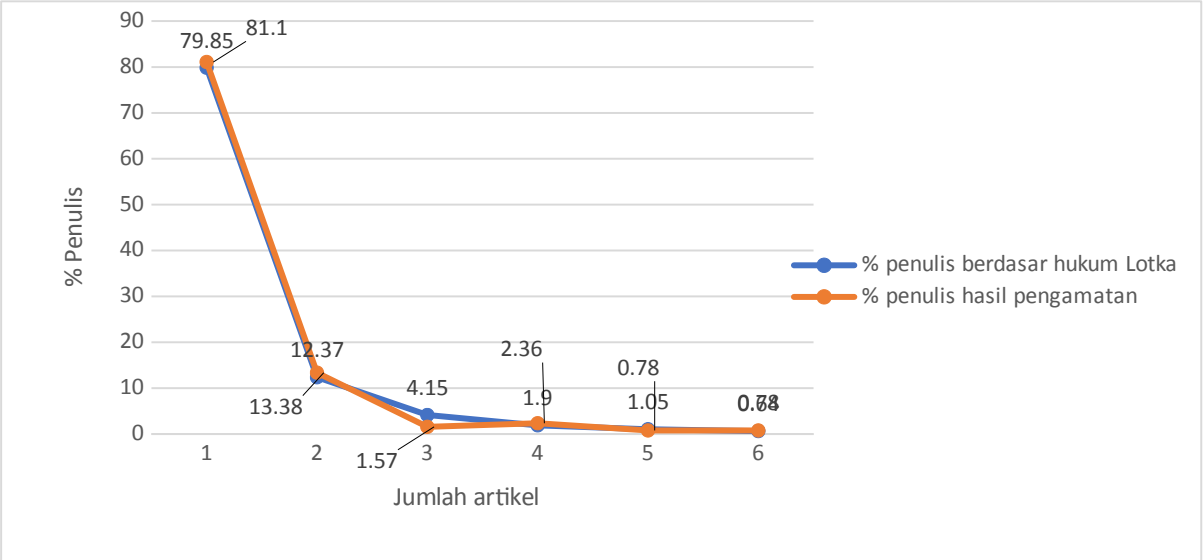

Figure 2. Writer productivity comparison graph

Based on author distribution calculation data for 2011-2021, it can also be seen that the most productive author who wrote articles in the edulib journal was the first author. The category of productive writers in this research is writers who have contributed at least 3 articles. Based on this category, there are seven most productive writers producing articles in the edulib journal in the 2011-2021 period. Details of the names of authors and the number of articles produced during 2011-2021 can be seen in Table 7.

Table 7. Names of the most productive authors and number of articles produced in the 2011-2021 period

Author	Number of Papers
Doddy Rusmono	6
Yunus Winoto	5
Dian Arya Susanti	4
Euis Rosinar	4
Tine Silvana Rachmawati	4
Riche Cynthia Johan	3
Rohanda	3

5. CONCLUSION

Based on the analysis, the following conclusions can be drawn: (i)From the calculation results, the parameter value n is 2.6895 and C is 0.7985. So the equation for the pattern of writer productivity in the Edulib journal for 2011-2021 is Yx. x2.6895 = 0.7985. This means that the number of authors who contributed 1 article is around 79.85% of the total authors who contributed articles to the Edulib journal over a period of 11 years. (ii) There is no significant difference between the writer's productivity pattern based on observations and the writer's productivity pattern based on Lotka's law. (iii) The largest number of author

DOI: https://doi.org/10.17509/edulib.v13i2.56710
p- ISSN 2528-1410 e- ISSN 2527-8045

collaborations is five authors in producing one article. (iv) There are 7 first authors who are most productive in producing 3-6 articles.

6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

7. REFERENCES

Askew, C. A. (2008). An Examination of Lotka's law in the Field of Library and Information Studies [disertasi]. Florida International University. https://digitalcommons.fiu.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1235&context=etd

Diodato, V. (1994). Dictionary of Bibliometrics. The Haworth Press Inc.

Febriyanti, N. (2020). Bibliometrik: Analisis Pengujian Hukum Lotka pada Pola Produktivitas Pengarang dan Analisis Pengujian Hukum Zipt pada Abstrak Artikel di Bidang Pendidikan Biologi. Jurnal Iqra', 14(2). http://jurnal.uinsu.ac.id/index.php/iqra/article/view/7706/3804

Iftinan, Dna., Avidiansyah, Z., & Meilia. R. A. (2019). Penerapan Hukum Lotka pada Jurnal Ilmu Sosial dan Ilmu Politik (JSP) Universitas Gadjah Mada. Bibliotika: Jurnal Kajian Perpustakaan dan Informasi, 3(1), 1-7. DOI: http://dx.doi.org/10.17977/um008v3i12019p001

Rahayu, R. N., & Rachmawati, R. (2015). Kolaborasi dan Produktivitas Penulis Artikel Visi Pustaka 2000-2014. BACA: Jurnal Dokumentasi dan Informasi, 36(2), 141-152. DOI: https://doi.org/10.14203/j.baca.v36i2.208

Pritchard, A. (1969). Statistical Bibliography Or Bibliometrics?. Journal of Documentation, 25(4), 348-349. https://www.researchgate.net/publication/236031787_Statistical_Bibliography_or_Bibliometrics

Wahyudi, A. (2015). Analisis Pola Produktivitas Penulis Artikel Bidang Perpustakaan dan Informasi di Indonesia: Suatu Kajian Bibliometrika. [Thesis]. Institut Pertanian Bogor

Zabed, A., Anisur, R. (2009). Lotka's law and authorship distribution in nutrition research in Bangladesh. Annals of Library and Information Studies, 56, 95-102. https://www.researchgate.net/publication/236020422_Lotka's_law_and_authorship_in_nutrition_research_in_Bangladesh