# Collaborative Indices and Inverse-square law in Global Geese literature: Scientometric perspective

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## Abstract

This article examines the publication efficiency index, average citations per paper, authorship pattern, degree of collaboration, collaborative index, collaborative coefficient, modified collaborative coefficient, and application of Inverse-square law of global geese literature based on 4801 records retrieved from the Scopus database during the time frame 2008 to 2017. The study revealed that Publication Efficiency Indices and Average Citations Per Publications are more significant from 2008 to 2012. But after 2012 value of PEI is less than one, which indicates that the research impact of geese research publications is gradually decreasing year by year. Three authorship patterns dominate other authorship patterns by contributing 29.74% of articles and 18.89% of the author's participation. The mean value of the Degree of collaboration is found to be 0.989, which implies that collaborative publications are remarkably dominating single-authored publications. Collaborative Index was topmost in 2016 with the value 5.275 since the total number of author participation per paper is the highest. The rate of CC and MCC is also monitored the largest in 2016 with 0.755 and 0.757 consecutively. Application of Inverse-square law and verification of Kolmogorov-Smirnov test disclosed that the scientific productivity of authors of geese research publication is well matched with the theoretical distribution of Inverse-square law.

**Keywords:** Scientometric, Geese, Authorship pattern, Publication Efficiency Index, Collaborative Indices, Inverse-Square law (Lotka's law), K-S test

**Abbreviations:** ACPP- Average Citations Per Publication, PEI- Publication Efficiency Index., CI- Collaborative Index, CC- Collaborative Coefficient, DC- Degree of Collaboration, MCC- Modified Collaborative Coefficient,

## 1.Introduction

Geese are aquatic fowls. These birds are raised all around the world cause of their ability to adjust to hot and cold climates. Geese are considered as one of the first domesticated fowls. The male one is known as 'gander' and female is known as 'goose.' They found in a variety of colours, size, shapes, and types such as Barnacle Geese, Bar-headed Geese, Bean Geese, Brent Geese or Brant Geese, Canada Goose, Cackling Geese, Embden Geese, Greylag Geese, Huoyan Geese, Kuban Geese, Landes Geese, Lesser White-fronted Geese, Pilgrim Geese, Pink-footed Geese, Pomeranian Geese, Red-breasted Geese, Synthetic Ukrainian Geese,

White Hungarian Geese, etc. They belong to the Anatidae family. These birds are very intelligent and possess a remarkable ability to memorize animals, humans, and situations. Geese are employed to guard animals, making very high piercing honks whenever they perceive anything unusual. It's down, and feathers are precious and profitable since they are internationally marketed and used for stuffing duvets and pillows and used in garments and linen industries. Down and feathers are also utilized for making homemade jewelry and decorative items. Geese likes grass, but they dislike broadleaf plants, and therefore, they also employed weed control over various crops. It is beneficial for the environment because it lowers the use of chemicals for weed-killing processes. Waste's by-products of crops are very savory food for geese. The Fatty liver of Geese is used for the production of the foie gras industry. Foie gras is a very costly and delicious food consumed by humans worldwide. It is also farmed for obtaining eggs and meat and for amusement and exhibitions. A large number of researches is undergoing subjecting to the field Geese. So, this paper tries to analyze the impact of geese research publications at the global level

## 2.Review of Literature

Aswathy, S., & Gopikuttan, A. (2013)[1] has conducted Scientometric analysis of Productivity pattern of Kerala, Mahatma Gandhi, and Calicut universities based on the data collected from the annual reports and websites of universities. The study indicates that the Degree of collaboration is higher for the University of Kerala than the other two Universities and the Inverse-square law is not fit with the literature productivities of the faculty members of the Universities of Kerala. Naqvi, S. H., & Fatima, N. (2017)[2] has been studied Authorship patterns in international business literature for the duration 2012 to2014 based on 11202 articles published in the Journal of World Business. Results of this study signify that the Inverse-square law fits with this literature field. Sudhier, K. P. (2013)[3] has executed a study on Inverse-square law and pattern of author productivity in physics research concerning the journal citations of the thesis of Kerala University. The study proved that the Inverse-square law is not applicable for Physics literature. Batcha, S. M. (2018)[4] has examined the degree of collaboration, collaborative indices, Relative growth rate and doubling time, co-authorship index, collaborative coefficient, and modified collaborative coefficients and scientific distribution of authors in the article on Scientometric Analysis of Dentistry Research for the period 2008-2017. Studies displayed that CI, CC, and MCC were highest in 2017, and the Inverse-square law is applicable for Dentistry publications. Jan, R., Wani, W.R., and Hafiz, O. (2015)[5] has investigated Average Citations of publications, high-quality papers, CI and MCC Scientometric analysis of cloud computing for the duration 2009-2013 using Web of Science database. The authorship pattern of this analysis shows that three authorship patterns prominent, and 8427 citations got for the total number of papers of this field.

## 3.Objectives

- To analyze Average citations per paper and Publication efficiency Index
- To analyze the authorship pattern of publications
- To study Degree of Collaboration, Collaborative Index, Collaborative Coefficient, and Modified Collaborative Coefficient of publications.
- To test Inverse-square law (Lotka's law) of the Scientific productivity of authors of Global Geese Research publications
- To verify Alfred's Inverse-square law with the Kolmogorov-Smirnov test.

## 4.Methodology

Data needed for this analysis are retrieved from the Scopus indexing database. In the search string, TITLE-ABS-KEY(Geese) is selected for extracting data from the Scopus indexing database. The search has been confined for the term 2008 to 2017 using the date range tag, 'LIMIT-TO (PUBYEAR, 2017 to 2008)'. A total of 4801 extricated data and its full bibliographical details were exported to a CSV excel file. These data were assorted and tabulated using Microsoft Excel file and SPSS software. Proper Scientometric tools are used for analyzing the extricated data.

## 5.Analysis and Results

### 5.1. Average Citations Per Publications and Publication Efficiency Index

The relative research effort of a particular year is assessed using the Publication efficiency index (PEI). It is based on the citations received to the research publications for that specific year. Publication efficiency index measured by the formula given by Guan, J. & Ma, M. (2007)[6].

$$\mathbf{PEI}=\frac{\mathbf{TNC_i/TNC_t}}{\mathbf{TNP_i/TNP_t}}$$

Where,
$TNC_i$=Total number of Citations in a particular year 'i.'
$TNC_t$ =Total number of Citations for all the years
$TNP_i$ = Total number of Publications in a particular year 'i.'
$TNP_t$ = Total number of Publications for all the year

| YEARS | Total publications | Total No. of Citations | ACPP | $TNC_i/TNC_t$ | TNPi/TNPt | PEI |
|---|---|---|---|---|---|---|
| 2008 | 398 | 6453 | 16.21 | 0.15 | 0.08 | 1.86 |
| 2009 | 425 | 6555 | 15.42 | 0.16 | 0.09 | 1.77 |
| 2010 | 524 | 6421 | 12.25 | 0.15 | 0.11 | 1.40 |
| 2011 | 495 | 5932 | 11.98 | 0.14 | 0.10 | 1.37 |
| 2012 | 496 | 4806 | 9.69 | 0.11 | 0.10 | 1.11 |
| 2013 | 551 | 4541 | 8.24 | 0.11 | 0.11 | 0.94 |
| 2014 | 486 | 2620 | 5.39 | 0.06 | 0.10 | 0.62 |
| 2015 | 390 | 1929 | 4.95 | 0.05 | 0.08 | 0.57 |
| 2016 | 516 | 1752 | 3.40 | 0.04 | 0.11 | 0.39 |
| 2017 | 520 | 890 | 1.71 | 0.02 | 0.11 | 0.20 |
| **Total** | **4801** | **41899** | **89.25** | | | **10.23** |
| **Average** | | | **8.92** | | | **1.02** |

**Table 1: Average Citations Per Publications and Publication Efficiency Index**

Table 1 indicates that the value of PEI is greater than 1, from the year 2008 to 2012, which implies that the impact of publication and research effort in the geese research is more significant to those years. In the same way, the value of ACPP is also observed larger in the same years. PEI and ACPP seem to be topmost in the year 2008 with the values 1.86 and 16.21respectively found to be less than 1 in the years 2013 to 2017, which implies that research effort and impact publication of researchers is lower in those years. PEI & ACPP attained the

lowest value in 2017 with the values of 0.20 and 1.71 successively. It can see that ACPP is8.92 and Average PEI is 1.02.

From Chart 1, it is visible that there is a steady decrease in Average Citations Per Publications and Publication Efficiency Indices from the year 2008 to 2017 since research impact in the field of geese research steps down year after year. It can also note from table 1 & chart one that the publication output of geese research is only 398 in the year 2008. Still, these publications got a more significant number of citations and a maximum value of PEI. But in the year 2017, the number of publications is 520. Still, its citations are only 890, and the value of PEI is also found to be the lowest in this year.

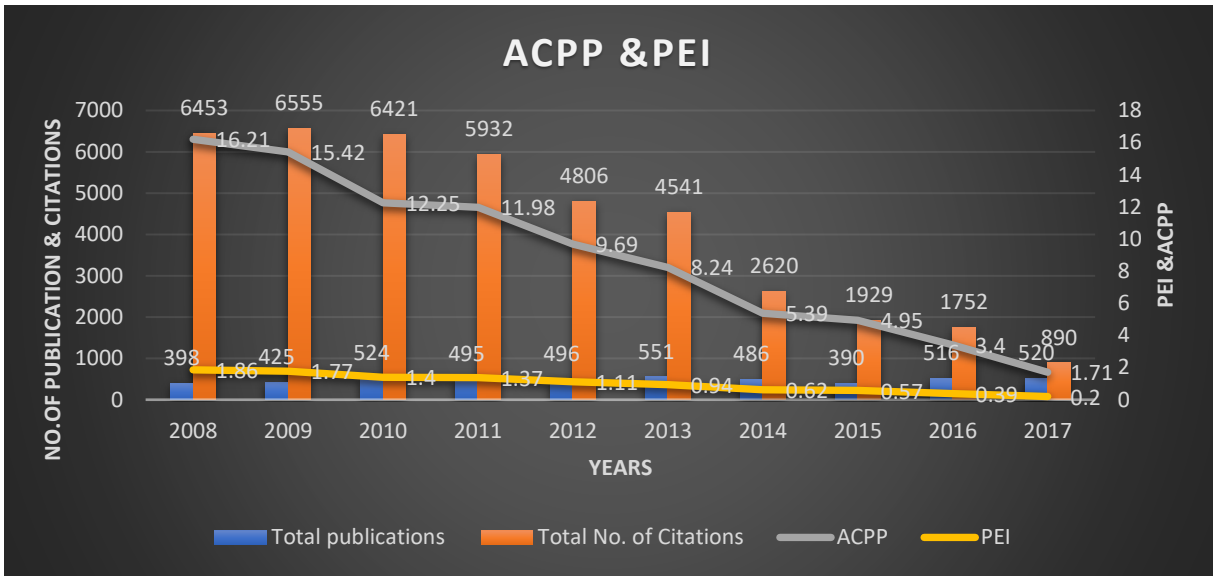


**Chart1: ACPP &PEI**

## 5.2. Authorship Pattern

Table 2 analyses the total number of author's participation in each authorship pattern, their number of publications, percentage of author's participation, and percentage of article contributions.

| Sl.No. | Authorship Pattern | No. of Articles | Total No. of Authors in articles | Percentage of authors | Percentage of articles |
|---|---|---|---|---|---|
| 1 | Single Authorship pattern | 56 | 56 | 0.25 | 1.17 |
| 2 | Two Authorship pattern | 565 | 1130 | 4.98 | 11.77 |
| 3 | Three Authorship pattern | 1428 | 4284 | 18.89 | 29.74 |
| 4 | Four Authorship pattern | 749 | 2996 | 13.21 | 15.60 |
| 5 | Five Authorship pattern | 547 | 2735 | 12.06 | 11.39 |
| 6 | Six Authorship pattern | 468 | 2808 | 12.38 | 9.75 |
| 7 | Seven Authorship pattern | 290 | 2030 | 8.95 | 6.04 |

| | | | | | |
|---|---|---|---|---|---|
| 8 | Eight Authorship pattern | 209 | 1672 | 7.37 | 4.35 |
| 9 | Nine Authorship pattern | 160 | 1440 | 6.35 | 3.33 |
| 10 | Ten Authorship pattern | 86 | 860 | 3.79 | 1.79 |
| 11 | Eleven & + Authorship pattern | 243 | 2673 | 11.78 | 5.06 |
| | **Total** | **4801** | **22684** | **100** | **100** |

**Table 2: Authorship Pattern**

From table 2, it can inspect that the topmost author participation (18.89%), as well as the most significant number of articles (29.74%), is contributed by three authorship patterns. Hence three authorship pattern dominates over other authorship patterns. Four authorship patterns occupy the second position with 13.21% of author participation and 15.60% of article contribution. The number of author's participation (0.25%) and article contribution (1.17%) were low in the single-authored pattern.

Chart 2 illustrates each authorship pattern and their percentage of article contribution in geese research publications.

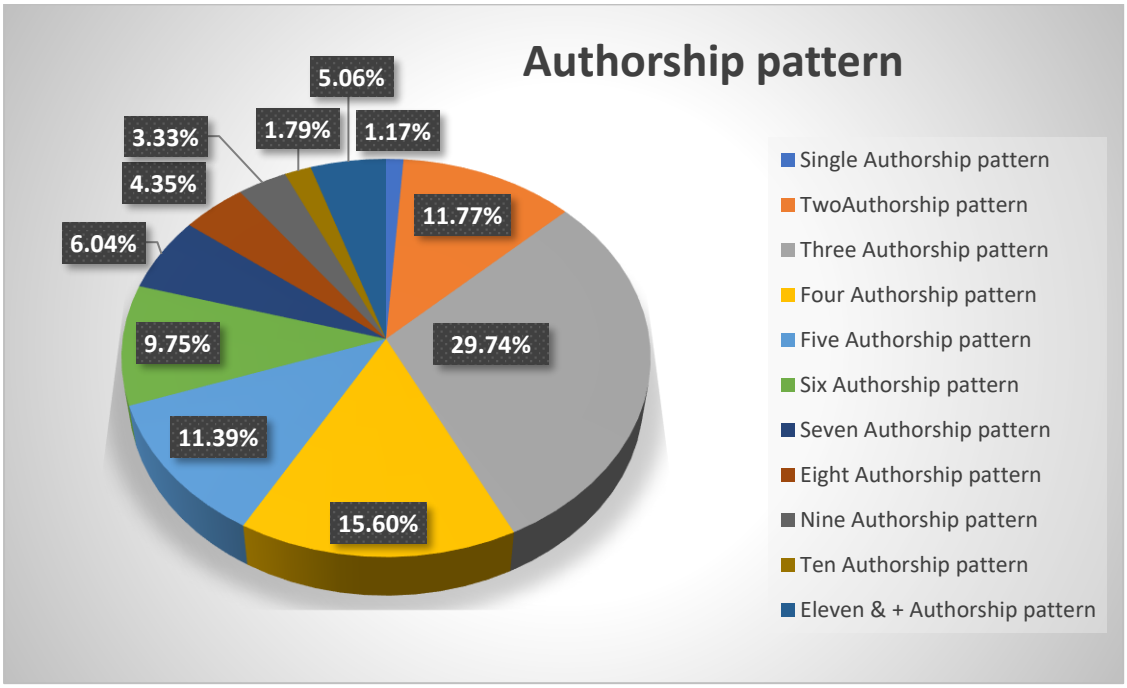


**Chart 2: Authorship Patten**

## 5.3. Degree of Collaboration, Collaborative Index, Collaborative Coefficient, and Modified Collaborative Coefficient

The degree of collaboration is the ratio of the number of collaborative research papers to the sum number of research papers published in the subject. The formula of DC (Subramanyam, 1983)[7] is as follows;

$$DC = \frac{N_m}{N_m + N_s}$$

DC - degree of collaboration in a subject; $N_m$ is the number of multiple-authored research papers in the subject published in a year; $N_s$ is the number of single-authored research papers in the discipline published during the same year.

Collaborative index (Lawani, 1980)[8] is the mean number of authors per paper. It can express mathematically as,

$$\mathbf{CI} = \frac{\sum_{j=1}^{A} jf_j}{N}$$

The collaborative coefficient has suggested by Ajiferuke (1988)[9]. It is based on the fractional productivity defined by Price and Beaver. It calculated from the formula,

$$\mathbf{CC=1 - \frac{\sum_{j=1}^{A}(\frac{1}{j})f_j}{N}}$$

Where fj is the number of j authored papers published in the discipline during a specific period; j is the number of authors; A is the most significant number of authors per paper in the discipline during a particular period. Modified Collaborative coefficient calculated by the equation,

$$\mathbf{MCC=\frac{A}{A-1}\left\{1 - \frac{\sum_{j=1}^{A}(\frac{1}{j})f_j}{N}\right\}}$$

Where in the section $\frac{A}{A-1}$

'A' is the total number of authors in a particular year.

| YEARS | Single authored Paper | Two authored Paper | Three authored Paper | Four authored Paper | Five authored Paper | Six authored Paper | Seven authored Paper | Eight authored Paper | Nine authored Paper | Ten authored Paper | 11 & more authored Papers | Total no.of papers | Total no. of authors in total articles | DC | CI | CC | MCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2008 | 0 | 48 | 148 | 63 | 37 | 42 | 17 | 15 | 8 | 8 | 12 | 398 | 1752 | 1.000 | 4.402 | 0.722 | 0.724 |
| 2009 | 1 | 54 | 139 | 64 | 54 | 36 | 26 | 18 | 15 | 6 | 12 | 425 | 1921 | 0.998 | 4.520 | 0.726 | 0.728 |
| 2010 | 20 | 83 | 152 | 93 | 54 | 38 | 20 | 19 | 9 | 14 | 22 | 524 | 2267 | 0.962 | 4.326 | 0.690 | 0.692 |
| 2011 | 7 | 59 | 151 | 80 | 59 | 47 | 28 | 18 | 19 | 8 | 19 | 495 | 2275 | 0.986 | 4.596 | 0.723 | 0.724 |
| 2012 | 7 | 52 | 160 | 82 | 57 | 54 | 24 | 24 | 12 | 5 | 19 | 496 | 2255 | 0.986 | 4.546 | 0.723 | 0.725 |
| 2013 | 3 | 63 | 173 | 82 | 63 | 57 | 35 | 21 | 18 | 6 | 30 | 551 | 2598 | 0.995 | 4.715 | 0.732 | 0.733 |
| 2014 | 7 | 59 | 140 | 69 | 49 | 58 | 40 | 20 | 22 | 6 | 16 | 486 | 2288 | 0.986 | 4.708 | 0.727 | 0.729 |
| 2015 | 3 | 41 | 103 | 58 | 60 | 34 | 15 | 17 | 14 | 13 | 32 | 390 | 1979 | 0.992 | 5.074 | 0.744 | 0.745 |
| 2016 | 1 | 51 | 130 | 79 | 57 | 44 | 45 | 33 | 20 | 11 | 45 | 516 | 2722 | 0.998 | 5.275 | 0.755 | 0.757 |
| 2017 | 7 | 55 | 132 | 79 | 57 | 58 | 40 | 24 | 23 | 9 | 36 | 520 | 2627 | 0.987 | 5.052 | 0.741 | 0.742 |
| **Total** | **56** | **565** | **1428** | **749** | **547** | **468** | **290** | **209** | **160** | **86** | **243** | **4801** | **22684** | **9.888** | **47.215** | **7.283** | **7.299** |
| **%** | **1.17** | **11.77** | **29.74** | **15.60** | **11.39** | **9.75** | **6.04** | **4.35** | **3.33** | **1.79** | **5.06** | **100** | **100** | **0.989** | **4.722** | **0.728** | **0.730** |
| | | | | | | | | | | | | | | Mean values | | ↑ | |

**Table 3: Degree of Collaboration, Collaborative Index, Collaborative Coefficient, and Modified Collaborative Coefficient**

In table 3, the DC rate signifies those multi-authored papers are extremely dominating over single-authored papers. It shows maximum values of one in 2008 since it has no single-authored article in the year 2008. Only one single-authored article is visible in 2009 and 2016, and it shows values of 0.998. A slightly lower value of DC was found in the year 2010 (0.962).

Out of 10, DC occupies a total value of 9.888 and a mean value of 0.989 during the preferred study term. It declared that collaborative publications remarkably headed the single-authored publications. The value of CI implies the average number of authors per publications. That is the total number of authors in articles in a particular year divided by the total number of papers of that specific year. The peak value of CI reflects in the year 2016 with the value 5.275 since the highest number of authors (2722) per papers (N=520) found in that year. The second-largest value of CI is in the year 2015, with a value of 5.074.

CI is seen lowermost in the year 2010 with a rate of 4.326. The mean value of CI is 4.722.CC is counting the fractional productivity of authors per paper. Therefore, the value of MCC will be higher than the value of CC. From table 3, it can be notable that the value of MCC in all years is slightly higher than the value of CC. Also, there is not remarkable difference between the values of MCC and CC as the number of authorship increases since there is no significant increase in the total number of authors in the corresponding years. Here, the highest rate of CC and MCC was inspected in 2016 with the rates 0.755 and 0.757. The lowest rate of CC and MCC was examined in 2010 with the rates of 0.690 and 0.692, respectively. The mean values of CC and MCC are 0.728 and 0.730 consecutively.

Yearly variance in the values of DC, CI, CC, and MCC is demonstrated in Chart 3.

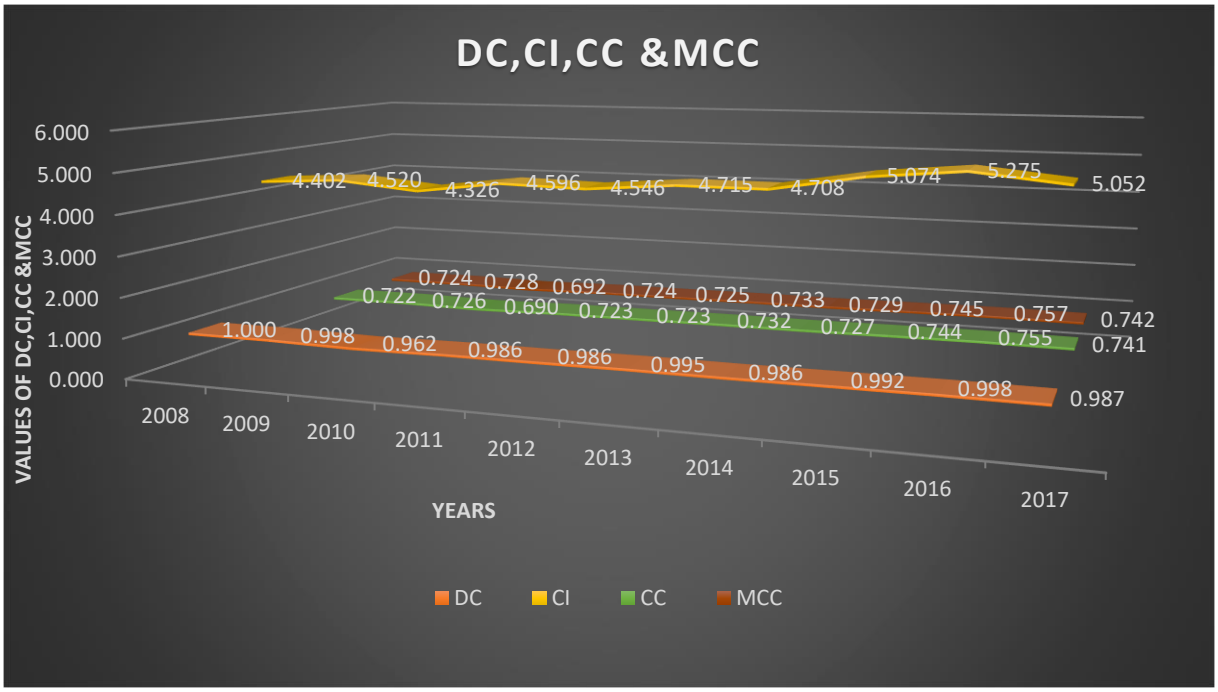


**Chart 3: DC, CI, CC, MCC**

## 5.4. Application of Inverse-square law (Alfred Lotka's law)

For testing the Inverse-square law in Global geese research publication, here applied straight count of authors keeping in view that first authors are the primary contributors of publications. From table 4, while the applied straight count in geese publications, it is observed that out of 3513 first authors during the study term, 2887 authors donated only a single article. Authors endowed articles between the range of one to twenty. Author Fox, A.D, who provided twenty articles as the first author, is considered as the primary contributor of this discipline. Author Wang, J., who granted 17 articles, and Chen, S, who gave 15 articles, are the other significant contributors. Table 4 indicates that only a small number of authors donated more than ten

articles. This premise is to test the Inverse-square law in geese research publication. The numbers of authors with their article contributions are listed in Table 4.

| Number of articles | Number of authors | Total number of articles of authors |
|---|---|---|
| 1 | 2887 | 2887 |
| 2 | 377 | 754 |
| 3 | 102 | 306 |
| 4 | 57 | 228 |
| 5 | 38 | 190 |
| 6 | 18 | 108 |
| 7 | 7 | 49 |
| 8 | 9 | 72 |
| 9 | 5 | 45 |
| 10 | 3 | 30 |
| 11 | 6 | 66 |
| 12 | 0 | 0 |
| 13 | 0 | 0 |
| 14 | 1 | 14 |
| 15 | 1 | 15 |
| 16 | 0 | 0 |
| 17 | 1 | 17 |
| 18 | 0 | 0 |
| 19 | 0 | 0 |
| 20 | 1 | 20 |
| **Total** | **3513** | **4801** |

**Table 4: Straight count of first authors**

For applying the Inverse-square law in geese research publications, the number of articles imparted by the authors taken as x, and the number of authors who contributed x article taken as y in table 5. Values in the first two columns of table 5 are identical to the values of table 4. The logarithm of the count of articles taken as X and logarithm of the count of authors taken as Y. The product of these values counted in the next two columns. The sum of these rates is calculated in the last row of table 5. The observed rate of the author's scientific distributions measured in the column 'y/∑y' and the cumulative observed distribution counts calculated in the next column. The expected number of distributions, $y_x$ is measured employing the Inverse-square law formula,

$$\mathbf{y_x = c \times x^{-n}}$$

The distribution of scientific productivity of authors which is denoted by exponent 'n' of Inverse-square law formula measured by the equation (Andrés 2009)[10],

$$n = \frac{N\sum XY - \sum X \sum Y}{N\sum X^2 - (\sum X)^2}$$

In geese, research publications value of 'n' in its absolute value measured as 2.816
The rate of 'C' which denotes the expected number of authors measured as 0.806
Cumulative expected number of distributions measured in the column $\sum y_x$

Difference between the observed number of authors scientific productivity distribution counts and expected distribution counts measured in Column D of table 5.

| **x** | **y** | **X** | **Y** | **$X^2$** | **XY** | **$y/\sum y$** | **$\sum(y/\sum y)$** | **$y_x$** | **$\sum y_x$** | **D** |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2887 | 0.000 | 3.460 | 0.000 | 0.000 | 0.822 | 0.822 | 0.806 | 0.806 | 0.016 |
| 2 | 377 | 0.301 | 2.576 | 0.091 | 0.776 | 0.107 | 0.929 | 0.114 | 0.920 | 0.009 |
| 3 | 102 | 0.477 | 2.009 | 0.228 | 0.958 | 0.029 | 0.958 | 0.037 | 0.957 | 0.001 |
| 4 | 57 | 0.602 | 1.756 | 0.362 | 1.057 | 0.016 | 0.975 | 0.016 | 0.973 | 0.001 |
| 5 | 38 | 0.699 | 1.580 | 0.489 | 1.104 | 0.011 | 0.985 | 0.009 | 0.982 | 0.003 |
| 6 | 18 | 0.778 | 1.255 | 0.606 | 0.977 | 0.005 | 0.991 | 0.005 | 0.987 | 0.003 |
| 7 | 7 | 0.845 | 0.845 | 0.714 | 0.714 | 0.002 | 0.993 | 0.003 | 0.990 | 0.002 |
| 8 | 9 | 0.903 | 0.954 | 0.816 | 0.862 | 0.003 | 0.995 | 0.002 | 0.993 | 0.002 |
| 9 | 5 | 0.954 | 0.699 | 0.911 | 0.667 | 0.001 | 0.996 | 0.002 | 0.994 | 0.002 |
| 10 | 3 | 1.000 | 0.477 | 1.000 | 0.477 | 0.001 | 0.997 | 0.001 | 0.996 | 0.002 |
| 11 | 6 | 1.041 | 0.778 | 1.084 | 0.810 | 0.002 | 0.999 | 0.001 | 0.997 | 0.002 |
| 12 | 0 | 1.079 | - | 1.165 | - | 0.000 | 0.999 | 0.001 | 0.997 | 0.002 |
| 13 | 0 | 1.114 | - | 1.241 | - | 0.000 | 0.999 | 0.001 | 0.998 | 0.001 |
| 14 | 1 | 1.146 | 0.000 | 1.314 | 0.000 | 0.000 | 0.999 | 0.000 | 0.998 | 0.001 |
| 15 | 1 | 1.176 | 0.000 | 1.383 | 0.000 | 0.000 | 1.000 | 0.000 | 0.999 | 0.001 |
| 16 | 0 | 1.204 | - | 1.450 | - | 0.000 | 1.000 | 0.000 | 0.999 | 0.000 |
| 17 | 1 | 1.230 | 0.000 | 1.514 | 0.000 | 0.000 | 1.000 | 0.000 | 0.999 | 0.001 |
| 18 | 0 | 1.255 | - | 1.576 | - | 0.000 | 1.000 | 0.000 | 1.000 | 0.000 |
| 19 | 0 | 1.279 | - | 1.635 | - | 0.000 | 1.000 | 0.000 | 1.000 | 0.000 |
| 20 | 1 | 1.301 | 0.000 | 1.693 | 0.000 | 0.000 | 1.000 | 0.000 | 1.000 | 0.000 |
| **Total** | **3513** | **18.386** | **16.390** | **19.269** | **8.402** | | | | | |
| | **$\sum$ y** | **$\sum$X** | **$\sum$Y** | **$\sum X^2$** | **$\sum$XY** | | | | | |

**Table 5: Application of Inverse-square law (Lotka's law)**

Column D of table 5 discloses that there is no considerable variation between the observed rate and expected rate of distributions. Maximum deviation obtained in the one author article productivity count with the rate of 0.016, followed by two author article productivity with 0.009. In the remaining author authors, productivity counts only very minute variations observed. Hence it can manifest that Inverse-square law is suitable for the scientific productivity of this discipline.

### 5.5. Kolmogorov-Smirnov Test (K-S Test)

Kolmogorov-Smirnov is implemented to confirm whether observed data is apt for the expected distribution of the Inverse-square law. The uppermost variation ($D_{max}$) was found in the single article productivity count with a rate of 0.016. Hence this rate is grabbed as for comparing with critical value (c.v.), which is calculated using the general formula (Andrés 2009)[10]: -

$$\mathbf{c.v.}=\frac{\mathbf{1.63}}{\left[\sum y+\left(\frac{\sum y}{10}\right)^{\frac{1}{2}}\right]^{1/2}}$$

Applying the count of ∑y in the formula;

$$\mathbf{c.v}=\frac{\mathbf{1.63}}{\left[\mathbf{3513}+\left(\frac{3513}{10}\right)^{\frac{1}{2}}\right]^{1/2}}=\mathbf{0.027}.$$

Critical value =0.027

$D_{max}$ =0.016

The maximum variance $D_{max}$ rate of 0.016 is less than the critical value of 0.027. Hence it can declare that the scientific productivity of authors of geese research publications is well suited with Inverse-square law.

## 6.Conclusion

The present study disclosed that the rate of PEI and ACPP is diminishing year after year indicates that the impact of research published in geese publication is reducing. The rate of PEI and ACPP is observed extreme in the year 2008, and the lowest rate found in the year 2017. However, the average rate of PEI is satisfactory, with a value of 1.02. The three authorship patterns of geese research publication are ruling other authorship patterns in terms of article contribution and the author's participation. Rates of DC revealed that collaborative papers were remarkably leading single-authored papers. Out of one, DC exhibits a mean value of 0.989 during the study term. The highest rate of CI was observed in the year 2016, with a rate of 5.275. The top rate of CC and MCC is in 2016 with 0.755 and 0.757 successively, since the highest number of authors (2722) per paper (N=520) were observed in the same year. Application of Inverse-square law and verification of Kolmogorov-Smirnov test proved that this law is apt for global geese research publications.

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