DESIDOC Journal of Library & Information Technology, Vol. 38, No. 5, Sept 2018, pp. 320-325, DOI : 10.14429/djlit.38.5.12917


# Collaborative Authorship Trend in Leading Indian LIS Journals

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**ABSTRACT**

The published articles in leading Indian LIS journals during 2012-2017 have been mapped to depict the authorship pattern and collaboration trend in LIS domain of India. The study assessed the collaborative authorship trend on using different parameters like journal wise pattern, year wise collaboration, co-authorship index, ranked list of most productive authors and the level of collaboration. The Lotka's law on author productivity has also been tested to confirm the applicability of the law to the present data set. It is found that two-authored papers are predominant (48%) in LIS publications and the collaborated articles of multi-authorships received greater average citations. Besides, in Indian LIS discipline, maximum collaboration occurs in intra-institutional level and inter-institutions within state level. Therefore, it is recommended that the LIS schools across the country should also consider inter-departmental collaboration to produce more quality works on emerging and innovative research areas.

**Keywords:** Authorship pattern; Collaboration; Annals of library and information studies; DESIDOC Journal of Library & Information Technology; SRELS Journal of Information Management; Bibliometrics.

## 1. INTRODUCTION

Collaboration indicates co-authorship, the formal acknowledgement of joint contribution[1]. Collaboration exists from the beginning of history of science. But, since last few decades it gets momentum in various disciplines of science and technology. Participating in collaborations is the increasing popular strategies for organisations/ individuals to share resources, ideas and expertise. It is also an opportunity to enhance the capability, to be more productive and to output more quality works. However, the extent of collaboration and their growth pattern varied from one discipline to another, one branch to another branch of the same subject and from one country to another country[2]. In recent days, it has also become common practice that many specialists from different disciplines are working together for an interdisciplinary project.

Bibliometric is an application of statistical methods to evaluate a particular discipline, publication pattern and characteristics. The present study is an attempt to quantify the authorship pattern and trend in Library and Information Science (LIS) literature by assessing the leading journals literature.

## 2. LITERATURE REVIEW

The review of literature summarises and highlights the literature on authorship pattern, collaboration and the Lotka's law of author productivity. The findings are as follows.

Garg and Padhi[2] analysed 3174 papers published in Laser Science and Technology discipline and revealed that the average value of collaborative coefficient is towards collaborative research pattern. The co-authorship index (CAI) also applied by calculating proportional output of single, two, multi and mega-authored papers for different nations and for different sub-specialties of laser science and technology.

Mondal, Kanamadi and Das[3] evaluated the papers of Indian authors published in foreign LIS journals during 2006-2015 and depicted that two authored papers share maximum articles (41.45 %). The University of Delhi shared maximum contributions and *Library Philosophy and Practice* has been found as the most preferred foreign journals for communication of research results.

In their study, Jain and Kumar[4] measured the research productivity of Indian scientists to world Soybean research during 1989-2008. India ranked 2nd position in world research publication and the authorship pattern showed the trend towards joint authorship contributions. The Lotka's law has been found applicable to the present data set.

In another study, Elango and Rajendran[5] assessed the authorship pattern and collaboration in Marine Sciences discipline and identified that the highest number of papers contributed by two author and by inter-institutional level of collaboration. The author productivity also followed the Lotka's law.

Biradar and Tadasad[6] identified the pattern of authorship and collaboration in Economics discipline during 2000-2014 by using collaborative index (avg. value of 2.14), degree of collaboration (avg. value of 0.58) and collaborative coefficient (avg. value of 0.37). Majority of the papers were found to be single authored but overall collaborative research trend had been seen.

Received : 11 April 2018, Revised : 16 July 2018
Accepted : 19 July 2018, Online published : 5 September 2018

Suresh Kumar[7] examined LIS publications and Naqvi and Fatima[8] analysed international business literature to study the applicability of Lotka's law to author productivity. Further, Kolmogorov –Smirnov goodness of fit test (K-S Test) and Chi square test also tested to compare and confirm the dataset. In both the cases, Lotka's law confirmed the author productivity distribution.

Aswathy and Gopikuttan[9] assessed the author productivity in the publication of three University in Kerala during 2005-2009 and Pillai Sudhier[10] evaluated the authorship distribution in physics literature. In both the study, Lotka's inverse square law has been applied using Pao's method and the data set was tested by K-S goodness-of-fit-test. But, the Lotka' generalised law is not applicable to these study.

## 3. OBJECTIVES

The study assesses the trend and impact of collaboration pattern in Indian LIS discipline. The main objectives are to:

- Illustrate the journal wise authorship trend and collaboration pattern
- Find out year wise collaboration trend
- Depict co-authorship index by year
- Reveal most productive authors
- Test the applicability of the Lotka's law on author productivity distribution and
- Examine the level of collaboration between authors.

## 4. SCOPE AND METHODOLOGY

The present bibliometric study is restricted to research 'article' publications of three leading Indian LIS journals[11] titled '*Annals of Library and Information Studies*' (ALIS), '*DESIDOC Journal of Library & Information Technology'* (DJLIT) and '*SRELS Journal of Information Management'* (SRELS) during 2012-2017. These promising journals have long traditional history of scholarly publications in Indian LIS discipline and have completed the volumes of 64, 37 and 54 respectively in the year 2017.

Total 900 article published in 96 issue of these journals have been taken into consideration for the study and retrieved from the archive of the respective journals website[12,13,14]. Then the bibliographical details have been collected and saved to MS-Excel file. The data are then analysed and presented in tabular and graphical format for interpretation. Further, the Google Scholar online database (*www.scholar.google.co.in*) has also been consulted during February, 2018 to get the citation data of the articles.

## 5. DATA ANALYSIS AND INTERPRETATION

The authors analysed and interpreted the bibliographical details of select articles in the following sections on the basis of different parameters.

### 5.1 Journal wise Distribution of Authorship Pattern

Table 1 illustrates the journal wise distribution of authorship trend and its citation impact. During the study period, the three Indian LIS journals publish total 900 articles which cited 1962 time at an average citation of 2.18. Out of total articles, maximum 432 articles (48 %) are written by two-authored, followed by 304 single-authored articles (33.77 %) and 126 three-authored article (14 %). Only 13 articles (1.44 %) are written by five or more author. Further, the 346 DJLIT articles received maximum average citation of 3.254 whereas the SRELS articles i.e. 353 received minimum average citation of 0.835. Further, it is also seen that the collaborated articles of two, three and four authorship attract more average citations than single authored articles as shown in Fig. 1.

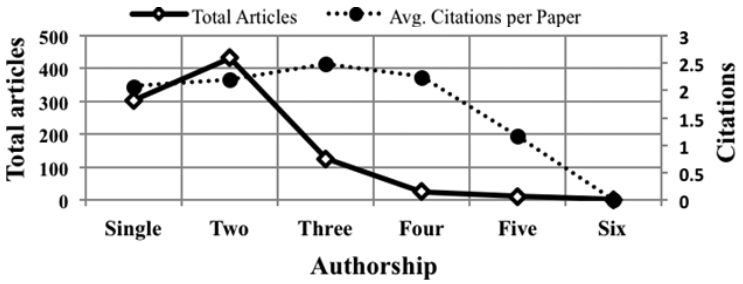


**Figure 1. Authorship trend and citation impact.**

**Table 1. Journal wise distribution of authorship trend and citation impact**

| Journals | Authorship Pattern | | | | | | Total Articles | Times Cited | Avg. citation per paper |
|---|---|---|---|---|---|---|---|---|---|
| | Single | Two | Three | Four | Five | Six | | | |
| ALIS | 70 (34.82%) | 95 (47.26%) | 27 (13.43%) | 05 (2.48%) | 03 (1.49%) | 01 (0.50%) | 201 | 541 | 2.691 |
| DJLIT | 115 (33.23%) | 165 (47.69%) | 49 (14.16%) | 12 (3.47%) | 05 (1.44%) | 00 | 346 | 1126 | 3.254 |
| SRELS | 119 (33.71%) | 172 (48.72%) | 50 (14.16%) | 08 (2.26%) | 04 (1.13%) | 00 | 353 | 295 | 0.835 |
| Total = | 304 | 432 | 126 | 25 | 12 | 01 | 900 | 1962 | 2.18 |
| Percentage | 33.77% | 48% | 14% | 2.77% | 1.33% | 0.11% | 100% | -- | -- |
| Times Cited | 631 | 949 | 312 | 56 | 14 | 00 | 1962 | -- | -- |
| Avg. citation per paper | 2.075 | 2.196 | 2.476 | 2.24 | 1.166 | 00 | 2.18 | -- | -- |

*Citation source: Google Scholar as on Feb., 2018*

### 5.2 Journal wise Distribution of Collaboration Trend

Table 2 reveals the journal wise distribution of collaboration trend. For this purpose, the authors test the Collaborative Index (CI) by *Lawani*[15] and the collaborative coefficient (CC) by *Ajiferuke*[15]*, et al*. The average Collaborative Index (CI) and the Collaborative Coefficient (CC) for total 900 article is 1.902 and 0.366 respectively which indicates the dominance of collaborative authorship in LIS publications. Out of three LIS journals, maximum collaboration trend has been seen in the publications of DJLIT journal followed by ALIS and SRELS.

The mathematical formula for calculation of collaboration tools are mentioned as follows[15].

$$\text{Collaborative Index (CI)} = \frac{\sum_{j=1}^{k} {}^{j} f_j}{N}$$

where $j$ = the number of author(s), $f_j$ = the number of j-authored research papers published in a discipline during a certain period of time, $N$= the total number of research papers published in a discipline during a certain period of time and $K$= the greatest number of collaborated authors per paper in a discipline.

$$\text{The Collaborative Coefficient (CC)} = 1 - \frac{\sum_{j=1}^{k} \left(\frac{1}{j}\right) f_j}{N}$$

where $j$ = Authorship, $f_j$ = Number of $j$ - authored research papers, $N$= the total number of research papers and $K$= the greatest number of authors per paper.

### 5.3 Year wise Distribution of Collaboration Trend

Table 3 depicts the year wise collaboration trend of LIS articles. During the study period, the CI varies from 1.839 to 2.021 and the CC also varies from 0.346 to 0.404. In both the cases, the maximum collaboration trend has been seen in the year 2014 whereas the minimum in the year 2013. However, slightly fluctuating trend has been observed in the collaboration trend of Indian LIS publications by years.

**Table 2. Journal wise collaboration trend**

| Journals | Authorship | | | | | | Total Articles | CI | CC |
|---|---|---|---|---|---|---|---|---|---|
| | Single | Two | Three | Four | Five | Six | | | |
| ALIS | 70 | 95 | 27 | 05 | 03 | 01 | 201 | 1.900 | 0.360 |
| DJLIT | 115 | 165 | 49 | 12 | 05 | 00 | 346 | 1.922 | 0.370 |
| SRELS | 119 | 172 | 50 | 08 | 04 | 00 | 353 | 1.884 | 0.364 |
| Total | 304 | 432 | 126 | 25 | 12 | 01 | 900 | 1.902 | 0.366 |

*CI= Collaborative Index; CC= Collaborative Coefficient*

**Table 3. Year wise collaboration trend**

| Year | Authorship | | | | | | Total Articles | CI | CC |
|---|---|---|---|---|---|---|---|---|---|
| | Single | Two | Three | Four | Five | Six | | | |
| 2012 | 57 | 73 | 24 | 1 | 3 | -- | 158 | 1.860 | 0.352 |
| 2013 | 62 | 78 | 24 | 2 | 1 | 1 | 168 | 1.839 | 0.346 |
| 2014 | 39 | 71 | 22 | 7 | 2 | -- | 141 | 2.021 | 0.404 |
| 2015 | 55 | 71 | 20 | 3 | 2 | -- | 151 | 1.847 | 0.349 |
| 2016 | 49 | 66 | 18 | 9 | 3 | -- | 145 | 1.972 | 0.373 |
| 2017 | 42 | 73 | 18 | 3 | 1 | -- | 137 | 1.890 | 0.376 |
| Total | 304 | 432 | 126 | 25 | 12 | 01 | 900 | 1.902 | 0.366 |

CI= Collaborative Index; CC= Collaborative Coefficient.

### 5.4 Co-Authorship Index

The co-authorship index (CAI) can be measured by calculating proportional output of single, two, multi and mega-authored papers for different nations. The following mathematical formula of Garg and Padhi[2] has been used to determine the co-authorship pattern.

$\text{CAI} = \{(N_{ij} / N_{io}) / (N_{oj} / N_{oo})\} \times 100$

$N_{ij}$ : number of papers having j authors in block i

$N_{io}$ : Total output of block i

$N_{oj}$ : number of papers having j authors for all blocks

$N_{oo}$ : total number of papers for all authors and all blocks

$j = 1, 2, 3, 4, \geq 5$.

CAI = 100 implies that co-authorship in a particular block for a particular type of authorship corresponds to the world average, CAI > 100 reflects higher than average co-authorship effort and CAI < 100 indicates lower than average co-authorship effort in a particular block for a particular type of authorship.

Table 4 illustrates the co-authorship index. It is observed that a decreasing trend has been seen in the value of CAI for single, three and four authored papers. Conversely, an increasing trend has been seen in two authored articles from 96.2 to 111 during the study period. This indicates that two-authored papers are increasing year by year in Indian LIS publications.

### 5.5 Most Productive Authors

Table 5 lists the most productive authors who have published minimum 09 or more articles in three leading Indian LIS journals. *B. M. Gupta* of *CSIR-NISTADS* published maximum number of 25 articles followed by *B K Sen, DST, GoI* with 21 article and *Ritu Gupta* of *Shri Venkateswar University* with 18 articles.

### 5.6 Application of Lotka's Law on Author Productivity

Table 6 shows the distribution of articles according to the observed authors and the expected authors. According to Lotka's law, number of article (X) produced is inversely proportional to number of authors (Y) producing them[8]. The authors have followed the Sen's method[16] to examine the applicability of the Lotka's law to the present data set of author productivity distribution.The simplest equation of Lotka's law is:

$$X^n . Y = C \qquad (1)$$

where $X$ stands for number of contributed articles; $Y$ stands for the number of authors; $n$ and $C$ are constants.

**Table 4. Co-authorship index**

| Year | Authorship | | | | | | | | | | Total Articles |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Single | CAI | Double | CAI | Three | CAI | Four | CAI | Five or more | CAI | |
| 2012 | 57 | 106.8 | 73 | 96.2 | 24 | 108.5 | 01 | 22.8 | 03 | 131.4 | 158 |
| 2013 | 62 | 109.2 | 78 | 96.7 | 24 | 102 | 2 | 43 | 2 | 82.4 | 168 |
| 2014 | 39 | 82 | 71 | 105 | 22 | 111.4 | 7 | 178.7 | 2 | 98.2 | 141 |
| 2015 | 55 | 107.8 | 71 | 98 | 20 | 94.6 | 3 | 71.5 | 2 | 91.7 | 151 |
| 2016 | 49 | 100 | 66 | 95 | 18 | 88.7 | 9 | 223.4 | 3 | 143.2 | 145 |
| 2017 | 42 | 90.7 | 73 | 111 | 18 | 94 | 3 | 79 | 1 | 50.5 | 137 |
| Total | 304 | 100 | 432 | 100 | 126 | 100 | 25 | 100 | 13 | 100 | 900 |

**Table 5. Most productive authors (2012-2017)**

| Rank | Authors | Affiliating Institute | State | Single Authored | First Authored | Total articles |
|---|---|---|---|---|---|---|
| 1 | B. M. Gupta | CSIR-NISTADS | New Delhi | 2 | 9 | 25 |
| 2 | B K Sen | DST, GoI. | New Delhi | 7 | -- | 21 |
| 3 | Ritu Gupta | Shri Venkateswar University | Andhra Pradesh | -- | 7 | 18 |
| 4 | K C Garg | CSIR-NISTADS | New Delhi | -- | 11 | 16 |
| 5 | Bidyarthi Dutta | Vidyasagar University | West Bengal | 1 | 5 | 12 |
| 6 | K. G. Pillai Sudhier | University of Kerala | Kerala | 1 | 2 | 11 |
| 7 | Partha Pratim Ray | Visva-Bharati | West Bengal | 5 | 5 | 10 |
| 8 | Shri Ram | Thapar University | Punjab | 4 | 3 | 09 |

**Table 6. Distribution of number of articles according to observed authors and expected authors**

| No of contributions (x) | Observed no of authors (y) | Percentage of observed authors in | Expected no of authors (n=2.654) | Percentage of expected authors |
|---|---|---|---|---|
| 1 | 895 | 78.23 | 895 | 77.9 |
| 2 | 142 | 12.41 | 142 | 12.36 |
| 3 | 49 | 4.28 | 48 | 4.17 |
| 4 | 16 | 1.4 | 23 | 2 |
| 5 | 19 | 1.66 | 12 | 1.04 |
| 6 | 5 | 0.44 | 8 | 0.7 |
| 7 | 4 | 0.35 | 5 | 0.43 |
| 8 | 6 | 0.52 | 4 | 0.35 |
| 9 | 1 | 0.08 | 3 | 0.26 |
| 10 | 1 | 0.08 | 2 | 0.17 |
| 11 | 1 | 0.08 | 2 | 0.17 |
| 12 | 1 | 0.08 | 1 | 0.08 |
| 16 | 1 | 0.08 | 1 | 0.08 |
| 18 | 1 | 0.08 | 1 | 0.08 |
| 21 | 1 | 0.08 | 1 | 0.08 |
| 25 | 1 | 0.08 | 1 | 0.08 |
| | 1144 | 100 | 1149 | 100 |

Now, putting the value of first row (i.e. $X$= 1; $Y$= 895) in Equation 1, the following can be found.

$1^n$. 895 = $C$ [$1^n$ = 1]

- $C$= 895.

Now, putting the value of second row (i.e. $X$=2; $Y$=142; $C$=895) in Eqn. 1, the following can be found.

2n. 142= 895

- $2n$ = 895/ 142
- $n$ *log* 2= *log* 6.30
- $n$ (0.301)= 0.799
- $n$ = 0.799/ 0.301
- $n$ = 2.654

Using the value of $C$=895 and $n$ = 2.654 in the Eqn. 1, the expected values are calculated and presented in the Table 7.

In the present study, total 1144 author contribute 900 article in three Indian LIS publications during the period of 2012 to 2017. There are 895 authors (78.23 %) contributing one article, 142 author (12.41 %) contributing two article, 49 author (4.28 %) contributing three articles and so on. To calculate the value of n, data from observed authors is used and is found to be 2.654 i.e., $n$=2.654. It is clear from Table 6 that the observed and expected authors are nearly same. Pao recommended[10] to use the Kolmogorov-Smirnov (K-S) goodness-of-fit test for confirmation of the applicability of Lotka's law in the present data set.

### *5.6.1 The Kolmogorov-Smirnov (K-S) One Sample Test*

The Kolmogorov-Smirnov (K-S) goodness-of-fit test was used to confirm the applicability of the Lotka's law to the observed values. The maximum deviation ($D_{max}$) is calculated by using $n$=2.654 in expected number of authors and it is found that the value of $D$ is 0.0051.

At 5 % significance level, the critical value can be computed using following equation:

Critical Value = $1.36/\sqrt{1144}$ = 0.040.

**Table 7. K-S Test of observed and expected distribution of authors**

| No of contributions (x) | Observed no of authors (y) | Cumulative frequency of observed authors | Relative frequency of observed authors Fo | Expected no of authors (n=2.654) | Cumulative frequency of expected authors | Relative frequency of expected authors Fe | Deviation $D_{max}$ = \| Fe-Fo \| |
|---|---|---|---|---|---|---|---|
| 1 | 895 | 895 | 0.7823 | 895 | 895 | 0.7789 | 0.0033 |
| 2 | 142 | 1037 | 0.9064 | 142 | 1037 | 0.9025 | 0.0038 |
| 3 | 49 | 1086 | 0.9493 | 48 | 1085 | 0.9442 | 0.0051 |
| 4 | 16 | 1102 | 0.9632 | 23 | 1108 | 0.9643 | 0.0011 |
| 5 | 19 | 1121 | 0.9798 | 12 | 1120 | 0.9747 | 0.0051 |
| 6 | 5 | 1126 | 0.9842 | 8 | 1128 | 0.9817 | 0.0025 |
| 7 | 4 | 1130 | 0.9877 | 5 | 1133 | 0.9860 | 0.0017 |
| 8 | 6 | 1136 | 0.9930 | 4 | 1137 | 0.9895 | 0.0034 |
| 9 | 1 | 1137 | 0.9938 | 3 | 1140 | 0.9921 | 0.0017 |
| 10 | 1 | 1138 | 0.9947 | 2 | 1142 | 0.9939 | 0.0008 |
| 11 | 1 | 1139 | 0.9956 | 2 | 1144 | 0.9956 | 0.0000 |
| 12 | 1 | 1140 | 0.9965 | 1 | 1145 | 0.9965 | 0.0000 |
| 16 | 1 | 1141 | 0.9973 | 1 | 1146 | 0.9973 | 0.0000 |
| 18 | 1 | 1142 | 0.9982 | 1 | 1147 | 0.9982 | 0.0000 |
| 21 | 1 | 1143 | 0.9991 | 1 | 1148 | 0.9991 | 0.0000 |
| 25 | 1 | 1144 | 1.0000 | 1 | 1149 | 1.0000 | 0.0000 |
| | 1144 | | | 1149 | | | |

**Table 8. Citation impact of level of collaboration**

| Types of Collaboration | No of Articles | | | Total articles | Percentage | Times cited | Avg. citations per paper |
|---|---|---|---|---|---|---|---|
| | ALIS | DJLIT | SRELS | | | | |
| No Collaboration (Single authored) | 58 | 99 | 104 | 261 | 29 | 543 | 2.08 |
| Intra-institutional Level (within same institutions) | 27 | 85 | 82 | 194 | 21.55 | 402 | 2.07 |
| Inter-institutions within State | 35 | 58 | 87 | 180 | 20 | 359 | 1.99 |
| Inter-institutions outside State | 33 | 56 | 50 | 139 | 15.44 | 370 | 2.66 |
| International | 03 | 07 | 01 | 11 | 1.22 | 34 | 3.09 |
| Foreign authored | 45 | 41 | 29 | 115 | 12.78 | 254 | 2.21 |
| Total | 201 | 346 | 353 | 900 | 100 | 1962 | 2.18 |

*Citation source: Google Scholar as on Feb., 2018*

The resulting critical value in the present data set is 0.040. Hence, the actual value of D falls within the critical value of D. Therefore, it can be said that the Lotka's law fits the author productivity distribution in the present data set.

### 5.7 Citation Impact of Level of Collaboration

Collaborating authors' affiliation appear in the papers have been considered for measurement of collaboration level. Table 8 presents the level of collaboration and its impact. Highest number of 261 articles (29 %) is written by single authors followed by intra-institutional level of collaboration with 194 article (21.55 %) and inter-institutions within state with 180 article (20 %). Only very few articles i.e. 11 are written by Indian LIS authors collaborated with foreign authors. The internationally collaborated articles attract maximum average citation of 3.09 followed by the collaborated articles of inter-institutions outside state with an average citation of 2.66. It is also observed that total 115 foreign authored article (12.78 %) appear in the three journals and the articles received total 254 citations with an average citation of 2.21 per paper.

## 6. CONCLUSIONS

In last 6 years, the three leading Indian LIS journals publish total 900 articles having average citation of 2.18. The average Collaborative Index (CI) and the Collaborative Coefficient (CC) indicate the trend towards dominance of collaboration and joint authorship in LIS publications. Further, the present dataset of author productivity distribution follows the Lotka's law and it is also confirmed by the Kolmogorov-Smirnov (K-S) goodness-of-fit test. In Indian LIS discipline, maximum collaboration happens in intra-institutional level and inter-institutions within state level. However, the citation impact also points out that the DJLIT articles and more authorship articles get more average citations. Further, the articles collaborated internationally and Inter-institutions outside state also attract greater citations compared to local level collaborations due to its wider readership.

Collaboration outcomes more and better results than what we can achieve individually. Indian LIS authors should give more emphasis on wide collaboration on different levels instead of being independent authors to output more quality

and interdisciplinary works. Hence, inter-departmental collaboration between LIS schools within state as well as outside state may boost the Indian LIS discipline by producing more quality works on emerging and other innovative research areas. There is also a dire need to enhance the research collaboration with LIS scientists from different countries. This move is bound to increase the collaborative research output in the international arena[3].

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His contribution in the current study is suggestion and improvement of the contents of the manuscript to shape it in the final approved version.