Asian Journal of Information Science and Technology
ISSN: 2231-6108 (P) Vol.10 No.2, 2020, pp.21-27
© The Research Publication, www.trp.org.in
DOI: https://doi.org/10.51983/ajist-2020.10.2.307

# Authorship Patterns and Degree of Collaboration of Cited Literature in Indian Chemistry Research Publications

**Kodandarama[1] and M.Chandrashekara[2]**
[1]Research Scholar, [2]Professor, Department of Studies in Library and Information Science,
University of Mysore, Karnataka, India
E-mail: ramsripa@gmail.com
(Received 3 September 2020; Accepted 26 October 2020; Available online 5 November 2020)

***Abstract* - The purpose of this study is to identify the authorship patterns and degree of collaboration of Indian research publications in the field of Chemistry. The main data source for the study is the citations/references of research publications of chemistry indexed in Web f Science during the period 2009-2018. The research method of this study was citation analysis method. Findings of the analysis revealed that the majority of the publications are contributed by multiple authors and the degree of collaboration found to be very high in cited journal literature compared to books and other forms of citations.**
***Keywords:*** **Citation analysis, authorship pattern and degree of collaboration**

## I. INTRODUCTION

The number of authors contributing to scholarly publications in terms of authorship pattern is an interesting part of any bibliometric study. A count of number of authors contributing to articles offers some indication to the degree of collaboration between authors. Cronin (2001) comments, authorship as "undisputed coin of the real in academia" and "absolutely central to the operation of the academic reward system". However, the concept of authorship was evolved over the course of the 20th century, with a steady increase in collaboration. This trend was anticipated by Price (1963), who stated, "by 1980 the single-author paper will be extinct" and scholarly publications will "move steadily toward infinity of authors per paper". Collaborative research refers to a research in which any research project is being carried out by at least two people by engaging their efforts in mind and body. It is very common in the field of sciences as compare to humanities.

## II. REVIEW OF LITERATURE

As part of literature search, the authors found various studies in different disciplines based on the authorship pattern and collaborative research. Some the earlier studies are mentioned here. Karisidappa, Maheswarappa & Shirol (1990) studied authorship pattern and collaborative research in psychology based on the data collected from Psychological Abstracts' for the year 1988, where 39.43% of the papers accounted for single-authorship and the degree of collaboration in psychology was 0.80. Khaiser Jahan Begum & Rajendra (1990) studied research collaboration in Zoological Sciences analysing 7854 items published during 1975-84, where 67.02% of the literature was by multiple authors. Munshi, Vashishth & Gautam (1993) have studied Research collaboration in agricultural sciences' analyzing about 9500 papers published during 1982-86 by six agricultural universities in India. Here 15.36% of the articles were single authored.

Sen (1997) has studied articles with ten or more authorship. Five percent of the papers published in Proceedings of the National Academy of Science New York, February - July 1996 were 'mega authored. Joshi & Maheswarappa (1994) in Multiple authorship trends in different subjects of science and technology: A review of literature" reviewed the studies related to multiple authorship trends in different subjects like mathematics, physics, chemistry, geology, engineering, agricultural sciences and chemical technology. In mathematics 94% of the papers were single-authored in 1940, 79% in 1960 and 44.23% in 1983.

Study conducted by Sudhier & Dileepkumar (2018) indicated that papers in biochemistry are found to be multi authored to an extent of 76.3%. Study also showed that the degree of collaboration of authors of research publications in biochemistry emanating from India is estimated as in the range of 0.97 to 0.98 during 2004-2013. Pupo & Katz (2018) revealed that the journal articles authored by library professionals were collaborative ones which accounted for 69%. Contrary result was observed in the study on economics theses that scholars while preparing doctoral theses had cited a large number of single authored sources which accounts for 72.81%.

## III. OBJECTIVES OF THE STUDY

The main purpose of this study is to know the amount solo and collaborative researches Cited in the research publications of chemistry.

The objectives of the present study are:

1. To examine the nature of authorship patterns in chemistry research;
2. To study the single v/s multi- author papers and average number of authors and
3. To determine the degree of research collaboration on chemistry literature.

## IV. METHODOLOGY

21025 number of citations appended in the 728 research publications of University of Mysore in the field of chemistry indexed in the Web of Science during 2009-2018 were considered for the study.

In order to perform a quantitative analysis, this study considered only journal articles indexed in the database. Selected articles were downloaded from the concerned websites of journals, institutional repository of University of Mysore and Research Gate. Further, cited references were recorded in MS excel, analyzed and tabulated for making observations.

And to calculate the degree of author's collaboration, the mathematical formula proposed by Subramanyam in 1983 is used.

## V. ANALYSIS AND RESULTS

According to the objectives of the study, analysis and findings of the study are outlined below

TABLE I AUTHORSHIP PATTERNS OF CITATIONS TO JOURNALS

| Authorship patterns | Citations | % | Cumulative citations | Cumulative % | No. of Authors |
|---|---|---|---|---|---|
| Single | 1894 | 9.89 | 1894 | 9.89 | 1894 |
| Two | 3346 | 17.48 | 5240 | 27.38 | 6692 |
| Three | 3506 | 18.32 | 8746 | 45.69 | 10518 |
| Four | 3000 | 15.67 | 11746 | 61.37 | 12000 |
| Five | 2519 | 13.16 | 14265 | 74.53 | 12595 |
| Six | 1528 | 7.98 | 15793 | 82.51 | 9168 |
| Seven | 952 | 4.97 | 16745 | 87.48 | 6664 |
| Eight | 566 | 2.96 | 17311 | 90.44 | 4528 |
| Nine | 374 | 1.95 | 17685 | 92.39 | 3366 |
| Ten | 302 | 1.58 | 17987 | 93.97 | 3020 |
| Above ten | 945 | 4.94 | 18932 | 98.91 | 15241 |
| Not available | 209 | 1.09 | 19141 | 100.00 | 0 |
| Total | 19141 | 100 | | | 85686 |
| Average authorship | | | | | 4.47 |

It is observed from the Table I that journal citations authored by three authors are high (18.32%) followed by two authored (17.48%) and four authored (15.67%). Single authored journal citations constituted 9.89% of total citations. Average authorship among journal citationsin the chemistry research publications of University of Mysore is 4.47.

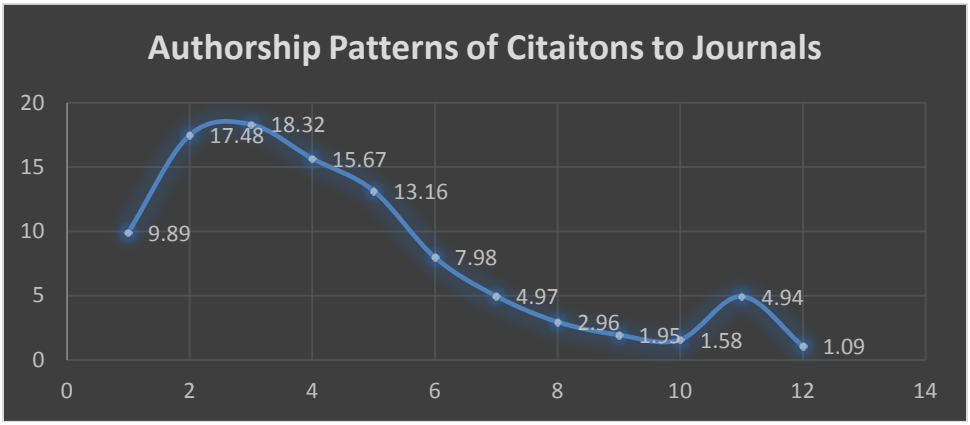


Fig.1 Authorship Patterns of Citations to Journals

TABLE II AUTHORSHIP PATTERNS OF CITATIONS TO BOOKS

| Authorship pattern | Citations | % | Cumulative citations | Cumulative % | No. of Authors |
|---|---|---|---|---|---|
| Single | 403 | 41.33 | 403 | 41.33 | 403 |
| Two | 221 | 22.67 | 624 | 64.00 | 442 |
| Three | 86 | 8.82 | 710 | 72.82 | 258 |
| Four | 70 | 7.18 | 780 | 80.00 | 280 |
| Five | 20 | 2.05 | 800 | 82.05 | 100 |
| Six | 4 | 0.41 | 804 | 82.46 | 24 |
| Seven | 5 | 0.51 | 809 | 82.97 | 35 |
| Eight | 5 | 0.51 | 814 | 83.49 | 40 |
| Nine | 1 | 0.10 | 815 | 83.59 | 9 |
| Ten | 3 | 0.31 | 818 | 83.90 | 30 |
| Above ten | 1 | 0.10 | 819 | 84.00 | 11 |
| Not available | 156 | 16.00 | 975 | 100.00 | 0 |
| Total | 975 | 100 | | | 1632 |
| Average authorship | | | | | 1.67 |

It is evident from the table II that single authored books are heavily cited by the chemistry researchers of University of Mysore. Percentage of single authored books citations predominated over multi authored books citations with41.33% of total citations and the remaining percentage of citations were spread among two (22.67%) three (8.82%) and four (7.18%) and other groups of authorship pattern (3.99%). Average authorship among books citations is 1.67.

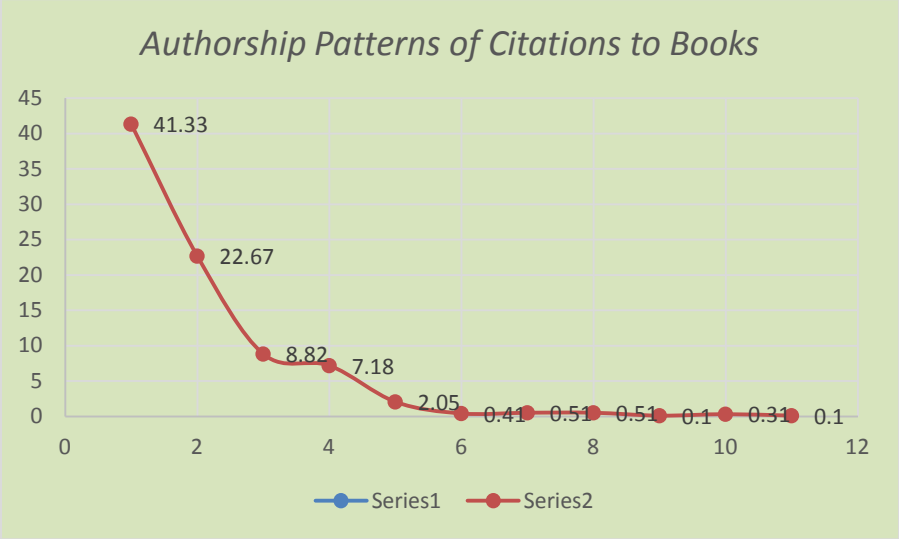


Fig. 2 Authorship Patterns of Citations to Books

Table III shows that 25.74% other forms of cited sources were by single authors followed by two (10.45%) and three (8.69%) authors. 37.62% of other sources cited are anonymous. Average authorship among other forms of cited sources in chemistry research publications of University of Mysore is 1.93

TABLE III AUT HORSHIP PATTERNS OF CITATIONS TO OTHER FORMS OF SOURCES

| Authorship pattern | Citations | % | Cumulative citations | Cumulative % | No. of Authors |
|---|---|---|---|---|---|
| Single | 234 | 25.74 | 234 | 25.74 | 234 |
| Two | 95 | 10.45 | 329 | 36.19 | 190 |
| Three | 79 | 8.69 | 408 | 44.88 | 237 |
| Four | 49 | 5.39 | 457 | 50.28 | 196 |
| Five | 37 | 4.07 | 494 | 54.35 | 185 |
| Six | 16 | 1.76 | 510 | 56.11 | 96 |
| Seven | 12 | 1.32 | 522 | 57.43 | 84 |
| Eight | 5 | 0.55 | 527 | 57.98 | 40 |
| Nine | 4 | 0.44 | 531 | 58.42 | 36 |
| Ten | 10 | 1.10 | 541 | 59.52 | 100 |
| Above ten | 26 | 2.86 | 567 | 62.38 | 357 |
| Not available | 342 | 37.62 | 909 | 100.00 | 0 |
| Total | 909 | 100 | | | 1755 |
| Average authorship | | | | | 1.93 |

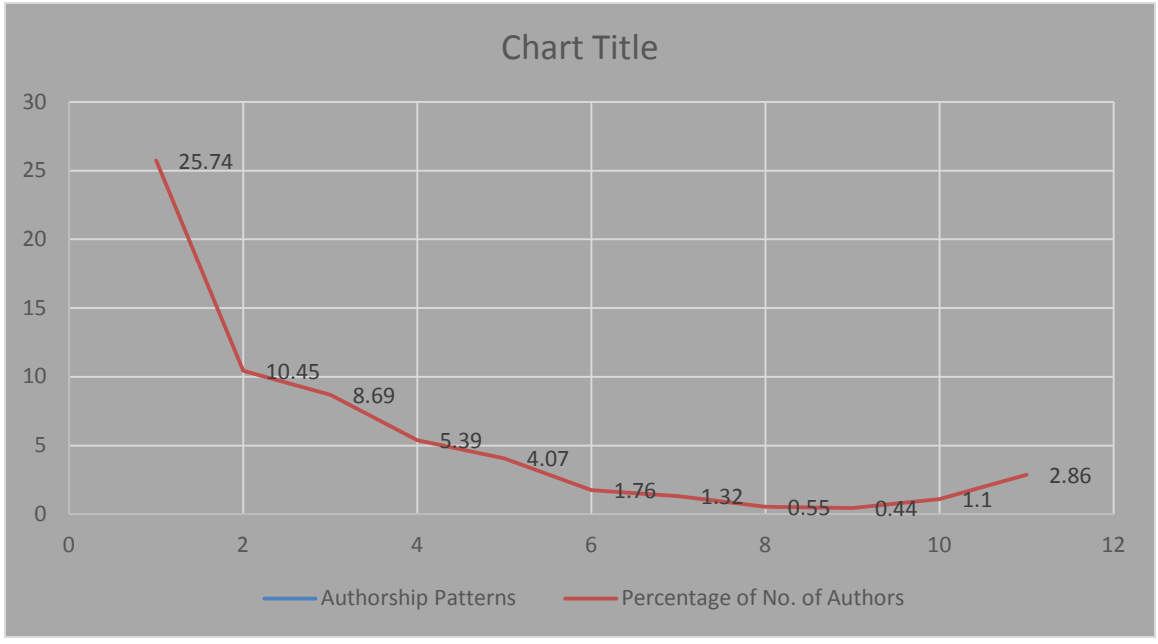


Fig.3 Authorship Patterns of Citations to other forms of sources

It is observed from the Table IV that majority of journals citations by single as well as multi authors cited by researchers in chemistry of University of Mysore were mainly published during 2001-2010. Single authored journal citations were increased by 4.57% from the period 1910 and before to 2001-2010. Similar trend was observed in the other authorship pattern like two authors, three authors and so on.

TABLE IV DECADE WISE AUTHORSHIP PATTERNS IN CITATIONS TO JOURNALS

| **Periods** | | **Single** | **Two** | **Three** | **Four** | **Five** | **>five** | **Not Available** | **Total** |
|---|---|---|---|---|---|---|---|---|---|
| Oldest to 1910 | No. | 23 | 8 | 0 | 1 | 1 | 3 | 1 | 37 |
| | % | 0.12 | 0.04 | 0.00 | 0.01 | 0.01 | 0.02 | 0.01 | 0.19 |
| 1911-1920 | No. | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 4 |
| | % | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| 1921-1930 | No. | 2 | 12 | 0 | 0 | 1 | 0 | 0 | 15 |
| | % | 0.01 | 0.06 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.08 |
| 1931-1940 | No. | 13 | 14 | 1 | 0 | 0 | 1 | 0 | 29 |
| | % | 0.07 | 0.07 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.15 |
| 1941-1950 | No. | 22 | 21 | 11 | 8 | 1 | 0 | 0 | 63 |
| | % | 0.11 | 0.11 | 0.06 | 0.04 | 0.01 | 0.00 | 0.00 | 0.33 |
| 1951-1960 | No. | 42 | 48 | 25 | 34 | 4 | 5 | 0 | 158 |
| | % | 0.22 | 0.25 | 0.13 | 0.18 | 0.02 | 0.03 | 0.00 | 0.83 |
| 1961-1970 | No. | 71 | 108 | 43 | 23 | 12 | 9 | 2 | 268 |
| | % | 0.37 | 0.56 | 0.22 | 0.12 | 0.06 | 0.05 | 0.01 | 1.40 |
| 1971-1980 | No. | 69 | 287 | 141 | 52 | 15 | 15 | 10 | 589 |
| | % | 0.36 | 8.58 | 4.02 | 1.73 | 0.60 | 0.32 | 4.78 | 3.08 |
| 1981-1990 | No. | 193 | 360 | 336 | 183 | 95 | 209 | 17 | 1393 |
| | % | 1.01 | 1.88 | 1.76 | 0.96 | 0.50 | 1.09 | 0.09 | 7.28 |
| 1991-2000 | No. | 423 | 689 | 674 | 612 | 302 | 612 | 29 | 3341 |
| | % | 2.21 | 3.60 | 3.52 | 3.20 | 1.58 | 3.20 | 0.15 | 17.45 |
| 2001-2010 | No. | 898 | 1376 | 1719 | 1473 | 1424 | 2099 | 106 | 9095 |
| | % | 4.69 | 7.19 | 8.98 | 7.70 | 7.44 | 10.97 | 0.55 | 47.52 |
| 2011-2018 | No. | 136 | 420 | 556 | 614 | 664 | 1714 | 44 | 4148 |
| | % | 0.71 | 2.19 | 2.90 | 3.21 | 3.47 | 8.95 | 0.23 | 21.67 |
| Not available | No. | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| | % | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| Total | No. | 1894 | 3346 | 3506 | 3000 | 2519 | 4667 | 209 | 19141 |
| | % | 9.89 | 17.48 | 18.32 | 15.67 | 13.16 | 24.38 | 1.09 | 100.0 |

TABLE V DECADE WISE AUTHORSHIP PATTERNS IN CITATIONS TO BOOKS

| **Periods** | | **Single** | **Two** | **Three** | **Four** | **Five** | **>five** | **Not Available** | **Total** |
|---|---|---|---|---|---|---|---|---|---|
| 1910 and before | No. | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| | % | 0.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.21 |
| 1911-1920 | No. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | % | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1921-1930 | No. | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 |
| | % | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.31 | 0.31 |
| 1931-1940 | No. | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | % | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 |
| 1941-1950 | No. | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 3 |
| | % | 0.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.31 |
| 1951-1960 | No. | 12 | 9 | 1 | 1 | 0 | 0 | 2 | 25 |
| | % | 1.23 | 0.92 | 0.10 | 0.10 | 0.00 | 0.00 | 0.21 | 2.56 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1961-1970 | No. | 36 | 14 | 6 | 1 | 0 | 1 | 2 | 60 |
| | % | 3.69 | 1.44 | 0.62 | 0.10 | 0.00 | 0.10 | 0.21 | 6.15 |
| 1971-1980 | No. | 59 | 39 | 5 | 6 | 3 | 0 | 11 | 123 |
| | % | 6.05 | 4.00 | 0.51 | 0.62 | 0.31 | 0.00 | 1.13 | 12.62 |
| 1981-1990 | No. | 96 | 36 | 20 | 22 | 2 | 2 | 23 | 201 |
| | % | 9.85 | 3.69 | 2.05 | 2.26 | 0.21 | 0.21 | 2.36 | 20.62 |
| 1991-2000 | No. | 118 | 75 | 25 | 14 | 5 | 5 | 45 | 287 |
| | % | 12.10 | 7.69 | 2.56 | 1.44 | 0.51 | 0.51 | 4.62 | 29.44 |
| 2001-2010 | No. | 65 | 40 | 23 | 18 | 8 | 7 | 61 | 222 |
| | % | 6.67 | 4.10 | 2.36 | 1.85 | 0.82 | 0.72 | 6.26 | 22.77 |
| 2011-2018 | No. | 12 | 8 | 6 | 8 | 2 | 4 | 7 | 47 |
| | % | 1.23 | 0.82 | 0.62 | 0.82 | 0.21 | 0.41 | 0.72 | 4.82 |
| Not available | No. | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | % | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.64 | 0.10 |
| Total | No. | 403 | 221 | 86 | 70 | 20 | 19 | 156 | 975 |
| | % | 41.33 | 22.67 | 8.82 | 7.18 | 2.05 | 1.95 | 16.00 | 100.00 |

Table V shows that researchers of chemistry belonging to University of Mysore preferred to cite single authored books that were published during 1991-2000. The percentage of growth of single authored books from 1910 and before to 1991-2000 is 11.89. The same growth of citations is observed among other authorship patterns in research publications of University of Mysore.

## VI. DEGREE OF AUTHORSHIP COLLABORATION IN THE CHEMISTRY RESEARCH PUBLICATIONS

The degree of collaboration is the ratio of multi authored papers published to the total number of papers published in a discipline during certain period of time. The formula given by Subramanyam is useful for determining the degree of collaboration in quantitative terms. The study followed the same formula which is mathematically put as:

$$C = \frac{Nm}{Nm + Ns}$$

Where, C= Degree of collaboration in a discipline.
Nm = number of multi-authored papers
Ns = number of single- authored papers

TABLE VI DEGREE OF COLLABORATION IN THE CITED LITERATURE

| Authorship | Single author | Multi authors | Total | Degree of collaboration |
|---|---|---|---|---|
| Journals | 1894 | 17038 | 18932 | 0.89 |
| Books | 403 | 416 | 819 | 0.50 |
| Others | 234 | 333 | 567 | 0.58 |
| Total | 2531 | 17788 | 20319 | 0.87 |

In the present case C is 0.87 for total citations in chemistry research publications of UOM and the calculation of the same is presented as below

$$C = \frac{17788}{17788+2531} = 0.87$$

From the Table VI it is observed that the degree of authorship collaboration for journal citations is 0.89, for books 0.50 and for forms of documents 0.58.The degree of collaboration in the field of chemistry for overall citations of University of Mysore is 0.87.

## VII. CONCLUSION

The authors studied patterns of authorship in the cited literature of Indian scholarly output in chemistry. The authorship pattern reveals a remarkable difference between the number of single author and multiple authors. As a far

as cited journal literature is concerned citations to journals authored by three authors are high (18.32%) while citations to books shows contrary results that 41.33% of citations were single authored. The degree of authorship collaboration for citations to journals is 0.89. The study concludes that multiple-authorship researches were predominantly cited as compared to solo researches in Indian researches in chemistry.

## REFERENCES


[1] Begum, K. J., and Rajendra, N. (1990). "Research collaboration in zoological sciences," *IASLIC Bulletin*, 35(2), 79-82.

[2] Joshi Anupam N. and Maheswarappa B. S. (1994). "Multiple authorship trends in different subjects of science and technology. A review of literature," *ILA Bulletin*,30(1), 31-37.

[3] Karisiddappa, C. R., Maheswarappa, B. S., and Shirol, M. V. (1990). "Authorship pattern and collaborative research in psychology," *IASLIC Bulletin, 35(* 2), 73-78.

[4] Ronda-Pupo, G. A., and Katz, J. S. (2018). "The power law relationship between citation impact and multi-authorship patterns in articles in Information Science & Library Science journals," *Scientometrics*, 114(3), 919-932.

[5] Sen, B. K. (1997). "Mega-authorship from a bibliometric point of view," *Malaysian Journal of Library & Information Science*, 2(2), 9-18.

[6] Sudhier, K. G., and Dileepkumar, V. (2018). "Collaborative authorship in scholarly Indian publications in biochemistry," *ILIS Journal of Librarianship and Informatics*, 1(1), 19-27.

[7] Usha, M. M., Vashishth, C. P., and Gautam, J. N. (1993). "Research collaboration in agricultural sciences," *ILA Bulltin, 28(2),* 57-60.