

## A COMPARATIVE STUDY OF CITATION PATTERNS AMONG EIGHT SCHOLARLY JOURNALS PUBLISHED BY NATIONAL INSTITUTE OF SCIENCE COMMUNICATION AND INFORMATION RESOURCES

### **Bidyarthi Dutta<sup>1</sup>**

Assistant Librarian  
Sammilani Mahavidyalaya  
(University of Calcutta)  
Baghajatin,  
Kolkata 700 075, India  
E-mail: bidyarthidutta@rediffmail.com

### **Anup Kumar Das**

Digital Information Consultants  
Kolkata 700 033, India  
E-mail: das\_anup@rediffmail.com,  
aupdas@mailmetoday.com

### **B K Sen**

80 Shivalik Apartments  
Alaknanda  
New Delhi – 110 019, India  
E-mail: bimalkantisen@  
hotmail.com

*The study covers 2800 citations appended to 152 articles published in 2001 in eight scholarly journals published by National Institute of Science Communication & Information Resources. In all, 7426 authors are figuring in the citations. On average, there are 18 citations per article and 3 authors per citation. The high percentage of multi-authored citations clearly indicates the dominance of team research in the concerned fields. On average, journal articles account for about 79 percent of the citations. Monographs rank second with a tally of about 12 per cent. Indian Journal of Marine Science receives high percentage of journal self-citation compared to others whereas Indian Journal of Chemistry Section B receives high percentage of author self-citation compared to others. Indian citations received by all journals figure only 10% on average.*

### **INTRODUCTION**

Council of Scientific and Industrial Research (CSIR) was constituted as an autonomous society in 1942[1] with broad objectives, encompassing promotion, guidance and coordination of scientific and industrial research, funding of laboratories and exploitation of research results for industrial development. It is also charged with rendering assistance to extramural research. CSIR has over the years established a network of 40 laboratories and 80 field/extension centres spread all over the

country. The laboratories conduct R&D in a wide range of areas. CSIR today figures among the largest chains of public-funded R&D laboratories in the world. Two separate institutions of CSIR were devoted to science information and communication: Indian National Scientific Documentation Centre (INSDOC) and National Institute of Science Communication (NISCOM). These two institutes have merged into National Institute of Science Communication & Information Resources (NISCAIR) w.e.f September 30, 2002.

NISCAIR publishes a family of 13 research journals in various disciplines of S&T [2]. They are covered by most of the important abstracting and indexing services. The eight journals selected for the present study are listed in the Table 1 of which two journals are covered by *Science Citation Index (Indian Journal of Chemistry Section A and Indian Journal of Chemistry Section B)* [3] and another two are covered by *Index Medicus (Indian Journal of Biochemistry and Biophysics and Indian Journal of Experimental Biology)* [4]. *Indian Journal of Pure and Applied Physics* was once covered by *Science Citation Index* but now has been discontinued. Chemical Abstracts, BIOSIS, INSPEC, CAB, Indian Science Abstracts and other indexing and abstracting services also cover all NISCAIR journals. These journals are highly prestigious Indian journals in the concerned fields.

<sup>1</sup> Address for Communication: 73/20, Golf Club Road, Kolkata 700033, India

## OBJECTIVES

The objectives of the study are to:

- i) Find out authorship pattern of cited references that appeared in different journals;
- ii) Find out types and distribution of publications figuring in cited references in different journals;
- iii) Draw a comparative scenario between Indian and foreign citations for different journals;
- iv) Draw a comparative scenario between author self-citation and journal self-citation for different journals;
- v) Draw a comparative scenario between journal self-citation and total number of citations for different journals;

vi) Find out variation in author self citation for different journals;

vi) Find out variation in journal self citation for different journals.

## SCOPE

The study covers eight journals published by NISCAIR. Three hundred and fifty citations were taken from each journal to carry out the study totalling 2800 citations. For all journals, issues of 2001 were taken except *Indian Journal of Chemistry Section B* and *Indian Journal of Engineering and Material Sciences*, for which last three issues of 2000 are also taken. Table 1 gives details of the eight journals with which the present study has been carried out with equal sample size for all cases to compare systematically so that a tangible conclusion can be drawn. The number of articles to which 350 citations were appended varied from 13 to 30. Hence, the number of citations per article also varied (Figure 1).

Table 1

*List of Journals Covered in the Present Study*

| Journal Name  |                  | Number of Articles | Citations/ Article |
|---|------------------|--------------------|--------------------|
| Full Name   | Abbreviated Name |                    |                    |
| Indian Journal of Biochemistry and Biophysics       | IJBB             | 13                 | 27                 |
| Indian Journal of Chemistry Section A               | IJCA             | 18                 | 19                 |
| Indian Journal of Chemistry Section B               | IJCB             | 30                 | 12                 |
| Indian Journal of Experimental Biology              | IJEB             | 13                 | 27                 |
| Indian Journal of Engineering and Material Sciences | IJEMS            | 25                 | 14                 |
| Indian Journal of Marine Science                    | IJMS             | 17                 | 21                 |
| Indian Journal of Pure and Applied Physics          | IJPAP            | 18                 | 19                 |
| Indian Journal of Radio and Space Physics           | IJRSP            | 18                 | 19                 |

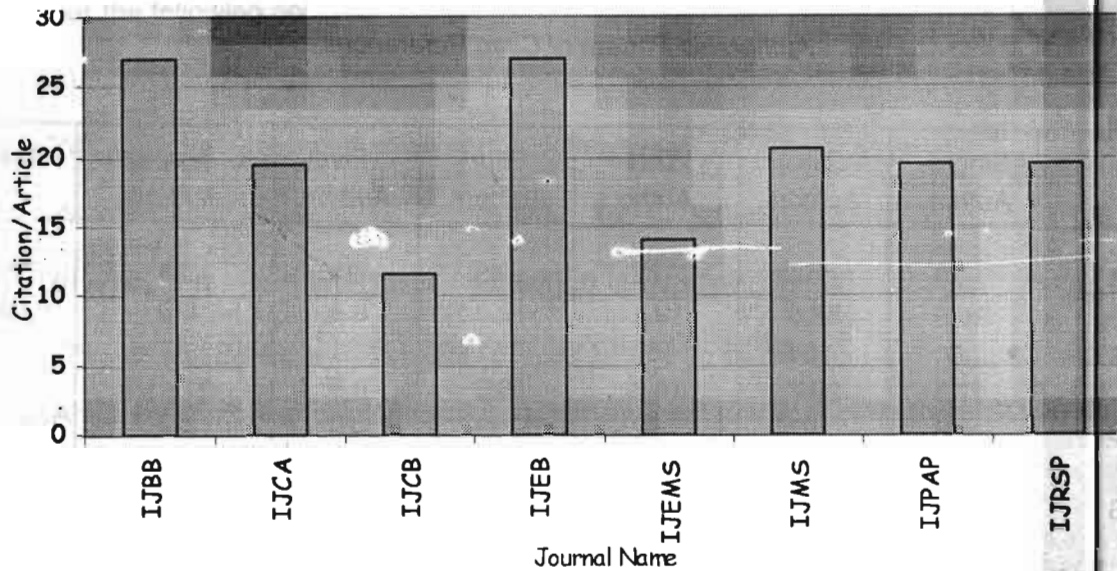


Fig. 1: Variation in Citation/Article for Different Journals

## METHODOLOGY

The data has been compiled manually from the journal articles involving systematic sampling method. For each cited reference, the following data has been noted: (i) number of author(s), (ii) type of document, (iii) country of origin of the document, (iv) whether author self-citation, and (v) whether journal self-citation.

## RESULTS AND ANALYSIS

### Authorship Pattern of Cited References

The cited items were broadly categorised into the following classes, i.e. journal articles, books, conference proceedings, theses, handbooks,

manuals, short communications, software, preprints, etc. Short communications, software, preprint, etc. were however classed under *others* category. The authorship of those citations where author fields end with *et al* are classed under *Suprapenta Authors* category.

Table 2 depicts that two-authored and three-authored citations are predominating in all journals. Single authorship is fairly large for the journals like IJEMS, IJMS and IJRSP. On the other hand, journals like IJCB, IJCA, IJEB etc. show small percentages of single authorship. Figure 2 depicts variations in single, multi and suprapenta (more than five) authorships in the concerned journals. Multi-authorship includes 2, 3, 4 and 5 numbers of authors while suprapenta authorship includes more than five authors.

Table 2

Authorship Pattern of Cited References

|       | Single Author | Two Authors | Three Authors | Four Authors | Five Authors | Suprapenta Authors | Total |
|-------|---------------|-------------|---------------|--------------|--------------|--------------------|-------|
| IJBB  | 73            | 114         | 67            | 43           | 31           | 23                 | 350   |
| %     | 20.9          | 32.6        | 19.1          | 12.3         | 8.9          | 6.6                | 100   |
| IJCA  | 60            | 104         | 58            | 57           | 31           | 40                 | 350   |
| %     | 17.1          | 29.7        | 16.6          | 16.3         | 8.9          | 11.4               | 100   |
| IJCB  | 58            | 92          | 92            | 53           | 29           | 24                 | 350   |
| %     | 16.6          | 26.3        | 26.3          | 15.1         | 8.3          | 6.9                | 100   |
| IJEB  | 60            | 101         | 83            | 49           | 24           | 33                 | 350   |
| %     | 17.1          | 28.9        | 23.7          | 14.0         | 6.9          | 9.4                | 100   |
| IJEMS | 133           | 111         | 64            | 28           | 7            | 7                  | 350   |
| %     | 38.0          | 31.7        | 18.3          | 8.0          | 2.0          | 2.0                | 100   |
| IJMS  | 128           | 112         | 61            | 29           | 10           | 10                 | 350   |
| %     | 36.6          | 32.0        | 17.4          | 8.3          | 2.9          | 2.9                | 100   |
| IJPAP | 107           | 106         | 77            | 44           | 6            | 11                 | 350   |
| %     | 30.6          | 30.3        | 22.0          | 12.6         | 1.7          | 3.1                | 100   |
| IJRSP | 138           | 97          | 79            | 23           | 10           | 3                  | 350   |
| %     | 39.4          | 27.7        | 22.6          | 6.6          | 2.9          | 0.9                | 100   |

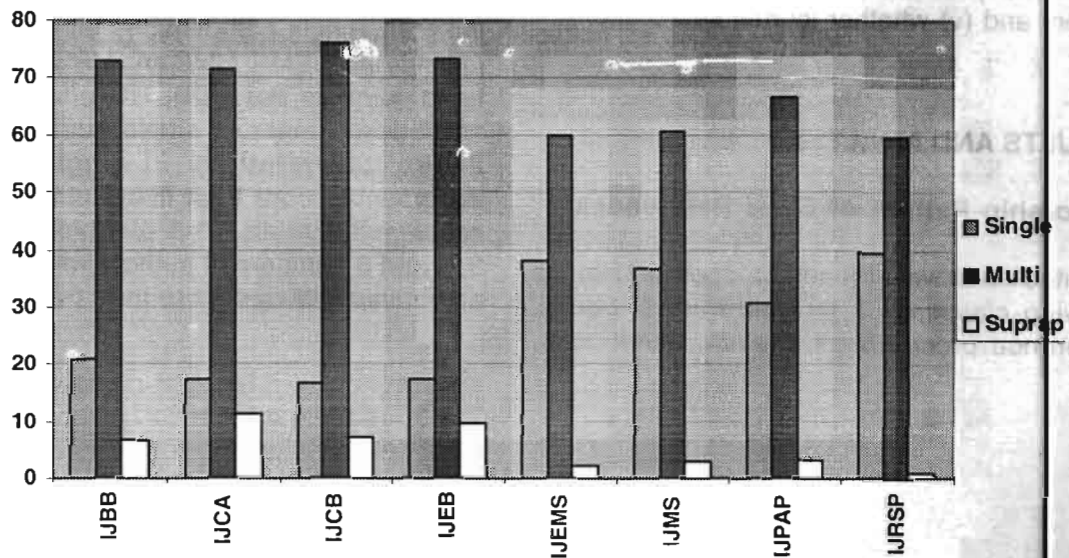


Fig. 2 : Variation in Single, Multi and Suprapenta authorship in different NISCAIR journals

### Distribution of Publications Among Cited References and Ratio of Indian to Foreign Cited References

Table 3 very clearly depicts importance of journals in the concerned fields which account

for more than 75% of total citations for all journals except IJMS and almost all of them pertain to foreign journals indicating that Indian journals are hardly consulted by researchers which is also obvious from its very low percentage i.e. ~10%.

Table 3

#### Distribution of Cited References among Different Document Types

| Abbv. Name of Journal | Citation Count Type | Document Types |      |                 |      |        |     |        |     |                        |     |                 |     |        |     | Grand Total |
|-----------------------|---------------------|----------------|------|-----------------|------|--------|-----|--------|-----|------------------------|-----|-----------------|-----|--------|-----|-------------|
|                       |                     | Book           |      | Journal Article |      | Patent |     | Thesis |     | Conference Proceedings |     | Handbook/Manual |     | Others |     |             |
|                       |                     | I              | F    | I               | F    | I      | F   | I      | F   | I                      | F   | I               | F   | I      | F   |             |
| IJB                   | No. of Citations    | 2              | 22   | 12              | 297  | 0      | 0   | 0      | 0   | 0                      | 8   | 1               | 7   | 0      | 0   | 350         |
|                       | % of Citations      | 0.6            | 6.3  | 3.4             | 84.9 | 0.0    | 0.0 | 0.0    | 0.0 | 0.0                    | 2.3 | 0.3             | 2.0 | 0.0    | 0.0 | 100.0       |
| IJCA                  | No. of Citations    | 0              | 49   | 14              | 256  | 0      | 0   | 2      | 0   | 0                      | 0   | 0               | 12  | 0      | 16  | 350         |
|                       | % of Citations      | 0.0            | 14.0 | 4.0             | 73.1 | 0.0    | 0.0 | 0.6    | 0.0 | 0.0                    | 0.0 | 0.0             | 3.4 | 0.0    | 4.6 | 100.0       |
| IJCB                  | No. of Citations    | 5              | 46   | 51              | 230  | 0      | 5   | 5      | 0   | 0                      | 0   | 5               | 0   | 0      | 5   | 350         |
|                       | % of Citations      | 1.4            | 13.1 | 14.6            | 65.7 | 0.0    | 1.4 | 1.4    | 0.0 | 0.0                    | 0.0 | 1.4             | 0.0 | 0.0    | 1.4 | 100.0       |
| IJB                   | No. of Citations    | 7              | 26   | 15              | 283  | 0      | 2   | 4      | 0   | 0                      | 3   | 2               | 4   | 0      | 4   | 350         |
|                       | % of Citations      | 2.0            | 7.4  | 4.3             | 80.9 | 0.0    | 0.6 | 1.1    | 0.0 | 0.0                    | 0.9 | 0.6             | 1.1 | 0.0    | 1.1 | 100.0       |
| IJEMS                 | No. of Citations    | 2              | 42   | 11              | 265  | 0      | 9   | 7      | 4   | 0                      | 7   | 0               | 4   | 0      | 0   | 350         |
|                       | % of Citations      | 0.6            | 12.0 | 3.1             | 75.7 | 0.0    | 2.6 | 2.0    | 1.1 | 0.0                    | 2.0 | 0.0             | 1.1 | 0.0    | 0.0 | 100.0       |
| IJMS                  | No. of Citations    | 3              | 49   | 72              | 168  | 0      | 0   | 0      | 3   | 6                      | 12  | 3               | 12  | 3      | 20  | 350         |
|                       | % of Citations      | 0.9            | 14.0 | 20.6            | 48.0 | 0.0    | 0.0 | 0.0    | 0.9 | 1.7                    | 3.4 | 0.9             | 3.4 | 0.9    | 5.7 | 100.0       |
| JPAP                  | No. of Citations    | 1              | 22   | 18              | 302  | 0      | 0   | 3      | 0   | 0                      | 1   | 0               | 1   | 0      | 0   | 350         |
|                       | % of Citations      | 0.3            | 6.3  | 5.1             | 86.3 | 0.0    | 0.0 | 0.9    | 0.0 | 0.0                    | 0.3 | 0.0             | 0.3 | 0.0    | 0.0 | 100.0       |
| JRSP                  | No. of Citations    | 0              | 13   | 28              | 291  | 0      | 0   | 0      | 0   | 0                      | 0   | 5               | 13  | 0      | 0   | 350         |
|                       | % of Citations      | 0.0            | 3.7  | 8.0             | 83.1 | 0.0    | 0.0 | 0.0    | 0.0 | 0.0                    | 0.0 | 1.4             | 3.7 | 0.0    | 0.0 | 100.0       |

Table 4 depicts relative shares of Indian and foreign citations appearing in different journals. This is not peculiar to any particular area but more or less holds good for each and every scientific discipline. Though monographs rank just next to journal article, yet monograph is far behind the journal. The number of citations consisting of monographs is 105 and comprises

10.39% of total citations. This is because of rapid obsolescence of information in S&T fields, which makes monographs backdated very soon except some fundamental classics. Journals can supply updated and nascent information and hence they are highly acceptable to the scientific research communities.

Table 4  
*Indian and Foreign Citations Scenario of Different Journals*

| Journal      | Indian Citation (IC) | Foreign Citation (FC) |
|--------------|----------------------|-----------------------|
| IJBB         | 15 (4.29%)           | 335 (95.71%)          |
| IJCA         | 16 (4.57%)           | 334 (95.43%)          |
| IJCB         | 66 (18.86%)          | 284 (81.14%)          |
| IJEB         | 28 (8.00%)           | 322 (92.00%)          |
| IJEMS        | 20 (5.71%)           | 330 (94.29%)          |
| IJMS         | 87 (24.86%)          | 263 (75.14%)          |
| IJPAP        | 22 (6.29%)           | 328 (93.71%)          |
| IJRSP        | 33 (9.43%)           | 317 (90.57%)          |
| <b>Total</b> | <b>287 (10.25%)</b>  | <b>2513 (89.75%)</b>  |

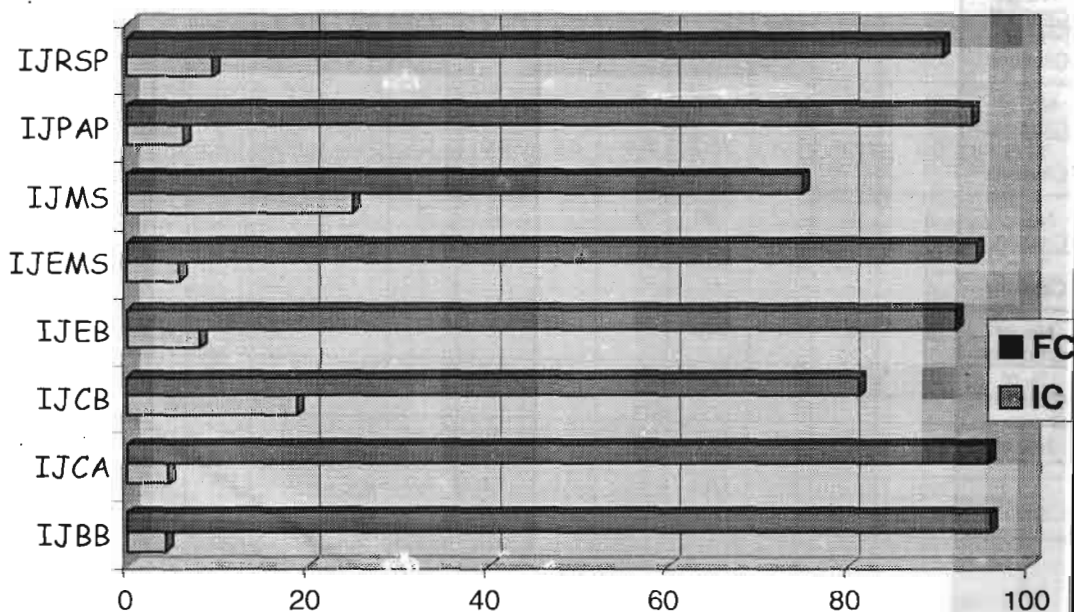


Fig. 3 : Foreign vs Indian Citations

Overall share of percentage between Indian and Foreign citation is shown in the Figure 4, which reveals the very fact that our scientists hardly consult Indian journals for research purpose. The percentage of Indian citation for IJMS is fairly large, i.e. 25%; this is due to the fact that IJMS is the only journal in the area of marine science in India. Very low percentages of Indian citation for

the journals like, IJBB and IJCA are due to the fact that the disciplines like chemistry, biochemistry and biophysics are highly dynamic and number of journals in these areas (both Indian and foreign) is very large. Everyday new information is emerging in these subject fields, which causes very quick obsolescence also.

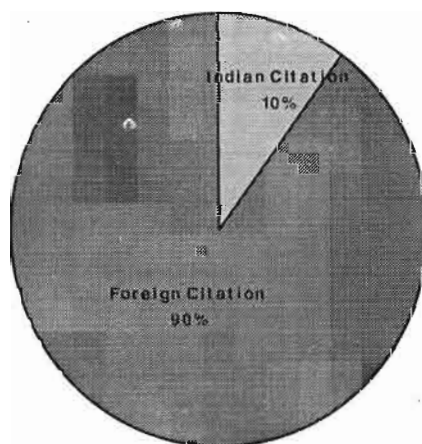


Fig. 4 : Foreign vs Indian Citations

#### Journal Self Citation and Author Self Citation

Whenever a citing journal cites any of its previous publications, journal self-citation occurs. Journal self-citation (JSC) substantially influences the impact factor of the concerned journal. This means high percentage of JSC not only enhances the impact factor of the corresponding journal but also indicates the relevance of the content of the journal to the scientific community using it. It is seen from Table 5 that the JSC of the journals like IJBB, IJEB

and IJEMS are very low, indicating thereby the low popularity of the said journals among the scientists belonging to the concerned areas of disciplines. On the other hand the journal IJMS enjoys highest percentage of self-citations, i.e. 21.14% followed by IJCB (6.86%) and IJRSP (6.57%). The large gap between JSC and ASC has also being revealed from Table 5. JSC is highest for IJMS and lowest for IJEB, on the other hand ASC is highest for IJCB and lowest for IJMS. IJMS has shown highest JSC and lowest ASC.

Table 5

*Journal Self-Citation and Author Self-Citation for different journals*

| Journal | JSC | JSC (%) | ASC | ASC (%) |
|---------|-----|---------|-----|---------|
| IJBB    | 8   | 2.29    | 24  | 6.86    |
| IJCA    | 13  | 3.71    | 31  | 8.86    |
| IJCB    | 24  | 6.86    | 76  | 21.71   |
| IJEB    | 4   | 1.14    | 15  | 4.29    |
| IJEMS   | 5   | 1.43    | 32  | 9.14    |
| IJMS    | 81  | 23.14   | 14  | 4.00    |
| IJPAP   | 15  | 4.29    | 31  | 8.86    |
| IJRSP   | 23  | 6.57    | 29  | 8.29    |

**CONCLUSION**

Multi-authorship for all journals ranges from 60% to 76%, this indicates dominance of team research in all major scientific disciplines with small team size. Solo research is present to some extent in the areas like material science and radio and space physics. Journal articles are mostly used cited references in case of scientific research in all major disciplines. Some classic books are evergreen; scientists cite them frequently. But in general, journal articles play vital role as they can present latest and updated information. Obsolescence thus very promptly can be traced out with the aid of journals, but other communication media, like books, thesis, conference proceedings, etc. always present some obsolete information. This is the most remarkable plus point of the journal as medium of scientific communication. Foreign journals are mostly cited by the Indian scientists, except few Indian journals like, IJMS and IJCB. Actually marine science is rather narrow area in comparison with chemistry and physics; IJMS is only Indian journal in this area, that is why it receives fair percentage of Indian citation. IJCB also receives better percentage of Indian

citation, which reflects the popularity of the said journal among the scientific community.

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