

Evaluation of Indian Physics Research on Journal Impact Factor and Citations Count: A Comparative Study

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Abstract

This paper evaluates citations performance of 1101 Indian physics research papers published in 29 high impact physics journals in 1997. The evaluation is based on citations won by these papers within six years of publication. The purpose is to verify to what extent research evaluation based on journal impact factor can be considered objective and fair. The study finds that journal impact factor is not a surrogate to citations. Nearly 12% of papers in high impact journals did win even a single citation within six years of their publication. Secondly papers winning high range of citations per paper were published in a wide range of impact factor journals. The conclusion is that although impact factor is not a guarantee to citations but publication in high impact journals does improve the probability of winning citations. The higher the impact factor the greater their citations probability. The nationally and internationally collaborated papers have greater chances of winning high citations than the non-collaborative ones.

1. INTRODUCTION

Citations are known to symbolise merit and scholarship of the cited papers; acknowledge their worth and contribution to knowledge development; catalyse networks of peers and contributors; and endorse the authority of the cited authors and their affiliating institutions. Given their importance in research evaluation, citations are increasingly finding applications in measuring and assessing the impact of research papers, the authors, and their affiliating institutions. Besides, it is also finding application in computing journal impact factor, a measure of average citations per paper that a journal had come to receive within two years of its publication.

The academic and scientific agencies in the country are using journal impact factor for judging the merit and scholarship of research

papers, for deciding appointments to academic and research positions and nominations for research awards, and for benchmarking the performance of scientific staff and research laboratories for inter-comparisons¹. For them journal impact factor is nothing but a surrogate for citations.

But using journal impact factor as a surrogate for citations to papers, it seems, is gross misrepresentation of facts. This is because journal impact factor is a measure of the impact of the journal *per se* and not of every paper that constitutes the given journal. Fundamentally, journal impact factor is computed on total citations that the journal had come to receive within two years of its publication, no matter which papers actually caused the citations, whether total citations were won from one single paper or from several papers constituting the journal. What

matters is the total citations count to the journal alone and not to any specific paper. Hence, presuming journal citation factor as a surrogate of citations to journal papers is absolutely misplaced. In view of this, it is held that research evaluation based on impact factor is totally subjective.^{2,3}

This study was undertaken to substantiate the point that research evaluation based on journal impact factor is not objective. It compares the performance of research papers from India in physics on journal impact factor with that on citations these papers had won in six years of their publication, and highlights how the two evaluations differ with each other.

2. DATA SOURCE

The sample data on 1101 papers by Indian authors appearing in 29 high impact journals were collected from *Web of Science* for 1997 along with their citations data. These papers in high impact journals had won a total of 9454 citations in six years from their date of their publication in 1997. In other words 9454 citations were won during the period between 1997 and 2003. The selection of source data was specifically confined to high impact journals with impact factor varying between 1 and 6.14 as the intention is to see whether the papers in such high impact journals get high citations as expected. The selection of journal titles was done using *Journal Citation Reports*, 1997.

3. DATA ANALYSIS

3.1 Distribution of Papers by Citations Count

The analysis revealed that citations to papers were spread over a wide range from 0 to 157 citations per paper. The average citation per paper is 8.58. For convenience in analysis average citation figure is taken as 8. The distribution of papers by citations count is given below:

- (i) Of the 1101 papers, 368 won citations between 8 and 157 per paper and they account for 33% of the total sample output;

- (ii) Contrary to expectations, 587 papers despite their publication in high impact journals could win citations below the sample average only, between 1 and 7 per paper, and they account for 53% of the sample;
- (iii) Contrary to expectations, 136 papers despite their publication in high impact journals did not receive even a single citation and they account for 12% of the sample.
- (iv) It implies that bulk of the papers (65%) despite their publication in high impact journals failed to come up to expectations in respect of their citations performance.
- (v) The 33% output winning citations between 8 and 157 per paper is indeed a quality output.
- (vi) The pockets of excellence in the research output are confined to select few papers as only 28 papers account for 20% citations, 56 papers for 31% citations, 112 papers for 45% citations, and 164 for 55% citations (Figure 1, Table 1). These 164 papers do not belong to very high impact journals alone but to journals with impact ranging between 1 and 6.14.
- (vii) Evidently, impact factor is not a guarantee for high citations. It belies the presumption of the academic and scientific agencies that impact factor is a surrogate to citations.

However, the probability of winning high citations increases with the increase in journal impact factor, it decreases with decrease in journal impact factor. This is evident from the two groups of papers (i) papers winning above average citations per paper, (ii) papers winning zero or below average citations per paper.

It was noted that in the group of papers winning above average citations the per cent share of papers goes on increasing with the corresponding increase in the journal impact factor (Figure 2, Table 1). In the other group of papers winning below average citations, it was noted that the per cent share of papers goes on decreasing with the increase in the journal impact factor (Figure 3, Table 1).

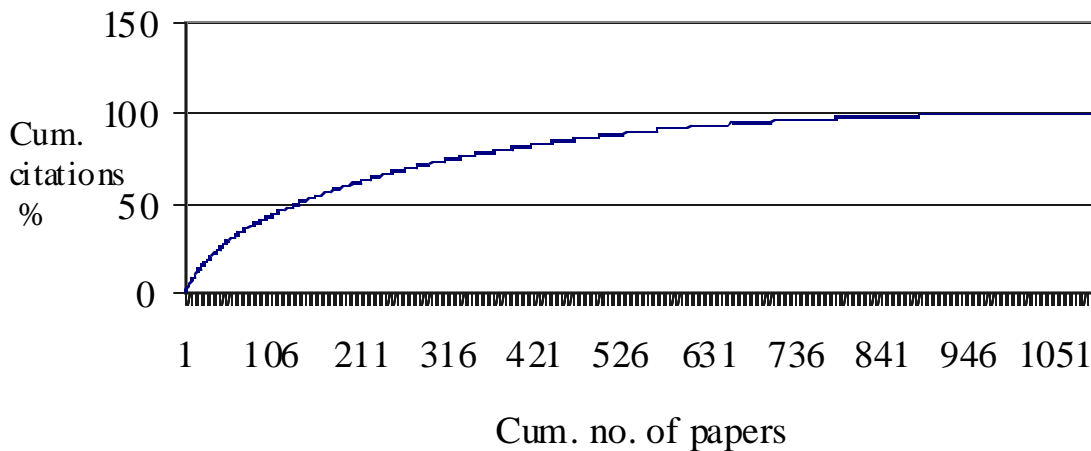


Figure 1. Distribution of citations to papers by Indian authors in high impact physics journals

Table 1. Distribution of 1101 papers winning citations by impact factor

29 journals by impact factor	Number of papers winning citations per paper					Total
	Zero citations	Between 1–7 citations	Between 8–15 citations	Between 16-30 citations	Between 31–157 citations	
	Below average citations			Above average citations		
IF 1 and < 2	69(15.1)	281(61.5)	62(13.6)	26(5.7)	9(2.0)	457
IF 2 and < 3	35(10.7)	182(55.8)	61(18.7)	30(9.2)	18(5.5)	326
IF 3 and more	32(10.1)	124(39.0)	81(25.5)	52(16.4)	29(9.1)	318
Total	136	587	204	108	56	1101
% Share	12.4	53.3	18.5	9.8	5.1	100.0

Figure within parentheses are per cent shares.

3.1.1 Collaboration: Key to Winning Citations

On distributing papers winning 15 or more citations per paper and those receiving zero citations per paper by nature of collaboration, national or international, it was observed that collaborated papers have higher probability of winning citations than the non-collaborated ones (Table 2).

The per cent share of non collaborated papers goes on decreasing as their citations per paper figures start showing rise. Thus collaboration appears to be the key to winning high citations.

3.1.2 Profile of Highly Cited Papers by Institutional Affiliation of Authors

Fifty six papers, receiving 31 or more citations per paper, were examined by the institutional affiliation of their respective authors. Mainly, these papers were the collaborative efforts involving national and international institutions. In 33 papers, the authors were spread across 5 major Indian institutions, and their output was 3 to 22 papers per institution. In remaining 23 papers, the authors were distributed across 21 Indian institutions, and their output was one to two papers per institution. The distribution of papers by five Indian institutions is given in

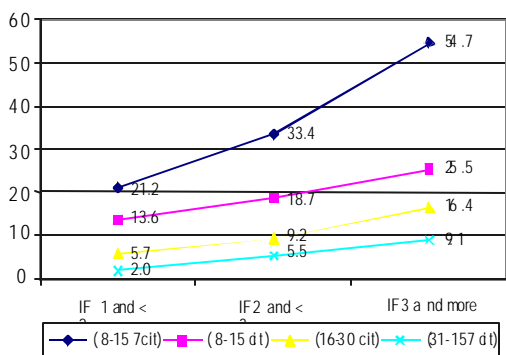


Figure 2. % share of papers winning above average citations distributed by journal impact factor

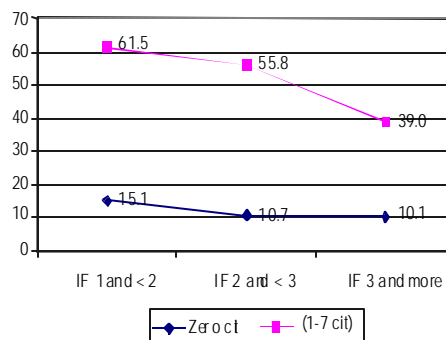


Figure 3. % share of papers winning below average citations distributed by journal impact factor

Table 2. Distribution of papers by nature of collaboration

Range of citations received	No. of papers	Nature of collaboration		
		International collaboration	National collaboration	Others
0	136	30 (22.1)	29 (21.3)	77 (56.6)
15-30	108	49 (45.4)	17 (15.7)	42 (38.9)
31-157	56	36 (64.3)	9 (16.1)	11 (19.6)

Figure within parentheses are per cent shares.

Table 3. Distribution of highly cited papers from five leading Indian institutions by nature of collaboration

Institution	International collaboration	National collaboration	Others	Total papers
TIFR	17	1	4	22
IIS	1	6	1	8
JNCAR	0	6	0	6
Punjab Univ.	4	0	0	4
Pune Univ.	2	1	0	3

Table 3. Tata Institute of Fundamental Research (TIFR) along with other institutions had collaborations in 22 papers, Indian Institute of Sciences, Bangalore (IIS) in 8 papers, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore (JNCAR) in 6 papers, Punjab University, Chandigarh in 4 papers, and University of Pune in 3 papers. The total publication count

is more than the actual number since these institutions had collaborated with more than one institution.

CONCLUSIONS

Publication in high impact journals is not a guarantee to citations although publication in high impact journal does improve the probability of winning high citations. The

higher the journal impact factor, the greater the citations probability. These findings are evident from a sample study of 1101 papers in high impact journals. Contrary to expectations, nearly 12% papers in high impact journals did not receive even a single citation within six years of their publication, and 53% could win just below average citations per paper. The pockets of excellence are confined to select few papers as such papers are mainly responsible for winning high range of citations per paper. Such highly cited papers do not come from high impact journals alone, rather they are spread across whole range of journals with impact medium to high. Evidently impact factor is not a surrogate to citations. Citations depend mainly on the theoretical and practical significance of the research reported in the paper⁴. In view of this finding, research evaluation based on journal impact factor alone cannot be considered objective and fair. Citation count seems to be a more reliable indicator of a paper worth than the journal IF.

Collaborative papers involving national and international institutions have greater chances of winning citations. The funding agencies and research institutions should use collaboration as the key to generating good quality research.

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