

Authorship Pattern and Collaborative Research in Physics: A Bibliometric Study

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Abstract

The present study is an attempt to find the authorship pattern and collaborative research in the field of Physics on the basis of the articles published in the journal 'Indian Journal of Pure and Applied Physics' published by NISCAIR. The study is descriptive in nature. Total 718 articles were published in the 60 issues of the journal in the five years. Single authored articles were the minimum i.e. 79 articles, which is 11% of total articles published. Rests of the articles i.e. 639 were published under joint authorship, which is 89% of total articles published during the period of the study of the journal. Two and three authors collaboratively contributed 60% of the total articles. Four or more authors contributed 211(29.39%) articles.

Introduction

Pritchard first introduced the term 'Bibliometrics' in 1969 in preference to the term 'Statistical Bibliography' coined by E. W. Hulme. Its scope includes the studying the relationship within a literature or describing the literature. Typically this description focuses on consistent patterns involving authors, monographs, journals or subject/language. Bibliometrics is generally defined as the study and measurement of the publication patterns of all forms of written communication and their authors. Pritchard coined the term Bibliometrics to quantify the process of written communication. According to him bibliometrics is "the application of mathematical and statistical methods to books and other media of communication". Fairthorne defines bibliometrics as "quantitative treatment of the properties of recorded discourse and behavior appertaining to it". Sengupta defines bibliometrics as "organization, classification, and quantitative evaluation of publication patterns of all macro and micro communications along with their authorship by mathematical and statistical calculus".

There are some analogous and synonymous terms, which are also used in handling information and measuring science. These are 'Librametrics', 'Scientometrics' and 'Informetrics'. These concepts are more or less supplementary to each other with some broader and narrower extension of human ideas. The term 'Librametrics' was first introduced by Ranganathan in 1948. He was of view that since application of statistical calculus has given rise to some disciplines with greater potentiality like Biometry, Econometrics, and Psychometrics etc. then why not the librarians should utilize it develop librametrics to streamline the day today library activities for better library management.

Scientific and technological journals are universally accepted to be a vital element of research activity. This is the single most important medium through which researchers communicate and interact with one another and have great influence on the nature and direction of the research being carried out. They play a major role in defining to the field of their workers according to the field of their specialization, language and nationality. As the journals are organized largely on a national basis, they also serve the purpose giving a national identity to the different scientific communities. The productivity, purposefulness and originality of the research done in a country can be quite reliably gauged from the scientific journals of that country. Thus an analysis of the quality of journals is very important way of comprehending certain vital aspect of research activity of that country.

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Such an analysis of quality of contents of a journal can be done by using research tools like content analysis or bibliometrics.

Methodology

For the purpose of the study 'Indian Journal of Pure & Applied Physics' was selected as the source of data. The journal is monthly publication of National Institute of Science Communication and Information Resources (NISCAIR) a unit of Council of Scientific Industrial Research (CSIR), New Delhi in association with Indian National Science Academy, New Delhi. Both the Organisations are engaged in developing scientific and industrial research in India.

The journal started publication in the year 1963. The journal completes a volume in a calendar year. The journal publishes full papers and short notes, reporting significant new results of research, in all areas of physics except Radio & Space Physics. The allied fields covered are Electronics, Electrical Engineering, Instrumentation and Applied Mathematics. The research papers and short communications are covered for the study. The present study is based on the articles published in 5 volumes of 'Indian Journals of Pure and Applied Physics' during 2000-2004.

Objectives of the Study

The present study is undertaken to have an in-depth study in the journal. The study is intended to study the following:

1. Yearwise distribution of articles
2. Authorship pattern of the articles
3. Various types of collaboration among the authors
4. Degree of collaboration among various categories of authors

Data Analysis and Interpretation

Data collected from 'Indian Journal of Pure & Applied Physics' has been classified, tabulated and analysed in accordance with the set objectives of the study. Five volumes (vol. 38-42) of the journal published from the year 2000 to 2004 contained 718 contributions in their 60 issues. These contributions are the basis of data for the study.

Table: 1 Year wise Distribution of Articles

Year	No. of Articles	Percentage (%)
2000	141	19.64
2001	143	19.92
2002	132	18.38
2003	155	21.58
2004	147	20.47
Total	718	100

Table 1 shows the year wise distribution of 718 articles published in Indian Journal of Pure and Applied Physics during 2000 to 2004. The maximum number of articles i.e. 155 (21.58%) was published in the year 2003. The lowest number of articles i.e. 132 (18.38%) was published in the year 2002.

Table: 2 Average Number of Articles Published Per Issue

<i>No. of Issues Published</i>	<i>No. of Articles Published</i>	<i>Average Articles Published Per Issue</i>
60	718	11.96

As the journal is a monthly publication total 60 issues were published regularly during the five years (2000-2004) without any gap and contained 718 articles. Therefore, the average number of articles published per issue comes to 11.96 (i.e.12 articles per issue).

Table: 3 Authorship Patterns of the Articles

No. of Authors	2000	2001	2002	2003	2004	Total	Percentage (%)
Single	19	15	13	17	15	79	11.00
Two	54	39	39	50	42	224	31.20
Three	28	43	47	37	49	204	28.41
Four or more authors	40	46	33	51	41	211	29.39
Total	141	143	132	155	147	718	100

The literature on any subject reflects not only basic publishing trends but also the characteristics of the authors themselves. Details of the authorship pattern of the articles published in the journal during the period of study are shown in the Table 3. Articles published by single authors are minimum i.e. 79 articles only, which is 11% of total articles published. Rests of the articles (639) were published under joint authorship, which is 89% of total articles published during the study period of the journal. Two and three authors collaboratively contributed 60% of the total articles. Four or more authors contributed 211(29.39%) articles. It may be inferred that collaborative research activities are predominated in Physics like other fields of science. It may be due to the fact that the articles are contributed by the researchers' and the supervisors' combination.

Table: 4 Yearwise Articles by Single Author V/S Multiple Authors

Year	Single Author	%	Multiple Authors	%	Total Articles
2000	19	13.48	122	86.52	141
2001	15	10.49	128	89.51	143
2002	13	9.85	119	90.15	132
2003	17	10.97	138	89.03	155
2004	15	10.20	132	89.80	147
Total	79	11.00	639	89.00	718

Table: 4 gives the year wise authorship pattern of articles by single author v/s multiple authors. In the year 2000 there were the maximum number of single authored articles i.e. 19 articles (13.48%) of total articles published in that year. The lowest number of single authored articles was published in the year 2002 that was 13 articles (9.85 %). On the other hand the maximum numbers of multiple authored articles were published in the year

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2003 i.e. 138 articles but the highest percentage of articles was published in the year 2002 that was 90.15%. The lowest percentage of multiple authored articles were published in the year 2000 that was 86.52% of total articles published in that year, whereas the lowest number of multiple authored articles were published in the year 2003 which was 119 articles.

Table: 5 Percentages of Collaborated Articles

Year	Two Authors	%	Three Authors	%	Multiple Authors	%
2000	54	38.29	28	19.86	40	28.37
2001	39	27.27	43	30.07	46	32.17
2002	39	29.45	47	35.61	33	25.00
2003	50	32.26	37	23.87	51	32.90
2004	42	28.57	49	33.33	41	27.89

Table 5 shows the yearwise percentage and number of collaborative articles published in the journal. In the year 2000, 54 two authored articles were published which was 38.29% of total articles published in that year which was highest percentage of the two authored articles contributed in any year. The maximum numbers of three authored articles i.e. 49 were published in the year 2004 however the highest percentage of three authored articles i.e. 35.61 % of that year's total articles were contributed in the year 2002. Similarly in the year 2003 multiple authored papers dominated with maximum articles and the highest percentage (32.90 %).

Table: 6 Degree of Collaboration among Co-authors

Year	No. of Co-Author Publications	Percentage (%)	Degree of Collaboration
2000	122	86.53	0.87
2001	128	89.51	0.90
2002	119	90.15	0.90
2003	138	89.03	0.89
2004	132	89.78	0.90

The degree of collaboration was defined as the ratio of the number of collaborative articles to the total number of articles in the discipline during a certain period of time. The degree of collaboration in quantitative terms has been determined by the formula given by K. Subramanyam

The formula is : $C = Nm / (Nm + Ns)$

Where C = Degree of collaboration in the discipline

Nm = Number of multi authored publications

Ns = Number of single authored publications

Hence degree of collaboration in the present study is: $C = 639 / 718 = 0.89$

When value of C increases it means that the level of collaboration is increasing and vice-versa. The table 6 shows that the degree of collaboration during the years 2000-2004 varies from 0.87 to 0.90

Summary of findings and conclusion

The present study undertaken to analysis the various bibliographical features of the articles and the contributors, published in 'Indian Journal of Pure & Applied Physics' which is to be considered a journal of great significance for the researchers in India in the subject Physics. The study found that 89% of the articles were contributed in joint authorship, which is a common phenomenaon in sciences out of which approximate 30% of the articles were contributed by a team 4 or more of researchers. Degree of collaboration among co-authors varied from 0.87 to 0.90.

The present study was conducted to ascertain quantitatively bibliographic features of the literature published in India in the subject physics on the bases of the articles published in the journal 'Indian Journal of Pure and Applied Physics'. The journal cover almost all the areas of the subject and published by an institution of National as well as International repute, reflected the true research trend in the subject. But it is not the only journal being published in India. There are many other journals in the field (like journals published by Indian Institute of Science, Banglore) which also accounts for a major position of the research in India. Therefore, the findings of the study cannot be generalized these are simply indicators followed few possible trend of publishing in the physics in India.

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