Publication Productivity of Pondicherry University Seen through Scopus: A Scientometric Study

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Abstract

The present study evaluates the publication pattern of Pondicherry University based on the data collected from Scopus database over a period of twenty seven years from 1987-2013.. The study shows that majority (84.8%) of the researchers preferred to their research papers are joint authorship and the degree of collaboration ranges varies from 0.61 to 0.96 and its mean value 0.88. The study also analysed that Physics and Astronomy which produces more number of papers while the multi-authorship also possesses a lead role in this subject. S.A. Abbasi is the most prolific author (contributed 132 articles) in the present study. The researchers are most preferred to publish their work in the journal of Acta Crystallographic a Section E Structure Reports Online (2.17%) followed by current science (1.79%).

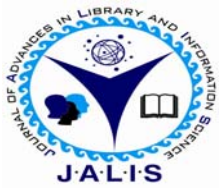
Keywords

Scientometrics, Scopus, Degree of colloboration and Pattern of co-authorship

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INTRODUCTION

Scientometrics is the quantitative study of the disciplines of science based on published literature and communication. This could include identifying emerging areas of scientific research, examining the development of research over time, or geographic and organizational distributions of research (Glossary of Thompson, 2008)[1]. Moreover, Scientometrics is one of the most important measures for the assessment of scientific productions. It is the study of the quantitative aspects of science as a discipline or economic activity[2]. The university which is generating a huge number of good quality research papers in particular field may be considered as a leading edge university in that field. This study aims to ascertain the growth of literature and publication productivity of researchers in Pondicherry University. The distribution of literature analysed by year, authorship pattern, degree of collaboration among authors and find out the year, document type, most prolific authors, international collaboration and also analysed highly cited papers.

PONDICHERRY UNIVERSITY: A SHORT PROFILE

Pondicherry University, established under an Act of Parliament in the year 1985, has grown from strength to strength in all possible ways all these years and has become a place on the educational hub of the country. 15 Schools, 37 Departments and 10 Centers offering 175 PG and Research programmes are within its fold and housed in the 800-acre sprawling Wi-Fi-enabled vibrant campus. The University has made a giant leap in promoting usage of Information & Communication Technology (ICT) products/ services in the areas of teaching / learning, research and administration. The Ananda Rangapillai Library at the University has a collection of more than 2-lakh books and over 25,084 e-journals, 7,455 e-books, 36 e-databases and 620 e-theses. The thrust areas of the University will be Research and Innovations both in Sciences and Social Sciences.

LITERATURE REVIEW

Baby and Kumaravel[3] examined the growth of research had steadily increased from a single article in 1998 to 102 articles in 2010. The study revealed that relative growth rate and doubling time is 0.45 and 2.27 respectively and three-authored publications predominate amongst the pattern of authorship. A scientometric study conducted by Lee[4] to find out

research performance of the Institute of Molecular and Cell Biology (IMCB) of first ten years since its establishment. The findings showed that in the ten years, IMCB produced 395 research papers, 33 book chapters, 24 conference papers, and 4 monographs, graduated 46 PhDs, and filed 10 patents. Matthews[5] studied the publication productivity of physics teachers of South African universities during 2009-2011 based on the data retrieved from departmental websites and Thomson Reuters' *Web of Science* with the objective to find typical ranges of two measures of individual productivity: number of papers and sum of author share, where author share per *n*-author paper is 1/*n* author units. In another scientometric study done by Thirumagal[6] is based on the scientific publications generated by the Manonmaniam Sundaranar University as reflected in Web of Science. The analysis revealed that yearly output of research product and focuses on publishing trend, impact factor, authorship pattern, types of articles, institutional collaboration of authors, affiliated institutions of authors, countries of contributing authors and individual author's research.

Sevukan, *et al.*[7] evaluated research output in plant sciences of the faculties in central universities of India by analysing a total of 348 bibliographic records of plant sciences retrieved from ISI SCIE for a period of 10 years from 1997 to 2006 by year, document type, authorship pattern, and collaboration pattern at different levels, viz., international, national, and local. Fakhree *et al*, [8] provides the scientific outcomes of seven medical science universities by using Scopus as search engine, have been compared with each other. Comparison were made by the number of published articles per year, number of citations received per year, number of citations received per year per article, total *h*-indices, top ten authors, and top ten journals. Jeyshankar *et al*, [9] analysed bibliographic details of 1282 research articles published by the scientists of CECRI during the period 2000-2009. The study revealed that 2009 was the most productive year with 194 articles, (15.13%) published in the year. The study also revealed that collaborative research was dominant with the highest degree of collaboration being 0.98% in the year of 2005. Sharma[10] evaluated research performance and collaborative writing pattern among scientists of Central Potato Research Institute (CPRI). The study indicated that majority of scientists preferred to work in collaboration and publish research papers in joint authorship. Sevukan and Sharma[11] pointed out the growth of literature in biotechnology has steadily increased from 15 articles in 1997 to 43 articles in 2006; two-authored publications predominate amongst the pattern of authorship; applicability of Lotka's law is validated from the values n = 2.12, C = 0.669, and D = 0.027 obtained using least square method. A bibliometric study done by Aswathy and Gopikuttan[12] examined the publication pattern of faculty members of three universities in Kerala viz., University of Kerala, Mahatma Gandhi University and University of Calicut. Authorship Pattern, Degree of Collaboration, the appropriateness of Lotka's Inverse Square law has been studied.

OBJECTIVES OF THE STUDY

The objectives of the present study are to:

1) Trace the rate of growth in university research publications
2) Identify the nature of authorship pattern and collaborative measures
3) Find out the highest and lowest productive subject areas
4) Find out country-wise and institution-wise research collaboration
5) Identify most preferred journals and most cited papers

METHODOLOGY, DATA SOURCE AND LIMITATION

The data for the present study were retrieved from SCOPUS multidisciplinary database. Scopus database covers 53 million records, 21,915 titles and 5000 publishers. The bibliographic details of the published literature were collected using general search option of *SCOPUS*. The database searched under the address heading University or Institution - 'Pondicherry University' research in the field of Search Box. The search was limited for a period of twenty seven years, i.e., 1987 to 2013 and 2348 records were retrieved. Thus a total of 2348 records of different type viz. articles (1863), conference papers (334), reviews (72), letters (19), book chapters (16), article in press (9), erratum (7), editorials (5), notes (5), short surveys (5), books (1), and undefined (12) were retrieved. The collected data were analysed using MS Excel and subjected to further analysis to meet the objectives and using some scientometric indicators. The study is limited to a period of 1987 to 2013 covered in the Scopus database only, even though some of the publications were not covered in this database.

ANALYSIS OF DATA

YEAR-WISE DISTRIBUTION OF PUBLICATION

A total of 2348 contributions have been published in twenty seven years (1987-2013), which consists of full articles, review articles, editorial, conference papers and short communications. Table 1 given the details regarding the distribution of 2348 contributions published from 1987-2013. The analysis shows that maximum number of articles i.e., 1041 (44.34 %) were published in the years of 2011-2013 and minimum number of contributions i.e., 18 (0.77%) in the study period. The analysis shows that declining period for the block years of 1993-1995, and thereafter an increasing trend.

Table 1: Year-wise distribution of publication output

Sl. No	Year	No. of research paper produced	Cumulative no. research paper	% age of total output	Cumulative % age of total output
1	1987-1989	18	18	0.77	0.77
2	1990-1992	49	67	2.09	2.86
3	1993-1995	39	106	1.66	4.52
4	1996-1998	120	226	5.11	9.63
5	1999-2001	165	391	7.03	16.66
6	2002-2004	233	624	9.92	26.58
7	2005-2007	248	872	10.56	37.14
8	2008-2010	435	1307	18.53	55.67
9	2011-2013	1041	2348	44.34	100.00
Total		**2348**		**100.00**	

AUTHORSHIP PATTERN

Table 2 gives the details about the authorship pattern. Out of 2348, 139 contributions (5.92%) were contributed by single author followed by 772 contributions (32.88%) by two authors, 536 contributions (22.83 %) by three authors, 380 contributions (16.18%) by four authors, 226 contributions (9.13%) by five authors and 295 contributions (12.56%) by more than five authors. The analysis shows that majority of contributions (n=772, 32.88%) contributed by two authored papers.

Table 2:Authorship pattern

No. of author(s)	Total no. of contributors	% age	Cumulative % age
Single	139	5.92	5.92
Two	772	32.88	38.80
Three	536	22.83	61.63
Four	380	16.18	77.81
Five	226	9.63	87.44
More than Five	295	12.56	100.00
Total	**2348**	**100.00**	

DEGREE OF COLLABORATION

Subramanyam[13] proposed a mathematical formula for calculating degree of author's collaboration in a discipline. The degree of collaboration among authors is the ratio of the number of papers published in a discipline during certain period of time.

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

Where,

C= degree of collaboration
Nm= number of multi authored papers
Ns= number of single authored papers

The degree of collaboration in different years calculated as per the equation proposed by Subramanyam is presented in Table 3. The degree of collaboration over the years from 1987-2013 is calculated and it varies from 0.61 to 0.96. The mean value is found to be 0.88.

Table- 3: Degree of Collaboration

Year	Single authored (Ns)	% age	Multi authored (Nm)	% age	Total (Ns + Nm)	DC
1987-1989	7	5.04	11	0.50	18	0.61
1990-1992	11	7.91	38	1.72	49	0.78
1993-1995	4	2.88	35	1.58	39	0.90
1996-1998	14	10.07	106	4.80	120	0.88
1999-2001	15	10.79	150	6.79	165	0.91
2002-2004	8	5.76	225	10.19	233	0.97
2005-2007	15	10.79	233	10.55	248	0.94
2008-2010	25	17.99	410	18.56	435	0.94
2011-2013	40	28.78	1001	45.31	1041	0.96
Total	**139**	**100.00**	**2209**	**100.00**	**2348**	**0.88 (Mean)**

PATTERN OF CO-AUTHORSHIP

To assess the pattern of co-authorship, the following formula suggested by Garg and Padhi[14] was used:

$$CAI = \frac{N_{ij}/N_{io}}{N_{oj}/N_{oo}} * 100$$

Where,

N_{ij} =Number of papers having 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

Table 4: Co-Authorship Index (CAI)

Sl. No	Year	Single Author	CAI	Two Authors	CAI	More than Two Authors	CAI	Total
1	1987-1989	7	1083.57	4	255.39	7	217.03	18
2	1990-1992	11	152.50	21	167.60	17	65.88	49
3	1993-1995	4	54.32	25	195.45	10	37.96	39
4	1996-1998	14	282.32	61	708.13	45	253.67	120
5	1999-2001	15	203.71	73	570.72	77	292.32	165
6	2002-2004	8	64.14	65	300.01	160	358.60	233
7	2005-2007	15	82.50	81	256.45	152	233.68	248
8	2008-2010	25	37.64	142	123.07	268	112.79	435
9	2011-2013	40	57.87	300	249.84	701	283.48	1041
Total		**139**		**772**		**1437**		**2348**

MOST PROLIFIC AUTHORS

Table 5 depicts that thirteen authors have been identified as most productive authors who have published 50 or more research papers in Pondicherry University. The authors together contributed 1627 papers during 1987-2013. The analysis shows that S.A. Abbasi is the leading author contributing 162 articles followed by K. Porsezian with 168 articles each securing the second position. M. Venkateswarlu contributed 76 articles and he has secured third rank. P. Dhavachelvan contributed 73 articles with fourth rank. P.S. Rao and P.P. Mathur were contributed 70 articles each, they securing with fifth rank.

Table 5: List of prolific authors with more than fifty publications

Sl. No	Name	Total Authorship	Rank
1	S.A. Abbasi	132	I
2	K. Porsezian	79	II
3	M. Venkateswarlu	76	III
4	P. Dhavachelvan	73	IV
5	P.S. Rao	70	V
6	P.P. Mathur	70	V
7	P. Sambasiva Rao	59	VI
8	R.V.S.S.N. Ravikumar	58	VII
9	N. Satyanarayana	56	VIII
10	G. Govindaraj	53	IX
11	K.M. Tamizhmani	53	IX
12	S. Mohan	52	X

13	T. Abbasi	50	XI

SUBJECT-WISE RESEARCH OUTPUT

It is clear from the Table 6, highest contributions coming from Physics and Astronomy with 564 papers, followed by chemistry (470), Pharmacology, Materials Science (417), Biochemistry, Genetics and Molecular Biology (353), Engineering (284), Agricultural and Biological Sciences (267), Computer science (265), Environmental Science (257), Chemical Engineering (170), Pharmacology, Toxicology and Pharmaceutics (167) and Mathematics (156). Other subjects had contributed less than one hundred and fifty papers

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Table 6: Subject-wise Research Output on Pondicherry University

Sl. No	Subject	No. of articles	Percentage
1	Physics and Astronomy	564	14.02
2	Chemistry	470	11.69
3	Materials Science	417	10.37
4	Biochemistry, Genetics and Molecular Biology	353	8.78
5	Engineering	284	7.06
6	Agricultural and Biological Sciences	267	6.64
7	Computer Science	265	6.59
8	Environmental Science	257	6.39
9	Chemical Engineering	170	4.23
10	Pharmacology, Toxicology and Pharmaceutics	167	4.15
11	Mathematics	156	3.88
12	Medicine	136	3.38
13	Immunology and Microbiology	99	2.46
14	Earth and Planetary Sciences	94	2.34
15	Social Sciences	74	1.84
16	Energy	69	1.72
17	Multidisciplinary	60	1.49
18	Business, Management and Accounting	41	1.02
19	Economics, Econometrics and Finance	33	0.82
20	Decision Sciences	18	0.45
21	Arts and Humanities	9	0.22
22	Psychology	7	0.17
23	Health Professions	4	0.10
24	Neuroscience	3	0.07
25	Nursing	3	0.07
26	Dentistry	1	0.02
27	Veterinary	1	0.02
Total		**4022**	**100.00**
*The total output is more than real output because quite a lot of journals are classified in more than one discipline.			

RANKING OF JOURNALS

Table 7 displays that Pondicherry University researchers preferred to publish their articles in different journals. It is evident that, the researchers to publish their work in a wide range of journals indexed in Scopus. The above table indicates that maximum number of papers, i.e., 51(2.17%) are published in the journal of *Acta Crystallographic a Section E Structure Reports Online* followed by *Current Science* 42(1.79%), *Spectrochimica Acta Part A Molecular and Biomolecular Spectroscopy* 38 (1.62%), *Aip Conference Proceedings* 37 (1.58%) and other journals are below one percentage.

Table 7: **Ranking (15) of Journals on the basis of number of contributions**

Sl. No	Name of the Journal	No. of articles	Percentage	Rank
1	Acta Crystallographic a Section E Structure Reports Online	51	2.17	I
2	Current Science	42	1.79	II
3	Spectrochimica Acta Part A Molecular and Biomolecular Spectroscopy	38	1.62	III
4	Aip Conference Proceedings	37	1.58	IV
5	Tropical Ecology	23	0.98	V
6	Journal of Alloys and Compounds	22	0.94	VI
7	Materials Chemistry and Physics	19	0.81	VII
8	Journal of Loss Prevention in the Process Industries	17	0.72	VIII
9	Tetrahedron Letters	17	0.72	VIII
10	Journal of Physics and Chemistry of Solids	16	0.68	IX
11	Communications in Computer and Information Science	15	0.64	X
12	Radiation Effects and Defects in Solids	15	0.64	X
13	Bioresource Technology	15	0.64	X
14	Physica B Condensed Matter	14	0.60	XI
15	Indian Journal of Experimental Biology	14	0.60	XI

GEOGRAPHICAL DISTRIBUTION

Table 8 clearly define that distribution of research output by geographical regions illustrates the collaboration of other countries with the researchers/scholars of Pondicherry University. On the whole (2348) contributors, the major collaborative contributors from USA with 19.49%, followed by France (n=61, 9.74%), Japan (n=47, 7.51%), Taiwan (n=41, 6.55%), Canada (n=32, 5.11%), Germany (n=31, 4.95%), South Korea (n=29, 4.63%), Malaysia (n=23, 3.67%), Italy and China with 3.04% each respectively. It is clearly observed from this study United States is the major collaborative partner of Pondicherry University.

INSTITUTION-WISE RESEARCH COLLABORATION

Table 9 shows that institution-wise colloboration of research contributions in Pondicherry University for the study period. It is observed that majority of the contributions are made from Anna University (71 papers) followed by Pondicherry Engineering College (60 papers), Acharya Nagarjuna University (38 papers), University of Madras (36 papers), Ecole Polytechnique (33 papers), Sri Venkateswara University (29 papers), Annamalai University (26 papers), Institute of Bioinformatics and Universite Paris 7- Denis Diderot with 24 papers each respectively.

Table 8: Geographical distribution of publication output

Sl. No	Name of Country	No. of papers	% age
1	United States	122	19.49
2	France	61	9.74
3	Japan	47	7.51
4	Taiwan	41	6.55
5	Canada	32	5.11
6	Germany	31	4.95
7	South Korea	29	4.63
8	Malaysia	23	3.67
9	Italy	19	3.04
10	China	19	3.04
11	United Kingdom	18	2.88
12	Australia	18	2.88
13	Netherlands	16	2.56
14	Cameroon	11	1.76
15	Mexico	10	1.60

Table 9: Institution-wise research collaboration output during 1987-2013

Sl. No	Name of the Institution	No. of contributions	Rank
1	Anna University	71	I
2	Pondicherry Engineering College	60	II
3	Acharya Nagarjuna University	38	III
4	University of Madras	36	IV
5	Ecole Polytechnique	33	V
6	Sri Venkateswara University	29	VI
7	Annamalai University	26	VII
8	Institute of Bioinformatics	24	VIII
9	Universite Paris 7-Denis Diderot	24	VIII
10	University of Hyderabad	22	IX
11	Physical Research Laboratory India	20	X
12	Bharathidasan University	20	X
13	Indira Gandhi Centre for Atomic Research	19	XI
14	National Taiwan University of Science & Tech.	19	XI
15	Indian Institute of Science	18	XII
16	Manipal University	18	XII
*Total Collaborative Papers by Pondicherry University during 1987-2013 = **1354**			

CONCLUSION

In the present scenario, scientometrics/bibliometrics has become an important field of study to scrutinize the progress in scientific performance of a research group, a department, a university etc. It can be used to identify the emerging research areas in any branch of knowledge to evaluate the research performance of scientists, research groups and countries, to map the cognitive or intellectual structure of a research area..

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