

## Research Output of Advanced Centre for Treatment, Research and Education in Cancer (2003-2018): A Scientometrics Analysis

Garvita Jhamb\*, Sapna Verma\*\*

### Author's Affiliation:

\*Research Scholar, Department of Library and Information Science, University of Delhi, Delhi 110007, India

E-mail: [j.garvita7@gmail.com](mailto:j.garvita7@gmail.com)

\*\*Research Scholar, Department of Library and Information Science, University of Delhi, Delhi 110007, India

E-mail: [sapnaverma.du@gmail.com](mailto:sapnaverma.du@gmail.com)

### Corresponding Author:

**Sapna Verma**, Research Scholar, Department of Library and Information Science, University of Delhi, Delhi 110007, India

E-mail: [sapnaverma.du@gmail.com](mailto:sapnaverma.du@gmail.com)

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### Abstract

*The present paper is an attempt to analyze the research output of Advanced Centre for Treatment, Research and Education in Cancer (ACTREC). The study conducted for the 2003 -2018 time period using Web of Science, a citation database and R Studio. The study reveals that the compound annual percentage of growth rate is 35.1% and an overall citation per paper is 16. It also reports that ACTREC has a strong collaboration at International level, as it has more than 1 affinity value. The most preferred journals by the scientists of ACTREC are PLoS One and International Journal of Cancer.*

**Keywords:** Authorship pattern; Dominance factor (DF); Affinity Index (AI); Relative Growth Rate (RGR), Doubling Time (DT)

## INTRODUCTION

Research productivity is one of the utmost factors for intellectual contributors of any institution as it helps in enhancing the rank and visibility of Institution at global level (Saric, Jurg & Bassirou, 2018). In the area of research, scientists communicate through scholarly publications such as journal articles, conferences papers, thesis, dissertation, monographs, book chapters, reports, and editorial (Moracasik, 1985) and these publications help to flourish the new knowledge as well as growth of a profession (Winston and Williams, 2003). These scientific scholarly outputs are measured through Scientometrics. Scientometrics is defined as quantitative study of scientific scholarly output (Hood & Wilson, 2001). There are various indicators to measure the research productivity such as Dominance Factor, Affinity Index, Relative Growth Rate, Doubling Time, etc.

Advanced Centre for Treatment, Research and Education in Cancer (ACTREC) is established in 2002 with a motto to “function as a national centre for treatment, research and education in cancer. ACTREC comprises of two units for research in cancer area which includes, basic research and clinical research” (<http://actrec.gov.in>).

## **REVIEW OF LITERATURE**

There are plenty of literatures available on the research productivity of renowned institutions in India. Some of the noteworthy studies are by Kumar and Dora (2012), identified the trends in the research productivity of IIMA during the period of 1999 -2010 and reported that trend of collaboration has been increased in multidisciplinary area instead of sole publications; Singh (2015) studied the research output of Central University of Himachal Pradesh and it also reports the increasing collaboration pattern among researchers at national and international level. Siwach and Parmar (2018) mainly focused on the research contributions of CCS Haryana Agricultural University and reveal that during 2001-2015; total 2649 paper published from university received 15282 citations. It also reports that university has an increased trend of collaboration with many institution; Nagarkar (2013) revealed that there is a continuous growth of publications in chemistry department of University of Pune during the period of 1999-2012 and majority of the papers are published in the area of physical chemistry; Singh (2015) assessed the research output of ISI, Kolkata and reports that collaboration of US has been increased during 1990-2014 followed by Canada and UK. The study also explored that Mathematics and Information Science are the most research studied area followed by Physics in ISI Kolkata; Nagarkar and Kengar (2017) analyzed the physics research output during the period of 1990-2014 which reports that research productivity of faculty members has been increased and collaboration of scientist has been increased from USA followed by UK and Germany.

The exhaustive review of literature has been performed by the authors but not found any research study on the research productivity of Advanced Centre for Treatment, Research and Education in Cancer. So, the present study is an attempt to study an article, entitled “Research Output of Advanced Centre for Treatment, Research and Education in Cancer (2003-2018): A Scientometrics Analysis”.

## **OBJECTIVES OF THE STUDY**

The foremost objective of the study is to analyze the research productivity of the Advanced Centre for Treatment, Research and Education in Cancer (ACTREC) during the 2003-2018 time period. Specifically, the study includes the following objectives, as mentioned below:

1. To identify the authorship pattern of the papers published from ACTREC during the period 2003-2018;
2. To identify the most prolific authors from ACTREC;
3. To identify the year-wise growth of articles and calculate relative growth rate;
4. To identify the international collaboration and affinity index; and
5. To identify the most preferred journals by authors from ACTREC.

## **METHODOLOGY**

The source for the dataset of present study is Web of Science, core collection of Science Citation Index, Social Science Citation Index and Humanities Index. The search query consists of “Advanced Centre for Treatment, Research and Education in Cancer” under "Organization-Enhanced with a time frame of 2003-2018. In all a total 734 research articles were retrieved on WoS and the data was downloaded for the analysis in MS Excel. R Studio software written in R language is used along with MS Excel for the data analysis purpose.

## DATA ANALYSIS

## Authorship Pattern and Citation Impact

Table 1: Authorship Pattern and Citation Impact

Number of Authors	TP (2003-2010)	TC	TP (2011-2018)	TC	TP (2003-2018)	TC	Impact (CPP)
1	0	0	1	24	1	24	24
2	21	402	32	292	53	696	13
3	25	537	39	194	64	732	11
4	24	388	66	857	90	1242	14
5	27	485	76	1010	103	1502	15
6 to 15	72	2181	320	3923	392	6125	16
16 to 25	3	132	20	399	23	532	23
26 to 35	0	0	4	80	4	82	21
36 to 45	0	0	1	17	1	17	17
46 to 55	0	0	2	22	2	22	11
383	1	1056	0	0	1	1058	1058
	173	5181	561	6818	734	12042	16

(TP= Total Publication, TC= Total Citation, CPP- Citation per Paper)

Table 1 shows the authorship pattern of the Advance Centre for Treatment, Research & Education in Cancer. In the first eight year block (2003-2010) 23.6% articles were published which received 43.1% of the total citations. In second eight-year block (2011-2018) 76.4% of the total output was produced receiving 56.9% of the total citations. Overall Citation per paper is 16.

Only one publication is published without collaboration while 99.9% are in collaboration. Maximum articles (44.7%) been produced by collaboration of authors ranging from 6 to 15 followed by collaboration of 5 authors (14%). One article was written in collaboration with 383 authors who received highest citations. Highest citation per paper (CPP= TC/TP) is received by the 23 articles as a result of collaboration among 16 to 25 authors.

## Most Productive Authors

Table 2: Most Productive Authors

S. No.	Authors	TP	TC	CPP	H index
1	Sadhana Kannan	64	956	15	16
2	Sudeep Gupta	49	684	14	11
3	C. Murali Krishna	48	738	15	15
4	Tejpal Gupta	47	922	20	16
5	Rajiv P. Gude	36	533	15	15
6	Arvind Ingle	32	697	22	16
7	Rita Mulherkar	30	577	19	14
8	Rajiv Sarin	30	1504	50	12
9	Vedang Murthy	29	605	21	11
10	Ashwini Budrukhar	27	581	22	11

Table 2 mentions the top 10 authors according to the number of articles they published. Sadhana Kannan has contributed maximum and ranks 1 followed by Sudeep Gupta. Rajeev Sarin with rank 8 has got highest number of citations (CPP=50) followed by Arvind Ingle and Ashwini Budrukhar (CPP= 22).

### Dominance Factor (DF)

Table 3: Author Dominance Ranking

S. No.	Author	Total Articles	Single - Authored Articles	Multi - Authored Articles	First- Authored	DF
1	Vedang Murthy	29	0	29	13	0.45
2	Supriya Chopra	21	0	21	09	0.43
3	Tejpal Gupta	47	0	47	20	0.43
4	Pradyumna K. Mishra	21	0	21	05	0.24
5	Vikram Gota	25	0	25	05	0.20
6	Rakesh Jalali	21	0	21	01	0.05
7	Ashwini Budrukkar	27	0	27	01	0.04
8	Umesh Mahantshetty	27	0	27	01	0.04
9	Rita Mulherkar	30	0	30	01	0.03
10	Arvind Ingle	32	0	32	01	0.03

Table 3 mentions the author ranking based on dominance factor. The table was obtained using R software. Vedang Murthy has obtained the highest dominance factor (0.45) followed by Supriya Chopra (0.43). The higher the number of first author articles in collaboration, higher is the dominance factor.

### Annual Scientific Production

Table 4: Growth of Articles

Year	Articles	Cumulative Number of articles	Ln W1	LnW2	RGR	D <sub>t</sub>
2003	06	6		1.79		
2004	08	14	1.79	2.64	0.8	0.8
2005	14	28	2.64	3.33	0.7	1.0
2006	21	49	3.33	3.89	0.6	1.2
2007	14	63	3.89	4.14	0.3	2.8
2008	36	99	4.14	4.60	0.5	1.5
2009	33	132	4.60	4.88	0.3	2.4
2010	41	173	4.88	5.15	0.3	2.6
2011	49	222	5.15	5.40	0.2	2.8
2012	63	285	5.40	5.65	0.2	2.8
2013	64	349	5.65	5.86	0.2	3.4
2014	78	427	5.86	6.06	0.2	3.4
2015	80	507	6.06	6.23	0.2	4.0
2016	83	590	6.23	6.38	0.2	4.6
2017	72	662	6.38	6.50	0.1	6.0
2018	72	734	6.50	6.60	0.1	6.7

The Relative Growth Rate (RGR) and Doubling Time (Dt.) of publications in India have been presented in Table 4 and calculated using the given formula (Sangam & Meera, 2013):

i) Relative Growth Rate (RGR): is the increase in the number of publications per unit time.

$$R = \frac{W_2 - W_1}{T_2 - T_1}$$

where

R = mean relative growth rate over the specific period of intervals;

W1 = Log W1 (natural log of initial number of publication);  
 W2 = Log W2 (natural log of final number of publication);  
 T2 - T1 = the unit difference between the initial and final time

ii) Doubling Time

$$Dt = 0.693/R$$

It indicates that the value of Relative Growth Rate (RGR) of publications decreased from 0.8 in the year 2003 to 0.1 in 2018. Simultaneously, the values of Doubling Time (Dt.) increased from 0.8 in 2003 to 6.7 in 2018. It is evident from the study that research output of Advance Centre for Treatment, Research & Education in Cancer has increased over a period of time.

Compound Annual Growth Rate for the period of 16 years was calculated. The compound annual growth rate is calculated by taking the nth root of the total percentage growth rate, where n is the number of years in the period being considered. (Choi, Lee & Sung, 2011)

$$CAGR = [V(tn)/V(t0)]^{1/n} - 1$$

Where,

V(t0) = value at the beginning period

V(tn) = value at the end period

n = no of years

$$\begin{aligned} CAGR &= [734/6]^{1/16} - 1 \\ &= (122.33)^{0.0625} - 1 \\ &= 1.351 - 1 \\ &= 0.351 \end{aligned}$$

The CAGR for the thirty-year period suggested publication growth of 35.1% per year.

### International Collaboration

**Table 5: Top Ten Collaborating Countries and Affinity Index**

S. No.	Countries	Articles	Affinity Index
1.	USA	63	29
2.	UK	20	9
3.	Germany	17	8
4.	France	13	6
5.	Norway	9	4
6.	Italy	9	4
7.	Switzerland	7	3
8.	Canada	7	3
9.	Australia	7	3
10.	Japan	6	3

Affinity Index (AFI): Affinity index is the measure of research collaboration between institutions/countries in a given area of research. It is mathematically expressed as (Jhamb, Meera & Singh, 2019)

AFI = No. of co-operation links between A and B / No. of cooperation links between and the rest of the institutions X 100

Out of total research output, 114 (15.6%) articles are written in international collaborations with 37 countries of the world. These articles received 2909 citations (24%) of total citations. The highest number of collaboration was with USA with 63 papers (55%) followed by UK with 25 papers (17.5%). These 114 papers have generated 216 links by counting all countries as they appeared in each paper. Top 10 nations contribute maximum links (73%) while rest of the 27 countries appears 58 times. table 5 mentions the affinity index of India with top 10 countries. AFI value >1 more production in collaboration, while <1= reverse. All the values during the period of study were >1 which shows that there exist positive affinity between the India and top 10 countries.

**Sources of Publications**

**Table 6: Sources of Publication**

S. No.	Sources of Publication	TP	TC	CPP
S1	PLOS One	34	953	28
S2	Journal of Cancer Research And Therapeutics	19	228	12
S3	Scientific Reports	15	87	6
S4	Indian Journal of Medical Research	13	104	8
S5	Head And Neck-Journal For The Sciences And Specialties of The Head And Neck	12	159	13
S6	British Journal of Radiology	11	132	12
S7	International Journal of Cancer	11	307	28
S8	Biochemical And Biophysical Research Communications	11	98	9
S9	Indian Journal of Cancer	10	51	5
S10	Oral Oncology	10	171	17
S328	Other Sources	588	9752	17

Total output is distributed in 328 journals out of which top 10 according to number of publications are listed in Table 6. These top 10 journals contain 19.9% of the total output and have received 19% of total citations. Out of the rest 588 articles 191articles (32%) are scattered in 191 journals and followed by 124 articles (21%) in 62 journals which shows that scattering is high. Authors from this institute mostly preferred PLOS One to publish their research followed by Journal of Cancer Research and Therapeutics. Highest citation per paper is received by *PLOS One* and *International Journal Of Cancer* (CPP=28) followed by the journal *Oral Oncology* (CPP=17).

**FINDINGS OF THE STUDY**

The finding of the study during 2003-2018 reveals:

- Overall citation per paper is 16.
- Sadhana Kannan has contributed maximum and ranks 1st followed by Sudeep Gupta. Rajeev Sarin with rank 8 has got highest number of citations (CPP=50) followed by Arvind Ingle and Ashwini Budrukkar (CPP= 22).
- Vedang Murthy has obtained the highest Dominance Factor (0.45) followed by Supriya Chopra (0.43)
- Annual Percentage Growth Rate is 18.01%.
- The highest number of collaboration was with USA with 63 papers (55%) followed by UK with 25 papers (17.5%).
- All the values during the period of study were >1 which shows that there exist positive affinity between the India and top 10 countries.
- Highest citation per paper is received by *PLOS One* and *International Journal of Cancer* (CPP=28) followed by the journal *Oral Oncology* (CPP=17).

## CONCLUSION

Scientific contribution for the intellectuals is essential for representing their research output, as it helps in enhancing the ranking of their institution as well as helps in promotion of an individual scientist. The present study analyses the research output of ACTREC and its findings concludes that institution has a strong collaboration at global level.

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