

Publication Productivity of Bharat Ratna Prof. C.N.R. Rao during 1956-1975: A Scientometric Portrait

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***Abstract** - Prof. C.N.R. Rao has published more than 2000 research papers in his almost 60 years of research career. During 1956-1975 he has published 226 research papers, in which maximum papers are authored by three authors with 88 articles and highest number of papers published in the year 1975 with 20 (8.85%). Highest number of papers published in Can. J. Chem.-Rev. Can. Chim. With 19 and he used 57 different channels of communication to publish his research output. His research papers were categorised into 10 different chemistry domains, in which he has published maximum number of papers in Physical Chemistry with 74 and also he received highest number of citations in the same domain with 2760.*

***Keywords:** Bharat Ratna, Citation analysis, Scientometric Portrait, Prof. CNR Rao, Authorship pattern, Channels of Communication.*

Introduction

Prof. CNR Rao stands in the zenith position because of his ever-ending research contributions in the field of Chemistry. He is the one from India, among most prominent chemists of the world. Prof. Rao is a role model personality inspired many students, research colleagues and young scientists through his dynamic insights, friendly attitude and remarkable research work. Thus various honours and awards came searching this outstanding personality from across the world, which includes 'Bharat Ratna'. Thus in this study researchers have been analysed Prof. C.N.R. Rao's research publication were published during 1956-75.

Objectives of the Study:

Prof. C.N.R. Rao's Publications have been taken as a case study for the current Scientometric analysis. The study emphasizes on:

1. Year wise publications and productivity of Prof. C.N.R. Rao
2. Types of publications, published by Prof. C. N. R. Rao,
3. Authorship pattern of Prof. C.N.R. Rao during 1956-75
4. Dissemination of the Channels of Communication
5. Distribution of articles in different domain and its citations

Methodology:

Scientific publications seem to provide the best available for measuring research publications, thus the data presented in this research paper have been accessed from Web of Science (WoS) published by Thomson Scientific for the period 1956-1975, later converted into Tab Delimited format and MS-Excel worksheets have been used to analyse the data to meet the above mentioned objectives and also represented in suitable graphs and charts.

Data interpretation and analysis:

Table 1: Year wise Distribution of publications during 1956-1975

Year wise Distribution of publications during 1956-1975					
S. No.	Year	No. of Papers	%	Cumulative	Cumulative %
1	1956	2	0.88	2	0.88
2	1957	9	3.98	11	4.87
3	1958	11	4.87	22	9.73
4	1959	11	4.87	33	14.60
5	1960	12	5.31	45	19.91
6	1961	3	1.33	48	21.24
7	1962	11	4.87	59	26.11
8	1963	8	3.54	67	29.65
9	1964	2	0.88	69	30.53
10	1965	2	0.88	71	31.42
11	1966	18	7.96	89	39.38
12	1967	12	5.31	101	44.69
13	1968	18	7.96	119	52.65
14	1969	14	6.19	133	58.85
15	1970	15	6.64	148	65.49
16	1971	19	8.41	167	73.89
17	1972	13	5.75	180	79.65
18	1973	13	5.75	193	85.40
19	1974	13	5.75	206	91.15
20	1975	20	8.85	226	100.00
	Total	226	100.00		

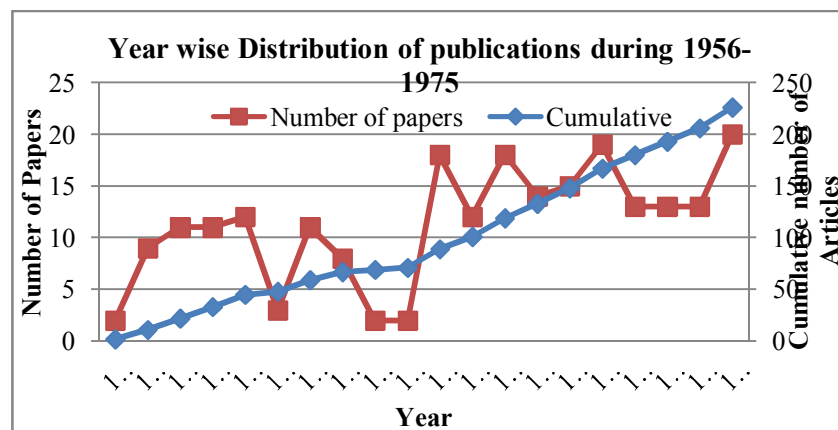


Figure 1: Year wise Distribution of publications during 1956-1975

Table no. 1 reveals that year wise distribution of articles during 1956-1975, Prof. CNR Rao has started his research career in 1956 publishing 02 research papers. Cumulative line in the figure no. 1 shows consent growth in publishing research article. During this tenure (i.e. 1956-75) he has published highest number of articles in 1975 with 20 (8.85%), which followed by 19 in 1971.

Table 2: Authorship pattern of Prof. CNR Rao during 1956-1975

Year	Authorship pattern of Prof. CNR Rao during 1956-1975							Total
	Single Author	2*	3*	4*	5*	6*	>6*	
1956	2							2
1957	3		5	1				9
1958	1	3	3	3	1			11
1959		4	5	1	1			11
1960	1	4	7					12
1961	1	2						3
1962		6	1	3			1	11
1963		2	4	1		1		8
1964		1	1					2
1965	1		1					2
1966		7	6	5				18
1967		8	2	1	1			12
1968	1	8	7	2				18
1969	1	2	7	4				14
1970		4	9	2				15
1971		7	6	6				19
1972	1	2	6	1	1	2		13
1973		6	6		1			13
1974	2	3	4	2	2			13
1975	3	4	8	4	1			20
Total	17	73	88	36	8	3	1	226

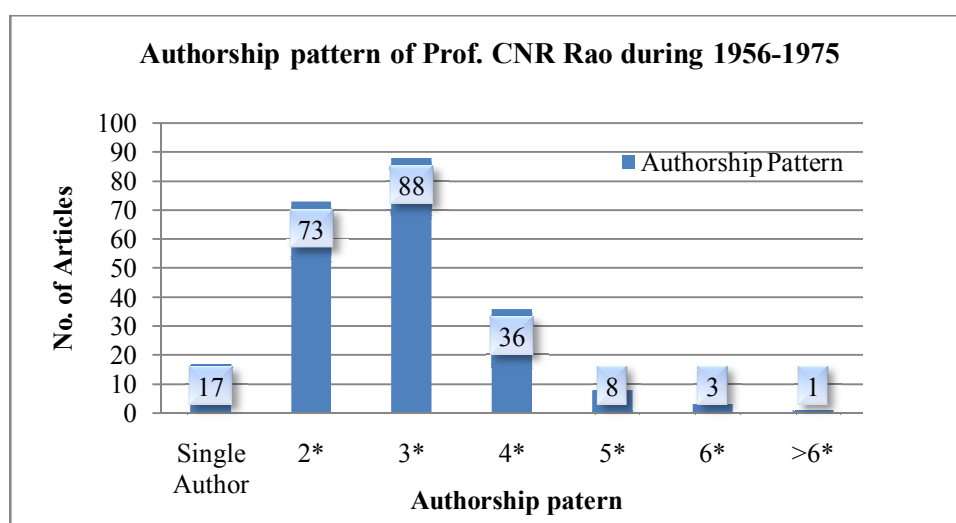


Figure 2: Authorship pattern of Prof. CNR Rao during 1956-1975

Prof. CNR Rao is one of the world's leading chemists from India, who published more than 2000 research papers, but during selected tenure i.e. 1956-1975 he published 226 papers, in which maximum papers authored by three authors which followed by 73 with two authors, apart from his busy schedule he published 17 papers as single author. Comparatively his single authored papers are less than multiple authored papers, which is replicated in table no. 2. And figure no. 2 as well

Table 3: Channels of Communications used by C.N.R. Rao during 1956-1975

S. No.	Channels of Communications	Year		Duration	Total	Total %
		FPY	LPY			
1	Can. J. Chem.-Rev. Can. Chim.	1957	1964	8	19	8.41
2	J. Chem. Soc.-Chem. Commun.	1970	1975	6	16	7.08
3	Trans. Faraday Soc.	1958	1971	14	15	6.64
4	J. Am. Chem. Soc.	1957	1970	14	11	4.87
5	Indian J. Chem.	1967	1975	9	10	4.42
6	Spectroc. Acta Pt. A-Molec. Biomolec. Spectr.	1969	1975	7	10	4.42
7	Chem. Phys. Lett.	1967	1975	9	9	3.98
8	J. Phys. Chem.	1959	1973	15	9	3.98
9	Chem. Ind.	1956	1966	11	8	3.54
10	J. Sci. Ind. Res.	1961	1975	15	8	3.54
11	J. Inorg. Nuclr. Chem	1963	1969	7	7	3.10
12	Spectroc. Acta	1958	1963	6	7	3.10
13	J. Org. Chem.	1957	1963	7	6	2.65
14	Can. J. Chem.	1966	1969	4	5	2.21
15	Nature	1959	1975	17	5	2.21
16	Four each articles published in 6 different journals	1957	1975	19	24	10.62
17	Three each articles published in 6 different journals	1959	1974	16	18	7.96
18	Two each articles published in 9 different journals	1962	1975	14	18	7.96
19	One each article published in 21 different journals	1956	1975	20	21	9.29
	Total				226	100.00

Channels of communication refer a medium through which a message is transmitted. Prof. CNR Rao has published his high quality research in 57 different channels during 1956-1975 to publish 226 research papers, in which highest number of articles published in the Can. J. Chem.-Rev. Can. Chim. With 19 (8.41%), followed by J. Chem. Soc.-Chem. Commun. With 16 (7.04%).

Table 4: Year-wise distribution of articles in different forms during 1956-1975

S.No.	Data Type	Year-wise distribution of articles in different form during 1956-1975																			Total	Total %	
		1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974			1975
1	Article	1	5	7	6	7	2	9	6	2		17	8	10	8	12	17	11	9	12	15	164	72.57
2	Book Review										1											1	0.44
3	Editorial Material				1	1										1						3	1.33
4	Letter		1		1						1		3	3							1	10	4.42
5	Meeting Abstract						1						2	1								4	1.77
6	Note	1	3	4	4	4		1	2			4	3	2	1	2	1	4	1	4	41	18.14	
7	Review									1						1	1					3	1.33
	Total	2	9	11	11	12	3	11	8	2	2	18	12	18	14	15	19	13	13	13	20	226	100.00

Based on the observation, it is proved that along with research articles Note, and latter are the part any scientist research publications. Thus in this study researchers have been observed that Prof. CNR Rao has published maximum research output in the form of research articles with 164 (72.57%), followed by Note 41 (18.14%).

Figure 3: Year-wise distribution of articles in different form during 1956-1975

S. No.	Different Domains	(a)= Articles (c)= Citations	Year wise Distribution of Articles & Citations in different domains during 1956-1975																	Total	Total %			
			1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972			1973	1974	1975
A	Analytical Chemistry	a	0	4	1	0	0	1	2	2	0	1	5	0	0	0	0	0	0	0	0	1	17	7.52
		c	0	105	16	0	0	3	68	17	0	66	239	0	0	0	0	0	0	0	0	9	523	7.30
B	Chemistry in General	a	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0.44
		c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	0.04
C	Condensed Matter	a	0	0	0	1	0	0	0	0	0	0	0	4	0	0	2	2	2	0	1	12	5.31	
		c	0	0	0	77	0	0	0	0	0	0	0	64	0	0	175	51	29	0	152	548	7.65	
D	Inorganic and Nuclear	a	0	0	0	0	0	0	1	0	0	4	2	0	2	0	1	0	2	0	1	13	5.75	
		c	0	0	0	0	0	0	10	0	0	125	88	0	27	0	53	0	40	0	74	417	5.82	
E	Material Sciences	a	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	2	5	2.21	
		c	0	0	0	0	0	0	0	0	0	102	0	17	0	0	0	0	0	32	42	193	2.69	
F	Miscellaneous	a	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	0.88	
		c	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0.01	
G	Molecular and Chemical	a	0	0	0	0	0	0	0	0	0	0	1	0	0	2	1	1	0	4	1	10	4.42	
		c	0	0	0	0	0	0	0	0	0	0	22	0	0	26	11	19	0	27	1	106	1.48	
H	Multidisciplinary sciences	a	1	1	6	6	6	0	4	0	2	0	5	6	7	6	6	6	4	4	3	5	78	34.51
		c	0	38	299	113	111	0	216	0	243	0	216	242	183	73	197	126	54	34	21	146	2312	32.26
I	Organic Chemistry	a	0	2	1	1	1	0	1	3	0	0	0	0	1	1	0	1	1	1	0	0	14	6.19
		c	0	109	3	14	5	0	30	83	0	0	0	0	13	13	0	0	23	11	0	0	304	4.24
J	Physical Chemistry	a	1	2	3	3	5	2	4	2	0	1	3	3	5	5	6	8	3	4	5	9	74	32.74
		c	23	36	11	132	219	1	519	83	0	0	57	101	116	211	400	89	342	50	124	246	2760	38.51
Total		a	2	9	11	11	12	3	11	8	2	2	18	12	18	14	15	19	13	13	13	20	226	100.00
		c	23	288	329	336	335	4	833	193	243	66	739	453	393	324	624	454	492	164	204	670	7167	100.00

Citation analysis is a way of quantifying the relative importance or impact of an author, research paper by counting the number of times that author, research publication has been cited by other works, and on other hand quality of the research work is measured by the number of citation which received. In this study researchers have made an attempt to analyse citations, received by Prof. CNR Rao during 1956-1975. And also 226 papers were distributed in 10 different domains, thus it replicates that Prof. CNR Rao has published highest papers in the domain multidisciplinary sciences with 78, which followed by 74 in Physical Chemistry, but highest number of citations were received in the domain Physical Chemistry, it is also represented in the table- 5.

Conclusion:

Many prominent personalities from across the world figured out Prof. C.N.R. Rao in such way which can be emulated by every reader. One among is Prof. Robert W. Renowned metallurgist and great researcher in material Chemistry illustrated C.N.R. Rao in his book entitled as the coming of Materials Science, as “Prof. C.N.R. Rao is one of the famous recent exponents in the field of Materials Science (Chemistry), because of his extraordinary and wide ranging contributions along with hid research team, the domain has reached most vital stage in chemistry”. Thus this attempt helps the researchers to know Prof. CNR Rao research papers.

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