

Quantitative and Qualitative Study of the Research Collaboration among Scientists at the Indian Institute of Oilseeds Research

Surendra Kumar
ICAR-Indian Institute of Soybean Research
Khandwa Road, Indore - 452001. India
skumar9861@gmail.com



S. Kumar
Board of Studies
S.S. in Library and Information Science, Vikram University, Ujjain. India
sudhirkumarvuujain@gmail.com

Shilpa Dhoble
S.S. in Library and Information Science
Vikram University, Ujjain. India
shilpadhoble1@gmail.com

ABSTRACT: The paper analyses 2195 research papers published in 35 years is distributed into 3 blocks, in analysis communication channels and calculates RGR & DT. Shows that most of papers have published in collaboration of 2 to 5 authors. Paper calculates authorship pattern of contributors. Dominance factors of 44 authors with 10 or more papers have been calculated. Concludes with high collaboration pattern and variable dominance factors.

Keywords: Oilseeds, Collaboration Pattern, Dominance Factors

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1. Introduction

The paper studies quantitative and qualitative analysis of collaboration among the scientists of Indian Institute of Oilseeds Research, Hyderabad (India) (IIOR) under the Indian Council of Agricultural Research (ICAR). The establishment of All India Coordinated Research Project on Oilseeds (AICORPO) in April, 1967, based on the recommendations of a based on the recommendations of a sub – committee appointed by the Government of India, was the most significant event in the history of oilseeds research in India. The project had its beginning with one project Coordinator to coordinate and monitor the research programmes of groundnut, rapeseed- mustard, sesame, linseed and castor operating at 32 research centres. Later, during 1972, safflower, sunflower and niger were brought under the umbrella of AICOPRO and the number of research centre increased to 40.

Realizing the need for one national institute for oilseeds, the AICORPO was elevated to the status of Directorate of Oilseeds Research (DOR) on August 1, 1977 with a Project Director as its administrative head and seven project Coordinators for the seven mandate crops. Subsequently, groundnut and rapeseed- mustard were delinked from the Directorate with the establishment of National Research Centre for each of the crops during 1979 and 1993, respectively. In April 2000, the AICRP on Sesame & Niger and Linseed were separated from the administrative control. Sesame, Niger and Linseed were also separated from the DOR as per recommendation of H. K. Jain Committee. At present, only Sunflower, Safflower and Castor crops are under the administrative control of DOR. Later on during February, 2015 DOR has been upgraded as Indian Institute of Oilseeds Research². The institute mainly work on research in 3 oilseeds, sunflower, safflower and castor.

2. Review of Literature

For the purpose of this paper few studies have been reviewed on collaboration research. Kannappanavar and Vijaykumar (2001)³ have analyzed the authorship trend in International Monetary Fund literature. Morrison and others (2003)⁴ have analysed 444 collaborative projects undertaken by staff in the science faculty of New Zealand University. Kumar and Hashemzadeh (2004)⁵ have studied the growth of literature, country wise input, highly preferred journals in physics and engineering. Vijay (2005)⁶ has studied collaborative research and authorship trends in the area of food science and technology in India. Senthikumarnan and Amudhavali (2007)⁷ have conducted a quantitative analysis of the spices literature of India. Kumar and Kumar (2008)⁸ has studies the collaboration in research productivity in oilseeds research Institutes of Indian Council of Agricultural Research in India. Elango and Rajenran (2012)⁹ have studied collaboration pattern in marine sciences for the duration of 10 years (2001-2010). Sooryamoorthy (2013)¹⁰ has conducted is study in the natural sciences research publications from Science Citation Index Expanded (1945 to 2013). Jain and Kumar (2013)¹¹ have analyzed Indian contributions to world soybean research. Dutt and Nikam (2014)¹² have studied the collaborative pattern in solar cells research in India for the period of 20 years from 1991-2010 as reflected by the publication indexes in Thomas Reuters 'Web of Science (WoS)'. Meena, Kumar and Jain (2014)¹³ have studied on pigeon pea for the duration of 9 years (2000-2008). Kumar and Kumar (2014)¹⁴ have analysed quantitative and quality measurement of collaboration among scientists at Directorate of Rapeseed and Mustard Research (DRMR) from 2000 to 2009.

3. Methodology

The statistical population consists of contributions of scientists made in various communication channels over the years of their services in the institute. For this purpose annual report of IIOR since 1982 to 2016 have been procured which publish lists of the publications of scientists as an official policy. The scientists do report to the office for their own goodwill and insist inclusion of their works so these reports include comprehensive data. After that list have been prepared and was sent to the institutes and scientists to check any mistake or omission. Beside, librarian of the IIOR has been consulted before finalizing the list. A final list of publications has been prepared digitally. Each entry consists of information about authors, title, name of the communication channels, year and pages etc. The scope of the study is to find out publication activities in safflower, sunflower and Castor crop only. Various statistical methods have been applied to find out results. In total 2195 research papers and articles have been reported and enclosed. The period of 35years (1982-2016) has been divided in 3 blocks.(1982-96, 1997-2006, and 2007-2016) to find out changing trend over each block period of time.

Statistical Methods: Following statistical methods have been used to find out results.

Collaboration Coefficient

For calculation of degree of collaboration formula given by Subramanyam (1983)¹⁵ has been applied, which take the proportion of co-authored publications (N_m) in total publications ($N_m + N_s$), mathematically represented as

$$Q = \frac{N_m}{N_m + N_s} \quad (1)$$

Collaboration Index

Collaboration index has been calculated with the formula suggested by Lawani,¹⁶ which calculation mean number of authors per publication. This has been modified in this study and does not take into consideration single authored publications, as it is always constant "one". It is now mean of number of authors (N_{am}) per multi-authored publication (N_{pm}), mathematically represented as:

$$CI = \frac{Nam}{Npm} \quad (2)$$

Dominance Factor

Dominance Factor formula has been developed by author of the paper Prof. Sudhir Kumar (2008)¹⁷. D. F. is proportion of number of multiauthored papers of an author as first author (Nmf) to total number of multi authored papers of the author (Nmt). Single authored papers have been omitted due it constant value “one” of single authored papers. Mathematically it is represented as:

$$DF = \frac{Nmf}{Nmt} \quad (3)$$

High DF value shows more dominance of an author as first author while low DF value shows low dominance of author as first author.

Relative growth rate and doubling time

1. RGR

$$1 - 2^R = \frac{\text{Log}_{e2} w - \text{Log}_{e1} w}{2^T - 1^T}$$

Where $1 - 2^R$ = Mean relative growth rate over the specific period of interval

$\text{Log}_{e1} w$ = log of initial number of articles.

$\text{Log}_{e2} w$ = log of final number of articles after a specific period of interval

$2^T - 1^T$ = the unit difference between the initial time and the final time

2. DT

$$DT = \frac{0.693}{R}$$

Analysis: The paper has analyses contributions on various parameters

Distribution of Contributions

The table 1 shows that during last thirty five years (from 1982 to 2016), 2195 papers have been contributed by of IIOR scientists. They have categorised in three blocks. It is observed that highest 1004 papers (45.74%) have been contributed in the III block years 1996 - 2006. In the starting years 1982-96, only 200 papers have been contributed.

Communication Channels

Table 1 shows blockwise distribution of contributions in various communication channels. The highest 941 (42.87%) papers have been contributed in various journals out of which 803 (36.58%) are in Indian journals and only 138 (6.29%) are in foreign journals. There are 573 (26.1%) papers in conferences, symposiums & seminars, out of which only 125 (5.69%) papers have been contributed at international level 448 (20.41%) papers have been contributed at national level. Other 681 (31.02%) papers have been contributed in newsletters, books, in-house publications etc. So it is observed that publication at national level journal and conference are much highly at international.

Relative Growth Rate and Doubling Time

Table 2 presents growth rate is which has gradually decreased from 1.79 to 0.60 during block II to block III. Correspondingly doubling time has increased from 0.39 to 1.16. Mean number of articles shows increase in the publications from 13.33 to 100.40 from block 1 to 2 and again decrease to 99.10 in block 3 during the study period.

Authorship Pattern of Contributions

Table 3 studies authorship pattern of contributions. Most of the papers have been published by single, two & three and four

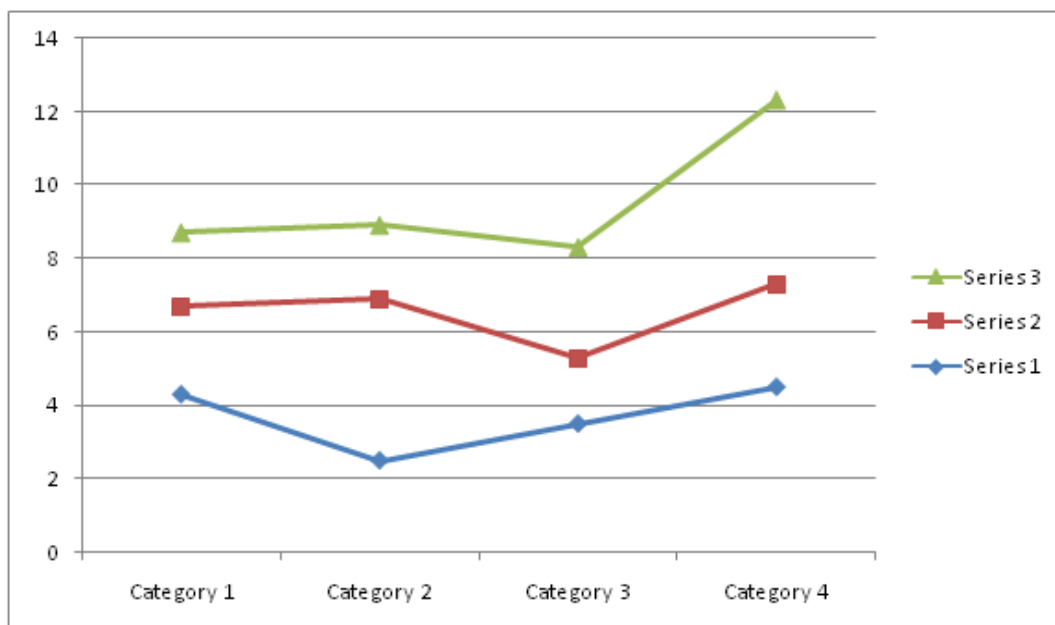
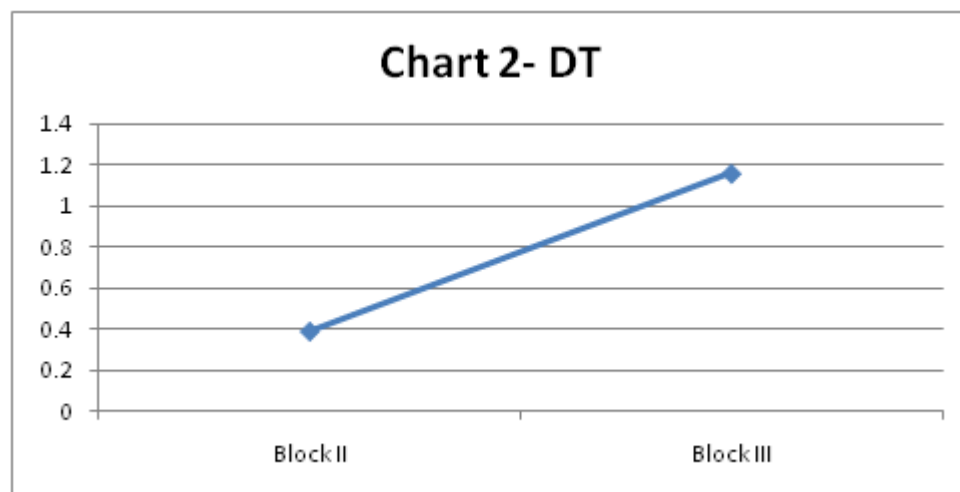
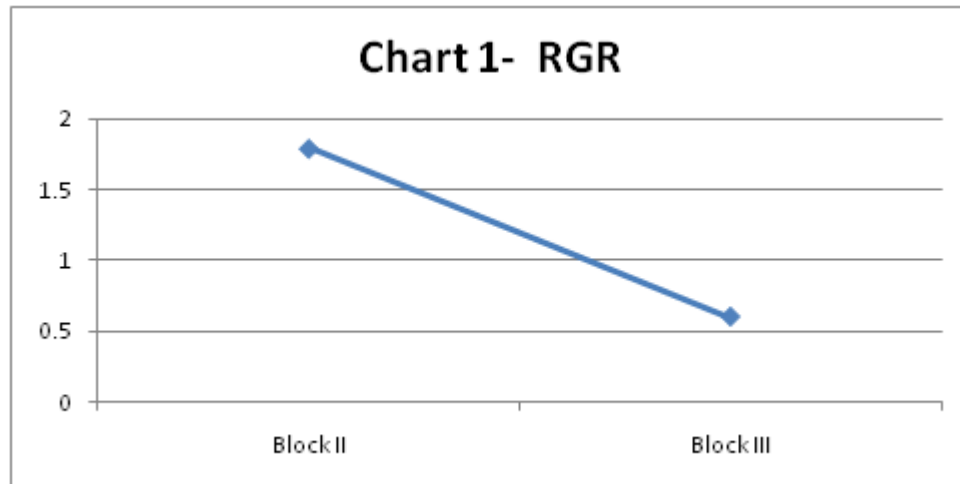
Sr. No.	Name	1982-96	1997-2006	2007-2016	Total	%
		Block I	Block II	Block III		
1.	Indian Journals	77	283	443	803	36.58
2.	Foreign Journals	18	54	66	138	6.29
3.	National Conferences / Seminars / Symposiums	36	281	131	448	20.41
4.	International Conferences / Seminars / Symposiums	16	49	60	125	5.69
5.	In house publications (technical bulletin)	9	31	97	137	6.24
6.	Newsletters	9	23	1	33	1.50
7.	Book Chapter	20	88	113	221	10.07
8.	Edited Books	1	15	1	17	0.77
9.	Popular Articles	14	149	71	234	10.68
10.	Others	-	31	8	39	1.78
11.	Total	200	1004	991	2195	100
12.	%	9.11%	45.74%	45.15%	100.00%	

Table 1. ICAR-IIOR: Distribution of Contributions (All p)

	Year	Articles	Mean	Cumulative Total	W2	W1	RGR	DT
Block I	1982-96	200	13.33	200	5.30			
Block II	1997-2006	1004	100.40	1204	7.09	5.30	1.79	0.39
Block III	2007-2016	991	99.10	2195	7.69	7.09	0.60	1.16

Table 2. ICAR-DGR: Relative Growth Rate and Doubling Time (new)

authors. But there are as many as five to seven or even more authors in good number of papers. The table 3 shows highest 569 (25.92%) papers with two authors 482 (21.96%) by three authors. 302 (13.76%) papers have been published by four authors. There are 155 (7.06%) papers with five authors, 78 (3.55%) papers with six authors and 32 (1.46%) papers with seven authors 39 (1.78%) seven and more authors. It shows that there are multiple authorship trend among scientists of ICAR-IIOR. Single author papers only 26% most of them in bulletin, newspapers and other papers. Most of the papers published in journals and conferences are joint author papers. Surprisingly in last block i.e. the last data 2007-2016, there are many as 71 (3.78%) papers with 7 and 7+ authors. Which were only 5 in II block & zero in I st block. Hence it can be concluded that more authors are collaborating for an article. This is significantly high,



Sr. No.	Authors	Authorship of Contribution			Total	Authorship
		Time Block I	Time Block II	Time Block III		
		1982-96	1997-2006	2007-2016		
1	Single/ One	69 (34.5)	281 (27.98)	188 (18.97)	538 (24.51)	538
2	Two	58 (29.0)	306 (30.48)	205 (20.69)	569 (25.96)	1138
3	Three	44 (22.10)	209 (20.82)	229 (23.10)	482 (21.24)	1446
4	Four	19 (9.5)	117 (11.65)	166 (16.75)	302 (13.76)	1208
5	Five	8 (4.0)	59 (5.88)	88 (8.88)	155 (7.06)	775
6	Six	2 (1.0)	21 (2.09)	55 (5.55)	78 (3.55)	468
7	Seven	-	6 (0.60)	26 (2.62)	32 (1.46)	224
8	Seven +	-	5 (0.50)	34 (3.43)	39 (1.78)	349
9	Total	200 (100)	1004 (100)	991 (100)	2195 (100)	6148
10	%	9.11	45.74	8.77	100	—

Table 3. ICAR-IIOR: Authorship Pattern of Contributions

Prolific Authors and their Dominance Factor

The list of 44 highly profile authors shows Sujatha, M on top with 200 papers follow by Hegde, D. M (188), Paddmaiah, M. (161) and so on in total there 7 authors with 100 + contributors. Simealy 90-99 are 3, 80-89 are one, 3 & so can which be observed for the table.

There are 6148 authors who have contributed 2195 articles in this study only productive authors have been contributed. For this purpose highly productive authors are those who have contribute at least 10 research papers in this study. There were 44 highly productive authors. In the table 4 dominance factors of 44 highly productive authors with ten or more contributions have been calculated. Out of the listed 44 authors, 4 authors have not contributed any paper as first author. So their dominance factor is zero.

Padmavathi, N. (Sr36) have DF 1.00 and top the list, followed by Prasad, R. D. (Sr 30) (DF 0.913), Virupakshappa, K (Sr.37) (DF 0.846), Reddy, B. N. (Sr15) (DF 0.810), Lakhamama, P. (Sr 21) (DF 0.800), Hegde, D.M. (Sr 02) (DF 0.716), and Reddy, P.S. (Sr38) (0.636). There are many authors who have very low DF value. The lowest DF value is 0.031.

Table 5 shows categorization of DF values of prolific authors. 5 authors have very high DF value 0.80 - 1.00. 3 authors have high DF value 0.601 – 0.079. 7 authors have medium DF value 0.401 – 0.590. 19 authors have low DF value 0.201 – 0.059. 6 authors have very low DF value 0.000 – 0.190. 04 authors have nil DF value. Out of the list of 44 with 10 contribution or more, 29 (65.91%) have low or very low DF while only 15(34.09%) have high or very high DF. So, we can conclude that dominance of prominent authors is not prevalent in the study.

4. Conclusion

The paper is based on study of contributions made by scientists of very important institute in oilseeds research. The paper reveals high collaboration pattern in among scientist of the Indian Institute of Oilseed Research is a pioneer institute in India in this field. We find that journals are most preferred communication channels followed by conferences & seminars. Similarly paper also reveals increasing trend in collaboration pattern. The paper also find out that dominance factor is low, very low in 70% authors. The high collaboration pattern and low DF show high quality of collaboration among authors in this research which will be helpful in improving quality of research in future. To meet oilseed demand more research in necessary to increase productivities in the country.

Sl.No.	Name	Total Papers	Single Author	Multiple Author	First Author	First Author in multiauthored papers	Dominance Factor
1.	Sujatha, M	200	35	165	101	66	0.400
2.	Hegde, DM	188	72	116	155	83	0.716
3.	Padmaiah, M	161	49	112	100	51	0.455
4.	Sudhakara Babu, SN	132	14	118	34	20	0.169
5.	Basappa, H	121	34	87	88	54	0.621
6.	Ranganatha, ARG	102	9	93	38	29	0.312
7.	Raghavaiah, CV	100	36	64	63	27	0.422
8.	Anjani K	99	29	70	66	37	0.529
9.	Nagraj, G	99	45	54	65	20	0.370
10.	Murty,IYLN	93	22	71	63	41	0.577
11.	Chanderrao, S	84	1	83	18	17	0.205
12.	Lakshmi Prayaga	76	1	75	27	26	0.347
13.	Lavanya, C	76	3	73	30	27	0.370
14.	Singh, Harvir	71	4	67	23	19	0.284
15.	Reddy, BN	69	11	58	58	47	0.810
16.	Murlidharudu, Y	65	5	60	29	24	0.400
17.	Vimala Devi, PS	65	24	41	57	33	0.805
18.	Vishnuvardhan Reddy, A	64	4	60	20	16	0.267
19.	Raoof, MA	62	3	59	22	19	0.322
20.	Padmavathi, P	59	8	51	36	28	0.549
21.	Lakhamamma, P	50	0	50	0	40	0.800
22.	Mukta, N	50	8	42	21	13	0.310
23.	Lakshminarayana, M	43	4	39	15	11	0.282
24.	Singh, Vijay	41	10	31	22	12	0.387
25.	Prabhakaran, AJ	34	3	31	14	11	0.355
26.	Srinivas, CVS	34	0	34	0	8	0.235
27.	Prasad, MVR	30	2	28	12	10	0.357
28.	Prasad, RD	30	7	23	28	21	0.913
29.	DOR Pub.	29	29	-	0	-	0.000
30.	Hanumantha Rao, C	24	0	24	0	-	0.000
31.	Prasad, YG	23	0	23	0	3	0.130
32.	Chakrabarthy, SK	18	4	14	7	3	0.214
33.	Ganesh, M	18	0	18	0	-	0.000
34.	Kiresur, V	18	0	18	0	6	0.333
35.	Lingappa, S	18	0	18	0	1	0.056
36.	Padmavathi, N	18	13	5	18	5	1.000
37.	Virupakshappa, K	16	3	13	14	11	0.846
38.	Reddy, PS	15	4	11	11	7	0.636
39.	Ramanjaneyulu, GV	14	1	13	4	3	0.231
40.	Kalpna Sastry, R	13	0	13	0	3	0.231
41.	Chattopadhyay, C	11	0	11	0	3	0.273
42.	Negeshwarrao, TG	11	2	9	6	4	0.444
43.	Ramchandran, M	10	1	9	0	-	0.000
44.	Singh, Mev	10	0	10	0	1	0.100

Table 4. ICAR-IIOR : First author Analysis and Dominance Factors

Sr. No.	Categories	Dominance factor	Authors
1	Very High	0.80-1.00	5 (11.36%)
2	High	0.60-0.79	3 (6.81%)
3	Medium	0.40-0.59	7 (15.92%)
4	Low	0.20-0.39	19(43.18%)
5	Very Low	0.00-0.19	6 (13.64%)
6.	Nil	0.00-0.0	4 (9.09%)

Table 5. ICAR-IISR : Categorization of Dominance Factor of Prolific Contributors

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Author Biography



Sudhir Kumar is well known author in Collnet. Published app. 300 papers including Collnet& IFLA. Presented papers at Collnet (Berlin) & IFLA (Singapur) App 20 Ph.Ds in his supervision.



Surendra Kumar is working as Chief Documentation Officer in ICAR- Indian Institute of Soybean Research, Indore (India). He has submitted his Ph.D. thesis to Vikarm University, Ujjain. He published 13 research papers in reputed journals and 23conference papers including Collnet, Ila, and Aaldi etc. He is life member for more than 7 library professional societies. Currently Council Member, Indian Library Association, 2017-18 and Joint Secretary, Indore Library Association, 2013-16



Shilpa Dhoble is working as Librarian in St. Paul Institute of Professional Studies, Indore from last 6 years. She has a B.Sc., PGDCA, M. Lib. Sc. and pursuing Ph.D. in Library and Information Science from Vikram University, Ujjain.