

# COLLABORATIVE PUBLICATION TRENDS AMONG FACULTY MEMBERS OF CENTRAL UNIVERSITIES OF NORTH INDIA

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**Abstract** This paper attempts to highlight the collaborative publication trend of library and information science (LIS) faculty members in the select central universities of north India. The data for the study was collected by questionnaire and from the websites of universities. A total of 1292 publications were published by LIS faculty during the period 1978-2014, out of these 854 are multi-authored publications. The study depicts that highest publications are contributed as double-authored. The co-authorship index is highest in 1991 i.e. 294.12 as single-authored, in 1982 i.e. 153.85 as double-authored, in 1989 i.e. 219.78 as triple-authored and in 2014 i.e. 404.04 as  $\geq 4$  authored publications. Total authors involved in the publications are 2349. The highest MCC is in 2014 (0.46) and the lowest in 1991 (0).

**Keywords:** A Collaborative Publication, Collaborative Measures, Collaborative Research, Central Universities, North India, Library and Information Science, Central University of Himachal Pradesh, Dharamshala (CUHP), University of Delhi, Delhi (DU), Aligarh Muslim University, Aligarh (AMU), Banaras Hindu University, Varanasi (BHU), Babasaheb Bhimrao Ambedkar University, Lucknow (BBAU)

## INTRODUCTION

Collaboration is an indispensable part of research. It can be within departments/disciplines/institutions and across departments/disciplines/institutions. This type of interdisciplinary/multi-contextual collaboration has inspired the pace of research and encouraged the development of innovative and ground-breaking strategies in investigating new areas of research. There are a number of factors driving the trend toward increased collaboration. Most of the identified factors that can be seen are the rapidly changing context of research<sup>1</sup>. The degree of collaboration varies from one discipline to another. It is generally high in the intensely collaborative scientific and technical fields, but low in the humanities. For example, Garfield (1979)<sup>2</sup> reported that multi-authored papers accounted for only 17% to 25% of samples of published papers in economics, social work, and sociology; but in gerontology, psychiatry, psychology and biochemistry, multi-authored papers constituted 47% to 81% of the samples. In the study Multi-authored (more than one author) publications has shared 66.10% of total publications

<sup>1</sup> [http://ori.hhs.gov/education/products/niu\\_collabresearch/collabresearch/need/need.html](http://ori.hhs.gov/education/products/niu_collabresearch/collabresearch/need/need.html)

<sup>2</sup> Garfield, E. (1979). Is citation analysis a legitimate evaluation tool? *Scientometrics*, 1(4), 359-375.

in Library and information science by faculty members of select central universities of north India.

## OBJECTIVES OF THE STUDY

- To identify Authorship Pattern and Collaborative Measures in the subject of LIS in select central universities of north India.
- To Find Co-Authorship Index (CAI) of select central universities of north India.

## METHODOLOGY

The data for the study was collected by questionnaire and from the websites of universities. A total of 1292 publications were published by LIS faculty during the period 1978-2014. The study covered 5 central Universities, which has the department of library and information science and only presently working permanent employees are considered for gathering publication details. It includes the Central University of Himachal Pradesh, Dharamshala (CUHP) have 3 Faculty members, University of Delhi, Delhi (DU) have 8 Faculty members, Aligarh Muslim University, Aligarh (AMU) have 9 Faculty members, Banaras Hindu University, Varanasi (BHU) have 5 Faculty members, Babasaheb

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Bhimrao Ambedkar University, Lucknow (BBAU) have 5 Faculty members.

## COLLABORATION MEASURES

Different measures for collaboration are in vogue like collaborative index, the degree of collaboration, collaborative coefficient and modified collaborative coefficient. The following notations are used in the equations to calculate the collaborative index, the degree of collaboration, collaboration coefficient and modified collaborative coefficient.

$f_j$  is a number of papers having  $j$  authors during a certain period of time;  $N$  is the total number of papers published during a certain period of time, and  $k$  is the greatest number of authors per paper in a discipline.

(a) *Collaborative Index (CI)*: This is a measure of a mean number of authors per paper. It is not easily interpretable as a degree. It has no upper limit and cannot be expressed as a percentage. It gives a non-zero weight to single-authored papers, which involve no collaboration. To determine collaborative index, the formula given by Lawani<sup>3</sup> was used. The formula is:

$$CI = \frac{\text{Total number of Authors}}{\text{Total number of Publication}} \quad (1)$$

(b) *Degree of Collaboration (DC)*: The DC gives the proportion of multiple authored papers, as measures of strength of collaboration in a discipline. The DC can be interpreted as a degree, i.e., lies between 0 and 1. It gives a zero weight to single-authored papers and does not differentiate among levels of multiple authorships. The DC equals 1 for maximal collaboration. To determine the degree of author collaboration in quantitative terms, the formula given by K. Subramanyam was used. The formula is:

$$DC = \frac{NM}{NM + NS} \quad (2)$$

Where DC is the degree of collaboration, NM is a number of multi-authored papers, and NS is the number of single-authored papers. In the present study, the average value of DC is 0.50. As a result, the degree of author collaboration in the journal under study clearly indicates its dominance on multiple author contributions.

(c) *Collaborative Coefficient (CC)*: The CC was defined by Ajiferuke, *et al.*,<sup>4</sup> It was designed to remove the short comings

pertaining to CI and DC. The CC always lies between 0 and 1. As the numbers of single authors dominate, CC 0. CC distinguishes between single-authored, two authored, three-authored, etc. The problem with CC is that it does not give the value 1 for maximal collaboration except in the case where the number of authors is infinite. The collaborative coefficient is defined as (CC), recreate as

$$CC = 1 - \frac{\sum_{j=1}^A (1/j)f_j}{N} \quad (3)$$

(d) *Modified Collaborative Coefficient (MCC)*: CC gives 0 for single-authored papers, but it does not give the value 1 for maximal collaboration. This is taken care of MCC which is defined by Savanur & Srikanth<sup>5</sup>

$$MCC = \frac{A}{A-1} \left\{ 1 - \frac{\sum_{j=1}^A (1/j)f_j}{N} \right\} \quad (4)$$

(e) *Co-Authorship Index (CAI)*: Co-authorship Index (CAI) has been obtained by calculating the proportional output of single, double, three and four & more authored publications of different years in Library and Information Science. The methodology is similar to one suggested by Price<sup>6</sup> and used to calculate Activity Index (AI) suggested by Frame<sup>7</sup> and elaborated by Schubert and Braun<sup>8</sup>.

Here  $CAI = \{(N_{ij} / N_{io}) / (N_{oj} / N_{oo})\} * 100$  where

$N_{ij}$  = Number of publications having  $j^{th}$  authors from  $i^{th}$  year,

$N_{io}$  = Total output of  $i^{th}$  year,

$N_{oj}$  = Number of papers having  $j^{th}$  authors from all years,

$N_{oo}$  = Total output for all years and

$j = 1, 2, 3$  and  $4$

$i = 1978-2014$

Here 'all' implies years listed in Table 1.

$CAI = 100$  implies that co-authorship in a particular year for particular types of authorship corresponds to the

<sup>3</sup> Lawani, S.M. (1980). *Quality, collaboration, and citations in cancer research: A bibliometric study* (Unpublished Doctoral Thesis). Florida State University School of Information Studies, United States.

<sup>4</sup> Ajiferuke, Isola; Burell, Q. & Tauge, Jean. Collaborative coefficient: A single measure of the degree of collaboration in research. *Scientometrics*, 1988, 14(5-6), 421-33.

<sup>5</sup> Savanur, Kiran & Srikanth, R. Modified collaborative coefficient: A new measure for quantifying degree of research collaboration. *Scientometrics*, 2010, 84(2), 365-71.

<sup>6</sup> Price, D. D. S. (1981). The analysis of scientometric metrics for policy implications, *Scientometrics*, 3, 47-54.

<sup>7</sup> Frame, J. D. (1977). Mainstream research in Latin America and Caribbean, *Interiencia*, 2, 143-148.

<sup>8</sup> Schubert, A. & Braun, T. (1986). Relative indicators and relational charts for comparative assessment of publication output and citation impact, *Scientometrics*, 9, 281-291.

world average, CAI > 100 reflects higher than average co-authorship effort and CAI < 100 lower than average co-authorship effort in a particular year for a particular type

of authorship. The measure is different than what has been suggested by Bordons et al<sup>9</sup>.

**Table 1: University-Wise Research Output**

Sr. No.	Name of University	Total Publications	Percentage
1	Central University of Himachal Pradesh, Dharamshala (CUHP)	135	10.45
2	University of Delhi, Delhi (DU)	429	33.20
3	Aligarh Muslim University, Aligarh (AMU)	271	20.98
4	Banaras Hindu University, Varanasi (BHU)	183	14.16
5	Babasaheb Bhimrao Ambedkar University, Lucknow (BBAU)	274	21.21

The table 1 shows the university-wise distribution of research output in the select central universities. University of Delhi, Delhi (DU) has highest publications 429 (33.20%) followed by Babasaheb Bhimrao Ambedkar University, Lucknow

(BBAU) (274, 21.21%), Aligarh Muslim University, Aligarh (AMU) (271, 20.98%), Banaras Hindu University, Varanasi (BHU) (183, 14.16%) and Central University of Himachal Pradesh, Dharamshala (CUHP) (135, 10.45%).

**Table 2: Authorship Pattern of Publications and Co-Authorship Index (CAI)**

Year	Single	CAI	Double	CAI	Triple	CAI	Four & More	CAI	TP	Percentage
1978	8	235.29	2	38.46	0	0.00	0	0.00	10	0.77
1979	5	245.10	1	32.05	0	0.00	0	0.00	6	0.46
1980	2	98.04	4	128.21	0	0.00	0	0.00	6	0.46
1981	1	98.04	2	128.21	0	0.00	0	0.00	3	0.23
1982	1	58.82	4	153.85	0	0.00	0	0.00	5	0.39
1983	4	147.06	4	96.15	0	0.00	0	0.00	8	0.62
1984	2	196.08	1	64.10	0	0.00	0	0.00	3	0.23
1985	2	147.06	2	96.15	0	0.00	0	0.00	4	0.31
1986	1	73.53	3	144.23	0	0.00	0	0.00	4	0.31
1987	2	147.06	2	96.15	0	0.00	0	0.00	4	0.31
1988	3	147.06	2	64.10	1	128.21	0	0.00	6	0.46
1989	3	126.05	2	54.95	2	219.78	0	0.00	7	0.54
1990	3	220.59	1	48.08	0	0.00	0	0.00	4	0.31
1991	5	294.12	0	0.00	0	0.00	0	0.00	5	0.39
1992	6	147.06	6	96.15	0	0.00	0	0.00	12	0.93
1993	5	210.08	2	54.95	0	0.00	0	0.00	7	0.54
1994	3	176.47	2	76.92	0	0.00	0	0.00	5	0.39
1995	7	205.88	3	57.69	0	0.00	0	0.00	10	0.77
1996	4	147.06	4	96.15	0	0.00	0	0.00	8	0.62
1997	4	235.29	1	38.46	0	0.00	0	0.00	5	0.39
1998	12	168.07	8	73.26	1	36.63	0	0.00	21	1.63
1999	15	245.10	2	21.37	1	42.74	0	0.00	18	1.39
2000	8	156.86	7	89.74	0	0.00	0	0.00	15	1.16
2001	16	196.08	5	40.06	3	96.15	0	0.00	24	1.86

<sup>9</sup> Bordons, M., Gomez, I., Fernandez, M.T., Zulueta, M.A. & Mendez, A. (1996). Local, domestic and international scientific collaboration in biomedical research, *Scientometrics*, 37, 279–295.

Year	Single	CAI	Double	CAI	Triple	CAI	Four & More	CAI	TP	Percentage
2002	21	193.01	7	42.07	3	72.12	1	312.50	32	2.48
2003	27	189.08	11	50.37	3	54.95	1	238.10	42	3.25
2004	26	136.55	25	85.85	5	68.68	0	0.00	56	4.33
2005	18	98.04	33	117.52	3	42.74	0	0.00	54	4.18
2006	14	87.61	29	118.66	4	65.47	0	0.00	47	3.64
2007	10	55.49	34	123.37	9	130.62	0	0.00	53	4.10
2008	31	100.19	47	99.32	13	109.89	0	0.00	91	7.04
2009	31	112.56	29	68.85	20	189.93	1	123.46	81	6.27
2010	35	86.51	63	101.81	19	122.82	2	168.07	119	9.21
2011	41	74.44	87	103.28	29	137.70	5	308.64	162	12.54
2012	27	50.90	98	120.81	28	138.07	3	192.31	156	12.07
2013	19	55.88	75	144.23	6	46.15	0	0.00	100	7.74
2014	16	47.53	61	118.49	18	139.86	4	404.04	99	7.66
Total/ Mean	438	146.21	669	83.35	168	49.80	16	47.22	1292	100.00

The table 2 depicts authorship pattern and co-authorship index in the select central universities of north India. The table shows year-wise distribution of publications in authorship pattern by faculty members of library and information science. The study highlights that double-authored publications are highest i.e. 669 (51.78%) followed by single-authored publications i.e. (33.90%). In the category of single-authored publications, the year 1991 has highest Co-Authored Index (CAI), 294.12. In double-authored publications, the year 1982 has highest CAI, 153.85. In the category of three authored publications and four & more authored publications, the year 1989 & 2014 has highest CAI, 219.78 & 404.04 respectively. The mean value of CAI (single-authored publications) is 146.21. It is also greater than 100. In the years 1978-1979, 1983-1985, 1987-1988, 1990-2003 have the greater value than average

mean value. The mean value of CAI (double-authored publications) is 83.35, which is less than 100. In the category of triple-authored and four & more authored, mean CAI are 49.80 and 47.22 respectively. The CAI designate each author involved in the research paper. In the year 1978-1979, 1983-1985, 1987-1988, 1990-2003, 2008-2009 have the higher CAI (single-authored publications) than 100. In the years 1980-1982, 1986, 2005-2007, 2010-2014 have the higher CAI (double-authored publications) than 100, in the years 1988-1989, 2007-2012, 2014 have the higher CAI (triple-authored publications) than 100 and in the years 2002-2003, 2009-2012, 2014 have the higher CAI (four & more authored publications) than 100. This shows that as the authorship pattern move from single-authored to four & more authored, CAI is decreasing.

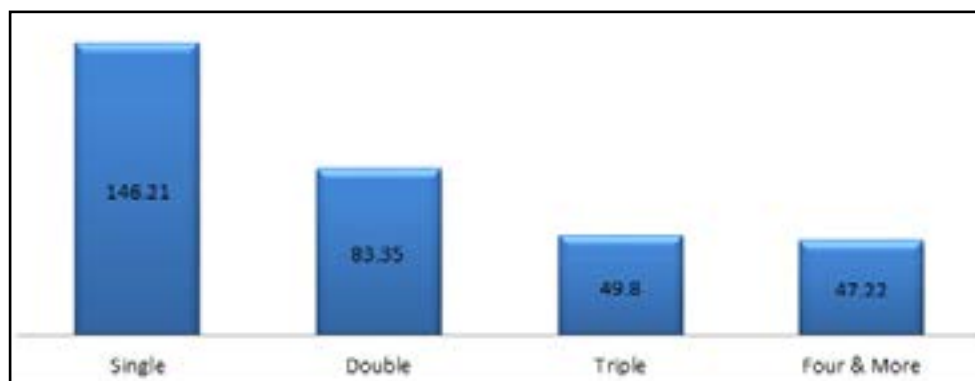


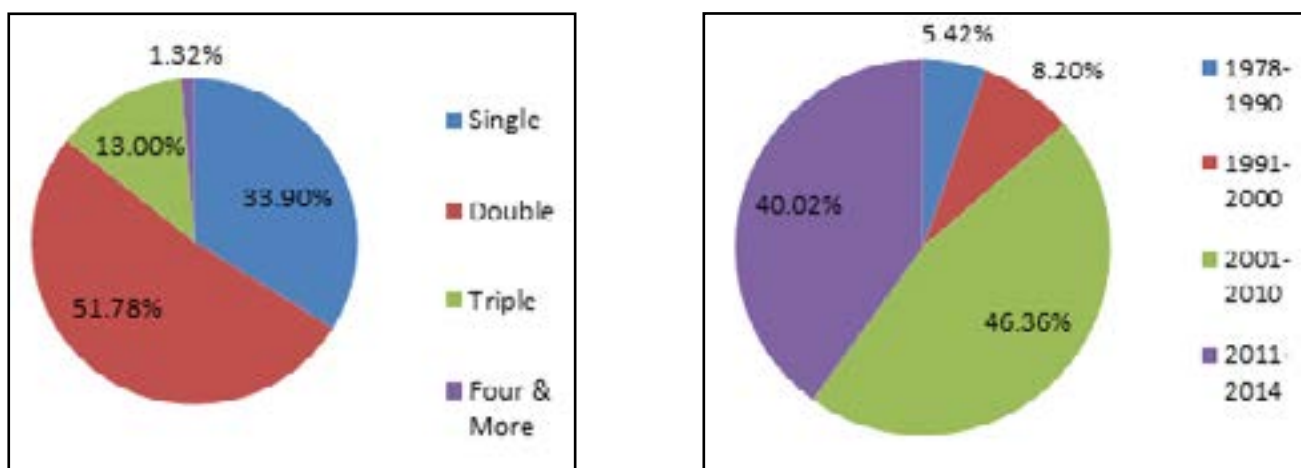
Fig. 1: Mean Co-Authorship Index (CAI)

**Table 3: Authorship Pattern of Publications**

	Single	Double	Triple	Four & More	
1978-1990	37	30	3	0	70
1991-2000	69	35	2	0	106
2001-2010	229	283	82	5	599
2011-2014	103	321	81	12	517
Total	438	669	168	17	1292

In the above table 3, the researcher has divided the whole study period into 4 parts. The first part comprises 1978-1990, second part targets 1991-2000, third part contains 2001-2010

and fourth part consists of 2011-2014. The overall results are same like the previous table. In 1978-1990 and 1991-2000, faculty members publish the highest number of publications as single-authored i.e. 37 (52.86%) and 69 (65.09%) respectively. The respondents under study publish less paper in the category of four & more authored publications. In 2001-2010 and 2011-2014, faculty members publish the highest number of publications as double-authored i.e. 283 (47.25%) closely followed by single-authored publications i.e. 229 (38.23%) and 321 (62.09 %) respectively. The study follows the same pattern in all the years in regard to four & more authored publications i.e. lowest publication in this category. The overall table depicts that the years 2001-2010 have maximum publications i.e. 599 (46.36%).



**Fig. 2: Authorship Pattern**

**Table 4: Collaborative Measures of the Publications**

Year	TA	MA	CI	DC	CC	MCC
1978	12	2	1.2	0.2	0.1	0.11
1979	7	1	1.17	0.17	0.08	0.1
1980	10	4	1.67	0.67	0.33	0.4
1981	5	2	1.67	0.67	0.33	0.5
1982	9	4	1.8	0.8	0.4	0.5
1983	12	4	1.5	0.5	0.25	0.29
1984	4	1	1.33	0.33	0.17	0.25
1985	6	2	1.5	0.5	0.25	0.33
1986	7	3	1.75	0.75	0.38	0.5
1987	6	2	1.5	0.5	0.25	0.33
1988	10	3	1.67	0.5	0.28	0.33
1989	13	4	1.86	0.57	0.33	0.39
1990	5	1	1.25	0.25	0.13	0.17
1991	5	0	1	0	0	0
1992	18	6	1.5	0.5	0.25	0.27

1993	9	2	1.29	0.29	0.14	0.17
1994	7	2	1.4	0.4	0.2	0.25
1995	13	3	1.3	0.3	0.15	0.17
1996	12	4	1.5	0.5	0.25	0.29
1997	6	1	1.2	0.2	0.1	0.12
1998	31	9	1.48	0.43	0.22	0.23
1999	22	3	1.22	0.17	0.09	0.1
2000	22	7	1.47	0.47	0.23	0.25
2001	35	8	1.46	0.33	0.19	0.2
2002	48	11	1.5	0.34	0.2	0.2
2003	63	15	1.5	0.36	0.2	0.2
2004	91	30	1.63	0.54	0.28	0.29
2005	93	36	1.72	0.67	0.34	0.35
2006	84	33	1.79	0.7	0.37	0.37
2007	105	43	1.98	0.81	0.43	0.44
2008	164	60	1.8	0.66	0.35	0.36
2009	153	50	1.89	0.62	0.35	0.36
2010	226	84	1.9	0.71	0.38	0.39
2011	322	121	1.99	0.75	0.41	0.41
2012	319	129	<b>2.04</b>	0.83	0.45	0.45
2013	187	81	1.87	0.81	0.42	0.42
2014	208	83	2.1	<b>0.84</b>	<b>0.46</b>	0.46
Total	2349	854	1.82	0.66	0.36	0.36

SA= Single Author

TA=Triple Author

FIA=Five Author

TP=Total Publications

MA=Multi-Authors

CI= Collaborative Index

MCC= Modified Collaborative Coefficient

DA=Double Author

FOA= Four Author

SIA=Six Author

TA=Total Authors

DC=Degree of Collaboration

CC= Collaborative Coefficient

Table 4 shows that yearly distribution of CI, DC, CC, and MCC. The extent of collaboration in a specific field or a year can be identified through measures like the CI (Collaborations Index) that measures the mean authors per paper. Later on, Subramanyam<sup>10</sup> developed the DC (Degree of Collaboration) measure that was derived by the simple calculation of the proportion of multiple authors to the total papers. DC was further extended to derive a measure, called as CC (Collaborative Coefficient) that combined the mean value of authors per paper and the proportion of multiple authors. A recent measure that modified the CC, called as MCC (Modified Collaboration Coefficient), by Savnur

& Srikanth<sup>11</sup> represents a better and efficient indication of the collaboration among authors<sup>12</sup>. Adopting the MCC calculation of Savnur & Srikanth<sup>13</sup>. Table 4 reveals that the CI,

<sup>10</sup> Subramanyam, K. (1983). Bibliometric studies of research collaboration: A review. *J. inf. Sci.*, 6(1), 33-38.

<sup>11</sup> Savnur, K. & Srikanth R. (2010). Modified collaborative coefficient: A new measure for quantifying degree of research collaboration. *Scientometrics*, 84, 365-71.

<sup>12</sup> Kumar, H.A., Dora, M. & Desai, A. (2015). A bibliometrics profile of Gujarat University, Ahmedabad during 2004-2013. *DESIDOC Journal of Library & Information Technology*, 35(1), 9-16.

<sup>13</sup> Savnur, K. & Srikanth R. (2010). Modified collaborative coefficient: A new measure for quantifying degree of research collaboration. *Scientometrics*, 84, 365-71.

DC, CC and MCC has highest values in the year 2012, 2014, 2014 and 1986 i.e. 2.04, 0.84, 0.46 and 0.50 respectively.

The CI has lowest value in 1991 i.e. 1 (one). The DC, CC and MCC also has lowest values in 1991 i.e. 0 (Zero).

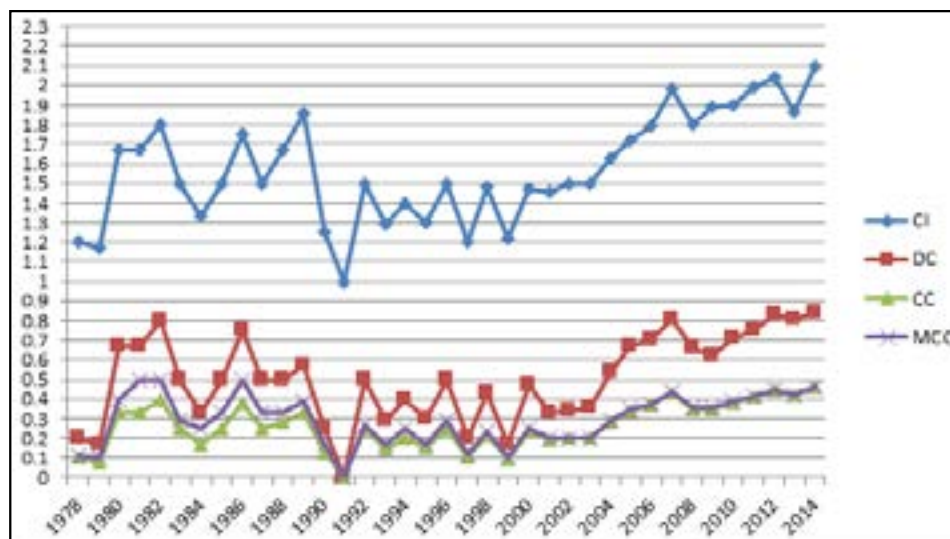


Fig. 3: Collaborative Measures

## CONCLUSIONS

The authors conclude that double-authored publications are higher than other authorship. The mean value of CAI (single-authored publications) is 146.21. The mean value of CAI (double-authored publications) is 83.35. In the category of triple-authored and four & more authored, mean CAI are 49.80 and 47.22 respectively. In 2001-2010 and 2011-2014, faculty members publish the highest number of publications as double-authored. The CI, DC, CC and MCC has highest values in the year 2012, 2014, 2014 and 1986 i.e. 2.04, 0.84, 0.46 and 0.50 respectively. The CI has the lowest value in 1991 i.e.1 (One). The DC, CC and MCC also has the lowest values in 1991 i.e. 0 (Zero).

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