

MEASURE THE REACH OF SCIENTIFIC PUBLICATIONS: A SCIENTOMETRIC STUDY

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ABSTRACT

Citation frequency reflects the value of scientific publications. The cited papers were considered as Reach of the paper and uncited publications were considered as unreached publications. Measures of reach of scientific output were made using Reach percentage (RP); Reach Activity Index (RAI); Unreach/Reach Activity Index (URAI) and Unreach Activity Index (UAI). In order to identify the reach of the publications, the publications pertaining to Indian Institute of Management, Internationally renowned management institutions, were taken up for the study with the opinion that these publications were reached globally. Therefore 13 IIMs faculty research publications were taken up for the study. The data were collected from Scopus data base. 5755 publications were identified during the period of 1965 to 2018. Out of 5755 papers, 3625 (63.0%) papers were cited where as 2130 (37.0%) were not cited. It can be inferred that 63% of the IIM's research publications were reached the users. RAI ranges between 0.65 and 1.08. IIM- Rohtak was ranked first in the reach of their publications even the number of publications were positioned seventh place in total number of papers. It is followed by IIM-C positioned second and IIM-B and IIM-A were positioned third even though the number of publications were more.

Keywords: Indian Institute of Management; Reach Activity Index; Reach Percentage; Unreach/Reach Activity Index; Unreach Activity Index

1. INTRODUCTION

Science and scientific communication are interrelated which influences in generating information. Among scientists and social scientists, it is widely accepted that publication of research performed in academic and governmental research institutions, is a driving force behind high technology and economic growth. It is true that research makes an important contribution to the economic growth of a nation. Such research output is used as the yardstick for measuring the quality and quantity of research done in a country or in a discipline

Citation frequency reflects the value of scientific publications and the use made of it. Citation analysis, along with peer review, has over the past three decades been increasingly used to judge the reach of the publication and quantify the importance of scientists and scientific research. Citation analysis is also the used as mean behind journal "impact factors". Indeed, the output from citation studies is often the only way that un-specialists in governments and funding bodies – or even those in different scientific disciplines – can judge the importance of a piece of scientific research.

The cited papers were considered as Reach of the paper and uncited publications were considered as unreached publications. In this study the paper reach of publications were analysed using few derived formulas.

2. REVIEW OF RELATED LITERATURE

Studies related to citations of papers and authors, and especially of highly cited ones, always attract a lot of attention (VanNoorden, Maher, & Nuzzo, 2014), one reason being that citations act as indicators in individual and institutional evaluations (Persson, 2010; Leydesdorff, 2012; Abramo, Cicero, & D'Angelo, 2014; Bornmann, 2014). Citations, moreover, reflect relations in the network of scientific communications (Cronin, 1984).

Garg and Kumar (2014) identified that 6231 (17.5%) Indian scientist papers out of 35,640 papers published during the period 2008-2013 remained uncited. Most of the uncited papers were published by State Agricultural Universities and the Indian Council of Agricultural Research. The highest proportion of uncited papers was in the discipline of agricultural sciences followed by multidisciplinary and mathematical sciences.

The Evidence report of Thomson Reuters has shown that there is a decrease in the percentage of papers emanating from India which do not receive citations. (Report, India).

High share of uncited publications, which include those produced by top scientists was repeatedly reported to exceed 10% of the total papers produced. Petr Heneberg (2013) analyzed the uncitedness among two independent groups of highly visible mathematicians represented by Fields medalists, researchers in physiology or medicine represented by Nobel Prize laureates. over 90% of the uncited database records of highly visible scientists has been presented in progress reports, meeting abstracts, letters to the editor, discussion, personalia, by errors of omission and commission of the Web of Science (WoS) database and of the citing documents. Only 0.9 and 0.3%, of original articles and reviews were found to be uncited.

Uncitable documents was responsible for up to 30% of the total citations to the top-tier journals, with the highest values found for medical science journals (New England Journal of Medicine, JAMA, and the Lancet) and lower values found for the Science, Nature, and Cellseries journals. Self-citations to some of the top-tier journals reach values higher than the total citation counts accumulated by papers in most of the Web of Science-indexed journals. Petr Heneberg (2014).

Bathrinarayana and Tamizhchelvan (2013) studied the MEMS output of Scopus database on the growth of literature. Gopalakrishnan et al (2015) identified the uncited publications in micro-electro mechanical systems (MEMS) and found that even the top author papers were also cited. Vaijinath and Shivshankar (2017) studied the author productivity patterns in the DJLIT journal upto 2015.

3. OBJECTIVES

The objectives of the study were

- To identify the reach of the research output to the user.
- To derive a methodology for identifying the reach of the research output

4. MEASURE OF REACH

Measures of reach of scientific output were made using Reach Percentage (RP); Reach Activity Index (RAI); Unreach/Reach Activity Index (URAI) and Unreach Activity Index (UAI). The method of calculation were as follows

1. **Reach % = Reach output of Institution/ Total output of the institution . . . (1)**

2. **Reach Activity index**

The formula reads as follows:

$$RAI = \frac{R_{ij}/T_{io}}{R_{oj}/T_{oo}} \dots (2)$$

Where, R_{ij}= Number of cited publications for the particular Institutions a particular country

T_{io}= Total output for the particular Institution

R_{oj}= Total Reach output of the particular Institution

T_{oo} = Total output of all the Institution block

3. URAI = Unreach/Reach Activity Index

The formula reads as follows:

$$URAI = \frac{R_{ij}/U_{io}}{R_{oj}/U_{oo}} \dots (3)$$

Where, R_{ij}= Number of Reached publications for the particular Institutions a particular country

U_{io}= Number of Unreached publications for the particular Institution

R_{oj}= Total Reach output of all the Institution

U_{oo} = Total Unreach of all the Institution block

4. UAI = Unreach Activity Index

The formula reads as follows:

$$UAI = \frac{U_{ij}/T_{io}}{U_{oj}/T_{oo}} \dots (4)$$

Where, U_{ij}= Number of Unreached publications for the particular Institutions a particular country

T_{io}= Total output for the particular Institution

U_{oj}= Total Reach output of the particular Institution

T_{oo} = Total output of all the Institution block

Reach of IIM publications

In order to identify the reach of the publications, the publications pertaining to Indian Institute of Management, Internationally renowned management institution, were taken up for the study with the opinion that these publications were reached globally. There exist 20 IIMs of which 6 of them were established in 2015 (Table 1). Therefore 13 IIMs faculty research publications were taken up for the study. The data were collected from Scopus data base. 5755 publications were identified during the period of 1965 to 2018.

Table 1 List of IIMs in India with short name, year of establishment, location and URL

S.No	Name	Short Name	Year of Establishment	Location	Website

1	Indian Institute of Management Calcutta	of	IIM-C	1961	Kolkata, West Bengal	iimcal.ac.in
2	Indian Institute of Management Ahmedabad	of	IIM-A	1961	Ahmedabad, Gujarat	iimahd.ernet.in
3	Indian Institute of Management Bangalore	of	IIM-B	1973	Bangalore, Karnataka	iimb.ernet.in
4	Indian Institute of Management Lucknow	of	IIM-L	1984	Lucknow, Uttar Pradesh	iiml.ac.in
5	Indian Institute of Management Kozhikode	of	IIM-K	1996	Kozhikode, Kerala	iimk.ac.in
6	Indian Institute of Management Indore	of	IIM-I	1996	Indore, Madhya Pradesh	iimidr.ac.in
7	Indian Institute of Management Shillong	of	IIM-S	2007	Shillong, Meghalaya	iimshillong.in
8	Indian Institute of Management Rohtak	of	IIM-Rohtak	2010	Rohtak, Haryana	iimrohtak.ac.in
9	Indian Institute of Management Ranchi	of	IIM-R	2010	Ranchi, Jharkhand	iimranchi.ac.in
10	Indian Institute of Management Raipur	of	IIM-Raipur	2010	Raipur, Chhattisgarh	iimraipur.ac.in
11	Indian Institute of Management Trichy	of	IIM-T	2011	Trichy, Tamil Nadu	iimtrichy.ac.in
12	Indian Institute of Management Udaipur	of	IIM-U	2011	Udaipur, Rajasthan	iimu.ac.in
13	Indian Institute of Management Kashipur	of	IIM-Kashipur	2011	Kashipur, Uttarakhand	iimkashipur.ac.in
14	Indian Institute of Management Nagpur	of	IIM-N	2015	Nagpur, Maharashtra	iimnagpur.ac.in
15	Indian Institute of Management Bodh Gaya	of	IIM-BG	2015	Bodh Gaya, Bihar	www.iimbg.ac.in
16	Indian Institute of Management Visakhapatnam	of	IIM-V	2015	Visakhapatnam, Andhra Pradesh	iimv.ac.in
17	Indian Institute of Management Amritsar	of	IIM Amritsar	2015	Amritsar, Punjab	iimamritsar.ac.in

18	Indian Institute of Management, Sambalpur	of	IIM Sambalpur	2015	Sambalpur, Odisha	iimsambalpur.ac.in
19	Indian Institute of Management, Sirmaur	of	IIM Sirmaur	2015	Sirmaur district, Himachal Pradesh	http://www.iimsirmaur.ac.in/
20	Indian Institute of Management, Jammu	of	IIMJ	2016	Jammu	http://www.iimj.ac.in/

Reach of the publications identified based on the citation. Therefore citation analysis of 5755 papers thus taken up for study has been carried out and the same has been shown in table 2.

Table 2 Cited/uncited

S.No.	Cited/Uncited	Papers	Percent	Cumulative Percent
1	Cited	3625	63.0	63.0
2	Uncited	2130	37.0	100.0
	Total	5755	100.0	

Out of 5755 papers, 3625 (63.0%) papers were cited where as 2130 (37.0%) were not cited. It can be inferred that 63% of the IIM’s research publications were reached the users. The study has further been extended to identify the 13 IIM’s publications that has reached the users were shown in Table 2. The formula used for calculating the Reached % were shown in (1) above. Similarly RAI, URAI and UAI were calculated using the formula in (2), (3) and (4) above. The ranks were assigned based on Reach %, RAI, URAI and UAI. The number of publications that has reached and unreached the user out of the total publications were identified and their percentages were shown in Table 3 along with Reach %, RAI, URAI and UAI.

Table 3 Reached Vs Unreached publications of IIMs

S.No.	IIMs	Reached publications			Unreached Publications			Total		RAI	Rank	URAI	Rank	UAI	Rank
		Papers	%	Rank	Papers	%	Rank	Papers	Rank						
1	IIM-A	999	64.8%	4	543	35.2%	9	1542	1	1.03	3	1.08	3	0.95	9
2	IIM-B	725	64.8%	3	394	35.2%	10	1119	3	1.03	3	1.08	3	0.95	9
3	IIM-C	836	67.1%	2	410	32.9%	12	1246	2	1.07	2	1.20	2	0.89	12
4	IIM-I	178	50.9%	8	172	49.1%	6	350	6	0.81	8	0.61	8	1.33	6
5	IIM-Kashipur	35	46.7%	10	40	53.3%	4	75	9	0.74	10	0.51	10	1.44	4
6	IIM-K	236	64.5%	5	130	35.5%	11	366	5	1.02	5	1.07	5	0.96	11
7	IIM-L	314	62.9%	6	185	37.1%	8	499	4	1.00	6	1.00	6	1.00	8
8	IIM-Raipur	74	50.0%	9	74	50.0%	5	148	8	0.79	9	0.59	9	1.35	5
9	IIM-R	26	41.9%	11	36	58.1%	3	62	12	0.67	11	0.42	11	1.57	3

10	IIM-Rohtak	117	68.0%	1	55	32.0%	13	172	7	1.08	1	1.25	1	0.86	13
11	IIM-S	40	60.6%	7	26	39.4%	7	66	10	0.96	7	0.90	7	1.06	7
12	IIM-T	18	40.9%	12	26	59.1%	2	44	13	0.65	13	0.41	13	1.60	1
13	IIM-U	27	40.9%	13	39	59.1%	1	66	11	0.65	13	0.41	13	1.60	1
Total		3625	63.0%		2130	37.0%		5755		1.00		1.00			

(RAI – Reach Activity Index; URAI – Unreach / Reach Activity Index; UAI – Unreach Activity Index)

UAI of publications ranges between 0.86 and 1.60. IIM- T and IIM-U were positioned first in the unreach of their publications. It is followed by IIM-R positioned third; IIM-Kashipur positioned fourth and IIM-Raipur were positioned fifth unreach of publications.

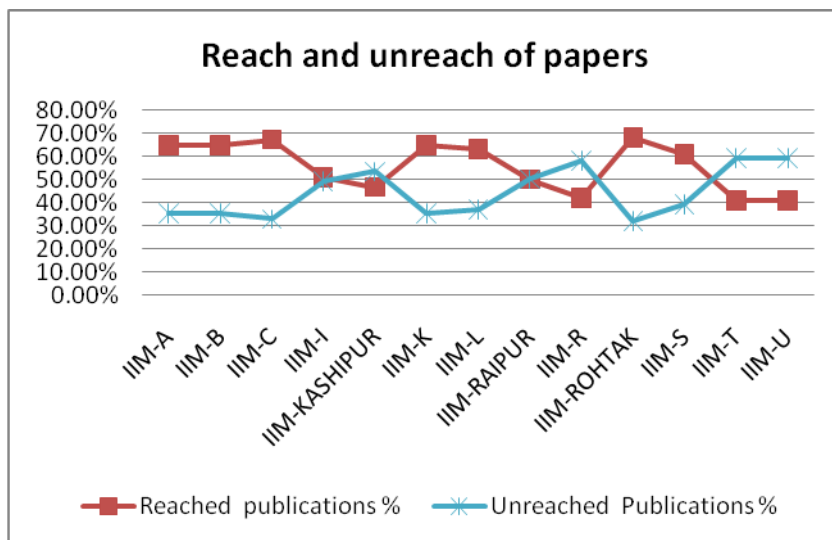


Figure 1 Reach and Unreach of papers

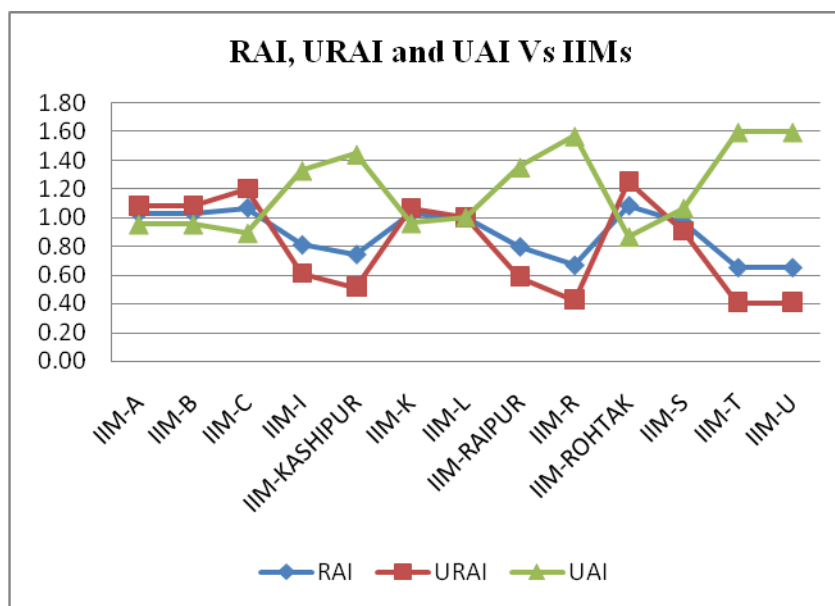


Figure 2 RAI, URAI and UAI Vs IIMs

Based on total publications IIM-A centre has highest number of publications (1542). It is followed by IIM-C (1246); IIM-B (1119) and IIM-L (499). Least number of publications can be seen in IIM-T (44); IIM-R (62); IIM-S (66) and IIM-U (66). Nearly 40.9% to 68% of individual centre publications were reached the user. The ranks were assigned based on the percentage of the publications that has reached of particular centres. Accordingly IIM-Rohtak has 68% of their publications were reached the user. It is followed by IIM-C (67.1%); IIM-B (64.8%) and IIM-A (64.8%). The unreached publications were ranging between 59.1% and 32.0%. Unreached publications were more in IIM-U (59.1%); IIM-T (59.1%); IIM-R (58.1%) and IIM-Raipur (50.0%). Least unreached publications were from IIM-Rohtak (32.0%) and IIM-C (32.9%).

The RAI ranges between 0.65 and 1.08. IIM-Rohtak were ranked first in the reach of their publications even the number of publications were positioned seventh place in total number of papers. It is followed by IIM-C positioned second and IIM-B and IIM-A were positioned third even thou the number of publications were more.

URAI of publications ranges between 0.41 and 1.08. IIM- Rohtak were ranked first in the unreach/reach of their publications even the number of publications. It is followed by IIM-C positioned second and IIM-B and IIM-A were positioned third even though the number of publications were more. IIM-T and IIM-U were least in reach of publications.

UAI of publications ranges between 0.86 and 1.60. IIM- T and IIM-U were positioned first in the unreach of their publications. It is followed by IIM-R positioned third; IIM-Kashipur positioned fourth and IIM-Raipur were positioned fifth unreach of publications.

The ranks derived through the four methods were identical. Hence the methods, adopted to identify the reach were verified.

The yearwise distribution of reach of articles were identified and the same has been shown in Table 3

Table 3 Reach of articles - Yearwise

S.No	Year	Reached publications		Un Reached Publications		Total Publications		RAI	URAI	UAI
		Papers	%	Papers	%	Papers	%			
1	1965	1	50.0%	1	50.0%	2	100.0%	0.79	0.59	1.35
2	1966	3	75.0%	1	25.0%	4	100.0%	1.19	1.76	0.68
3	1967	1	50.0%	1	50.0%	2	100.0%	0.79	0.59	1.35
4	1968	3	75.0%	1	25.0%	4	100.0%	1.19	1.76	0.68
5	1969	2	50.0%	2	50.0%	4	100.0%	0.79	0.59	1.35
6	1970	3	75.0%	1	25.0%	4	100.0%	1.19	1.76	0.68
7	1971	5	100.0%	0	.0%	5	100.0%	1.59	0.00	0.00
8	1972	3	100.0%	0	.0%	3	100.0%	1.59	0.00	0.00
9	1973	4	57.1%	3	42.9%	7	100.0%	0.91	0.78	1.16
10	1974	6	85.7%	1	14.3%	7	100.0%	1.36	3.53	0.39
11	1975	4	100.0%	0	.0%	4	100.0%	1.59	0.00	0.00
12	1976	10	83.3%	2	16.7%	12	100.0%	1.32	2.94	0.45
13	1977	7	87.5%	1	12.5%	8	100.0%	1.39	4.11	0.34
14	1978	7	77.8%	2	22.2%	9	100.0%	1.23	2.06	0.60
15	1979	7	87.5%	1	12.5%	8	100.0%	1.39	4.11	0.34
16	1980	9	75.0%	3	25.0%	12	100.0%	1.19	1.76	0.68
17	1981	11	78.6%	3	21.4%	14	100.0%	1.25	2.15	0.58
18	1982	6	42.9%	8	57.1%	14	100.0%	0.68	0.44	1.54
19	1983	13	65.0%	7	35.0%	20	100.0%	1.03	1.09	0.95
20	1984	5	41.7%	7	58.3%	12	100.0%	0.66	0.42	1.58
21	1985	14	93.3%	1	6.7%	15	100.0%	1.48	8.23	0.18
22	1986	12	60.0%	8	40.0%	20	100.0%	0.95	0.88	1.08
23	1987	9	42.9%	12	57.1%	21	100.0%	0.68	0.44	1.54
24	1988	10	90.9%	1	9.1%	11	100.0%	1.44	5.88	0.25
25	1989	10	66.7%	5	33.3%	15	100.0%	1.06	1.18	0.90
26	1990	12	75.0%	4	25.0%	16	100.0%	1.19	1.76	0.68
27	1991	11	64.7%	6	35.3%	17	100.0%	1.03	1.08	0.95
28	1992	20	87.0%	3	13.0%	23	100.0%	1.38	3.92	0.35
29	1993	23	88.5%	3	11.5%	26	100.0%	1.40	4.50	0.31
30	1994	21	70.0%	9	30.0%	30	100.0%	1.11	1.37	0.81
31	1995	23	76.7%	7	23.3%	30	100.0%	1.22	1.93	0.63

MEASURE THE REACH OF SCIENTIFIC PUBLICATIONS: A SCIENTOMETRIC STUDY

32	1996	38	77.6%	11	22.4%	49	100.0%	1.23	2.03	0.61
33	1997	39	67.2%	19	32.8%	58	100.0%	1.07	1.21	0.89
34	1998	40	65.6%	21	34.4%	61	100.0%	1.04	1.12	0.93
35	1999	48	72.7%	18	27.3%	66	100.0%	1.15	1.57	0.74
36	2000	50	73.5%	18	26.5%	68	100.0%	1.17	1.63	0.72
37	2001	57	75.0%	19	25.0%	76	100.0%	1.19	1.76	0.68
38	2002	59	70.2%	25	29.8%	84	100.0%	1.12	1.39	0.80
39	2003	94	84.7%	17	15.3%	111	100.0%	1.34	3.25	0.41
40	2004	94	77.0%	28	23.0%	122	100.0%	1.22	1.97	0.62
41	2005	98	77.8%	28	22.2%	126	100.0%	1.23	2.06	0.60
42	2006	115	79.9%	29	20.1%	144	100.0%	1.27	2.33	0.54
43	2007	119	79.9%	30	20.1%	149	100.0%	1.27	2.33	0.54
44	2008	146	77.2%	43	22.8%	189	100.0%	1.23	2.00	0.61
45	2009	169	74.4%	58	25.6%	227	100.0%	1.18	1.71	0.69
46	2010	176	78.6%	48	21.4%	224	100.0%	1.25	2.15	0.58
47	2011	225	78.9%	60	21.1%	285	100.0%	1.25	2.20	0.57
48	2012	260	77.6%	75	22.4%	335	100.0%	1.23	2.04	0.60
49	2013	265	77.0%	79	23.0%	344	100.0%	1.22	1.97	0.62
50	2014	288	73.1%	106	26.9%	394	100.0%	1.16	1.60	0.73
51	2015	325	67.7%	155	32.3%	480	100.0%	1.07	1.23	0.87
52	2016	320	57.0%	241	43.0%	561	100.0%	0.91	0.78	1.16
53	2017	245	37.5%	408	62.5%	653	100.0%	0.60	0.35	1.69
54	2018	80	14.0%	490	86.0%	570	100.0%	0.22	0.10	2.32
Total		3625	63.0%	2130	37.0%	5755	100.0%	1.00	1.00	1.00

(RAI-Reach Activity Index; URAI – Unreach / Reach Activity Index; UAI – Unreach Activity Index)

The RAI ranges between 0.22 and 1.59. Maximum RAI were can be seen in the year 1971, 1972 and 1975. RAI were below one only in eleven years out of the 54 years study period. It can be inferred that the IIM publications of 43 years were reached the users.

URAI of publications ranges between 0.10 and 8.23. Maximum RAI can be seen during the year 1985. It is followed by 5.88 during the year 1988; 4.50 in the year 1993 and 4.11 in 1977 and 1979. This indicates the publications in the indicated in the year were used maximum.

UAI of publications ranges between 0.00 and 2.32. The maximum UAI can be seen in the year 2018 (2.32); 1.69 (2017) and 1.58 (1984). Only eleven years of publications were unreached to the users.

It can be inferred that the majority of the IIM publications were reached the user.

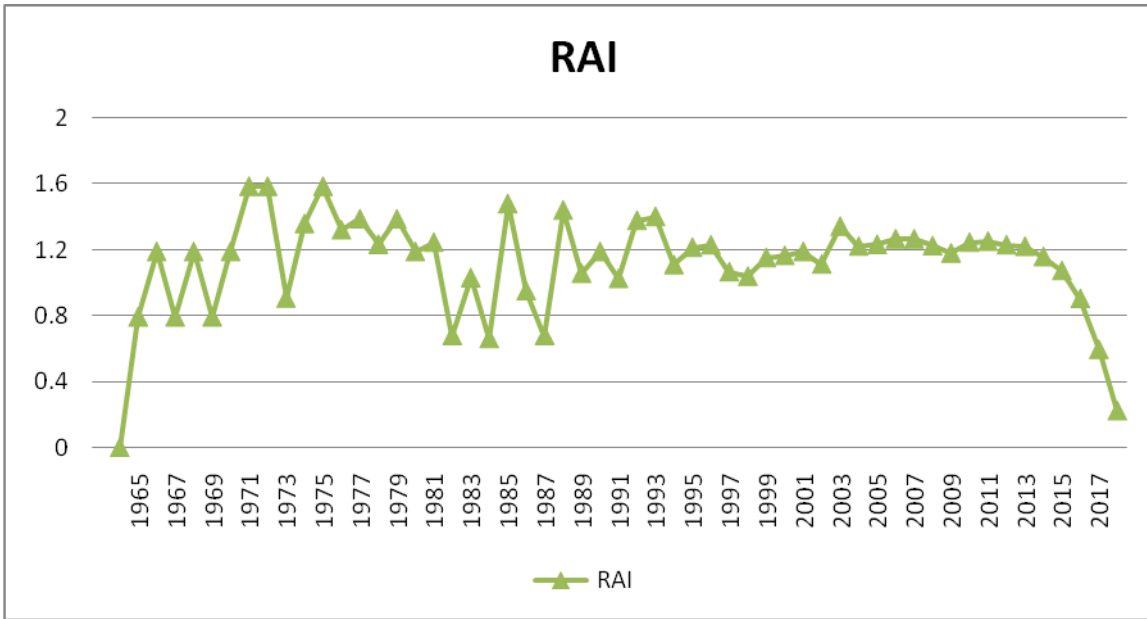


Figure 3 Reach Activity Index

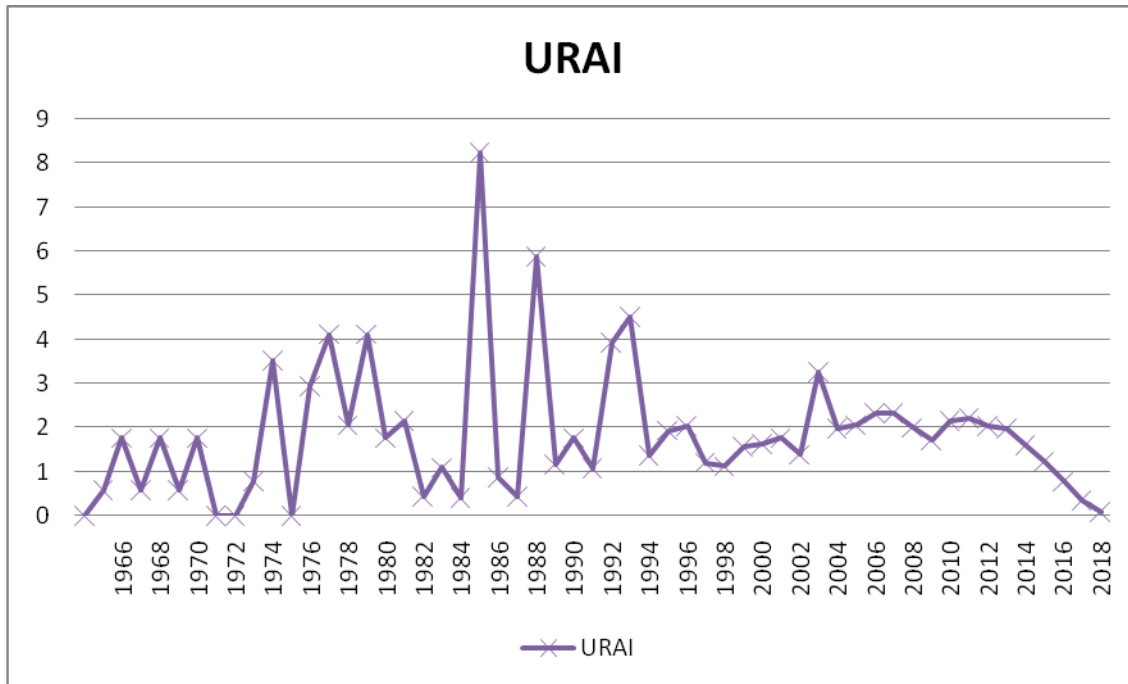


Figure 4 Unreach/Reach Activity Index

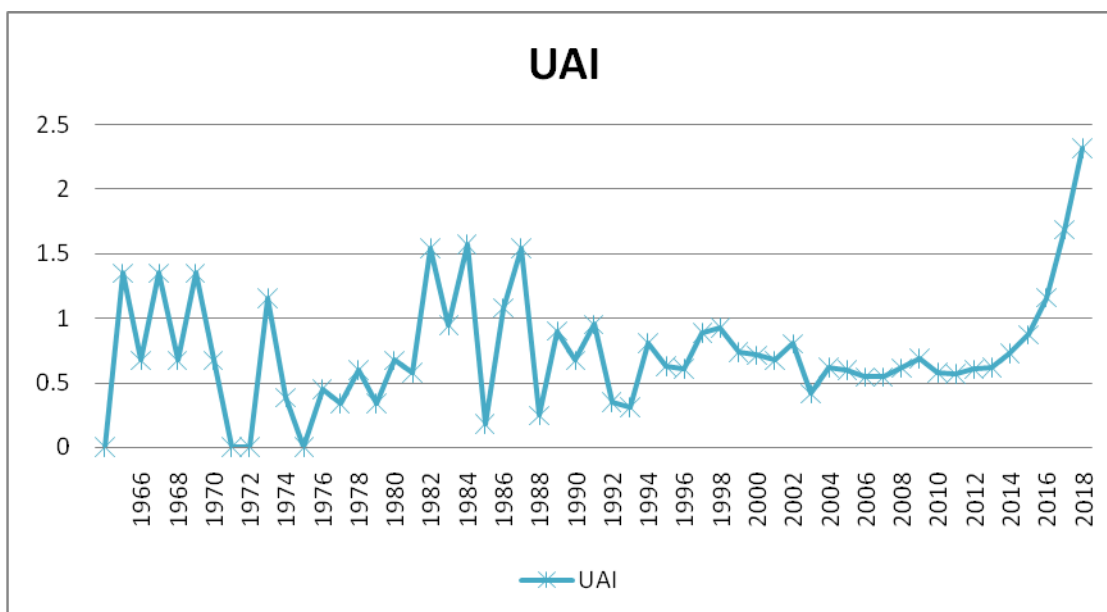


Figure 5 Unreach Activity Index

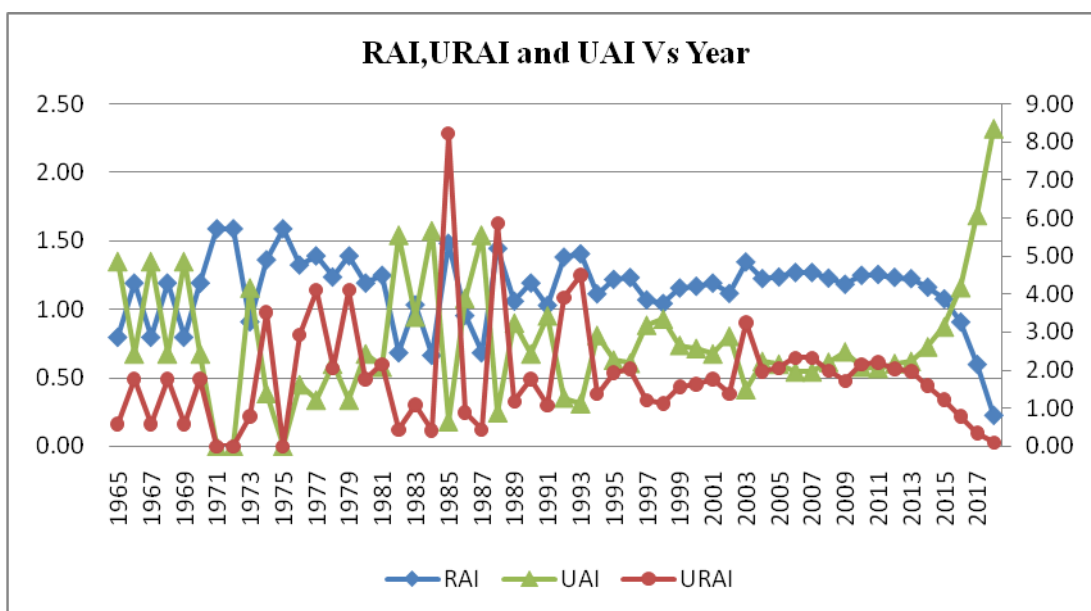


Figure 6 RAI, URAI and UAI Vs Year

The percentile of reach publications ranges between 14.0% and 100%. Similarly unreached publications percentile ranges between 0.0% and 86.0%. All the publications that were published in the year 1971, 1972 and 1975 were reached the user. During the period 1999 and 2014, more than 70% of publications were reached the user.

The authorship pattern of reached publications were analysed and the same has been shown in Table 4

Table 4 Authorship pattern of Reached publications

S.No.	Authorship pattern	Reached		Unreached		Total		RAI	URAI	UAI
		Papers	%	Papers	%	Papers	%			
1	Single author	882	56.5%	678	43.5%	1560	100.0%	0.90	0.76	1.17

2	Two author	1377	64.9%	746	35.1%	2123	100.0%	1.03	1.08	0.95
3	Three author	815	65.0%	439	35.0%	1254	100.0%	1.03	1.09	0.95
4	Four author	321	67.4%	155	32.6%	476	100.0%	1.07	1.22	0.88
5	Five author	110	64.3%	61	35.7%	171	100.0%	1.02	1.06	0.96
6	Six and above	120	70.2%	51	29.8%	171	100.0%	1.11	1.38	0.81
Total		3625	63.0%	2130	37.0%	5755	100.0%	1.00	1.00	1.00

(RAI-Reach Activity Index; URAI-Unreach/Reach Activity Index; UAI-Unreach Activity Index)

The RAI for authorship pattern ranges between 0.90 and 1.18. Six and above authors publications were highest RAI (1.11) which indicates that these publications were reached the user. It is followed by four authors (1.07); three authors and two authors (1.03). Single author publications were not reaching the user. This indicates that collaborative reach paper were reaching the users substantially.

URAI of authorship pattern publications ranges between 0.76 and 1.38. RAI and URAI shows identical in the research output.

UAI of authorship pattern publications ranges between 0.81 and 1.17. The unreach of the publications were below one in all authorship pattern except single author publications.

The inference derived through the four methods, were identical. Hence the methods adopted to identify the reach were verified.

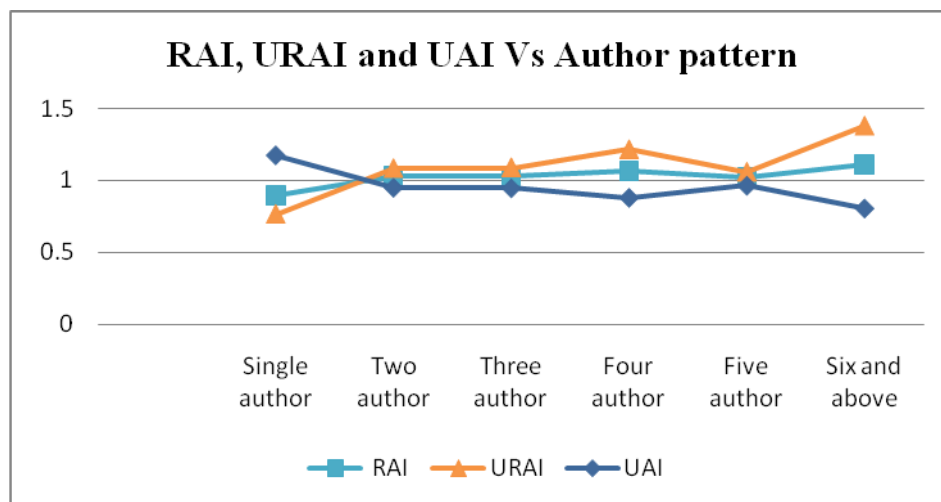


Figure 7 RAI, URAI and UAI Vs Authorship Pattern

The study has further been extended institutions and authorship pattern and the same has been shown in Table 5.

Table 5 Reached publications Vs Authorship pattern

S.No.	IIMs	Single author		Two authors		Three authors		Four authors		Five authors		Six and above		Total		Rank
1	IIM-A	257	25.7%	374	37.4%	202	20.2%	77	7.7%	31	3.1%	58	5.8%	999	100.0%	1
2	IIM-B	178	24.6%	243	33.5%	177	24.4%	73	10.1%	18	2.5%	36	5.0%	725	100.0%	2
3	IIM-C	167	20.0%	329	39.4%	187	22.4%	94	11.2%	41	4.9%	18	2.2%	836	100.0%	3
4	IIM-I	49	27.5%	86	48.3%	28	15.7%	12	6.7%	2	1.1%	1	.6%	178	100.0%	6
5	IIM-Kashipur	10	28.6%	15	42.9%	7	20.0%	3	8.6%	0	.0%	0	.0%	35	100.0%	10
6	IIM-K	52	22.0%	107	45.3%	62	26.3%	11	4.7%	3	1.3%	1	.4%	236	100.0%	5
7	IIM-L	99	31.5%	125	39.8%	71	22.6%	13	4.1%	5	1.6%	1	.3%	314	100.0%	4
8	IIM-Raipur	4	5.4%	16	21.6%	24	32.4%	22	29.7%	6	8.1%	2	2.7%	74	100.0%	8
9	IIM-R	3	11.5%	16	61.5%	5	19.2%	2	7.7%	0	.0%	0	.0%	26	100.0%	12
0	IIM-Rohtak	52	44.4%	38	32.5%	16	13.7%	6	5.1%	3	2.6%	2	1.7%	117	100.0%	7
1	IIM-S	4	10.0%	12	30.0%	18	45.0%	5	12.5%	0	.0%	1	2.5%	40	100.0%	9
2	IIM-T	3	16.7%	9	50.0%	5	27.8%	1	5.6%	0	.0%	0	.0%	18	100.0%	13
3	IIM-U	4	14.8%	7	25.9%	13	48.1%	2	7.4%	1	3.7%	0	.0%	27	100.0%	11
Total		882	24.3%	1377	38.0%	815	22.5%	321	8.9%	110	3.0%	120	3.3%	3625	100.0%	

IIM –A has been ranked first in the authorship pattern. It is followed by IIM-B; IIM-C and IIM-L. RAI for the same has been calculated and shown in Table 6.

Table 6 RAI Vs Authorship pattern

S.No.	IIMs	Single	RAI	Two	RAI	Three	RAI	Four	RAI	Five	RAI	& six above	RAI	Total
1	IIM-A	257	1.06	374	0.99	202	0.90	77	0.87	31	1.02	58	1.75	999
2	IIM-B	178	1.01	243	0.88	177	1.09	73	1.14	18	0.82	36	1.50	725
3	IIM-C	167	0.82	329	1.04	187	0.99	94	1.27	41	1.62	18	0.65	836
4	IIM-I	49	1.13	86	1.27	28	0.70	12	0.76	2	0.37	1	0.17	178
5	IIM-Kashipur	10	1.17	15	1.13	7	0.89	3	0.97	0	0.00	0	0.00	35
6	IIM-K	52	0.91	107	1.19	62	1.17	11	0.53	3	0.42	1	0.13	236
7	IIM-L	99	1.30	125	1.05	71	1.01	13	0.47	5	0.52	1	0.10	314
8	IIM-Raipur	4	0.22	16	0.57	24	1.44	22	3.36	6	2.67	2	0.82	74
9	IIM-R	3	0.47	16	1.62	5	0.86	2	0.87	0	0.00	0	0.00	26
10	IIM-Rohtak	52	1.83	38	0.86	16	0.61	6	0.58	3	0.84	2	0.52	117
11	IIM-S	4	0.41	12	0.79	18	2.00	5	1.41	0	0.00	1	0.76	40
12	IIM-T	3	0.68	9	1.32	5	1.24	1	0.63	0	0.00	0	0.00	18
13	IIM-U	4	0.61	7	0.68	13	2.14	2	0.84	1	1.22	0	0.00	27
Total		882	1.00	1377	1.00	815	1.00	321	1.00	110	1.00	120	1.00	3625

(RAI- Reach Activity Index)

CONCLUSION

The present study on measure of reach of scientific publications of Indian institute of Management institutions scientific output has implications a large proportion of their publications were reached the users. This study will pave way to enhance the quality of the papers they publish. Further method has been designed to identify the type of the unreached papers. It cannot be said that unreached papers are not being used and do not contribute to scientific progress. Here the author introduced an indicator called as RAI, URAI, and UAI which are calculated in a way similar Relative Uncitedness Index (RUI) by Garg and S. Kumar and to Relative Citation Impact (RCI) used by Kumari (2009) in a study on synthetic organic chemistry research. The present study enables to derive a methodology to measure the reach of the publications among the users using Reach Activity Index, Unreach/Reach Activity Index, Unreach Activity Index and Reach percentage. Similar studies may be undertaken for other R & D organization, subject areas in order to identify the worthiness of measurement technique suggest in this study.

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