
Scientometric Analysis on Disaster Management Research Output During 2009-2018

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Abstract

This research study explores the scientometric applications towards Disaster Management literature between the year 2009-2018 as indexed in Scopus Database. It analyses Publishing trend and Growth Ratio by year wise distribution, Relative Growth Rate with corresponding Doubling Time, Co-Authorship Index and Degree of Collaboration. A total number of 10498 articles are published in Disaster Management literature with 1049.8 yearly averaged during the period 2009 – 2018. In the year 2010 the growth ratio accelerates to 1.22 but in 2014 it decelerates to 0.99. The major contribution of articles in Disaster Management literature is from double authors 2547 (24.26%) followed by triple authors 2285 (21.76%).

Keywords

Relative Growth Rate; Doubling Time; Scientometric Indicators; Time Series Analysis; Co-Authorship Index; Degree of Collaboration; Publishing Trend, Disaster Management.

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1 Introduction

A scientometric research can be enforced to define general productivity in a given subject; it may also be applied to evaluate the productivity of scientific literature, individual researchers, journal, countries or any other published activities. Characteristics of literature assessed using its attributes by quantitative study - scientometrics. Characteristics of scientific productivity are empirically assessed provided with attributes of scientific literature by quantitative and qualitative studies. The assessment is of subjective, institutional and /or personal units. Scientometrics is empirical not theoretical and one of the most important measures for the assessment of scientific publications. Scientometrics is used to study the quantitative and qualitative aspects of science as a discipline or economic activity.

Research and development are promoted by journals by publishing new findings and transmitting the knowledge among the researchers. Scientometric indicators are applied to evaluate the standard of a journal and to evaluate the literature growth of any subject. This paper applies the scientometric techniques on the Disaster Management literature. Disasters have grown strongly over the years. The field Disaster Management increasingly coming into its own, with journals, conferences, professional associations, academic programs etc. But crisis and disasters are becoming part of everyday governance; the time has come for the disaster management field to familiarize itself with some of the key developments and approaches. There is an immediate need for initiating action of various levels by all concerned on this issue in order to streamline and improve our disaster preparedness and response capacities. The issue of communication, flow of information, role clarity of various organizations and agencies involved, networking, involvement of the panchayats and strong interface amongst various government departments, institutions, etc. are equally important.

2 Review of Literature

Nishavathi & Jeyshankar (2018) studied the growth of research literature produced by AIIMS (All India Institute of Medical Sciences) for the period of 2007 to 2016. A total of 14410 records were retrieved from the Scopus database. Descriptive statistics for the research publication output revealed mean= 1441, Sd= 318.92, minimum= 1087, maximum= 2141 at

95.0% confidence level. The curve fitting methodology was used to fit the growth of research publication of AIIMS. R square value for exponential growth model was higher (0.908) than the linear growth model (0.849). Journals were identified as most the preferred publication pattern (69.42%). The research output of top 20 departments aggregated to 57.77% of total productivity. Chithiraivel & Jeyshankar (2019) analysed the Eosinophilia research output carried out during the year 1998 – 2017. The different parameters including authorship pattern, growth, Time Series Analysis, Degree of Collaboration, Institutions' contribution, most productivity journals were analysed. The overall growth rate of literature output was found to be positive with an increasing trend in Eosinophilia research throughout the study period. Two and more authored papers constitute majority of the contribution and degree of collaboration had a maximum value of 7.14..

Vellaichamy & Jeyshankar (2018) highlighted quantitatively the growth and development of world literature on hemophilia in terms of publications output as per SCOPUS database (2003-2017). During 2003-2017 a total of 13503 papers were published by the scientists in the field of hemophilia. The yearly analysis of data showed that there was a rapid growth of literature from 2011 onwards. There were 126 countries involved in the research in this field. USA was the top producing country with 3986 authorships (29.52%) followed by United Kingdom with 1438 authorships (10.65%). Semertzidou, Eleni (2017) analyzed the literature on the utilization of intragastric balloon use in Obese people during 1980 to 2017. In the gathering of the top 50 articles, Obesity Surgery distributed half. The number of publications was gradually ascending from 2001 until 2015 (7 to 41 articles per year) and during 2016-2017, the interest in intragastric balloon use in obese people had all the earmarks of being more grounded, with in excess of 50 productions for every year. Vijayakumar & Hariharan (2016) used various parameters of Scientometrics to study Malaria research performance during 2010 to 2014. Analysis of authorship pattern, Co-authorship pattern also indicated that author was willing to work with co-author. Collaboration index is 6.07 for the study period which revealed that there existed a high level. Malaria Journal had produced number of records 221 Chitra, Jeyshankar & Abu (2014) used scientometric indicators to analyze lung cancer research literature among G7 and BRIC countries for the period 2003-2012. It revealed that among the G7 countries, USA

topped with 44.58% of publications followed by Japan with 17.37%. China had the highest growth rate of 12.65 among the BRIC countries. The publication activity had been increased in the BRIC countries (China, India and Brazil) than that of G7 countries. In terms of productivity and citation impact, G7 countries lead in lung cancer research than the BRIC countries. Goel, Maurya & Desai (2013) explored the research and development indicators in solar energy research in India. It was observed that USA has been the major producer of solar photovoltaic followed by India. In terms of publications of solar energy output, India on per capita basis continued to be approximately one fourth that of the world and was one among the five leading countries. Eghbal, Ardakani & Asgary (2012) did a comparative study on endodontic articles published in Iran with the neighbouring countries. Among the quantity of endodontic articles distributed from 29 nations, Turkey stood first with 962 articles pursued by Israel, Iran, Jordan and Saudi Arabia. The rate of science production (GI; growth index) from 1980-1994 to 1995-2009 at the national level had the quickest development in Iran (GI of 14.4).. Jeyshankar (2015) studied research publication trend among scientists of Indira Gandhi Centre for Atomic Research during the period 1989-2013. Data were analyzed based on type of publication, year of publication, language, source, country, institutions, most preferred journals and most prolific authors among other variables. The study revealed that majority (96.26%) of the researchers preferred to publish their research papers in joint authorship only and the degree of author collaboration ranges from 0.84 to 0.99 and its mean value is 0.95.

3 Objective of the study

The fundamental target of this study is to dissect research output in Disaster Management discipline in the accompanying viewpoints

- ❖ To map the year wise dissemination of articles;
- ❖ To evaluate the Growth Ratio of literature;
- ❖ To figure out the Relative Growth Ratio and Doubling time of research articles;
- ❖ To explore the authorship pattern of publications and Co-Authorship Index;
- ❖ To compute the Degree of collaboration among researchers &
- ❖ To locate the future growth of publication using Time Series Analysis.

4 Limitations

- ❖ The present examination is bounded to Articles, Reviews, Editorial, Note, Erratum, Conference Papers distributed in Disaster Management Literature
- ❖ This review is confined to the distributions between the period 2009 and 2018.

5 Scope and Methodology

The Present examination is about to discover the Literature growth, authorship, Relative Growth Rate and Doubling Time, Collaborative Authorship Index of the Disaster Management Literature. Data were acquired from SCOPUS database and 10498 articles in the Disaster Management between 2009 to 2018 have been considered for the present study. A

datasheet was set up in MS-Excel to record the data and the gathered data was analysed utilizing the following scientometric indicators.

- ❖ Extent of Authorship Pattern (Single Vs. Multiple)
- ❖ Degree of collaboration
- ❖ Co-authorship index
- ❖ Relative Growth Rate and Doubling Time

6 Results and Discussions

Year wise distribution of articles: Disaster Management has 10498 articles during the period 2009-2018 with a yearly average of 1049.8 and at least 593 (5.64%) in 2006 and at most of 1397 (13.3%) in 2018.

Table 1: Year wise distribution of articles

S.No.	Year	No.of articles	Percentage	Cumulative	Cumulative %
1	2009	593	5.64	593	1.17
2	2010	727	6.92	1320	2.62
3	2011	824	7.84	2144	4.25
4	2012	936	8.91	3080	6.11
5	2013	1090	10.38	4170	8.28
6	2014	1089	10.37	5259	10.44
7	2015	1157	11.02	6416	12.75
8	2016	1333	12.69	7749	15.39
9	2017	1352	12.88	9101	18.08
10	2018	1397	13.3	10498	20.85
Total		10498	100		

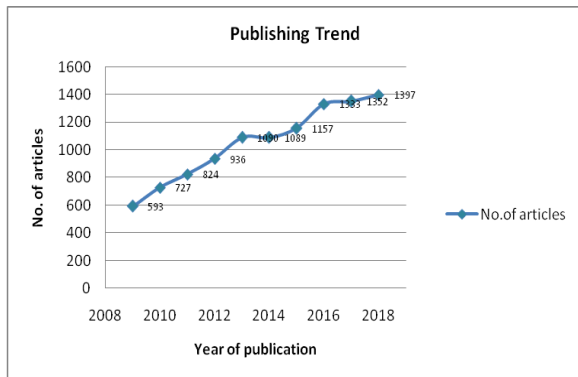


Fig.1: Year wise distribution

Growth Ratio by Year-wise Publications:

The growth ratio of articles distributed in Disaster Management literature progress over the preceding period has been determined and the equivalent appeared in Table 2. The Growth proportion differs from 1.22 to 0.99; from the table it is seen that there exists a change in growth. The general perception in pattern of growth ratio is appeared in Figure 2; the growth ratio is somewhat downwards.

Table 2: Growth Ratio

S.No.	Year	No.of articles	Growth ratio
1	2009	593	-
2	2010	727	1.22
3	2011	824	1.13

4	2012	936	1.13
5	2013	1090	1.16
6	2014	1089	0.99
7	2015	1157	1.06
8	2016	1333	1.15
9	2017	1352	1.01
10	2018	1397	1.03
Total		10498	

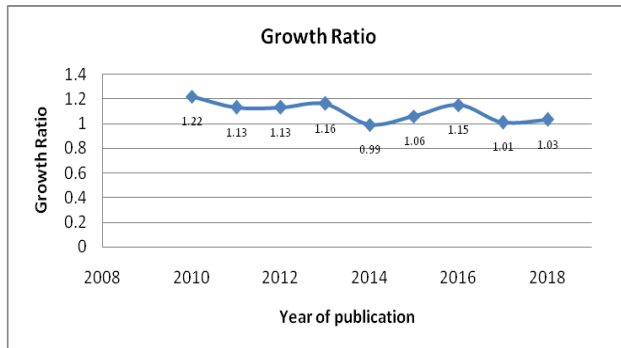


Fig.2: Growth Ratio 1

Relative growth rate and Doubling time: The rate of growth of articles distributed in the Disaster Management literature is concluded by figuring relative growth rate and doubling time for publications. Table.3 predicts data of relative growth rate and doubling time for the articles published in the literature Disaster Management. The RGR for the year 2010 is 1.48, the last year 2018 is 0.11, and the general esteem is 0.38, the values moderately decreased thought the years. On the other hand, the Doubling Time (DT) appear as increasing pattern, for the year 2010 is 0.46 and the last year 2018 is 6.07. RGR has appeared decreasing pattern, which implies the rate is low regarding extent, and this featured by doubling time for publication, which is more than the relative growth rate.

Table 3: Relative growth rate and Doubling time

S.No.	Year	No.of articles	Cumulative	W1	W2	RGR	Dt
1	2009	593	593	-	6.38	-	-
2	2010	727	2603	6.38	7.86	1.48	0.46
3	2011	824	4614	7.86	8.43	0.57	1.21
4	2012	936	6626	8.43	8.79	0.36	1.91
5	2013	1090	8639	8.79	9.06	0.26	2.61
6	2014	1089	10653	9.06	9.27	0.21	3.31
7	2015	1157	12668	9.27	9.44	0.17	4
8	2016	1333	14684	9.44	9.59	0.14	4.69
9	2017	1352	16701	9.59	9.72	0.12	5.38
10	2018	1397	18719	9.72	9.83	0.11	6.07
Total		10498		Average		0.38	3.29

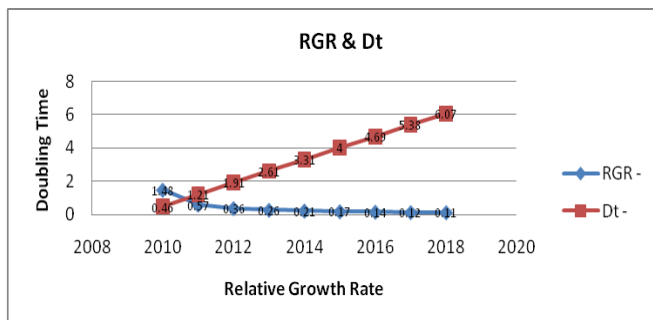


Fig.3: RGR and Dt

Authorship Patter: Table 4 demonstrates the authorship observed in the research articles on the literature Disaster Management between the year 2009-2018. In the authorship pattern, double author contribute the most noteworthy rate 2547 (24.26%) trailed by triple authors 2285 (21.76%); whereas single author contribute 2013 (19.18%) and four authors 1578 (15.03%). The minimal level of contribution is five authors 935(8.91%) only.

Table 4: Authorship Pattern

No.of authors	No. of papers	Percentage	Cumulative	cumulative %
1	2013	19.18	2013	4.83
2	2547	24.26	4560	10.94
3	2285	21.76	6845	16.42
4	1578	15.03	8423	20.2
5	935	8.91	9358	22.44
>5	1140	10.86	10498	25.17
Total	10498	100	41697	100

Authorship Pattern –Year wise: The data relating to year wise authorship pattern have been given in Table 5. As to single author contribution the year 2015 has the highest 244 pursued by 2013 with 231 contributions. It is seen that in double authored papers 2017 and 2018 has the most elevated contributions with 330 followed by 2016 with 321

articles. The year 2018 has the maximum contributions regarding three and four with 327 and 355 and the year 2017 has the maximum contribution for five authors, the year 2018 has the highest contributions in multi-authored paper with 158, 186 respectively.

Table 5: Authorship Pattern–yearwise

Year	Number of Authors					
	1	2	3	4	5	>5
2009	151	147	131	74	38	50
2010	161	172	171	94	61	66
2011	194	223	162	104	76	67
2012	201	226	200	141	83	86
2013	231	274	242	149	77	115
2014	206	269	237	164	97	113
2015	244	275	245	162	92	139
2016	217	321	298	226	126	142
2017	223	330	277	200	158	164
2018	183	330	327	255	125	186
Total	2011	2567	2290	1569	933	1128

Authorship Index: The publications by single, two, multi and mega authored papers for different blocks of the years / nations / sub-disciplines are calculated proportionally in order to calculate the Co-Authorship Index. The formula suggested by **Garg and Padhi** has been employed to find the co-authorship index.

Noo – Total number of papers by all authors and all years

If Co-authorship index is equal to 100 then the number of publications corresponds to the average within the co-authorship pattern and if co-authorship index is less than 100, it implies that the numbers of publications are lower than the average and if it is greater than 100 then the numbers of publications are higher than the average.

$$CAI = ((N_{ij} / N_{io}) / (N_{oj} / N_{oo})) \times 100$$

Where

N_{ij} – Number of Papers in i^{th} year by j authors

N_{io} – Total number of papers in i^{th} year

N_{oj} – Numbers of papers by j authors in all years

Table 6: Co-Authorship Index Total to be added at bottom of tab

Year	Single Author		Two Authors		Three Authors		Four Authors		Five Authors		> 5 Authors	
	No.	CAI	No.	CAI	No.	CAI	No.	CAI	No.	CAI	No.	CAI
2009	151	133.38	147	101.72	131	101.61	74	83.78	38	72.35	50	78.74
2010	161	115.93	172	97.02	171	108.12	94	86.75	61	94.68	66	84.72
2011	194	122.61	223	110.41	162	89.91	104	84.24	76	103.53	67	75.49
2012	201	111.98	226	98.64	200	97.85	141	100.68	83	99.67	86	85.42
2013	231	110.84	274	102.9	242	101.97	149	91.63	77	79.64	115	98.37
2014	206	99.022	269	101.30	237	100.04	164	101.04	97	100.50	113	96.84
2015	244	110.09	275	97.20	245	97.07	162	93.68	92	89.47	139	111.81
2016	217	85.17	321	98.70	298	102.71	226	113.69	126	106.60	142	99.37
2017	223	86.1	330	99.82	277	93.92	200	98.98	158	131.50	164	112.89
2018	183	67.95	330	95.99	327	106.61	255	121.35	125	100.03	186	123.11

In this present study the authors have been arranged to be specific single, two, three and multiple authors orderly in four blocks and using the above equation the Co-authorship index are calculated and tabulated in Table 6.

It is noticed from the above table that there is an uncertainty in CAI for single authored and two authored papers. But two authored paper's CAI is enhanced from 101 during 2009 to 106 during 2018. This evidence concludes that the pattern of co-authorship is increasing among the contributing authors. Though there exists fluctuation, the four and five authored publications are considered for CAI calculation since during 2012, 2014 and 2018 the

papers are exactly equal to the average number of articles published. Then again for multi authored contributions CAI favour to increasing trend with minimal fluctuation.

Single in Contrast Multiple Authors: The following Table 7 presents the research papers of single and multiple authors in the Global level Disaster Management literature. Multiple authors contribution towards Disaster Management literature ruled with 8487 (80.84%) over single authors with 2011 (19.16%).

Table 7: Single in contrast Multiple Authors

No of authors	No. of articles	Percentage	Cumulative	Cumulative %
Single	2011	19.16	2011	16.08
Multiple	8487	80.84	10498	83.92
Total	10498	100	12509	100

Degree of collaboration for Single Vs. Multiple Authors: The Equation proposed by Subramanian (1983) is used to calculate the degree of research collaboration among the single and multiple authorship patterns.

$C = NM / (NM + NS)$, Where C represents Degree of collaboration;

NM denotes Number of Multi-authored papers;

NS denotes Number of single-authored papers

Here, $C = 8487 / (8487 + 2011)$

$C = 0.81$

The calculated degree of collaboration value in the field of Topology literature is 0.81 which is greater than 0.50; this demonstrates multiple authors' predominance towards Disaster Management Literature.

Time series analysis – Future growth of publication: A Straight-line equation is used as a model for forecasting the growth of publications based on previously observed values. The equation of a straight line is $Y_c = a + bX$, where X is the time period, and 'Y' is the number of publications against

the year, 'a' is estimated Y intercept when X is Zero and 'b' is the co-efficient of X, indicating the slope of

regression line, where N is the number of observations in the data.

Table 8: Time series analysis

S.No.	Year	No. of articlesY	X	X ²	XY
1	2009	593	4	25	2372
2	2010	727	3	16	2181
3	2011	824	2	9	1648
4	2012	936	1	4	936
5	2013	1090	0	1	0
6	2014	1089	-1	0	-1089
7	2015	1157	-2	1	-2314
8	2016	1333	-3	4	-3999
9	2017	1352	-4	9	-5408
10	2018	1397	-5	16	-6985
Total		10498		85	-12658

Calculations:

Straight line equation
 $Y_c = a + bX$
 $a = \Sigma Y / N = 10498 / 10 = 1049.8$
 $b = \Sigma XY / \Sigma X^2 = -12658 / 85 = -148.92$
 Predicted publications during 2023,
 $X = 10$ years (2023-2013)
 $Y_c = a + bX$
 $= 1049.8 + (-148.92 * 10) = 2539$
 Predicted publications during 2028,
 $X = 15$ years (2028-2013)
 $= 1049.8 + (-148.92 * 15) = 3283.6 = 3284$

2285 (21.76%), single author 2013 (19.18 %) and four authors 1578 (15.03 %). CAI exceeds the average number of publications during the year 2009-2013, and 2015 for unique authored papers. DC is 0.81 > 0.50 show the multiple authors' supremacy in contribution. Straight line equation findings predict the number of publications in 2023 as 2539 and for the year 2028 as 3284 which concludes increasing pattern in the future growth of articles.

From the above calculations it is inferred that the publications during 2023 could be predicted as 2539 and during 2028 be 3283.6. It is noteworthy that the future growth of Disaster Management literature will have an expanding pattern in the year 2023 to 2028.

The analysis explores the Growth ratio fluctuation imitate the unsteady growth of article publications and publishing trend pictures out the dramatic publication standing in Disaster Management literature. CAI is higher than the average number of publications replicates the existence of social and cognitive relationship among the scientists in Disaster Management discipline with high degree of collaboration. Finally research grants and financial support to researchers may increase the growth ratio in order to conclude the demand in Disaster Management literature.

7. Major Findings and Conclusion

The Average year wise distribution of articles in the Disaster Management literature is 1049.8 and the year 2018 contributes highest percentage as 13.3 followed by 2017 as 12.88%. Growth ratio varies from 1.22 to 1.03 which replicates that there exists no steady growth of article publications. From the calculation, RGR for the year 2010 is 1.48 and its decline to 0.11 in 2018 and the overall average is 0.38. The decline in Relative Growth Rate predicts that the Disaster Management literature may take more time to double its publication. Two authors publications found as 2547 (24.26%), the major contribution among all; followed by three authors

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