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Collaborative Research Publications Trends on Disaster Management: A Scientometric Analysis

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0. Abstract

Totally 24900 documents are retrieved from Scopus database covering from 1994 to 2018. Activity index and specialized index are deployed to study about research efforts, eminence and collaborative pattern of most prolific countries in the field of disaster management. Increasing trend of world productivity in the field of disaster management identified among most prolific countries. China and USA dominated by producing 19.88% and 19.42% of research documents and collaborated with other countries. India has attained with 5th position in the most productive countries and collaborated with 37 countries in the field of disaster management. India has higher affinity towards USA and produced 66 documents. During the study period 54.65% of articles are developed from collaborative work. International collaboration between developed and developing, under-developed countries will reduce the happening of disaster and aids the government to make policies to overcome from disasters.

Key words: Disaster Management, Collaborative Countries, Co-authorship Index , Activity Index

1. Introduction

Scientometrics is a branch of science which is used to calculate and compute statistical methods and computational techniques and practice for quantitative analysis. Scientometrics has been effectively applied in studying the efficiency, evaluating the scientific and technological probability of the society, its competitiveness and performance of the country. The UNO defined disaster is a severe interruption of the functioning of a community or society, which involve extensive human, material, economic or ecology or environmental impacts that surpass the aptitude of the affected community or society to deal with using its own resources. Disaster management is how we deal with the human, material, economic or environmental impacts of disaster,

it is the process of how we "prepare for, respond to and learn from the effects of major failures" (Elliott, 2014). Though often caused by nature, disasters can have human origins. Disasters are volatile and not to be predictable when it will occurs. It is considerable for every government, state or region to deal with disasters by being organized for it in progress. The government provides legislation, laws, and other safety measure methods to assign resources and does the unbiased preparation and sustainable growth. They should be equipped to face the natural disasters without leaving the people to endure for basic needs.

Disaster management and preparation is a key part of government work and an issue to be taken up critically by the concerned authorities. Disaster is of two types they are Natural disaster and man-made disaster. Natural disasters are generally unexpected and the devastation caused by these depends upon the strength of the disasters. Man-made disasters are generally taking place due to human actions and human casualness and can lead to a lot of devastation in the terms of existence and belongings. According to the International Federation of Red Cross & Red Crescent Societies a disaster occurs when a hazard impacts on vulnerable people. The combination of hazards, vulnerability and inability to reduce the potential negative consequences of risk results in disaster. The collaboration between countries facilitates to share their possessions and proficiency knowledge in this regard. Scientific collaboration assists resource convenience, research funding, concentrate on scientific problems, and promote health and wealth of a nation. There are quantity of literature, applied scientometrics tools and techniques to estimate research activities at micro, macro and meso level on a variety of disciplines and disaster management methods.

2. Review of Literature

There are cumbersome researches works are carried out in Disaster Management which has gained enormous significance with the time being and is moving in a new direction by aliening with latest technologies of Computer Science (Amandeep Kaur and Sood, 2019). There is also a significant increase in publication and citations also due to the occurrence of several major disasters (Liang Zhou, Ping Zhang, et al, 2018). Collaborative measures of published documents in the field of chromosome anomalies. The bibliographical database PubMed is used as sources for bibliometrics and 35912 citations examined for co - authorship pattern, collaborative behavior of the scientists during the year 2007-2016 (Nishavathi & Jeyshankar (2018).

Research output descriptors suggested a solid development in earthquake research, in terms of both increasing scientific production and research collaboration

(Xingjian Liu et al, 2012). Some other researchers introduced an activity index (AI) and an attractive index (AAI) to generate time evolution trajectories of some major countries and also to evaluate their trend and performances (Shen, Cheng, Yang, Yang, 2018). National Institute of Ocean Technology (NIOT), researchers are more interested in publishing with Joint authorship contributions (Senthil Kumar,N and Prabahar,P, 2018). The researchers (Anil Sagar, Kademani, Garg and Kumar, 2010) evaluated that in Japan, India, Italy and France prefer to work in larger groups when compared to scientists in USA, UK and Australia whose researchers prefer to work in smaller groups to progress the research on Tsunami related publications (Wen-ta chiu and Yuh-shan ho, 2007). The most publications are in geosciences and multidisciplinary subject category concluded that after the occurrence of Indonesia tsunami more documents published in higher-impact factor journals. Research grants and financial support to researchers may increase the growth ratio in order to conclude the demand in Disaster Management literature (Kousalya and Jeyshankar, 2019). Collaboration with developed countries helps to improve the research performance of India (Grace and Jeyshankar, 2015). The researchers Bakthavachalam Elango et al. (2013) aimed to assess the nanotribology research output to recognize the global research patterns and inclination to establish the upcoming research directions. Jeyshankar (2015) evaluated the research publication trend among scientists of Indira Gandhi Centre for Atomic Research during the period 1989-2013. 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. The outcome of this research work will help the government to manage the happening of disasters and also to control the natural hazards with some safety measures, by providing funds, and developing infrastructure facilities to analyse the natural hazards. It also helps the authors to know the availability of research resources in other countries.

3. Objectives of the Study

The main objective of this study is to the research output on chromosomal anomalies retrieved from the SCOPUS database for 25 years (1994-2018). The specific objectives are as follows -

- To measure the Temporal evolution of the research productivity of Disaster Management during 1994-2018;
- To explore the

- To explore the authorship pattern and Degree of collaboration of Disaster Management during 1994-2018;
- To examine the Authorship of cited documents, Degree of Collaboration of Cited Documents of Disaster Management during 1994-2018;
- To analyze the Co-authorship index (CAI) of published documents and Co-Authorship Index (CAI) of cited documents of Disaster Management and
- To evaluate the Collaborative Measures and Dominance Factor of Disaster Management research literature.

4. Methodology

The SCOPUS database was selected to retrieve relevant bibliographical records on Disaster management and used appropriate keywords ("Disaster Management") OR ("Disaster relief") OR ("Disaster Control") OR ("Disaster Protection") OR ("Disaster Prevention")) AND PUBYEAR > 1993 AND PUBYEAR < 2019) in the search interface, the following keywords with wildcard * were input as an advance search technique in the title and topic option by Boolean operator OR. The time frame of 25 years from 1994 to 2018 resulted in 24900 bibliographical records. The retrieved 24900 records, including the full bibliographical records and cited references, are downloaded in RIS and CSV format.

5. Data Analysis and Interpretation

Table 1: Temporal evolution of the research productivity of Disaster Management

S.No	Year	Recs.	Rank	Cum.	Rec%	Cum %
1	1994	80	24	80	0.32	0.32
2	1995	84	23	164	0.34	0.66
3	1996	74	25	238	0.30	0.96
4	1997	87	22	325	0.35	1.31
5	1998	117	21	442	0.47	1.78
6	1999	151	20	593	0.61	2.38
7	2000	210	18	803	0.84	3.22
8	2001	200	19	1003	0.80	4.03
9	2002	284	17	1287	1.14	5.17
10	2003	384	16	1671	1.54	6.71
11	2004	464	15	2135	1.86	8.57
12	2005	730	14	2865	2.93	11.51
13	2006	854	13	3719	3.43	14.94
14	2007	936	12	4655	3.76	18.69
15	2008	943	11	5598	3.79	22.48
16	2009	1095	10	6693	4.40	26.88
17	2010	1397	9	8090	5.61	32.49
18	2011	1679	7	9769	6.74	39.23

19	2012	1673	8	11442	6.72	45.95
20	2013	2041	5	13483	8.20	54.15
21	2014	2057	4	15540	8.26	62.41
22	2015	2008	6	17548	8.06	70.47
23	2016	2296	3	19844	9.22	79.69
24	2017	2306	2	22150	9.26	88.96
25	2018	2750	1	24900	11.04	100
Total		**24900**			**100**	**100.00**

Fig 1: Temporal evolution of the research productivity of Disaster Management

Table 1 and Fig 1 show the year-wise distribution of Disaster management research output for a quarter century covering 1994-2018 literature. The year 2018 is the most productive year (2750, 11.04%) tracked by the years 2017 (2306, 9.26%) and 2016 (2296, 9.22%) each contributing 9% -11% of total disaster Management research output. The least productive years are 1996 (74, 0.30%), 1994 (80, 0.32%) and 1995 (84, 0.34%). The considerable of literature is getting increased over a period of 25 years. The output was the minimum during the first few years of the study, modest during the middle period and the maximum during the last few years.

Table 2: Research Productive Institutions in Disaster Management 1994-2018

S.No	Institution	No. of publications	Percent of 3276	Percent of 24900
1	Chinese Academy of Sciences	487	14.87	1.96
2	Ministry of Education China	379	11.57	1.52
3	Kyoto University	246	7.51	0.99
4	China Earthquake Administration	236	7.20	0.95
5	University of Tokyo	232	7.08	0.93
6	Beijing Normal University	231	7.05	0.93

7	Tsinghua University	153	4.67	0.61
8	China University of Mining and Technology	142	4.33	0.57
9	Institute of Geology, Chinese Academy of Geological Sciences	134	4.09	0.54
10	Tohoku University	133	4.06	0.53
11	University of Chinese Academy of Sciences	128	3.91	0.51
12	China University of Mining & Technology, Beijing	117	3.57	0.47
13	Wuhan University	116	3.54	0.47
14	Harbin Institute of Technology	115	3.51	0.46
15	Texas A&M University	115	3.51	0.46
16	Tongji University	109	3.33	0.44
17	University of Melbourne	102	3.11	0.41
18	Southwest Jiaotong University	101	3.08	0.41
	Total	**3276**		

Fig. 2 Research Productive Institutions in Disaster Management 1994-2018

Table 2 and Fig.2 shows the top most productive institution in the field of Disaster Management research during 1994-2018. Chinese Academy of Sciences is the foremost publisher in Disaster Management research with 487 (1.96%) publications tracked by Ministry of Education China with 379 (1.52%) publications. These two institutions alone have contributed approximately 350-500 publications. The institutions with 200-250 publications are Kyoto University, China Earthquake Administration, University of Tokyo, Beijing Normal University with 246, 236, 232, 231 publications on Disaster Management research respectively. There are twelve institutions who have published

more than 100- 150 records in Disaster Management research are Tsinghua University(153), China University of Mining and Technology (142), Institute of Geology, Chinese Academy of Geological Sciences (134), Tohoku University(133), University of Chinese Academy of Sciences (128), China University of Mining & Technology, Beijing (117), Wuhan University (116), Harbin Institute of Technology (115), Texas A&M University (115), Tongji University(109), University of Melbourne (102), Southwest Jiaotong University (101). The lowest count was from University of Melbourne and Southwest Jiaotong University. The study found that 160 institutions which contributed minimum 35 publications during the study period and only 18 institutions contributed more than 100 documents. It implies that more collaboration among the institutions was seen. It also enables that the institutions can quintessence more in publishing records on Disaster Management research.

Fig 3: Organization mapping disaster management publications during 1994-2018

The figure 3 visualizes the collaborations between organizations in the research area of disaster management during 1994 -2018. Collaboration of organization can be categorized into intra – organizational, inter- organizational with national and international level. The colors of the nodes (organizations) are clustered according to their collaborative patterns.   The size of the nodes is indicative of number of collaborators. Mapping of organizational collaboration revealed that there has been inter-organizational collaboration at national level of China.   Particularly Beijing University of China has collaborated intra – organizationally rather than inter-

organizational. Hence China has produced 19.88% of world literature in the research area of disaster management over the study period (table 4).

In organization collaboration, various organizations and departments within china have highly collaborated. Various departments of being university have highly collaborated in institutions/ organizations wise.

Table 3: Funding Institutions / Organizations of Disaster Management Research

S.No	Funding Institutions	No. of Publications	Percent of 2178	Percent of 24900
1	National Natural Science Foundation of China	825	37.88	3.31
2	National Science Foundation	288	13.22	1.16
3	Japan Society for the Promotion of Science	153	7.02	0.61
4	National Basic Research Program of China	139	6.38	0.56
5	European Commission	111	5.10	0.45
6	Ministry of Education, Culture, Sports, Science and Technology	82	3.76	0.33
7	Fundamental Research Funds for the Central Universities	76	3.49	0.31
8	National Research Foundation of Korea	57	2.62	0.23
9	China Postdoctoral Science Foundation	54	2.48	0.22
10	Chinese Academy of Sciences	41	1.88	0.16
11	Seventh Framework Program	41	1.88	0.16
12	Engineering and Physical Sciences Research Council	40	1.84	0.16
13	Ministry of Science and Technology, Taiwan	37	1.70	0.15
14	Natural Sciences and Engineering Research Council of Canada	35	1.61	0.14
15	U.S. Department of Homeland Security	35	1.61	0.14
16	Economic and Social Research Council	34	1.56	0.14
17	National Aerospace Science Foundation of China	34	1.56	0.14
18	National Science Council	33	1.52	0.13
19	Ministry of Science and Technology of the People's Republic of China	32	1.47	0.13
20	National Aeronautics and Space Administration	31	1.42	0.12
Total		**2178**	**100**	**8.75**

Table 3 shows the highest funding organization in the field of Disaster Management research during 1994-2018 and Over the 25 years of study period, the funding agency that sponsored more than 30 research works. National Natural Science Foundation of China is the foremost publisher in Disaster Management research with 825 (3.31%) publications which published through project fund. This is the only one funding institution which contributes more records. There is a sudden ruin in the publication with 288 (1.16) records from National Science Foundation which shows the

variances of 537 records. It is tracked by Japan Society for the Promotion of Science 153(0.61%), National Basic Research Program of China 139 (0.56%) and European Commission 111 (0.45%). The above three institutions are contributing 100-200 publications. Other 15 funding institutions are contributing less than 100 publications. In that 4 institutions are contributing 50-100 records are Ministry of Education, Culture, Sports, Science and Technology 82 (0.33%), Fundamental Research Funds for the Central Universities 76 (0.31%), National Research Foundation of Korea 57(0.23%), China Postdoctoral Science Foundation 54(0.22%). While other 11 institutions contributing 30-50 records. National Aeronautics and Space Administration is least publishing institution with 31 (0.12%) of records on Disaster Management research. From the above table, it identified that more contributions were made through funding agencies of China.

Table 4: Country-wise contribution of Research Output on Disaster Management Research

S.No	Country	No. of publications	Percent
1	China	5317	19.88
2	United States	5194	19.42
3	Japan	2394	8.95
4	United Kingdom	1509	5.64
5	India	1275	4.77
6	Australia	1107	4.14
7	Germany	1019	3.81
8	Italy	772	2.89
9	Canada	697	2.61
10	Taiwan	691	2.58
11	South Korea	527	1.97
12	Netherlands	522	1.95
13	France	493	1.84
14	Indonesia	455	1.7
15	Turkey	384	1.44
16	Iran	365	1.36
17	Malaysia	345	1.29
18	Austria	327	1.22
19	Spain	283	1.06
20	New Zealand	258	0.96
21	Switzerland	257	0.96
22	Sweden	228	0.85
23	Brazil	189	0.71
24	Thailand	185	0.69
25	Norway	179	0.67

26	Philippines	172	0.64
27	Greece	167	0.62
28	Pakistan	167	0.62
29	Belgium	163	0.61
30	Singapore	157	0.59
31	Hong Kong	155	0.58
32	South Africa	150	0.56
33	Bangladesh	146	0.55
34	Mexico	134	0.5
35	Russian Federation	132	0.49
36	Romania	120	0.45
37	Portugal	105	0.39
Total		**26740**	**100**

Table 4 shows the contribution of countries in Disaster Management research during 1994-2018. 37 countries contributed a total of 26740 publications. Among the countries, the most productive countries in Disaster Management research output include China with 5317 records (19.88%), United States with 5194 records (19.42%), Japan with 2394 records (8.95%), United Kingdom with 1509 records (5.64%), India with 1275 records (4.77%), Australia with 1107 (4.14%) and Germany 1019(3.81%). The above seven countries alone produced more than 1000 documents. These 7 countries alone have contributed about 67% of total Disaster Management research output and rest of 30 countries contributed 33% of total Disaster Management research output. There are fifteen countries with 200-800 publications. and The 15 countries which contributed 25% on total research output on Disaster Management are Italy, Canada, Taiwan, South Korea, Netherland, France, Indonesia, Turkey, Iran, Malaysia, Austria, Spain, New Zealand, Switzerland, Sweden with 772, 697, 691, 527, 522, 493, 455, 38, 365, 345, 327, 283, 258, 257, 228 respectively. There are another 15 countries with 100-200 publications which contributes 8% of total research output on disaster analysis. The countries Mexico (134), Russian Federation (132), Romania (120) and Portugal (105) are the least productive countries on Disaster Management research. In country wise productivity, over the 25 years of study period it concluded that disaster might be the major research front of China.

Table 5: Source type of the Publications

S.No	Source Type	No. of publications	Percent
1	Journals	14752	59.24
2	Conference Proceedings	7255	29.14
3	Book Series	1222	4.91
4	Books	1064	4.27
5	Trade Publications	602	2.42
6	Undefined	5	0.02
Total		**24900**	**100**

Fig 4: Source type of the Publications

Table 5 and Fig.4 show the preferred form of communication of the researchers in polio literature. In terms of source type chosen by the contributors to made their publications to the public, the contributors were mainly published their articles in the journals 14752 (59.24%) tailed by 7225 (29.14%) in conference proceedings, book series with 1222 (4.91%) publications books with 106 (4.27%) records and Trade publication with 602 (2.2%) of publications are published on Disaster Management research output. The table depicts that most and more than half percent of contribution is from journals with 59% and rest of 41% are contributed by Conference Proceedings, Book series, Books, and Trade Publications. There is also an undefined source type with 5 (0.02%) publications on research output.

Table 6: Productivity of Top Seven Countries of Disaster Management

S.No	Publications	China	USA	Japan	UK	India	Australia	Germany
1	1994	1	14	3	3	0	5	1
2	1995	2	21	12	5	2	3	1
3	1996	2	25	5	7	1	2	1
4	1997	1	32	10	6	4	4	3
5	1998	10	33	11	9	3	2	3
6	1999	8	46	8	21	2	4	12
7	2000	11	57	30	22	9	7	5
8	2001	11	59	31	12	7	12	22
9	2002	22	86	45	24	8	5	5
10	2003	30	126	45	21	11	12	16
11	2004	72	123	53	28	12	10	19
12	2005	104	173	68	47	27	20	23
13	2006	97	258	90	38	37	18	35
14	2007	136	226	85	52	37	26	54
15	2008	170	240	92	45	37	30	49
16	2009	284	220	107	68	40	29	52
17	2010	365	269	114	82	66	51	51
18	2011	463	325	125	94	66	56	67
19	2012	470	345	152	87	82	80	61
20	2013	565	364	231	112	84	94	101
21	2014	565	362	187	102	115	124	91
22	2015	409	386	216	125	133	112	85
23	2016	470	428	223	172	172	123	91
24	2017	485	412	221	143	157	136	96
25	2018	564	538	228	169	162	137	73
Total		**5317**	**5168**	**2392**	**1494**	**1274**	**1102**	**1017**

Table 6 and Fig.5 shows the contribution of top seven countries in Disaster Management research during 1994-2018. Top seven countries contributed a total of 17764 publications. Among the top seven countries, the most productive countries in Disaster Management research output include China with 5317 records, USA with 5168 records, Japan with 2392 records. The countries have their productivity below 2000 are UK with 1494 records, India with 1274 records, Australia with 1102 documents and 1017 records from Germany.

Fig 5: Productivity of Top Seven Countries of Disaster Management

China and USA countries alone have contributed more than 50% of total Disaster Management research output of Top seven countries. China's contribution throughout the year shows an oscillating trend, they have a highest productivity in the years 2013, 2014 and 2018 with 565 and 564 documents. They have their least productivity in the preliminary years as 1994-1999 with 1-10 records and it raises to peak in the years 2013- 2018.If we separate the years in three blocks, the first block years1994-2003 had lowest number of productivities with 1-30 records. The second block of years 2004-2009 have mid-range of productivity with 70-300 records. The third block of years 2010-2018 have their productivity 350-570 records. Even though there seems a fluctuating in the last years the productivity is higher than comparing to beginning years. After 2007, china had a good start of research in this area and had more productivity.

The second topper productivity country on Disaster Management research is USA with 5168 records. There is a slight oscillation in the productivity but most of the subsequent years are increasing. In the preliminary years it has their least contribution of 14-86 records which is below 100 records in the years1994-2002. It raised to 120-

300 documents in the years 2003-2010. Above 300-540 records are in the years 2011-2018. As same as China, USA also has their highest productivity in the latest years. While comparing to other countries, from the beginning itself USA had published more papers than other countries.

Among top seven countries, Japan is the third contributor which produces more records of 2392 of overall 25 years. Like other countries its productivity is also in fluctuating trend. In 2013 its productivity is high with 231 records which is followed by the year 2018 with 228 records, 2016 with 223 records, 2017 with 221 records and 2015 with 216 records. The minimum productivity is in the preliminary years 1994 with 3 records, 1996 with 5 records and 1999 with 8 records.

The other four countries like UK (1494), India (1274), Australia (1102) and Germany (1017) have their productivity with 1000-1500 records on Disaster Management research. Every country has their contribution in higher range in the last years, in the initial years all the countries have a lowermost productivity. After 2013, United Kingdom had taken good effort in this area of research. From 2009 only, Japan has started to produce more publications. During the last five years India had taken good endeavor to produce research in this regard.

Fig 6: Country mapping disaster publications during 1994-2018

The country China has co-authored with 925 countries and very close link with the country USA and produced 233 papers and with japan produced 98 papers. USA has produced 155 papers with the collaboration of UK and 111 papers with japan. Japan has highly collaborated with USA followed by china and produced 98 papers. India had highly collaborated with USA and produced 66 papers.

Activity Index: Frame (1997) suggested the following formula for computing activity index,

$$AI = ((Nij / Nio) / (Noj / Noo)) \; X \; 100$$

Where Nij denotes the number of papers in theme i and block j, Nio denotes the number of papers in theme i for all blocks, Noj denotes the number of papers in all

themes for block j and Noo refers to the total number of papers in all themes and all blocks.

Table 7: Activity Index of the Top Seven Countries of Disaster Management

S.No	Year/ Activity index	China	USA	Japan	UK	India	Australia	Germany
1	1994	5.85	84.32	39.04	62.50	0.00	141.22	30.60
2	1995	11.15	120.45	148.71	99.21	46.54	80.70	29.15
3	1996	12.66	162.77	70.34	157.66	26.41	61.07	33.09
4	1997	5.38	177.22	119.65	114.94	89.86	103.89	84.43
5	1998	40.03	135.90	97.87	128.21	50.11	38.62	62.78
6	1999	24.81	146.78	55.15	231.79	25.89	59.86	194.57
7	2000	24.53	130.78	148.71	174.60	83.76	75.32	58.29
8	2001	25.76	142.13	161.35	100.00	68.41	135.57	269.32
9	2002	36.28	145.90	164.94	140.85	55.06	39.78	43.11
10	2003	36.59	158.09	121.99	91.15	55.99	70.61	102.02
11	2004	72.67	127.72	118.90	100.57	50.55	48.70	100.26
12	2005	66.72	114.18	96.97	107.31	72.29	61.90	77.14
13	2006	53.19	145.56	109.70	74.16	84.68	47.62	100.34
14	2007	68.04	116.33	94.53	92.59	77.26	62.76	141.25
15	2008	84.42	122.62	101.56	79.53	76.69	71.88	127.22
16	2009	121.46	96.80	101.72	103.50	71.40	59.84	116.27
17	2010	122.36	92.78	84.95	97.83	92.34	82.49	89.38
18	2011	129.14	93.26	77.50	93.31	76.83	75.36	97.70
19	2012	131.56	99.36	94.58	86.67	95.80	108.05	89.27
20	2013	129.64	85.93	117.82	91.46	80.44	104.06	121.16
21	2014	128.63	84.79	94.63	82.64	109.27	136.21	108.31
22	2015	95.39	92.62	111.98	103.75	129.45	126.03	103.64
23	2016	95.86	89.81	101.10	124.85	146.42	121.05	97.04
24	2017	98.50	86.08	99.76	103.35	133.07	133.26	101.93
25	2018	96.05	94.26	86.31	102.42	115.14	112.57	64.99

Table 7 shows the activity index of top seven countries in world Disaster Management research output during 1994-2018. In overall study period, Japan and Germany had a great fluctuation in their research activity. During the last five-year study period, India had good research activity in disaster research. Australia had high research effort during last seven years of the study period.

China: The activity index of china is highest in the year 2012 with the score of 131.56. It is tracked by the years 2013, 2011, 2014, 2010 and 2009 with the scores of 129.6, 129.1, 128.63, 122.36 and 121.6 respectively. In the years 2015-2018 the activity index of china attained a tremendous fall with 95.39, 95.86, 98.50 and 96.05 respectively. The

least activity index is in the years 1997 and 1994 with 5.38 and 5.85 correspondingly. China had good research effort, 1995-2008

USA: The score of activity index is 100-200 for 14 years (1995-2008) and remaining 11 years (1994 and 2009-2018) have their score below 100. In the year 1994, it was 84.32 which is the least score and the utmost score is 158.09 in the year 2003. In the beginning years the activity index rises and falls but in the latest years it had a tremendous fall of below 100 score.

Japan: Overall the span of 25-years, it has unbelievable ups and downs in the activity index score. The tiniest number of scores is in the year 1994 with 39.04, 1999 with 55.15, 1996 with 70.34 and 2011 with 77.50 and peak index score in the year 2002 with 164.94, 2001 with 161.35, and 2000 with 148.71. Japan has the highest Activity Index in 2009-2014

UK: The activity index score of UK also follows an oscillating trend. It has its lowest score of 62.50 in 1994, 91.15 in 2003, 91.46 in 2013 and highest activity index score is in the years 1999 with 231.79, 1996 with 157.66. The scores between 100-250 is secured by 14 years and remaining 11 years are below 100 score.

India: In the year 1994, India has scored zero activity index and raises to 46.5 in 1995 and falls to 26.41 in 1996. The activity index of years 1995 -2013 is below 100 score and above 100 for years 2014- 2018.

Australia: The activity index score is highest in the first year itself with the score 141.22 and the least score of 38.62 in the year 1998. After 1994 it had great fall in the score with 80.70 in the year 1995, 61.07 in the year 1996 and raises to 103.89 in the year 1997. Again, it decreases to 38.62 in the year 1998, like this the score moves up and down throughout the year.

Germany: The score is extreme in the year 2001 with 269.32, which is followed by the years 1999 with 194.57, 2007 with 141.25 and 2008 with 127.22. The lowest score of Germany is 29.15 in the year 1995, 30.6 in 1994 and 33.09 in the year 1996. This country also follows a fluctuating trend in scores of activity index.

Relative Specialization Index (RSI): Relative specialization index derived from the activity index implies that the share of country's publications has relatively lower or

higher than the world share in any given field of study. It can be calculated based on the formula,

RSI = (AI -1) / (AI +1) where AI stands for activity index. It ranges always between 0 and 1. 1 indicates the share of country's research efforts is equal to the world in the research area of disaster management.

Table: 8 Relative Specialization Index of Top seven Countries of Disaster Management

S.No	Years / RSI	China	USA	Japan	UK	India	Australia	Germany
1	1994	0.708	0.977	0.950	0.969	-1.000	0.986	0.937
2	1995	0.835	0.984	0.987	0.980	0.958	0.976	0.934
3	1996	0.854	0.988	0.972	0.987	0.927	0.968	0.941
4	1997	0.687	0.989	0.983	0.983	0.978	0.981	0.977
5	1998	0.951	0.985	0.980	0.985	0.961	0.950	0.969
6	1999	0.923	0.986	0.964	0.991	0.926	0.967	0.990
7	2000	0.922	0.985	0.987	0.989	0.976	0.974	0.966
8	2001	0.925	0.986	0.988	0.980	0.971	0.985	0.993
9	2002	0.946	0.986	0.988	0.986	0.964	0.951	0.955
10	2003	0.947	0.987	0.984	0.978	0.965	0.972	0.981
11	2004	0.973	0.984	0.983	0.980	0.961	0.960	0.980
12	2005	0.970	0.983	0.980	0.982	0.973	0.968	0.974
13	2006	0.963	0.986	0.982	0.973	0.977	0.959	0.980
14	2007	0.971	0.983	0.979	0.979	0.974	0.969	0.986
15	2008	0.977	0.984	0.980	0.975	0.974	0.973	0.984
16	2009	0.984	0.980	0.981	0.981	0.972	0.967	0.983
17	2010	0.984	0.979	0.977	0.980	0.979	0.976	0.978
18	2011	0.985	0.979	0.975	0.979	0.974	0.974	0.980
19	2012	0.985	0.980	0.979	0.977	0.979	0.982	0.978
20	2013	0.985	0.977	0.983	0.978	0.975	0.981	0.984
21	2014	0.985	0.977	0.979	0.976	0.982	0.985	0.982
22	2015	0.979	0.979	0.982	0.981	0.985	0.984	0.981
23	2016	0.979	0.978	0.980	0.984	0.986	0.984	0.980
24	2017	0.980	0.977	0.980	0.981	0.985	0.985	0.981
25	2018	0.979	0.979	0.977	0.981	0.983	0.982	0.970

Table 9 shows the Relative Specialization Index of top seven countries in world Disaster Management research output during 1994-2018. It depicts the year-wise participation of top seven countries on disaster analysis.

China: It has the highest relative specialization index score of 0.985 in the years 2011-2014. The next score 0.984 is secured by two years 2009 and 2010. The least score of RSI in the years 1997 with 0.687, 1994 with 0.708, 1996 with 0.854 and 1995 with

0.835. Most of the years 1998-2018 (21 years) are having the RSI score above 0.920 and remaining four years are having the score below 0.90

USA: The score of relative specialization index is above 0.975 for overall 25- years. It is 0.977 in the years 1994, 2013, 201 and 2017 which is the least RSI of USA. It increases to 0.978 in 2016 and again raises to 0.979 in four years are 2010, 2911, 2015 and 2018. The highest RSI score is in the year 1997 with 0.989.

Japan: Overall the span of 25-years, it has more ups and downs in the relative specialization index score. The least possible number of scores is in the year 1994 with 0.95, 1999 with 0.964, 1996 with 0.972 and 2011 with 0.975 and peak index score in the year 2002 and 2001 with 0.988.

UK: The relative specialization index score of UK also follows a wavering trend. It has its lowest score of 0.969 in 1994 which is tailed by 0.973 in 2016, 0.975 in 2009, 0.976 in 2003, 0.977 in 2004and 0.978 in 1998 and 2013. The same score 0.980 in the years1995, 2005, 2012 and 2015. The highest activity index score is in the years 2018 with 0.991, 2007 with 0.989. The scores between 0.960- 0.991 is secured by overall 25 years. Comprehensively contribution of UK is more than other countries.

India: In the year 1994, India has scored -1 relative specialization index and raises to 0.926 in 1999, 0.927 in 1996, 0.958 in 1995 and 0.961 in 1998. The relative specialization index of years 2016, 2017, 2015, 2018 and 2014 is 0.986, 0.985, 0.983 and 0.983 respectively.

Australia: The relative specialization index score is highest in the year itself with the score 0.986 and the least score of 0.950 in the year 1998. The relative specialization index score is same for two years 1999 and 2009 with 0.967, 1996 and 2005 with 0.968, 2000 and 2011 with 0.974, 1995 and 2010 with 0.976, 1997 and 2013 with 0.981, 2012 and 2018 with 0.982 and finally 2015 and 2016 with 0.984.

Germany: The relative specialization index score is extreme in the year 2001 with 0.993, which is followed by the years 1999 with 0.990, 2007 with 0.986 and 2013 with 0.984. The lowest score of Germany is 0.934 in the year 1995, 0.937 in 1994 and 0.941 in the year 1996. This country also follows a fluctuating trend in scores of relative specialization index.

The study found that overall activity index and relative specialization index of top seven countries. Activity index for the overall period reveals that the countries like China, USA, and Japan are actively participating in the disaster research activity and the research efforts made by them are higher than the world average. Relative specialization index calculated for the top seven countries for the overall period is not equal to the world average.

6. Major Findings, Suggestions and Conclusion

The present study reveals the research efforts, eminence and collaborative pattern of most productive countries in the field of disaster management search output from 24900 records published during the years 1994-2018 which is indexed in Scopus database. It was identified that the total output of Disaster Management research was increased throughout the year The significant of literature was increased over a period of 25 years. 2018 is the most productive year (2750, 11.04%) followed by the years 2017 (2306, 9.26%) and 2016 (2296, 9.22%). The output was the lowest during commencement years, average during the middle period and the utmost during the last few years. Chinese Academy of Sciences is the leading publisher in with 487 (1.96%) publications tracked by Ministry of Education China with 379 (1.52%) publications. It implies that more association among the institutions was seen. It also facilitates that the institutions can concentrate more in publishing records on Disaster Management research. Predominantly Beijing University of China has collaborated intra – organizationally fairly than inter- organizational. Hence China has produced 19.88% of world literature in the research area over the study period. Funding agencies of China has contributed more funds for research works, National Natural Science Foundation of China is the leading publisher in Disaster Management research with 825 (3.31%) publications which has been published through project fund. A total of 26740 publications were contributed by 37 countries. Among the countries, the most productive countries is China with 5317 records (19.88%), United States with 5194 records (19.42%), Japan with 2394 records (8.95%), United Kingdom with 1509 records (5.64%), India with 1275 records (4.77%), Australia with 1107 (4.14%) and Germany 1019(3.81%). In country wise output of past 25 years study period finalized that disaster might be the major research frontage of China. The source type preferred by the contributors to make their publications to the community is articles in journals with 14752 (59.24%) documents tracked by conference proceedings with 7225

(29.14%) documents. After 2007, china had a good beginning of research in this field and had more productivity with5317 records which are followed by USA with 5168 records. India has attained the 5th position in production with 1274 records. China has co-authored with 925 countries and very secure association with the countries USA and Japan to produced 233 and 98 documents respectively. USA has created 155 documents with the collaboration of UK and 111 documents with Japan. Japan has greatly collaborated with USA followed by china and produced 98 documents. India had extremely collaborated with USA and produced 66 documents. The study established that Activity index for the overall period reveals that the countries like China, USA, and Japan are actively participating in the disaster research activity and the research efforts made by them are superior to the world average. Relative specialization index computed for the top seven countries is not equal to the world average for any country.

The occurrence of disaster threatens public about their basic needs and socio-economic situation of the country. Lacks of awareness about disaster and unplanned government legislations and laws, not utilizing the innovative information and communication technologies to convey messages about disaster and alert people to be safe and secure are the drawbacks in the under developed and developing countries. Special funds may be given by world organizations like UNO and WHO to establish special   open access consortium for disseminating information about disaster management among developing countries. Funding organizations in India should give importance to disseminate the field disaster management for future research. The publications of disaster management may be made accessible through online platform that can be used by all the researchers on free of cost. The study recommends the researchers should focus to issue their production in other forms like peer-reviewed journals, books, editorials etc., with high impact factor which assist them to accomplish more number of people. This study mainly concerned with collaborative index, further researchers can compare the productivity with more citations, high impact factor journals, more publishing institutions and soo many other factors to enhance the research field of disaster management.

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