

A Scientometric Measures In Cloud Computing : A Special Reference to Authors' Productivity

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ABSTRACT

The computer science department developing and uprising as thrill grips the world about connecting Networks and communications from different places of the world. In this Study we have Made an Attempt to measure the research output through Scientometric analysis of Cloud computing to understands the trends of research in terms of H-Index, Collaborative pattern and Citations.

Keywords: Cloud computing, Scientometrics, H-Index, Authorship pattern, Citation Analysis

INTRODUCTION

This study deals with the scientometric analysis of web of science core collection database in the area of "cloud computing" research output during the period 1989-2013. 'Scientometrics' is the branch science of science that describes the output traits in terms of organizational research structure, resource inputs and outputs, develops benchmarks to evaluate the quality of information output. Scientometric research publications are a quantitative measure for the basic research activity in the particular area of the study.

This type of web-based computing frees you from the tyranny of desktop computing and opens up new forms of group collaboration. But as attractive as all that sounds, cloud computing isn't for everyone. Let's take a look at how the average end user can benefit from cloud computing—and why some end users should avoid these web-based applications, at least for now.

Cloud computing is an umbrella term used to refer to Internet based development and services. The cloud is a metaphor for the Internet. A number of characteristics define cloud data, applications services and infrastructure.

OBJECTIVES

This study deals the world research output in the field of Cloud computing during the period 1989-2013. This analyses, included authors productivity, h-index, collaborative pattern, highly cited papers and year wise growth of the Cloud computing research output.

METHODOLOGY

Data was collected from the Web of Science (WoS) core collection. The WoS is the search platform provided by Thomson Reuters (The former Thomson Scientific emerged from the Institute for Scientific Information (ISI) in Philadelphia). SCI database is one of the very comprehensive databases covering all aspects of science. The search string “Cloud computing” in the “Basic search” field for the years 1989-2013 to downloaded. The records on the subjects ‘Cloud computing, a total of 5543 records were downloaded and analyzed by using the web of science website application and HistCite Software as per the objectives of the study.

DATA ANALYSIS And DISCUSSION

Table: 1 Research Output, h-index of Top 10 Productive Authors of The world in Cloud Computing

Sl.No	Author	Recs.	Institution	TLCS	TGCS	h-index
1	Buyya R	40	University of Melbourne, Australia.	294	912	12
2	Yang P	40	The University of UTAH, USA.	221	1494	21
3	Liou KN	35	The University of UTAH, USA	290	2326	18
4	Li J	26	University of Victoria, Canada	50	366	8
5	Barker HW	24	NASA, Langley Research Centre, USA	164	917	15
6	Chen JJ	23	University of Technology, Sydney, Australia	34	121	7
7	Flower DR	22	University of Durham, England	67	1136	17
8	Baum BA	21	NASA, Langley Research Centre, USA	80	610	14
9	Hu YX	21	University Of Alaska	124	859	15
10	Minnis P	21	NASA, Langley Research Centre, USA	99	1194	15

Note: Recs.-Records *TLCS- Total Local Citation Score TGCS- Total Global Citation Scores

Table 1 reflects the contribution of top ten authors who contributed for the Cloud Computing in The world. Buyya R considered being the most productive author in Australia in the field of Cloud Computing as he tops total records, TLCS, TGCS as well as H-index number of publications Yang P stands at 2nd and 3rd rank followed by Liou. This analysis reflects just highest number of publications won't give much credit to the authors if it is not having quality which reflected with H-index.

Table:2 Authorship pattern of contributors

Year	Single	Double	Three	Four	Five	Six	Seven	Eight	Nine	Ten	Above 10	TOTAL
1989	1	1	0	0	1	0	0	0	0	0	0	3
1990	2	0	3	0	1	0	0	0	0	0	0	6
1991	16	32	17	8	5	3	2	1	0	0	0	84
1992	17	28	21	9	2	4	1	0	0	0	0	82
1993	14	36	18	13	7	4	5	0	0	1	0	98
1994	16	34	22	13	3	7	0	1	0	1	0	97
1995	19	39	25	17	6	1	0	0	1	0	2	110
1996	23	32	32	16	3	6	1	0	0	1	3	117
1997	15	40	22	23	8	3	7	1	1	0	1	121
1998	14	43	28	30	17	3	3	1	0	1	1	141
1999	11	34	25	21	16	8	4	2	2	0	1	124
2000	5	31	34	23	5	5	8	3	1	0	5	120
2001	17	31	28	23	12	6	4	2	1	1	1	126
2002	14	33	29	15	9	5	2	3	2	1	6	119
2003	11	44	31	26	9	10	2	1	2	1	2	139
2004	14	33	38	22	17	13	6	0	1	2	2	148
2005	11	50	36	27	16	6	7	8	0	1	5	167
2006	17	35	39	25	15	4	2	4	0	1	3	145
2007	13	38	46	31	14	9	9	4	2	0	7	173
2008	15	45	44	38	23	11	2	5	4	2	2	191
2009	48	57	54	41	21	16	9	6	7	3	8	270
2010	51	74	91	63	37	20	11	8	2	6	12	375
2011	72	124	146	104	77	18	15	9	8	8	17	598
2012	86	161	191	146	103	57	20	17	9	6	14	810
2013	89	219	278	235	155	93	45	14	13	6	32	1179
Total	611	1294	1298	969	582	312	165	90	56	42	124	5543

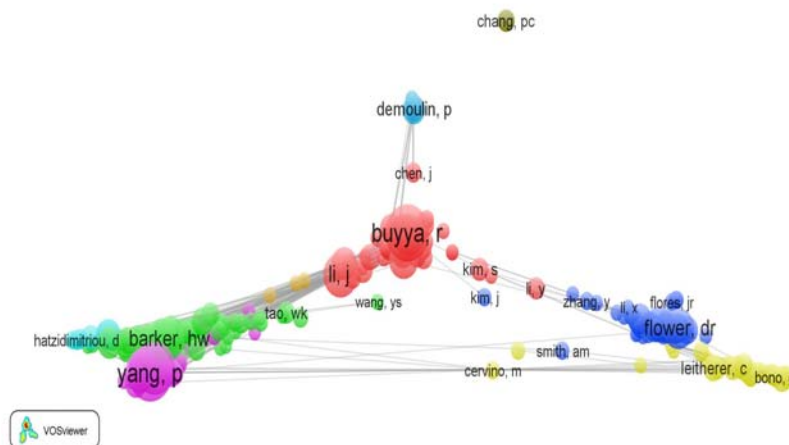
**Fig:1, Shows contribution of Authors**

Table 2 and Fig: 1, Reflects the collaborative pattern of authors involved in Cloud Computing in the world. Treble authors contribution stands top of the list followed by two, four and single authors. Contribution of three authors is 1298 papers which is 23.42 % Of the total records. The table shows that more than 60 percent of the contribution came from double, three and four authors which is really a positive aspect in collaboration

Table: 3 Single Vs Multi Author Collaboration of Research output

S.No	Single Author	Multi Authors	Total	Degree of Collaboration	Total	Degree of Collaboration
	No. of Output	%	No. of Output	%		
1989	1	0.16	2	0.04	3	0.67
1990	2	0.33	4	0.08	6	0.67
1991	16	2.62	68	1.38	84	0.81
1992	17	2.78	65	1.32	82	0.79
1993	14	2.29	84	1.7	98	0.86
1994	16	2.62	81	1.64	97	0.84
1995	19	3.11	91	1.85	110	0.83
1996	23	3.76	94	1.91	117	0.8
1997	15	2.45	106	2.15	121	0.88
1998	14	2.29	127	2.58	141	0.9
1999	11	1.8	113	2.29	124	0.91
2000	5	0.82	115	2.33	120	0.96
2001	17	2.78	109	2.21	126	0.87
2002	14	2.29	105	2.13	119	0.88
2003	11	1.8	128	2.6	139	0.92
2004	14	2.29	134	2.72	148	0.91
2005	11	1.8	156	3.16	167	0.93
2006	17	2.78	128	2.6	145	0.88
2007	13	2.13	160	3.24	173	0.92
2008	15	2.45	176	3.57	191	0.92
2009	48	7.86	222	4.5	270	0.82
2010	51	8.35	324	6.57	375	0.86
2011	72	11.8	526	10.7	598	0.88
2012	86	14.1	724	14.7	810	0.89
2013	89	14.6	1090	22.1	1179	0.92
Total	611	100	4932	100	5543	21.53(0.86)

A study of data from the above **Table 3** indicates the degree of collaboration in research output of Cloud Computing. The degree of collaboration is 0.86 during the study period 1989 to 2013. i.e., out of the total 5543 literature published 4932 are from multiple authors which 88.98 percent is of total output and 611 papers are published by single author which is 11.02 percent of total output. In case of collaboration co efficiency the year 2000 stands ahead of all with 96 percent.

It could be seen clearly from the above discussion that the degree of collaboration in producing research output on Green computing research has shown in fluctuation trend during the study period; because the researcher has identified the selection area of Cloud Computing is a new discipline. Based on this study, the result of the degree of collaboration $C = 0.86$ i.e., 86 percent of collaborative authors' articles published during the study periods.

Table: 4 Top 5 Most cited Papers

S.No	Author	Title	LCS	LCS/t	LCSx	GCS	GCS/t	NA	LCR	CR
1	Buyya R, Yeo CS, Venugopal S, Broberg J, Brandic I Future Generation Computer Systems-The International Journal of Grid Computing and E-science. 2009 Jun; 25 (6): 599-616	Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility	190	38.00	166	358	71.60	5	0	55
2	Armbrust M, Fox A, Griffith R, Joseph AD, Katz R, et al. Communications of the acm. 2010 apr; 53 (4): 50-58	A View of Cloud Computing	143	35.75	142	655	163.75	11	0	17
3	Vaquero LM, Rodero-Merino L, Caceres J & et.al, Acm sigcomm computer communication review. 2009 jan; 39 (1): 50-55	A Break in the Clouds: Towards a Cloud Definition	73	14.60	70	212	42.40	4	0	28
4	Sotomayor B, Montero RS, Llorente IM, Foster I IEEE Internet Computing. 2009 sep-Oct; 13 (5): 14-22	Virtual Infrastructure Management in Private and Hybrid Clouds	54	10.80	52	151	30.20	4	0	12
5	FU Q, LIOU KN Parameterization of the radiative properties of cirrus clouds 1993 jul 1; 50 (13): 2008-2025	Journal of the Atmospheric Sciences.	46	2.19	36	449	21.38	2	2	36

Highly Cited papers (Top 5)

Table 4 indicates ranking of papers by number of Total Citation Scores and average number of citations received per year. The paper "Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility "Buyya R, Yeo CS, Venugopal S, Broberg J, Brandic I top in total citation score as it received 358 total citations and average it received 38.0 citations per year.

Table 5: Shows the Top 10 Institution wise Distribution of Records

Sl. No	Institution	Recs.	Percent (%)	TLCS	TGCS
1	NASA	304	5.5	494	12396
2	Unknown	107	1.9	135	551
3	CALTECH	97	1.7	68	3113
4	NOAA	92	1.7	91	3018
5	Observ Paris	86	1.6	144	3023
6	Chinese Academy of Science	80	1.4	45	948
7	University of Maryland	80	1.4	155	2798
8	University of Wisconsin	80	1.4	117	2421
9	CNRS	75	1.4	80	5908
10	Colorado State University	64	1.2	123	2071

Note: *TLCS- Total Local Citation Score TGCS- Total Global Citation Scores

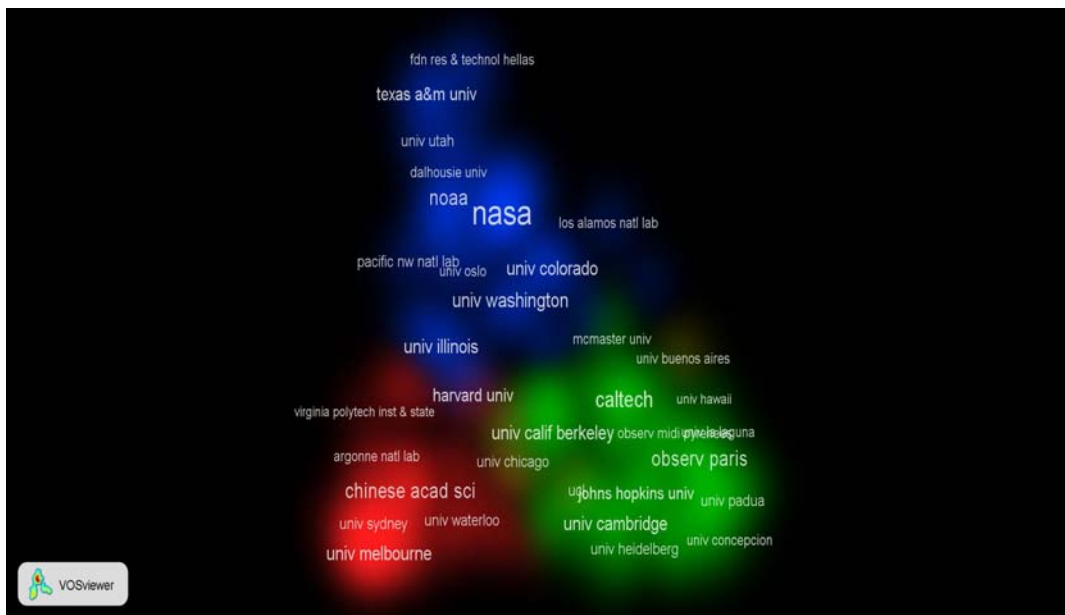
**Figure: 2 Bibliographic Coupling of Institutions**

Table 5 and fig. 2 shows the Institution wise distribution of records, whereas the NASA contributes first place total 304 records, 494 local citations and 12396 global citation scores followed by Unknown second place, it contributes 107 records 135 TLCS and 551 TGCS .

FINDINGS AND SUGGESTIONS

- There is no much variation in the early output up to 2005 but from 2006 onwards there is significant development in the research output of Cloud Computing but as compare to the global output the world still need to improve research performance in Cloud Computing as it is the mega Cloud Computing nation.
- Contribution of multiple authors is dominating with major contribution of double and three authors; so there is a need of promoting further collaboration in the field of Cloud Computing research in the world.

CONCLUSION

Cloud Computing research in the world has shown the importance of understanding the Cloud Computing for the sustainable development. Though the study started in recent decade but there is really a optimistic growth in the research. Most of the nations are very enthusiastic to take research in the field of Cloud Computing as it is the real asset of the mankind and the world is not exception for it but as compare to the world Cloud Computing still we need to improve the research performance in a way to protect our Cloud Computing.

REFERENCES

1. Dr.N. Amsaveni., M.Manjula.,& M.Manikandan.(2013),”Web Links for Assessment of Library Websites.”,International Journal of Scientific Research,Vol .2(11) pp.(16-18). ISSN No.2277-8179.
2. Dr.N.Amsaveni ,& M.Manjula. (2014), “Application of Statistical models to the collaborative publications in Bioinformatics,” International Journal of Computer Science and mobile computing. Vol.3(2).pp.(606-616). ISSN 2320-088X.
3. Dr.N.Amsaveni, M.Manikandan, & M.Manjula. (2013). Authorship patternand collaborative research in Bioinformatics.” International Journal of Computer Science and mobile computing,Vol.2(11).pp(230-238). ISSN 2320-088X.
4. Bhattacharya, S., & Nath, P. (2002). Using patent statistics as a measure of “technologies assertiveness”? A China-India comparison. Current Science. 83(1). 23–29.
5. Savanur, K., & Srikanth. R. (2010). Modified collaborative coefficient: A new measure for quantifying the degree of research collaboration. Scientometrics, 84, 365–371.
6. <http://www.ukoln.ac.uk/cultural-heritage/documents/briefing-47/html/>
7. Sachin Gupta (M.Tech student) "Cloud Computing : Delivery of Computing As A Service" International Journal of Computing and Business Research (IJCBR) Volume 3 Issue 1 January 2012. ISSN (Online) : 2229-6166.

