

# Productivity of “Cloud Computing” documents during 2009–2016 - A Study with Special Reference to SCOPUS

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## ABSTRACT

Cloud computing is new breed of service offered over the Internet, which has completely changed the way one can use the power of computers irrespective of geographic location. It has brought in new avenues for organizations and businesses to offer services using hardware, software, or platform by third-party sources, thus saving on cost and maintenance. In this regard, the Scopus is a premier research platform, helping to find, analyze, and share information in the sciences, social sciences, arts, and humanities. The present paper discusses the term “Cloud Computing” as reflected in SCOPUS for the period during 2009 to 2016. The present paper investigates the highly productive authors, Document Types, it aims to find out the top contributing institutions, most prolific authors, the preferred sources for publications by Geographical distribution by country, Subject area, Source Type, Affiliation, and Language etc. The result indicates that there are 11251 documents on Cloud Computing during 2009 to 2016. India's contribution to Cloud Computing is 1465 documents during 2009 to 2016, which is on the third rank.

**Keywords :** Scopus, Cloud Computing, Literature Analysis

## I. INTRODUCTION

The concept of cloud computing is dates back to 1960 when John McCarthy opined that “computation may someday be organized as a public utility”. The term ‘cloud computing’ is confusing to many people as the term can be used to mean almost anything. ‘Cloud’ is used as a metaphor for Internet and its main objective is customization and user defined experience. In other words cloud computing provides shared resources, software and information through Internet as a PAYGO (Pay-as-you-go) basis Mathew Saju (2012). The information being accessed is found in “the cloud” and does not require a user to be in a specific place to gain access to it. This type of system

allows employees to work remotely. Companies providing cloud services enable users to store files and applications on remote servers and then access all the data via the internet. Therefore, considering the importance of Cloud Computing, the authors have undertaken the study.

## II. Conceptual Analysis

### 2.1 Scopus

Scopus launched in November 2004. It is the largest abstract and citation database of peer-reviewed literature, featuring smart tools to track, analyze and visualize research. With over 21,500 titles from more than 5,000 international publishers, Scopus delivers

the most comprehensive overview of the world's research output in the fields of science, technology, medicine, social science and arts and humanities.

## 2.2 Cloud Computing

Cloud computing is a method for delivering information technology (IT) services in which resources are retrieved from the Internet through web-based tools and applications, as opposed to a direct connection to a server. Rather than keeping files on a proprietary hard drive or local storage device, cloud-based storage makes it possible to save them to a remote database. As long as an electronic device has access to the web, it has access to the data and the software programs to run it. It's called cloud computing.

(<http://www.investopedia.com/terms/c/cloud-computing.asp>)

## III. Objectives of Study

- 3.1 To Study the document types and number of documents in which Cloud Computing have been used.
- 3.2 To find out highly productive authors on Cloud Computing.
- 3.3 To classify documents published by country on Cloud Computing.
- 3.4 To identify documents on Cloud Computing by Subject & Year wise.
- 3.5 To know highly preferred Sources by the Scientists for writing research papers on the Cloud Computing.

## IV. Scope & Limitation of Study

The author wants to know the research productivity on "Cloud Computing" hence; the present Study is limited to search results on the Title of documents on 'Cloud Computing' in SCOPUS database during 2009 to 2016.

## V. Methods and Materials

The growth of publications on the Cloud Computing was derived from the SCOPUS during the period 2009–2016, the total 11251 number of documents were found by the title 'Cloud Computing'. Necessary data has been tabulated into separate sheets in terms of authorship pattern, geographical distribution of contributors, ranking list of Sources and collaborative measures, etc. The Present study adopted the search strategy for 'Cloud Computing' documents in Scopus database like Title ( "*cloud computing*" ) and ( limit-to ( pubyear , 2016 ) or limit-to ( pubyear , 2015 ) or limit-to ( pubyear , 2014 ) or limit-to ( pubyear , 2013 ) or limit-to ( pubyear , 2012 ) or limit-to ( pubyear , 2011 ) or limit-to ( pubyear , 2010 ) or limit-to ( pubyear , 2009 ) ).

## VI. Review of Related Literature

Beegam T Vahida (2015) focused on literature analysis of cloud computing in LIS field in Emerald Insight during the period of 2009–2014. This paper covers mainly authorship pattern, chronological-wise and geographical-wise distribution of articles/publications, type of references and number of references cited in the contribution of the journals and prolific contributions of the journal. The results showed that a number of articles increasing from year to year and the most prolific journal was Library Hi Tech News during the period under study.

Gupta B. M., Singh Neeraj Kumar & Gupta Ritu (2015) examines 21397 global publications in cloud computing research, as covered in Scopus database during 2004–13. The annual average growth rate is 96.77%. The global cloud computing research output comes from several countries, of which the top 15 most productive accounts for 90.07% share of the global output. The largest share of output (24.12% and 21.96%) came from China and USA, followed by Germany, India, UK, Taiwan, Australia, Italy, Japan,

etc. Austria registered highest share (49.83%) of international collaborative papers among the top 15 countries in cloud computing during 2004–13, Computer science contributed the largest share (79.06%) during 2004–13, followed by engineering (21.20%), mathematics (15.47%), social sciences (4.79%), etc. The top 25 organizations and 20 authors contributed 16.16% and 3.87% share to the global output during 2004–13. Conference proceedings (62.92%) and journals (22.05%) contributed the largest share to global output during 2004–13. The top 20 journals contributed 21.81% share to its total journal output during 2004–13. Only 71 publications (out of total global publications) have registered 100 or more citations since their publication till June 2014 registering an citation impact per paper of 216.68 during 2004–13.

Kale Vilas A., Deshmukh Rahul & Khiste Gajanan (2017) discusses the “Consortia” as reflected in Web of Science for the period from 1989–2016. This study investigates the highly productive authors, Document Type wise, Country wise, Language wise, Publication year wise, Research area wise, Source Title or Journal wise.

Khiste G.P. (2017) discusses the “Consortia” as reflected in Scopus for the period from 1989–2016. This study investigates the highly productive authors, Document Type wise, Country wise, Language wise, Publication year wise, Research area wise, Source Title or Journal wise, etc.

Muthu M (2016) mainly highlighted for history, what is cloud computing?, why cloud computing?, characteristics features, types, deployment models components, six attributes, seven ways to get started with cloud computing, properties, initiatives, applications in libraries, beyond library discovery services, service providers of cloud computing for libraries, role, advantages, disadvantages, benefits issues of cloud computing, standardization, research trends, cloud computing in India, examples of cloud libraries, cloud computing is the wave of the future.

Sinha Abhijeet (2016) Cloud Computing (CC) is gaining popularity in many industries as well as in the libraries and this continues to be adopted in its various forms. This article describes the conceptual framework of CC with respect to its definition, characteristics, services and deployment models along with security issues and so on. It further explores that how libraries can be benefitted using these technologies. Many existing library-based operations and services that are already offered through cloud infrastructure have been discussed. Some of the risks and crucial security issues with respect to protection of data have been delved upon with measures to overcome them.

Nagarkar Shubhada, Veer Chaitanya & Kumbhar Rajendra (2015) analyzed research productivity of life sciences faculty members at the Savitribai Phule Pune University (SPPU), Maharashtra, India. The research conducted with the intention to know the research productivity over 15 years (1999–2013), the citations received collaborations, and authorship patterns. Web of Science (WoS) database was used for the bibliographic and citation data. Data were analysed by using bibliometric techniques and software such as HistCite, Intcoll, and Pajek. Results show that the research productivity of faculty members is increasing, their publications are getting good citations and thereby their journals have better Impact Factor. The faculty members have collaborated with prominent international researchers and have extended interdisciplinary research.

Veer D.K. & Khiste Gajanan P. (2017) Indian Citation Index (ICI) database is an effective search product that let you search, track, measure and collaborates in the sciences, social sciences, arts, and humanities to turn raw data/information into the Information as per need. The present paper discussed the published documents and its citation from Agricultural Universities in Maharashtra during the period from 2004 to 2016.

Veer D.K. & KhisteGajanan P. (2017) discussed the “Digital Library” as reflected in Scopus for the period from 1995–2016. The present paper investigates the highly productive authors, document Types, the present study also aims to find out the top contributing Indian institutions, most prolific authors, the preferred sources for publications by Geographical distribution by country, Subject area, Source Type, Affiliation, and Language etc. The results indicate that there were total 18854 documents on digital library during 1995 to 2016. The main institutes contributing to Digital Library

are Virginia Polytechnic Institute and State University. Fox, E.A. is the most productive author in terms of publications. At the international front, India’s contribution to Digital Library is 578 documents during 1995 to 2016, which is rank on Seventh.

**Type of Documents:** Author wants to know how many documents are being published on the term “Cloud Computing”. The data were compiled accordingly and presented in Table No. 1.

**Table No. 1.**Types of Documents available on Cloud Computing

Sr. No.	Document Types	No. of Documents	Cumulative frequency	Percentage	Cumulative Percentage
1	Conference Paper	6804	6804	60.48	60.47
2	Article	3348	10152	29.76	90.23
3	Book Chapter	463	10615	4.12	94.34
4	Editorial	177	10792	1.57	95.92
5	Review	167	10959	1.49	97.40
6	Conference Review	146	11105	1.3	98.70
7	Book	59	11164	0.52	99.23
8	Article in Press	33	11197	0.29	99.52
9	Note	26	11223	0.23	99.75
10	Short Survey	19	11242	0.17	99.92
11	Letter	5	11247	0.04	99.96
12	Erratum	3	11250	0.03	99.99
13	Retracted	1	11251	0	100
	<b>Total=</b>	<b>11251</b>	<b>11251</b>	<b>100</b>	

Table No.1 indicates that there are 13 different types of documents however the maximum number of documents published under the category of Conference Paper is 6804 (60.48%), whereas 3348 (29.76%) under the category Article. There are 463 (4.12%) Book Chapter and the Editorial are 177 (1.57%). A small number of contributions are categorized under Retracted i.e. 1.

## VII. Productive Authors

The author has analysed the data related to productive authors and it is presented in Table 2.

**Table No. 2.**Top 5 Authors who wrote highest documents on the term Cloud Computing

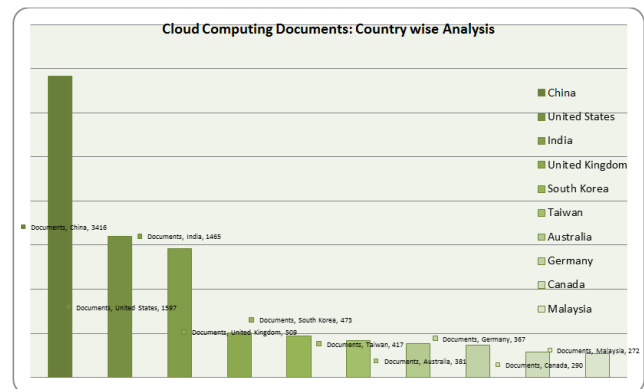
Sr. No.	Author Name	No. of Documents	Rank
1	Buyya, R.	64	1
2	Huh, E.N.	37	2
3	Gani, A.	34	3
4	Jin, H.	25	4
5	Vasilakos, A.V.	24	5

Table No. 2 depicts highly top five productive authors. It is observed that Buyya, R. ranks first who has contributed a maximum number of 64 documents, followed by Huh, E.N. with 37 documents and Vasilakos, A.V. is on 5<sup>th</sup> Rank by 24 documents. However, Graph No.1 shows a number of documents written by authors on cloud

The data related to Cloud Computing literature has been analyzed by top ten countries and presented it in the Table No.3.

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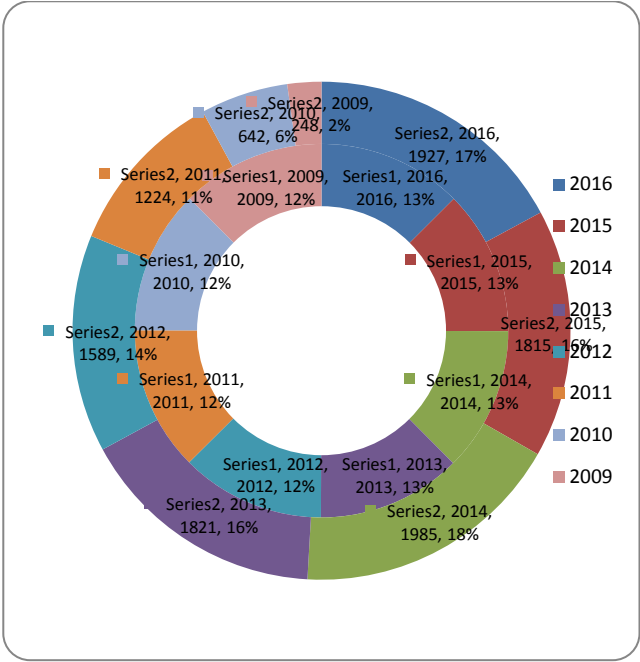
Sr. No.	Country	Documents
1	China	3416
2	United States	1597
3	India	1465
4	United Kingdom	509
5	South Korea	473
6	Taiwan	417
7	Australia	381
8	Germany	367
9	Canada	290
10	Malaysia	272



5	5	5	5	5	5
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Sr. No.	Publication Year	Documents	Cumulative frequency	Percentage	Cumulative Percentage
1	2016	1927	1927	17.13	17.13
2	2015	1815	3742	16.13	33.26
3	2014	1985	5727	17.64	50.90
4	2013	1821	7548	16.19	67.09
5	2012	1589	9137	14.12	81.21
6	2011	1224	10361	10.88	92.09
7	2010	642	11003	5.71	97.80
8	2009	248	11251	2.2	100
9	<b>Total</b>	<b>11251</b>		<b>100</b>	

**Graph 3.** Year wise documents published on Cloud Computing



**ix. Subject wise Analysis**

The author has analysed the compiled data by 26 different types of subjects and presented it in Table 5.

**Table No.5**

Analysis of Cloud Computing by Subject

Sr. no.	Subject	Documents	Cumulative Frequency
1	Agricultural and Biological Sciences	55	55
2	Arts and Humanities	38	93
3	Biochemistry, Genetics and Molecular Biology	137	230
4	Business, Management and Accounting	518	748
5	Chemical Engineering	44	792
6	Chemistry	60	852

7	Computer Science	8320	9172
8	Decision Sciences	403	9575
9	Earth and Planetary Sciences	141	9716
10	Economics, Econometrics and Finance	115	9831
11	Energy	147	9978
12	Engineering	3459	13437
13	Environmental Science	130	13567
14	Health Professions	53	13620
15	Immunology and Microbiology	13	13633
16	Materials Science	170	13803
17	Mathematics	1486	15289
18	Medicine	248	15537
19	Multidisciplinary	143	15680
20	Neuroscience	4	15684
21	Nursing	8	15692
22	Pharmacology, Toxicology and Pharmaceutics	66	15758
23	Physics and Astronomy	183	15941
24	Psychology	15	15956
25	Social Sciences	710	16666
26	Veterinary	1	16667

Table No. 5 presents the subject-wise categorization of the documents retrieved. Subject-wise analysis indicates that the maximum number of contributions were in the area of Computer Science i.e. 8320 followed by Engineering with 3459 documents. The documents contribution in the area of Veterinary is less i.e. 1. The Total 11251 of original documents in SCOPUS on Cloud Computing term and whenever from Table No.5 the Subject wise total is 16667 documents are available. The reason for this contradiction may be in by subject wise analysis

many documents overlapping in more than one subject.

## X. Sources of Ranking

The sources are nothing but in which documents the highest number of documents has been published on the term “Cloud Computing”. The related information is being presented in the Table 6.

**Table 6.**Top Ten Ranking Sources

Sr. No.	Ranking Sources	Documents
1	Lecture Notes In Computer Science Including Subseries Lecture Notes In Artificial Intelligence And Lecture Notes In Bioinformatics	392
2	Applied Mechanics And Materials	296
3	Communications in Computer And Information Science	212
4	Advanced Materials Research	187
5	Lecture Notes In Electrical Engineering	150
6	ACM International Conference Proceeding Series	128
7	Advances In Intelligent Systems and Computing	118
8	International Journal of Applied Engineering Research	113
9	Procedia Computer Science	93
10	Journal of Supercomputing	68

Table No. 6 indicates that Top Ten ranking sources in which documents were published. As per Table No.6, Lecture Notes in Computer Science ranks first with 392 documents to its credit, followed by

Applied Mechanics and Materials ranking on second with 296 documents. Journal of Supercomputing is on the Tenth rank with 68 documents.

## XI. Collaborative Platform

Author wants to know how many documents were published on the term “Cloud Computing” and their affiliating institutions. The data is analysed accordingly and presented in Table 7.

**Table 7.**Top Ten Affiliation wise Distribution of Documents

Sr. No.	Institution	Documents
1	Beijing University of Posts and Telecommunications	152
2	Chinese Academy of Sciences	126
3	Tsinghua University	109
4	Wuhan University	88
5	Xidian University	86
6	Huazhong University of Science and Technology	85
7	Ministry of Education China	84
8	Vellore Institute of Technology	82
9	Kyung Hee University	77
10	University of Melbourne	76

Table No. 7 presents the list of top ten Affiliation contributions on the subject Cloud Computing. The institution affiliation from the address field is taken as the data for this categorization. Beijing University of Posts and Telecommunications contributed 152 documents which is the highest while Chinese Academy of Sciences has 126 documents to its credit. University of Melbourne contributed 76 documents.

## XII. Language Wise-Analysis

There are hundreds of languages are there in the world, the data are analysed by language to know the in which highest documents contributed on Cloud Computing in Scopus. The related information indicated by Table No. 8.

**Table No.8.** Documents on Cloud Computing:  
Language wise Analysis

Sr. No.	Language	Documents
1	English	10799
2	Chinese	334
3	German	44
4	Spanish	22
5	Portuguese	21
6	French	15
7	Russian	10
8	Japanese	7
9	Polish	6
10	Persian	5
11	Turkish	5
12	Italian	4
13	Hungarian	2
14	Ukrainian	2
15	Arabic	1
16	Bosnian	1
17	Undefined	1
	<b>Total =</b>	<b>11251</b>

The Table 8 indicates that English is the most preferred language for publication of 10799 documents on Cloud Computing followed by Chinese with 334 documents.

### Types of Sources:

The total 11251 documents on Cloud Computing were published in five different sources which is presented in Table No. 9.

**Table No. 9.** Source Type wise documents in Scopus on Cloud Computing

The Table No.9 shows that the maximum number of documents published in Conference Proceedings i.e. 5486 (48.76%), whereas 3632 (32.28%) under the

Sr. No.	Source Type	Documents	Percentage
1	Conference Proceedings	5486	48.76
2	Journals	3632	32.28
3	Book Series	1537	13.66
4	Books	503	4.47
5	Trade Publications	93	0.83
	<b>Total =</b>	<b>11251</b>	<b>100</b>

category of Journals. While under Book Series 1537 (13.66%), Books 503 (4.47 %) and Trade Publications 93 (0.83).

### Documents by Top 20 Keywords

The Author has studied thoroughly all the documents related to cloud computing in Scopus database. It is observed that Scopus has analysed the documents on Cloud Computing in 160 plus Keywords. The Author has given Top twenty keywords related to Cloud Computing in Table No.10.

**Table 10.**Cloud Computing Documents by Top 20 Keywords

Sr. No.	Keywords	Documents	Rank
1	Cloud Computing	9422	1
2	Distributed Computer Systems	1697	2
3	Computer Systems	1418	3
4	Cloud Computing Environments	907	4
5	Information Technology	756	5
6	Algorithms	738	6
7	Digital Storage	723	7





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