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REJUVENATING LIBRARIES FROM THE CLOUD: A BIBLIOMETRIC ANALYSIS OF CLOUD COMPUTING

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Abstract

Cloud computing is a service through which we access in a remote application server and consume computing services through the internet. This modification of cloud computing has been quite popular since the last decade in enabling computing. Cloud computing plays a key role in the development of Modern Library. Modern libraries are being rejuvenated rapidly through cloud computing. The Bibliometric study of the publication on cloud computing has been done in the research paper presented. Web of Science Core collection database has been used for data collection. Total 11776 articles were retrieved on Cloud Computing through Web of Science database. The retrieved data were inputted in MS Excel sheet and various tables have been made for analysis of data. **R. Buyya** is top author with 138 articles followed by **J. Lee** with 114. In 2018, there were 2667 papers published on computing cloud followed by 2247 in year 2017. As per country wide, China is on top followed by USA. The India is on third position with 997 research papers. The Top Journal is *Future Generation Computer Systems the International Journal of Esience* Followed by *IEEE Access* and *Journal of Supercomputing*.

Keywords: Cloud Computing, Information Storage, ICT, Library, Bibliometrics

INTRODUCTION:

As we all know that we are living in digital environment where Information Technology (IT) has been used extensively to record, store, and disseminate the information in the multiple formats. The IT has almost rejuvenated the world into a global village. The Libraries are also changing to meet the demand put on it. With the emergence of ICT, the libraries are rejuvenating; previously it was on clay tabulate, Tadpatra and Bhojpatra. Rejuvenate means, to bring renewed structure to

something old by giving it new vitality, and rejuvenation is the process of freshening something up or reviving it. Cloud computing, a popular topic in the past few years involves various technologies and provides scalable IT related services over the Internet. **Cloud computing** is the use of various services, such as software development platforms, servers, storage and software, over the internet, often referred to as the "**cloud.**" Emergence of cloud computing technologies has changed the way we store, retrieve, and archive our data. With the promise of unlimited, reliable and always-available storage, a lot of private and confidential data are now stored on different cloud platforms.

Cloud computing is a concept used primarily in computer science, but in the last decade, the term "cloud computing" has always been used in the field of library and information science, as well as in other areas like Business, Industry, Medical Science and Corporate sector etc is also being done the application of cloud computing . As the involvement of the ICT is increasing, cloud computing is being used at a very fast pace, so it has become necessary to Bibliometric studies of publications related to this concept and other related concepts.

BIBLIOMETRIC STUDY:

Bibliometric analysis is used to study the development of literature published by researchers on a topic. According to Alan Pricehard, the term Bibliometrics is defined as the application of statistical and mathematical methods for texts and other communications. Bibliometrics has emerged as an important area of research involving various branches of knowledge. Under the Bibliometrics, we detailed study of the productivity of any literature is done. The Zips Law on frequency of words, Lotka's law of scientific productivity and Bradford's law of scattering are the important applicative laws of Bibliometrics.

LITERATURE REVIEW:

The literature review is an integral part of any research work, through which we explore the previous research work on that topic and prepare the outline of the research that is going on ahead. Through the literature review, we understand the previous trends of research done earlier. The literature review suggested understanding a significant step to get a clear picture for future research.

Siddagangaiah (2017) conducted a Bibliometric Study on Global Research Productivity in Cloud Computing. he found out that the Cloud Computing is an emerging area of Computer Science and after 1990s the subject recorded the scientific literature. The Buyya R of Australia is top author with 3697 citations. Mostly papers are having collaborative research... It is also found that, the productivity of the journal is based on the article used by citing the article.

Chaurasia, Chavan & Verma (2016) presented a bibliometric analysis of world research output on cloud computing. This study covers a large part of cloud computing articles published in

Elsevier's SCOPUS citation database in the last five years (2010- 2014). The 23811 data is obtained and analyzed to get the result. it has been found that the growth rate of literature in the year 2011 is more than double as compared to 2010 gradually it is increasing. It is found that Conference papers (70.60%) and articles (22.21%) contribute more than 92% of the total publications. Further it is seen that China is on first position followed by United States in the research publications, though India is at third position.

Jan, Wani & Hafiz (2015) conducted a Scientometric Analysis of Cloud Computing during 2009-2013 using WoS database. They found that the cumulative publication output of top ten countries and India in the field accounts to 1879 publications. USA is on the top having 626 publications followed by China with 367 publications. Further it is seen that the Publications rate are increasing every year. It increases from 55 publications in 2009 to 803 publications in 2013 witnessing a tremendous growth.

V. Viswanathan and S. Yugapriya (2015) presented a bibliometric analysis of literature on Soft Computing .The period of publication is covered 2005 – 2014. The data for the study has been retrieved from the Scopus database. They studied yearly productivity of literature, authorship pattern, citation pattern, major contributors, countries contributing to the literature, most preferred document of publications, Institution wise distribution. The search string is used to get the data from the database was (TITLE-ABS-KEY ("soft computing") AND PUBYEAR > 2004 AND PUBYEAR < 2015). Total 9919 publications were retrieved from database. They found that 15% contributions are Single authored of the total publications and rest is multi authored. Further it is seen that 3791 cited publications which yielded 26392 citations and 6158 publications are having zero citations.

Haag & Eckhardt (2014) conducted a scientometric study on current status of research on cloud services and their adoption by organizations. They analysed 52 journals and proceedings of the information systems field to identify systematically categorize 36 articles on the topic. It is found that the scarce theoretical and empirical work on organizational cloud service adoption has developed and further it is explored that directly or indirectly drive organizations to adopt or inhibit them from adopting cloud services from different perspectives and dimensions.

(Thirumagal, Sethukumari & Niruba (2013) analyzed the quantum literature Output in the area of cloud computing from 2008-2012 using the Web of Knowledge. The 2207 data were retrieved with the Bibexcel Tool. The study identifies and analyzes the growth rate of scholarly publication, authorship pattern. It also examine the application of Lotka's Law, Creating Label View, Cluster View and finding the Citation map.

M. Surulinathi, R. Balasubramani & Kalisdha (2013) presented a study continent wise analysis of Green Computing Research during 1956-2011 using Web of Science database. It is

observed that the Germany is at first position in the green computing research with 270 (16.24%) articles followed by France and Italy.

Sivakumaren, Swaminathan and Karthikeyan (2012) presented a Scientometric on Growth and Development of Publication on Cloud Computing. They found that 510 records related to Cloud Computing in “Web of Science’ appeared during the periods 2001-2010. It is seen that the author “Buyya.R” and the country “USA” have produced the majority of records.

Sriram & Hosseini (2010) presented a detail review of the work published by the academic community in the field of cloud computing using ACM Digital Library, IEEE Xplore, Springer Link, Science Direct and Google Scholar. They provided an overview of the swiftly developing advances in the technical foundations of cloud computing and their research efforts.

STATEMENT OF PROBLEM:

During literature review it is found that there are several study have been done on the Cloud computing but no comprehensive study has been conducted on bibliometrics on Cloud computing during 2010-2019 using Web of Science core collection, therefore a need was identified to conduct a comprehensive study which covers the growth of literature, Sources of publication, Identification of prolific authors, Institutions, document type and citation analysis etc.

OBJECTIVES:

The objectives of this paper are:

1. To identify and analyze the rate and growth of Cloud Computing research.
2. To know the authorship pattern in the publications of cloud computing.
3. To identify the document type of the publications in Cloud Computing research.
4. To identify the organizations conducting the research in Cloud Computing research.
5. To study the language wise distribution of Cloud Computing research.

SCOPE AND LIMITATION OF THE STUDY:

This study is based on the papers indexed by Web of Science only. Records for this study have been drawn exclusively from Web of Science database which follows its own standards for the inclusion or omission of items or periodicals in its coverage. Literature output, though available in parallel database sources and outside Web of Science database were not included in this measurement exercise. The records were downloaded using appropriate keywords ensuring the download of relevant required data/record output from the Web of Science database.

METHODOLOGY:

The database Web of Science (Core Collection) is used to search exclusively, to identify the productivity of Cloud computing. In Web of Science Core collection database, the search key used: topic “cloud computing”. We retrieved 11776 articles from WoS Core collection database on Cloud Computing. The Bibliometric Indicators such as authorship pattern, citation pattern were analyzed in the study. For analysis and making tables SPSS and Excel software has been used for the study.

DATA ANALYSIS AND INTERPRATATION:

1. YEAR WISE PUBLICATION GROWTH:

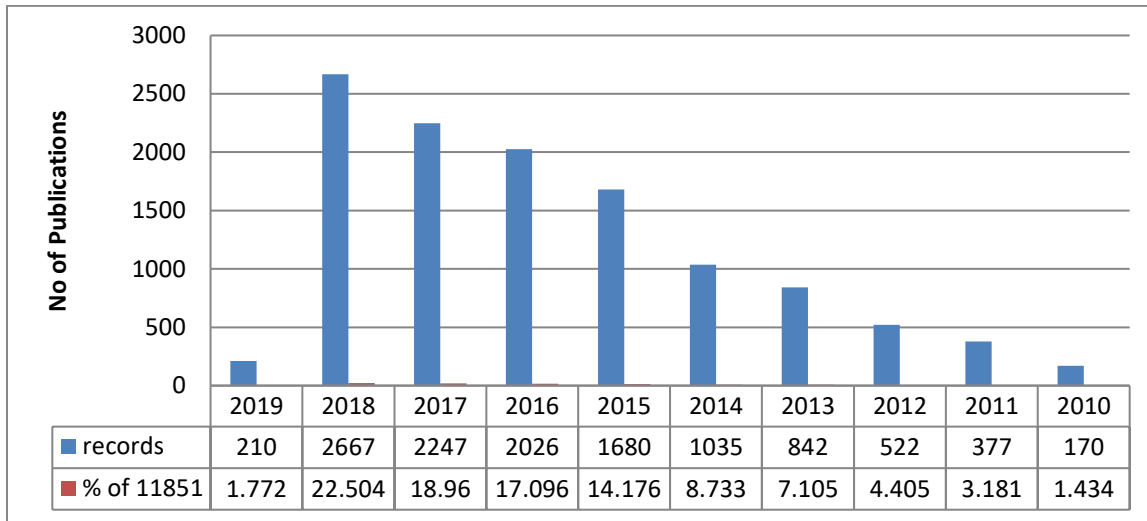


Figure No. 01

Figure No.01 portrays the overall growth of the literature published on cloud computing during 2010-2019. On the basis of analysis, the publication growth was recorded 22.50% in 2018 as compared to 18.96% in 2017. It is seen that 170 articles were published in 2010 whatever 2667 articles were recorded in 2018. Further, It is seen that the publication on Cloud Computing increasing rapidly and the continuous growth of the literature in this field also shows that the publication and research on cloud computing are continually going on.

2. Country Wise Publication Growth

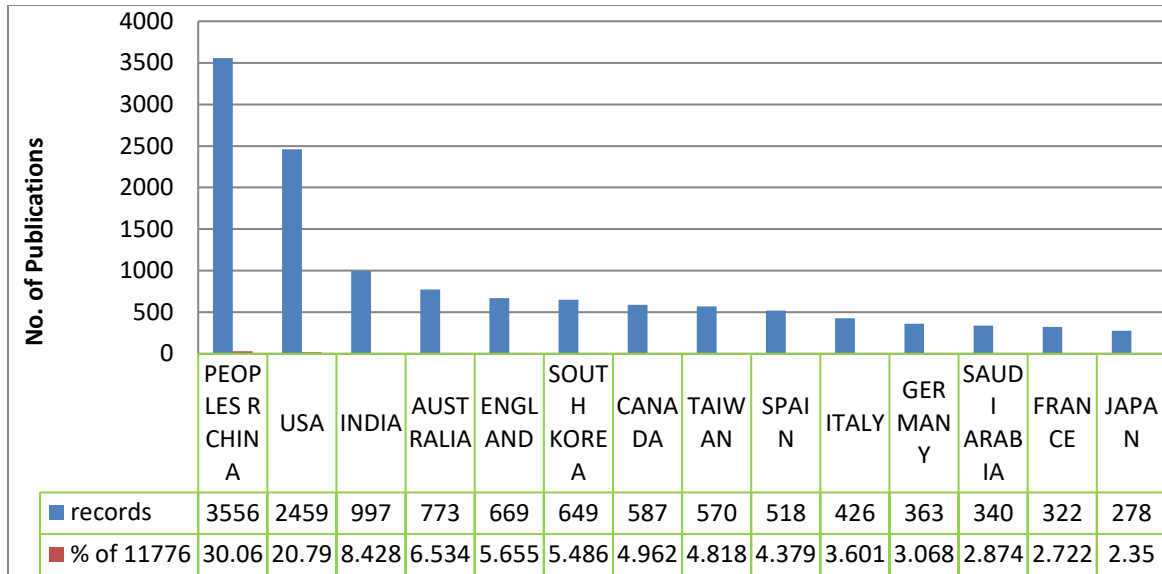


Figure No. 02

Figure No. 02 shows the countries wise research productivity on cloud computing during 2010-2019. It is arranged in the increasing order. It is found that China is the most productive country occupying first position with 3556 (30.06 %) of total publications followed by United States of America with 2459 (20.79 %) publications. India is at third position with 997 (8.42%) publications followed by Australia with 773 (6.53%) publications. Further it is seen that Japan is on 10th position with 278 (2.35%) publications. On the analysis of the above cited figure, it can be said that India may be at third rank in the publication of cloud computing, but it publishes almost two times and four times less literature than China and America, respectively.

3. MOST PROLIFIC AUTHOR:

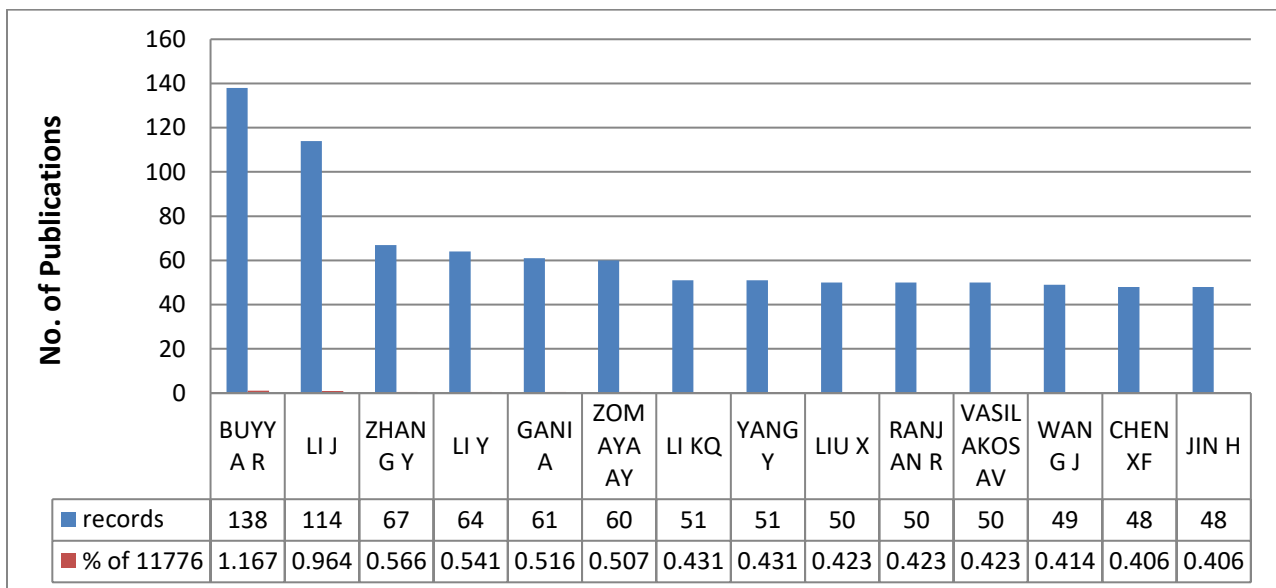


Figure No. 03

Figure no 03 shows that the list of top prolific authors which one published his/her paper on Cloud Computing. It is observed that Buyya, R. is at first position with 138(1.16%) publications followed by Lij with 114 (0.96%) publications. Zhang,Y. and Li,Y are at third and fourth position with 67 (0.56 %) and 64 (0.54 %) publications respectively. Ranjan,R. is at 10th position with 42 publications at world level.

4. DOCUMENT TYPE OF PUBLICATIONS:

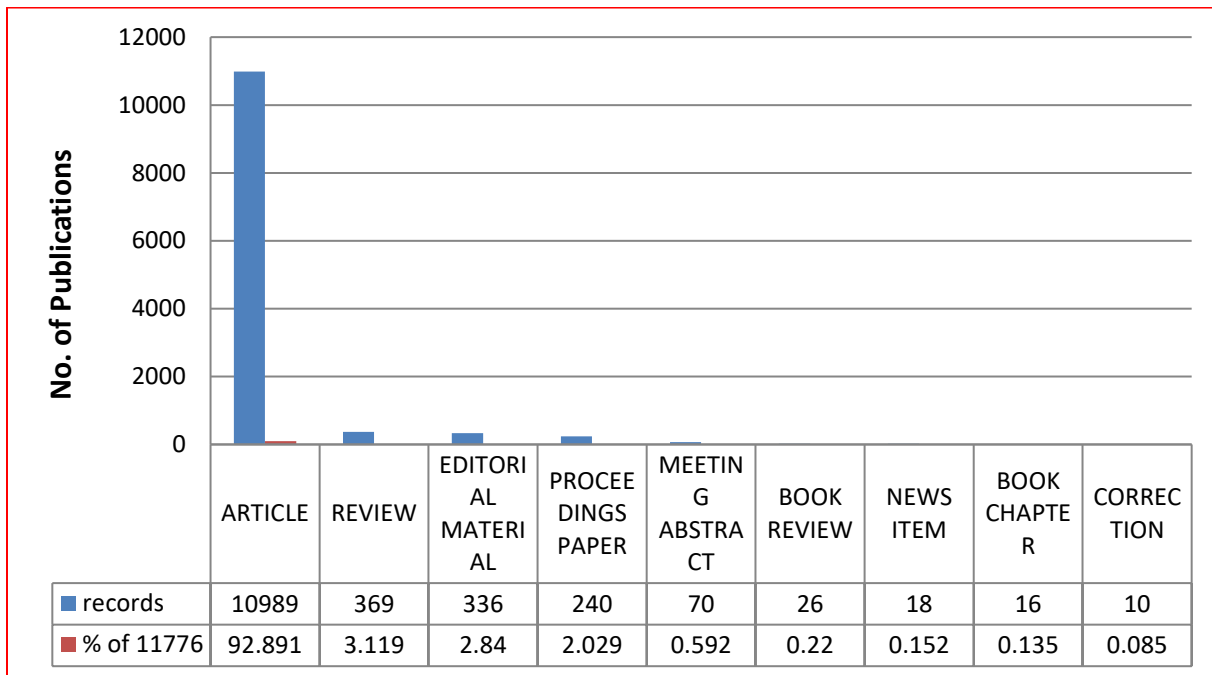


Figure No. 04

Figure 04 shows the documents types of publications which are covering cloud computing and its allied areas during 2010 to 2019. It has been observed that 92.89% publications of the total publications are published in article form whereas 3.11 % and 2.84 % of the total documents are published in Review and editorial Material respectively. It is also found that 16 (0.13%) documents are published in chapter in Book form.

5. LANGUAGE WISE PUBLICATION GROWTH:

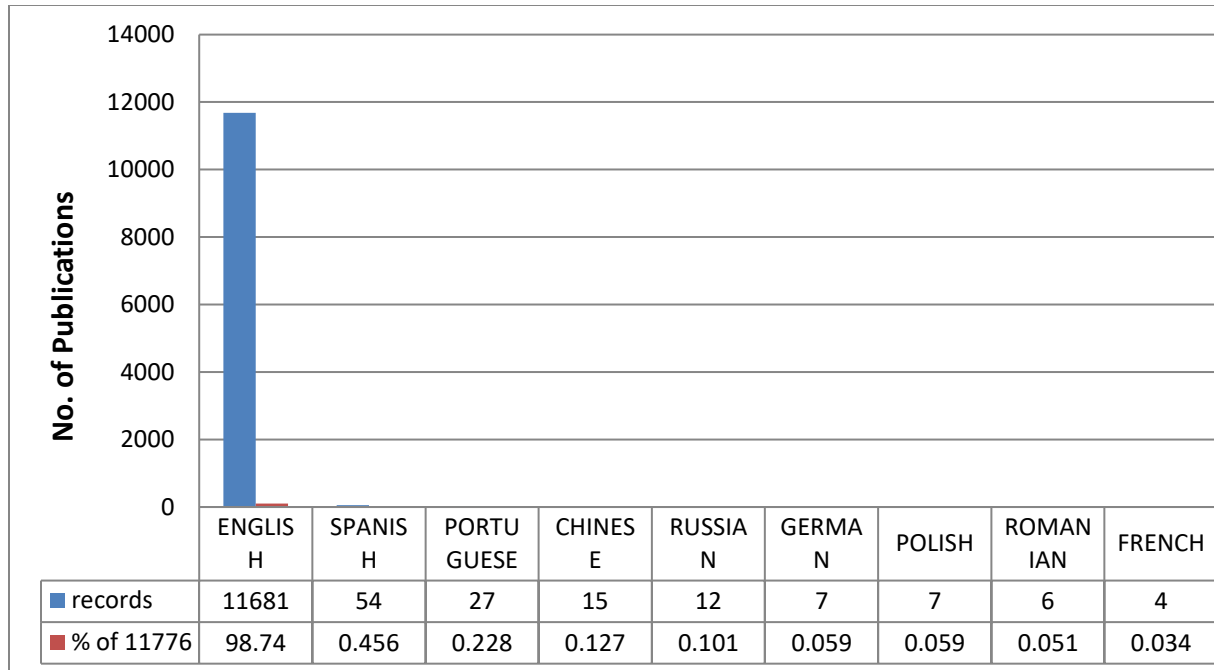


Figure No. 05

Figure 05 demonstrate the language wise publication on cloud computing during 2010-2019. It has been observed that *English* is the prominent language with 11681(98.74 %) publications. It is followed by *Spanish* Language covering 54 (0.45 %) publications. It is also observed that none of the publication has been found on cloud computing.

6. DISTRIBUTION OF PUBLICATIONS BY NATURE OF RECORD

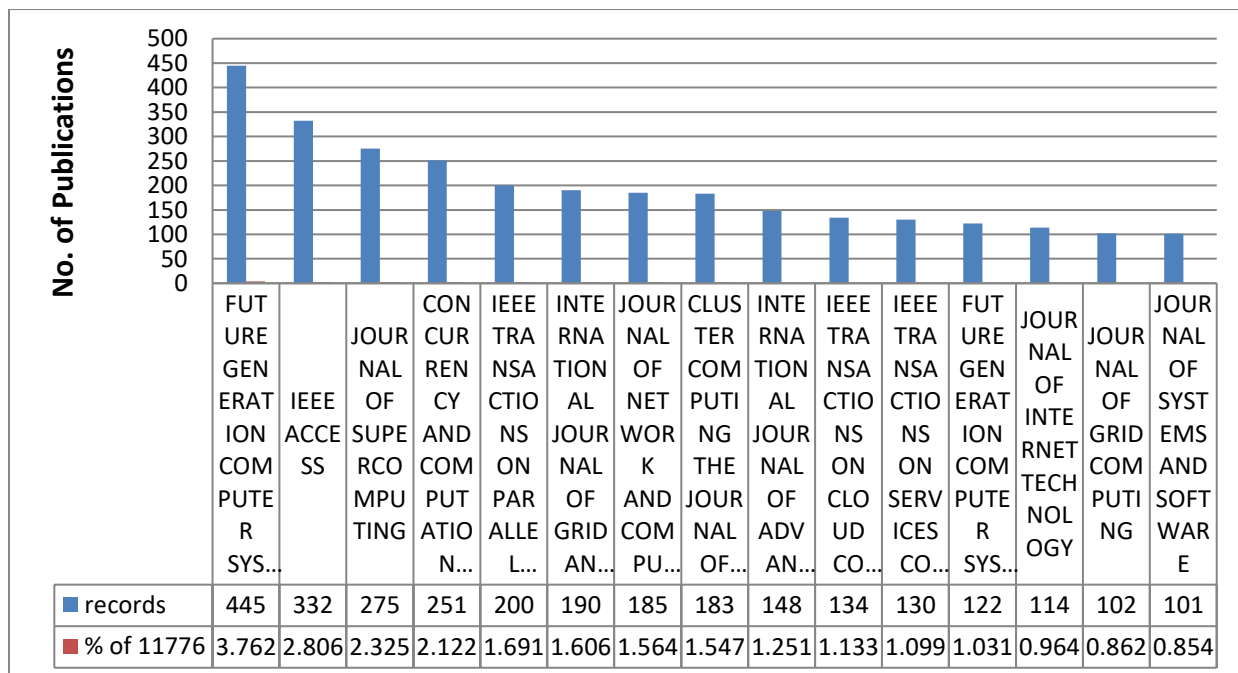


Figure No. 06

Figure no 06 shows the top 15 sources title which one published the largest number of literature on cloud computing. It is observed that the *Future Generation Computer* published largest number of literature i.e. 445 publication. The *IEEE Access* is at second position with 332 Publication followed by *Journal of Supercomputing* with 275 publications .The *IEEE Transection on cloud computing* is at 10th position with 134 publication and *Journal of Systems and Software* are on 15 the position with 101publications on cloud computing.

7. DISTRIBUTION OF PUBLICATIONS BY ORGANISATION

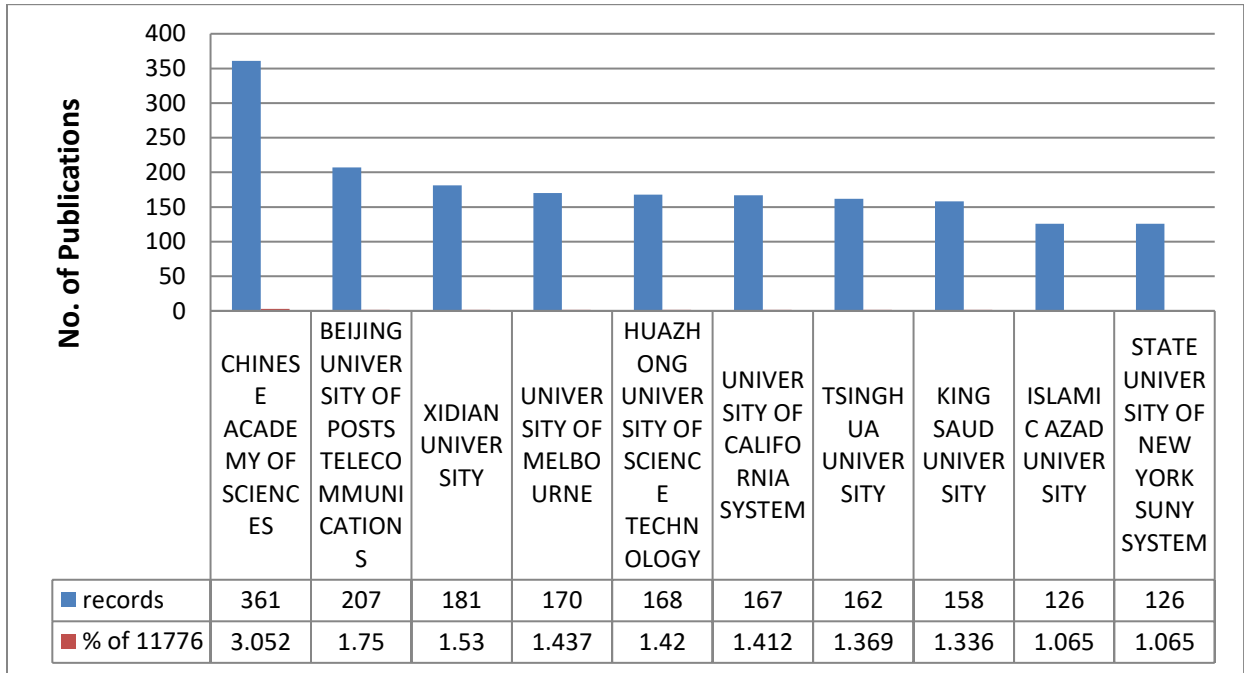
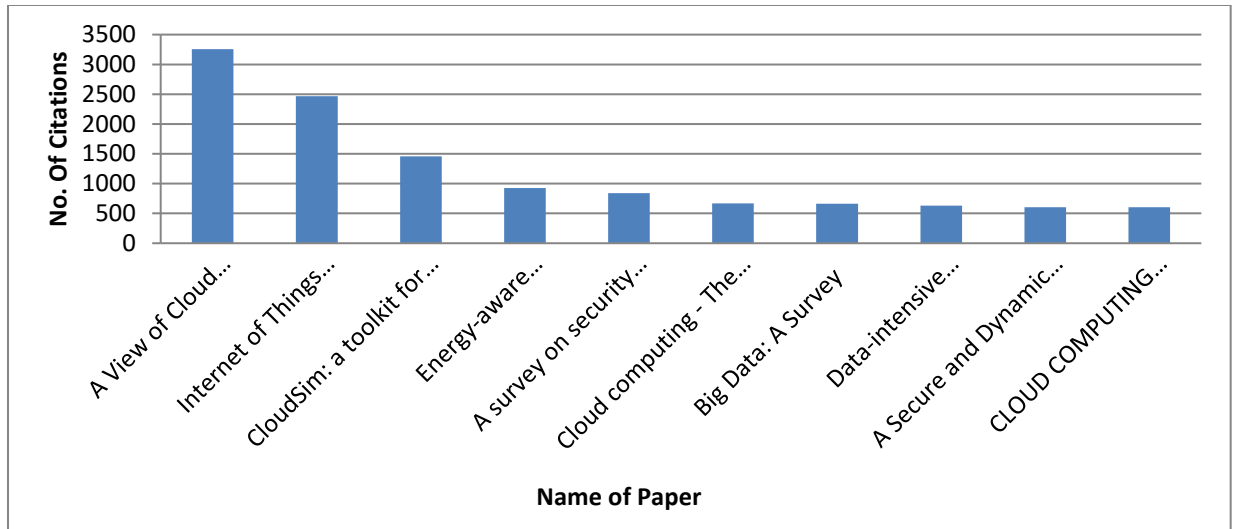


Figure No. 07

Figure no.07 shows the ranking of the affiliated institutes published papers on Cloud Computing at world level. On the basis of analysis it is found that *Chinese Academy of Sciences* is published largest number of literature on Cloud computing at world level i.e. 361 (3.052 %) of the total *publication*. Further it is observed that *Beijing University of post telecommunication* got second position with 207 (1.75 %) followed by *Xidian University* with 181 publications. *State University of Newark sunny system* secured 10th position with 126 publications. It has been also seen that there are little difference in the number of publication among ranking institutions.

8. HIGHLY CITED PAPER :



Sr.No.	Title	Authors	Citations	Average per Year
1.	A View of Cloud Computing	Armbrust, Michael; Fox, Armando; Griffith, Rean; Joseph, Anthony D.; Katz, Randy; Konwinski, Andy; Lee, Gunho; Patterson, David; Rabkin, Ariel; Stoica, Ion; Zaharia, Matei	3255	325.5
2.	Internet of Things (IoT): A vision, architectural elements, and future directions	Gubbi, Jayavardhana; Buyya, Rajkumar; Marusic, Slaven; Palaniswami, Marimuthu	2469	352.71
3.	CloudSim: a toolkit for modeling and simulation of cloud computing environments and evaluation of resource provisioning algorithms	Calheiros, Rodrigo N.; Ranjan, Rajiv; Beloglazov, Anton; De Rose, Cesar A. F.; Buyya, Rajkumar	1459	162.11
4.	Energy-aware resource allocation heuristics for efficient management of data centers for Cloud computing	Beloglazov, Anton; Abawajy, Jemal; Buyya, Rajkumar	926	115.75
5.	A survey on security issues in service delivery models of cloud computing	Subashini, S.; Kavitha, V.	840	93.33

6.	Cloud computing - The business perspective	Marston, Sean; Li, Zhi; Bandyopadhyay, Subhajyoti; Zhang, Juheng; Ghalsasi, Anand	669	74.33
7.	Big Data: A Survey	Chen, Min; Mao, Shiwen; Liu, Yunhao	661	110.17
8.	Data-intensive applications, challenges, techniques and technologies: A survey on Big Data	Chen, C. L. Philip; Zhang, Chun-Yang	629	104.83
9.	A Secure and Dynamic Multi-Keyword Ranked Search Scheme over Encrypted Cloud Data	Xia, Zhihua; Wang, Xinhui; Sun, Xingming; Wang, Qian	605	151.25
10.	Cloud Computing For Mobile Users: Can Offloading Computation Save Energy?	Kumar, Karthik; Lu, Yung-Hsiang	605	60.5

FINDINGS AND CONCLUSION:

The present study enumerates the literature productivity on Cloud Computing during 2010 to 2019 based on Web of Science core collections data base. Cloud computing is not just a technology but it is a powerful tool for taking decision for executive management. Cloud computing is rejuvenating library in modern society, so it is necessary to know the research productivity of the cloud computing. On the basis of analysis and observation of cloud computing research, the publication growth was recorded 22.50% in 2018 as compared to 18.96% in 2017. It is seen that 170 articles were published in 2010 whatever 2667 articles were recorded in 2018. Further, it is observed that the publication on Cloud Computing increasing rapidly and the continuous growth of the literature in this field also shows that the publication and research on cloud computing and its related fields are continually going on. It is observed that the field of Science and Technology such as Computer Science, Engineering, Library and Information Science, Management Science and Social Science are the major subject discipline covered the cloud computing research. Observation shows that 92.89% publications of the total publications are published in article form whereas 3.11 % and 2.84 % of the total documents are published in Review and editorial Material respectively. This shows that mostly publications are under article form. Country wise analysis shows that China and United states are leading the research publications, though India is at third position but it can be said that India may be at third rank in the publication of cloud computing, but it publishes almost two times and four times less literature than China and America, respectively. Author productivity analysis shows that **R. Buyya** is top author with 138 articles followed by **J. Lee** with 114. Top ten highly cited papers

also have been observed in the study. *A View of Cloud Computing* is highly cited paper with 3255 citations followed by *Internet of Things (IoT): A vision, architectural elements, and future directions* with 2469 citations. It also found that the Indian contributors S. Subashini and V Kavitha's paper *A survey on security issues in service delivery models of cloud computing* is at fifth position with 840 citations at world level. With the emergence of cloud computing, the way of libraries services are rejuvenating so this study provide a better understanding of patterns, developments and other important elements as a basis for executing library management and research actions in the area of cloud computing research.

REFERENCES:

1. **Chaurasia, N. K., Chavan, S. B. & Verma, V. K. (2016).** A bibliometric analysis of World research output on cloud computing. *International Journal of Information Dissemination and Technology*, 6(1), 1-4.
2. **Haag, S. & Eckhardt, A. (2014).** Organizational cloud service adoption: a scientometric and content-based literature analysis. *Journal of Business Economics*, 84(3), 407–440. doi:10.1007/s11573-014-0716-6
3. **Jan, R.W., Wasim, R. and Hafiz, O. (2015).** Scientometric Analysis of Cloud Computing" *Library Philosophy and Practice (e-journal)*. Paper 1273. Retrieved from <http://digitalcommons.unl.edu/libphilprac/1273>
4. **Siddagangaiah, K.N. (2017).** Global Research Productivity in Cloud Computing: A Bibliometric Study. *International Journal of Library and Information Studies*, 7(3).
5. **Sivakumaren, K.S., Swaminathan, S. and Karthikeyan, G. (2012).** Growth and Development of Publication on Cloud Computing: A Scientometric Study. *International Journal of Information Library and Society*, Vol 1 (1) , Retrieved from <http://www.publishingindia.com/ijils/52/growth-and-development-of-publication-oncloud-computing-a-scientometric-study/166/1310/>
6. **Sriram, I., and Khajeh-Hosseini, A. (2010).** Research agenda in cloud technologies. *arXiv preprint arXiv:1001.3259*.
7. **Surulinathi, M., Balasubramani, R and Kalisdha (2013).** Continent wise Analysis of Green Computing Research: A Scientometric Study. *Journal of Advances in Library and Information Science*, 2(1), 39- 44.
8. **Viswanathan, V. and Yugapriya, S. (2015).** Soft Computing: A Bibliometric Analysis on Research Outputs during 2005 – 2014. *Journal of Advances in Library and Information Science* ,4(3),243-247. Retrieved from [https:// www.jalis.in](https://www.jalis.in)
9. **Thirumagal, A., Sethukumari and Niruba, S. (2013).** Mapping of Scholarly Research in Cloud Computing: A Bibliometric Study. *SRELS journal of Information management*, 50(5), Retrieved from <http://srels.org/index.php/sjim/article/view/43804>