

**Global Research Productivity on Blockchain Technology: A  
Bibliometric Study**

**ABSTRACT**

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## ABSTRACT

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Literature plays an important role in conveying knowledge in any area for understanding the concept and meaning. This is very useful to know basic information and knowledge on any subject or topic. Literature means “a collection of basic theory or concept published on a particular topic or subject”. Everybody wants to get exact information and for the sake of knowledge they use the proper medium to reach his knowledge but in ancient era scientists and researchers preserved their information in clay tablets, stones etc. In modern times the number of literature publications is going to increase day by day because many journals, gateways produce scientific literature and represent the collaborative efforts of many scientists and authors of various subjects or areas. The publication of bibliometric analysis plays an important role in research in the field of information science. It could be described to the fact that bibliometric analysis is used to identify the top prominent subject authors and count the authorship pattern and secondary journal coverage. Literature is the body of many thoughts as revealed in published writings. It is an essential indicator for emerging new ideas in any subject.

Bibliometric analysis plays an important role in research in the field of information science. Bibliometrics is an application of Mathematical and statistical methods to analyses books and other media of communications. It has recently caught the attention of serious workers in Library and Information science from a theoretical and practical approach. The main purpose of Statistical Bibliography is to measure various facts of written communication to understand the nature of a discipline. It is a method in which numerical analysis of data, Book, Book chapter. Patents, software, designs, description of articles. It is also used to develop descriptive statistics as per the need. Generally, bibliometrics means “Book measurement” but it is not only books measurement it also covers journals, articles and other media of communication.

In 2008 Satoshi Nakamoto introduced an electronic (Crypto) currency named Bitcoin. The electronic currency is stored in a system and it works through a technique named e-currency or cryptocurrency. This e-currency mechanism is based on the distributed public ledger system and it is recognized as Blockchain Technology. So, the Blockchain Technology described that it is a data storage block which is arranged in sequential manner and connected with each other. This Blockchain Technology works as transfer data nodes and it is framed with inter connected pattern of information to perform a secure transaction and share through

all the nodes involved in the transaction which are connected to the network, it works as a decentralized distributed ledger system of recording digital information, all blocks are connected with their hash that makes it difficult or impossible to change any information of blocks no chance of hacking or cheating. Librarians play an important role in shaping how blockchain technology is applied to content creation, storage and distribution. In future libraries will be decentralized libraries, where library users can directly access the database without any difficulties. Library users can control their circulation records and manage their issue and return histories. Blockchain is the trending technology which has many potential applications to the library to a smart library. With the help of this technology it can be done in a distributed and timestamped manner.

Through this Technology anyone can track orders, payments, accounts, production and much more. If any business man shares a single view of any information but other people can see all details of the transaction end to end it also provides new efficiencies and opportunities. Blockchain is an emerging technology that will change the way we acquire and share information securely because this technology is a combination of cryptography, peer to peer network and smart contract. This is the era of information explosion and everybody wants nascent information in a few minutes so through this bibliometrics analysis information can be accessed in the easiest way.

### **OBJECTIVES OF THE STUDY**

1. To find out the growth pattern of publication in Blockchain technology literature.
2. To examine the authorship pattern in blockchain technology.
3. To examine the collaborative patterns in blockchain technology.
4. To identify the most prolific authors, journals, productive countries, and communication channels.
5. To examine the applicability of bibliometrics laws in Blockchain technology.
6. To compare India's research output along with the world's output in Blockchain technology.
7. To find out the highly cited authors(s), articles and journals.

### **HYPOTHESES OF THE STUDY**

1. Annual growth rate of research publication is increasing.
2. Multi-authored publications are greater than a single author.

3. India is the most collaborative country in Blockchain technology.
4. USA is the most productive country in Blockchain technology
5. Bradford's laws for journals are fit to Blockchain technology.
6. India's ranks among the top ten producing countries in world production.
7. USA is the most cited country in Blockchain technology research.

## **RESEARCH METHODOLOGY**

The study carried out using the Scopus database, an international database that searches for all records of articles contributed from various organizations and countries of the world. In order to fulfil the objectives, the related database was visited and the search term (TITLE-ABS\_KEY (blockchain AND technology) AND PUBYEAR< 2022) has been used. Total 14238 literature retrieved from database and MS Excel-19 version used for data analysis and for graphical presentation of data and also used VOSviewer and Biblioshiny software for data visualization and for measure of citations. Below the snapshot of the Scopus data retrieved result.

## **SCOPE AND LIMITATIONS OF THE STUDY**

There is another parallel database available for Blockchain related literature output but only the Scopus database has been used for this study. "Blockchain Technology" is the only keyword used for the data collection at Global level. The Bibliometric analysis is focused on the productivity of Blockchain Technology research for 15 years i.e. 2007-2021.

## **SIGNIFICANCE OF THE STUDY**

Bibliometric Analysis has emerged as one of the core parameters in research assessment and research output since a lot of techniques and tools were identified. The advent of new technologies and the generation maintained of bibliographic database research is gaining momentum. This study identifies prevailing trends of research, research prolific literature, geographical dominance in a particular subject enable the information generators and providers to design their own work and techniques, so it is enabled to serve the end user based on the detailed metric analysis of the research output. This study revealed that there has been a growing development in the field of Blockchain Technology day by day. This study collected all bibliographic information in one place which is more useful for future researchers who will be engaged with this technology and also helpful to those persons who

want to use this technology at their workplace such as library, Hospital, Banks and other companies.

## **CHAPTERIZATION**

### **CHAPTER 1: INTRODUCTION**

This is a brief introductory part of the thesis, which introduces Bibliometrics and Blockchain Technology. It also gives a short description of bibliometrics law and its related formulas. The historical background of bibliometrics, uses and types of blockchain technology have also been elaborated in this chapter.

### **CHAPTER 2: REVIEW OF THE LITERATURE**

In this chapter, the purposes and steps of reviewing literature have been explained. The chapter is divided into two parts: in the first part, the basics papers related to the fundamental bibliometrics have been reviewed and in the second part, the reputed papers related to bibliometrics study in the context of blockchain technology and its allied has been reviewed.

### **CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY**

This chapter gives a blueprint of the research work, like formulation of the research problem, objectives, scope and limitations, hypothesis formation, methods of data collection, data sorting, data analysis and data interpretations. Applicability of fundamental bibliometrics laws and their related formulas, such as relative growth rate (RGR) and doubling time (DT), Bradford's law of scattering of journals and an overview of VOSviewer, Biblioshiny, etc. have also been elaborated in this chapter.

### **CHAPTER 4: DATA ANALYSIS AND INTERPRETATION**

In this chapter, the data retrieved from Scopus databases on antibiotics research from 2007 to 2021 have been analyzed on the basis of certain formulas with the help of MS-Excel, VOSviewer, and Biblioshiny software. The tables and graphs are created based on data analysis. Bibliometrics law Bradford's law of scattering of journals, has also been applied to measure the research output.

### **CHAPTER 5: FINDINGS, CONCLUSION AND SUGGESTIONS**

This chapter made up findings, conclusion, suggestions, and area of further studies. Findings are a collection of summarized form of data interpretations, which are based on previous chapter-4. After findings, the conclusion, suggestions, and areas for further research have been stated in this chapter.

## **SUMMARY OF THE FINDINGS**

### **Year wise distribution**

A total number of 14238 literature were taken from the Scopus database on Blockchain Technology during the period of 2007-2021. The maximum literature published in 2020 with 4651 (32.66%) followed by 2021 with 3908 (27.44%) literature. The years 2008, 2009, 2011, 2012, and 2013 have found no publication. After 2016 the growth of publications is increasing in a continuous manner. The annual average growth rate of publications in the entire world is 1423.8 per year. (Excluding- 2008 to 2013).

### **Annual Growth Rate**

The Annual Growth rate (AGR) of the publication has decreased after 2015. After the analysis, it is found that the maximum AGR was counted in 2015.

### **Relative Growth Rate and Doubling Times**

The Relative Growth Rate has decreased year by year. Maximum RGR was recorded in the year 2015 and after the year 2015, the growth rate of RGR continuously decreased. The value of doubling time regularly increases year by year only excluding the year 2021.

### **India's Research Output**

India found the third position with 1626 (11.42%) literature whereas China was on top with sharing the highest literature which was 3162 (22.21%).

### **Authorship Pattern**

A total of 14238 literature was published by various authors of which 15.12 % of articles were published by a single author, 19.55 % of articles published by a double author. After the analysis, it is found that maximum literature was published by Three authors.

### **Most Prolific Authors**

After the analysis Kumar, N. and Salah, N found the most prolific authors with 38 articles. It is found that most of the author's publications are 10.

### **Author Keyword Occurrences**

During 2007-2021, a total of 14941 authors' keywords were found in 14238 literature published. Total 935 have been selected for visualization in which "Blockchain" was the most recurring author keyword followed by "Smart Contract".

### **Highly Cited Authors**

After the analysis, researchers found that Zhang, Y. highly cited authors with 2264 citations followed by Wang, H. 1581 citations, and Xu, X with 1441 citations.

### **Communication Channels**

Most of the literature is published in Journal and Conference Proceeding forms. Around 41.89% have been published in under journals and 40.62% literature published in Conference Proceeding form. Other communication channels such as Book Series, Book and Trade Journal.

### **Most Prolific journals**

A total of 5965 Journals have been founded in the contribution of Blockchain Technology. "Lecture Notes in Computer Science Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics" was the most prolific journal at rank first position with 496 publications. It has published the highest number of papers during the year 2007-2021.

### **Year Wise Journal Growth**

Researchers also record the yearly growth of the top 10 Highly productive journals in the year 2016-2021. "Lecture Notes In Computer Science Including Subseries Lecture Notes In Artificial Intelligence And Lecture Notes In Bioinformatics" published maximum literature in 2020. All top ten journals Year 2020 found the most productive year in which a maximum number of publications were published under the journal.

### **Highly Cited Journal**

After the analysis, the researcher found that a total of 5965 journals published literature in the field of Blockchain Technology during the study period. In which "PloS One" journal is cited

by maximum times whereas “Top 20 International journal of Web and Grid” with 589 citations.

### **Bradford’s Law of Scattering of Articles in Journals**

The 2.91% (46 Journals) of the total journals that published articles are scattered in zone-1 while 12.90% (204 Journals) in Zone-II and 84.20% (1332 journals) in Zone-III.

Expected values are calculated by formula  $1: n: n^2$  that is 46: 252: 1381 journals scattered in Zone-I, Zone-II, and Zone-III respectively.

The finding is that there is a difference between expected values and observed values so that Bradford’s law of scattering of articles in journals is not applicable in Blockchain Technology.

### **Collaboration of Countries**

In the analysis, the researcher observed that many countries collaborated with each other. United State collaborates with the maximum number of countries followed by the United Kingdom collaborates with 63 countries. India also collaborates with 57 countries with the fourth position.

### **Highly Productive Countries**

On the basis of analysis, the researcher observed that China (17.65%) contributes maximum literature in the field of Blockchain Technology. The United States published 9.88 % of the literature while India published 9.07% of literature which is in Third position.

### **Highly Cited Articles**

“An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends” has received a maximum of 1281 citations Followed by “IoT security: Review, blockchain solutions and open Challenges” with 868 citations.

### **Language Wise Distribution**

After analysis of data, the researcher finds that a total of 96.42% of literature has been published in the English language and remains in other languages such as Chinese, Spanish, German and Russian.

### **Fund Sponsoring Bodies**

National Natural Science Foundation of China is sponsoring to maximum no of institutes and provided grants followed by the European Commission, National Key Research and development program of China.

### **Subject Wise Distribution**

Total 29 subjects contribute in the field of Blockchain Technology in which highest 9653 (32.49%) articles were published under Computer Science subject followed by Engineering with 19.87 % and Decision Sciences with 8.44%. This study reveals that it has a multi-disciplinary scope, it has not been published only in Computer Science but also on other subjects as Mathematics, Engineering, and Management.

### **Highly Productive Institutions**

Chinese Academy of Sciences with 187 articles has been observed as a highly productive institution followed by Beijing University of Posts and Telecommunications with 163 articles and the Ministry of Education China with 107 articles.

### **Highly Cited Countries**

China has maximum citations with 20234 followed by the United States with 18954, United Kingdom. India is in 8th position with 4963 citations.

This study is a helpful tool in the assessment of research publications of researchers and scientists in the subject field of Blockchain technology. In the period of 2007-2021, it is observed that the Indian contribution has been low in Blockchain Technology hence the Indian should be encouraged to publish the research result in Blockchain technology. It will lead to enhancing the reputation of India. Indian authors should be initiated to produce the number of articles in this field. Indian Institutions should produce qualitative literature because no institution of India is in the tenth position.

## CONCLUSION

Basically, the bibliometric technique is one of the best techniques for conducting a quantitative analysis of research production and progress of any subject and institution. Blockchain Technology is an emerging technology so its bibliometric study will provide the best guidance for those who will use this technology. This technology came in 2007 but it grew up in the year 2015. Nowadays, almost every work has been carried out using emerging technologies and blockchain technology mostly used in the financial sector for privacy and security purposes. This study is based on 14238 literature indexed in the Scopus database and the literature taken from the year 2007-2021 in the field of Blockchain Technology. This bibliometrics study provides some factual and factorial data. All Research papers have been analysed for annual growth trends, authorship pattern, Relative growth rate, doubling time, Collaboration with countries, the applicability of Bradford's law, and examined the prolific authors, journals and also count the citations on a different base. In this study a total of 14238 literature was retrieved from the Scopus database during the period of 2007-2021. The maximum number of literature published in the year 2020 and maximum AGR is counted in 2015 and after 2016 there is a steady growth of publication for India and the world (Except-2021). Average of 1423.8 publications published per year at the global level. India is in the third position and China is in the first position. During the study Kumar, N. and Salah, H have been found to be highly prolific authors. Most of the literature was published in the English language and published by three authors. Literature published in journals on Blockchain Technology does not follow Bradford's law. "An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends" is a highly cited article published by "IEEE" journal in 2017. "PloS One " is a highly cited journal in the field of Blockchain Technology. Maximum works of literature are published in Journals and Conference Proceeding form. "National Natural Science Foundation of China" has sponsored various institutions. Maximum Literature published in Computer Science Subject. This study is the collection of all bibliographic information in one place which is more useful for future researchers who are engaged with this technology and also helpful to those persons who want to use this technology at their workplaces such as libraries, hospitals, banks, and other companies.

## **SUGGESTIONS**

- This study is a helpful tool in the assessment of research publications of researchers and scientists in the subject field of Blockchain technology. During the study process, it is observed that the Indian contributions have been considerably low in Blockchain Technology hence the Indian authors should be encouraged to publish research output in Blockchain technology.
- It leads to enhancing the reputation of India and Indian authors should be initiated to produce the number of articles in this field.
- Indian Institutions should be producing qualitative literature because no institution of India is in under the tenth position.

## **AREA FOR FURTHER RESEARCH**

- The present study is based on only the Scopus database. There is a need for a comprehensive and comparative bibliometric study on Blockchain technology with different databases like Web of Science, Up to Date, and PubMed.
- This study is based on literature from all over the world. The bibliometric study can also be done in India and also can be compared India to in the rest of the world.
- Only Bradford's law has been applied in this study but there are also remaining two laws like- Lotka's Law and Zipf's law also can be applied.