



Authorship Trend Evaluation on the impact of Covid-19 pandemic

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Abstract:

Presents a study of the trends in authorship pattern and collaborative research on Authorship trend evaluation on the impact of Covid-19 pandemic. In this study examines the Authors contribution on covid-19 disease for research beneficial purpose. For this paper focused on the various bibliometric Authorship parameter are analysed for the same i.e. Authorship, Co-Authorship, Degree of Collaboration, Author Productivity, Author per capita Growth also analyses the trends on authorships such as Relative Growth rate & Doubling Time, Pareto 80/20Rule, The paper is based on Bibliometric analysis of total 477 research articles contributed by the authors.in 2012-2021 total ten years' time period. It was seen that researchers utilize latest Technologies and Tools for new discovery of knowledge. The study reveals the conclusion about the Authors Contribution towards the Covid-19 infection is growing for successful result in positive health discovery and the findings must reveal various aspects of the characteristics and patterns of contributions of the study.

Keywords: Bibliometric, Covid-19, Impact, Authorship pattern, Pareto 80/20 principle, Collaborative coefficient, Collaborative Index, Per Capita.

01. Introduction:

The authorship pattern, one of prime aspects of Bibliometric analysis mainly deals with the kind of authors, nature and degree of collaboration among them and collaborative trend of authors. Authorship trend and collaborative research are important facets of scientometric, studies. Multiple authorship has been a characteristics feature of the social science and there has been consistent trends towards increased collaboration in all the branches of social science collaboration and them work are among the most important necessities sociological work today. Twenty first century has been collaborative research trend among scientists working in groups within and across the geographic boundaries of a country.

Bibliometrics is recent and most active field of "Library and Information science. The word bibliometrics appeared in print in Alan pitchards article statistical bibliography or bibliometrics. Bibliometrics has been known by other names, including "Statistical analysis of the literature" while Hulme used the term "Statistical bibliography" in 1923. Acknowledging the assistance and contributions of others

is now a well-established feature of the scholarly communication process. Acknowledgments in scientific publications are a common element in the scientific community, having a social function and cognitive significance (Tiew & Sen, 2002). Bibliometrics is a set of methods used to study or measure texts and information. Citation analysis and content analysis are commonly used Bibliometrics methods. Bibliometrics methods are most often used in the field of library & Information Science. In fact, bibliometrics method is used to explore the impact in the research. Bibliometrics also uses in quantitative research assessment.

02. Definitional Analysis: 2.1 Bibliometric:

The terms bibliometrics consist of two words namely 'Biblio' and 'Metrics', biblio means book and metrics means simply measurement. The terms was introduced and came into prominent with finding of journal named scientometric by T. Braunin in 1977. Originally published in Hungry and currently form Amesterdom scope of journal to publish all those studies of quantities aspect of science as discipline or economic activity. Bibliometrics is a relatively new metrics it is the application of mathematical and statistical analysis of graphical unit. The most basic bibliometric techniques which involve counting and categorizing publication by subject and by country. Oxford English Dictionary defines Bibliometrics as "The branch of library science concerned with the application of mathematical and statistical analysis to bibliography; the statistical analysis of books, articles, or other publications".

Definitions- Bibliometrics is a set of methods to quantitatively analyze scientific and technological literature. (Wikipedia.org)

Fairthorne (1969) defined as "quantitative treatment of properties of recorded discourse and behavior appearing to it. Bibliometric is also explained as quantitative analysis of bibliographic features of body of literature."

British Standard Institution (1976) described bibliometrics as "application of mathematical and statistical methods in the study of the use of documents and publication patterns."

Egghe (1988) explained that "The development and application of mathematical models and techniques to all aspects of communication. Bibliometrics is the quantitative study of literatures as they are reflected in bibliographies.

(Khaparde, 2011) stated Bibliometrics is described essentially a quantitative analysis of publications for the purpose of ascertaining specific kinds of phenomena.

2.2 Scientometrics:

Scientometric is the field of study which concerns itself with measuring and analyzing scientific literature. Scientometric is a sub-field of Bibliometrics. Major research issues include the measurement of the impact of research papers and academic journals, the understanding of scientific citations, and the use of such measurements in policy and management contexts. In practice there is a significant overlap between Scientometric and other scientific fields such as information systems, information science, science of science policy, sociology of science, and met science. Scientometrics has been traditionally convened with the analysis of the "information" parameters of science, such as of paper, patents, journals, laws of ageing and dissimilation of scientific information, citation process etc. Scientometrics aims at publishing original studies, short communications, preliminary report, and reviews, Scientometrics included the journal of research communication studies.

"Scientometrics is the investigation of science as development of information process". Nalimov and Mulchenk (1969)

3. Impact of Covid -19 infection

Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus. The COVID-19 pandemic has led to a dramatic loss of human life worldwide and presents an unprecedented challenge to public health, food systems and the world of work. The economic and social disruption caused by the pandemic is devastating: tens of millions of people are at risk of falling into extreme poverty, while the number of undernourished people, currently estimated at nearly 690 million, could increase by up to 132 million by the end of the year. The COVID-19 outbreak affects all segments of the population and is particularly detrimental to members of those social groups in the most vulnerable situations, continues to affect populations, including people living in poverty situations, older persons, persons with disabilities, youth, and indigenous peoples. COVID-19 Infection may also affect the areas of research also. Early evidence indicates that that the health and economic impacts of the virus are being borne disproportionately by poor people. For example, homeless people, because they may be unable to safely shelter in place, are highly exposed to the danger of the virus.

COVID-19 crisis food security, public health, and employment and labour issues, in particular workers' health and safety, converge. Adhering to workplace safety and health practices and ensuring access to decent work and the protection of labour rights in all industries will be crucial in addressing the human dimension of the crisis Comprehensive, universal social protection systems, when in place, play a much durable role in protecting workers and in reducing the prevalence of poverty, since they act as automatic stabilizers. That is, they provide basic income security at all times, thereby enhancing people's capacity to manage and overcome shocks. Data from the COVID-19 World Symptoms survey shows a decline in preventive behaviors such as physical distancing, mask wearing and hand washing as household overcrowding increases. Among people living in uncrowded households, 79% reported trying to physically distance themselves compared with 71% in moderately overcrowded and 65% in extremely overcrowded households. Similar trends were observed for hand washing and mask-wearing, underscoring vulnerabilities due to socioeconomic status.

3.1 Pub Med

Pub Med (Published Medical Literature) is an online version of MEDLINE, available free to anyone with internet access. Pub Med is a free search engine accessing primarily the MEDLINE database of references and abstracts on life sciences and biomedical topics. The United States National Library of Medicine at the National Institutes of Health maintains the database as part of the Entrez system of information retrieval. **Date launched:** January 1996 **Research centre:** National Library of Medicine (NLM) **Created by:** National Library of Medicine From 1971 to 1997, online access to the MEDLINE database had been primarily through institutional facilities, such as university libraries PubMed, first released In January 1996, ushered in the era of private, free, home- and office-based MEDLINE searching. The PubMed system was offered free to the public starting in June 1997. PubMed is a free resource supporting the search and retrieval of biomedical and life sciences literature with the aim of improving health—both globally and personally. The PubMed database contains more than 32 million citations and abstracts of biomedical literature.

04. Methodology

Methodology means study of method or a system of methods and rule applicant to research or work. It is connected basically with what principles and technique to be follow for collecting data information and material for a given research project. (Kothari, 1990). For the present study quantitative research method is used. It is also used as a way to research in different aspects of education.

05. Literature Review:

In recent years, many researchers have conducted Bibliometric analysis in different subject fields-

Gaikwad Deepa N. and Dongare Sudesh N. (2022) made study on Bibliometric study on Research analytics & Programming tools The study analysed the *In this study examines three* of Bibliometric laws i.e. Lotkas's law, (No. of authors) Bradford law, (No. of journals) Zip's law of (Word Occurrence). Also analyses the trends on authorships such as Relative growth rate & Doubling Time, Pareto 80/20Rule. This study focuses on Research Technique and programming tool and uses review analysis to determine important issues raised by recent research conducted on this topic.

Agarwal and Islam (2020) examined the articles published in the "Journal of the Association for Information Science & Technology (JASIST)" from 2000-2020. It was found that more than 3,000 articles were published in the journal in which 75.73% of articles were contributed by two or more authors while 24.27% articles by single authors. Three thousand fifty-two (3,052) articles received 1, 80,608 citations during the study period and the average citations per article were 59.18. Collaboration by country reveals that the United States contributed nearly 40% of the authors and ranked first, followed by the United Kingdom with 8% authorship shares.

Gaikwad Deepa N. and Khaparde Vaishali .S. (2019) were studied in scientometric analysis on mapping of plagiarism research output in India. The Study analysed the plagiarism research performance of India in national as well as global Context, Focused on geographical distribution that the most of the publication are from USA with 19.32% the study explained that the solo Research is predominant than the collaborative research and the degree of collaboration is 0.87 also shows that the Relative growth rate [R (A) is (0.346) while the Doubling time DT (A) gradually increased from (1.548) that shows rate of publication was decreased, the Doubling time was increased.

Hussain, Ibrahim, and Saeed (2019) studied the publication pattern of the journal of Islamic study. It was found that 91 articles were published during the study period in the journal. Single authors contributed the majority of the articles and 84.62% were male while 14.29% were female. Most of the contributions were from Pakistan, followed by the USA.

Hodonu-Wusu and Lazarus (2018) conducted a Bibliometric analysis of LIS research from 1980 to 2017. The records of articles were retrieved from the Web of Science database and 6498 records were analyzed. The year 2016 was the most productive with 595 publications while 1981 was least productive year with only 13 publications. The most cited document type was articles (4303 citations) 66.26% followed by proceeding papers (1014 citations) 15.61% and reviews (912- citations) 14.04%. The USA was ranked 1st based on the number of citations (39.54%) followed by England (9.53%) and China (6.13%).

Dongare Sudesh N. and Khaparde Vaishali .S. (2015) made study on Scientometric Analysis of Library Herald Journal. Focussed on geographical distribution, highly contributed authors in journal. That of the most contributions are from India with 75.49% and the rest 24.50% only from foreign sources.

Khaparde Vaishali and Fawaz Abdullah Alhamdi (2015) made study on The Electronic Library Journal: A bibliometric study (2010 to 2014). Focussed on the number of articles published per volume in each specific year, authorship patterns. Found that As DC value is more than 0.5, it is evident that multiple authored articles occupy the prominent position indicating the supremacy of solo research in the "The Electronic Library".

06. Objectives of the Study: - According to the specific field Like Year, Authorship, Journal wise distribution etc. objectives of the study categorized are as follows-

1. To estimate the Annual Growth rate (AGR) of publication.
2. To study the No. of journals wise distribution of publication.
3. To study Authorship & Pareto's 80/20 Principle wise distributions of Publications
4. To study the Co – Authorship Pattern of Publication
5. To distributing Authorship Productivity (AAPP)
6. Relative Growth Rate [r (a)] And Doubling Time [dt (a)] For Publications
7. To find out the author's degree of collaboration pattern in the publication
8. To find most productive author wise distribution of publication
9. To estimate the Collaborative Index (CI) of publication
10. To estimate the Collaborative Coefficient (CC) of publication
11. To distributing Authorship per capita Productivity.

07. Hypothesis of the Study: The following hypotheses are formulated for the present study:

- 1) Co-Authors is Predominant than the solo Author.

08. Scope and Limitation of the Study: The present study is based on Bibliometric study. The scope of the present study is limited to the 477 articles covered on 'Impact of Covid-19 (Corona) infection' on Pub Med Database during the total ten years i.e. (2012-2021).

09. Data Collection: The list of Articles on Impact of Covid-19 (Corona) infection were collected from the Pub Med Database the latest 10 Years from 2012-2021 with adequate details such as applied Authorship, Co-Author and also the Degree of Collaboration, Estimate Pareto 80/20 Principle, (RGR & DT) various other analysis done on basis upon data collected. These have been classified grouped and analysed to find the various dimensions of the study.

10. Data Analysis: The analysis will be done as per the parameters laid down in the objectives of the study. The data collection & analysis is done for Impact of Covid-19 (Corona) infection a Bibliometric study of total 477 articles was collected & analysed as per the objective laid down as well as by using various statistical tools.

According to the objective of the study, analysis & findings of the study are outline below:

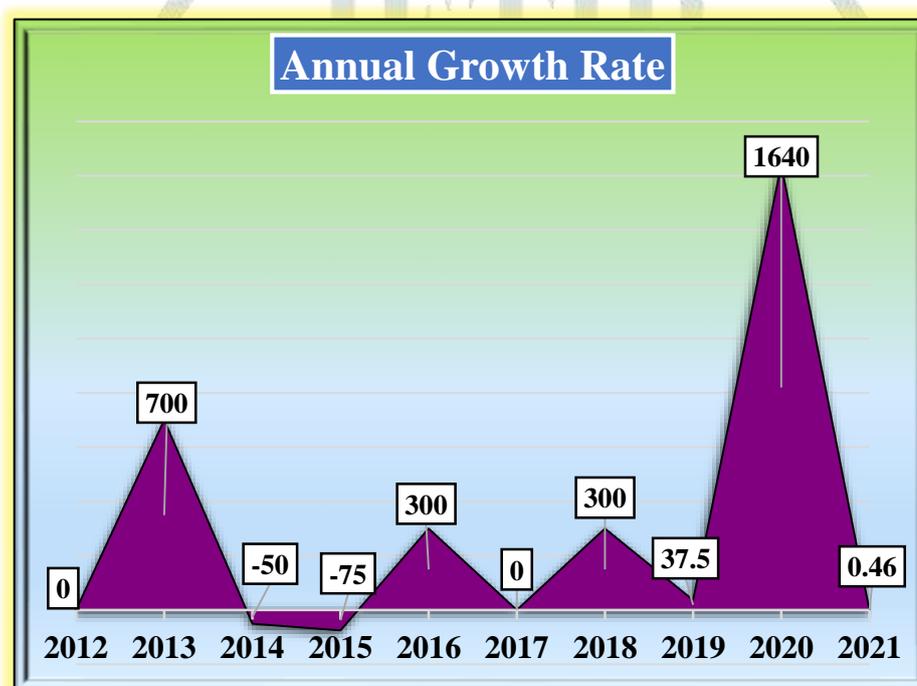
1. Annual Growth Rate (AGR) wise distribution

The growth rate is a measurement which is essential in any field. In meaning the growth of the number of publications in a particular discipline. This is often a measure of the annual increase or decrease. Here, the AGR has been determined as per the formula given below:-

$$\text{AGR} = (\text{End value} - \text{First value}) / (\text{First Value}) \times 100$$

Table No. 1. - Annual Growth Rate Wise Distribution

Sr. No.	Year	Frequency	Percentage%	AGR %
1	2012	1	0.21	
2	2013	8	1.68	700.00
3	2014	4	0.84	-50.00
4	2015	1	0.21	-75
5	2016	4	0.84	300
6	2017	4	0.84	0
7	2018	16	3.35	300
8	2019	10	2.10	37.5
9	2020	174	3.56	1640
10	2021	255	53.46	0.46

Figure No.01 Annual Growth Rate of Publication

In this Table 1. & Figure No.01 Describe the Annual growth rate of each year according to published paper during particular year. This table reveals that the AGR of 2013 is 66.66 followed by 2014 are -20 & in the year 2015 with 25 are indicated & so on.

2. Journal Wise Distribution of Publication

In the present era, journals play an important role in scientific communication of current information. Articles published in journals provide nascent micro thoughts to the researchers. The present study is therefore meant to identify the most important journals, constituting the most of the literature of research value in the field of "Research analytics & programming tools". In order to determine the ranking of journals the Articles were grouped according to the name of journals. The ranking of journals is essentially a practical tool designed to help the librarian and research scientist to select the journals of maximum utility in relation to their coverage of new and important literature in particular subject area. The ranking of journals is shown in the table no.02

Table No - 02 Journal -Wise Distribution of contributions

Sr. No.	Journal Name	Total Articles	Percentage%
1	Cureus	12	2.52
2	PLoS One	11	2.31
3	Int J Environ Res Public Health	10	2.10
4	Sci Rep	9	1.89
5	J Clin Med	6	1.26
6	Front Psychol	6	1.26
7	Diabetes Metab Syndr	5	1.05
8	Front Med (Lausanne)	5	1.05
9	Front Immunol	4	0.84
10	Front Psychiatry	4	0.84
11	Front Public Health	4	0.84
12	Ann Med Surg (Lond)	4	0.84
13	Andrology	4	0.84
14	Saudi J Biol Sci	4	0.84
15	Indian J Gastroenterol	3	0.63
16	J Infect	3	0.63
17	J Neurol Sci	3	0.63
18	Mater Today Proc	3	0.63
19	Medicine (Baltimore)	3	0.63
20	Neuroimage Clin	3	0.63
21	Pak J Med Sci	3	0.63
22	Pan Afr Med J	3	0.63
23	J Family Med Prim Care	3	0.63
24	Biomed Pharmacother	3	0.63
25	BMC Infect Dis	3	0.63
26	BMC Public Health	3	0.63
27	Sci Total Environ	3	0.63
28	Two Times Journal (2*50=100)	100	20.96
29	One Time Journal (1*250=250)	250	52.41
	Total	477	100.00

The journals are most preferred publication used by the researcher in their Study. It may be revealed that the authors are more than likely to publish their work in different journals with their respective subject areas/disciplines. In the collected data, Observed that the “Cureus” & scores the top position with 12 (2.52 %) & second rank goes to “PLoS One” Sustainability journal with 11 (2.31%) articles and other all journal ranking show in the table and also One Time Journals with 250 (52.41) Journals respectively.

03- Authorship and Pareto’s 80/20 Principle

In 1906, Italian economist Vilfredo Pareto created a mathematical formula to describe the unequal distribution of wealth in his country, observing that twenty percent of the people owned eighty percent of the wealth. In the 1940s, Dr. Joseph M. Juran inaccurately attributed the 80/20 rule to Pareto, calling it Pareto’s

Principle. More generally, the Pareto Principle is the observation (Not Law) that most things in life are not distributed evenly. It can mean all of the following things: 20% of the input creates 80% of the result

20% of the workers produce 80% of the result

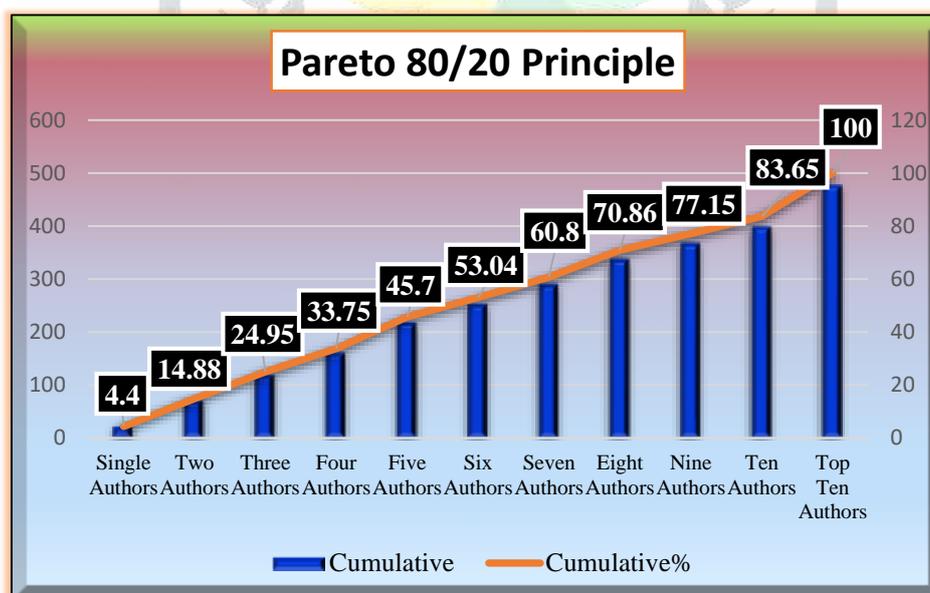
20% of the customers create 80% of the revenue, 20% of the bugs because 80% of the crashes, 20% of the features cause 80% of the usage and so on.

We must remember that idea: The numbers 20 and 80 must add to 100 – they don't! 20% of the workers could create 10% of the result, or 50%. Or 80% or 99%, or even 100%. Think about it- in a group of 100 workers, 20 could do all the work while the other 80 goof off. In that case, 20% of the workers did 100% of the work. Remember that the 80/20 rule is a rough guide about typical distributions.

Table No. 03 - Authorship & Pareto 80/20 Principle Distribution

Sr. No.	Authorship	Frequency	Percentage%	Cumulative	Cumulative%
1	Single Authors	21	4.40	21	4.40
2	Two Authors	50	10.48	71	14.88
3	Three Authors	48	10.06	119	24.95
4	Four Authors	42	8.81	161	33.75
5	Five Authors	57	11.95	218	45.70
6	Six Authors	35	7.34	253	53.04
7	Seven Authors	37	7.76	290	60.80
8	Eight Authors	48	10.06	338	70.86
9	Nine Authors	30	6.29	368	77.15
10	Ten Authors	31	6.50	399	83.65
11	Top Ten Authors	78	16.35	477	100.00

Figure no – 02 Pareto 80/20 Principle Distribution



In short, 80/20 principle states that 20% of source account for 80% of items and vice-versa i.e. other 80% of sources account for the rest 20% of items. This implies that the numbers of items are much more than the number of sources. In bibliometric/Informetric context, 20% of holdings account for 80% of circulation of library books, 20% of authors account for 80% of publication, etc.

It is observed from the above table no - 3 and figure No -02. that, the of single authors have Written 4.4 % total publication, two authors written 14.88, followed by Three authors 24.95, Four authors 33.75 & others authors respectively, i.e. more than ten times is 100.00 that it should be in increasing order.

4. Co - Authorship Pattern of contribution

Table No – 4 Co - Authorship Pattern of contribution

Year	Author Nature	Frequency	Total	Percentage	Cumulative
	Single Author	0		0.0	
2012	Co-Authors	1	1	100	100
	Single Author	0		0.0	0
2013	Co-Authors	8	8	100	100
	Single Author	0		0.0	0
2014	Co-Authors	4	4	100	100
	Single Author	0		0.0	0
2015	Co-Authors	1	1	100	100
	Single Author	0		0.0	0
2016	Co-Authors	4	4	100	100
	Single Author	0		0.0	0
2017	Co-Authors	4	4	100	100
	Single Author	0		0.0	0
2018	Co-Authors	16	16	100	100
	Single Author	1		10.0	10
2019	Co-Authors	9	10	90	100
	Single Author	12		6.9	7
2020	Co-Authors	162	174	93	100
	Single Author	8		3.1	3
2021	Co-Authors	247	255	97	100
	Total		477		

It is observed from the Table No – 4 that the value of Co- Authorship Pattern for Single authored papers during 2012-2021. From this table Observed that the highest Single authored papers with 12 publications (6.9 %) in the year 2019 And in the 2021 Co - Authorship Pattern for multi authored papers highest with 247 publications (97%) which indicated that the collaborative research is increasing over the study of “Bibliometrics”. **Hence where in which Hypothesis No.01 is valid, Co-Authors are Predominant than the solo Authors.**

5. To study the Author's Productivity

Table No – 5 Author Productivity

Year	No. of Articles	No. of Author	AAPP	PPA
2012	1	8	8.00	0.13
2013	8	82	10.25	0.10
2014	4	42	10.50	0.10
2015	1	10	10.00	0.10
2016	4	27	6.75	0.15
2017	4	41	10.25	0.10
2018	16	148	9.25	0.11
2019	10	78	7.80	0.13
2020	174	1066	6.13	0.16
2021	255	1670	6.55	0.15
Total	477	3172	85.48	1.22

The data pertaining to author productivity has presented in the Table No. 5 shows that the total average number of authors per paper is 85.48 for the relatively equal average number of authors per article when compared the total average number of authors per article. The average productivity per author is 1.22 during the year 2012 – 2021. Productivity has been calculated with the following formula.

Average Authors per Paper = No. of Authors / No. of Papers

Productivity per Author = No. of Papers / No. of Authors

6. Relative Growth Rate (RGR) and Doubling Timing (DT) of Articles

Table No – 06 (RGR) and (DT)

Year	Frequency	Cumulative Frequency	W1	W2	RGR	Mean[R(A)]	DT(A)	Mean DT(A)
2012	1	1		0				
2013	8	9	0	2.19	2.19	0.57	0.32	2.95
2014	4	13	2.19	2.56	0.37		1.87	
2015	1	14	2.56	2.63	0.07		9.90	
2016	4	18	2.63	2.89	0.26		2.67	
2017	4	204	2.89	5.31	2.42		0.72	
2018	16	220	5.31	5.39	0.08	8.66		
2019	10	230	5.39	5.43	0.04	17.33		
2020	174	404	5.43	6	0.57	1.22		
2021	255	659	6	6.49	0.49	1.41		

Table No – 06 it noticed that the mean relative growth for the first five years 2012 to 2016 is (0.57), and the mean relative growth rate for the last five years 2017 to 2021 increased to (0.72). While the mean doubling time for the first five years (i.e. 2012 to 2016) is only (2.95) which is increased to (5.78) during the last five

years (2017 to 2021). Thus as the rate of growth of Articles and the corresponding Doubling Time was increased.

7. Degree of Collaboration

Degree of collaboration in the international journal of “Computer Mediated Communication” the formula given by k. Subramanyam is useful for determining the collaboration in quantitative terms. The study followed the formula which is mathematically put as;

$$C = \frac{NM}{NM+NS} \quad \text{i.e. } C = NM / NM+NS$$

Where,

C = Degree of collaboration

NM = Number of multi authored papers

NS = Number of single authored papers

In the present study

NM =3143

NS=29

$$= \frac{3143}{3143 + 29}$$

$$\frac{3143}{3172} = 0.99$$

Those, C = 0.99

So, in the study the degree of collaboration during the overall 10 years (2009 – 2018) is = 0.99

Year	Total no. of articles	Total no. of authors	No. of single authors articles	% of articles	No. of Multi authored Articles	% of Multi Author Article	Degree of collaboration
2012	1	8	0	0.00	8	1.68	1.00
2013	8	82	0	0.00	82	17.19	1.00
2014	4	42	0	0.00	42	8.81	1.00
2015	1	10	0	0.00	10	2.10	1.00
2016	4	27	0	0.00	27	5.66	1.00
2017	4	41	0	0.00	41	8.60	1.00
2018	16	148	0	0.00	148	31.03	1.00
2019	10	78	1	0.21	78	16.35	1.00
2020	174	1066	20	4.19	1046	219.3	0.98
2021	255	1670	8	1.68	1662	348.4	1.00
Total	477	3172	29	6.08	3143	658.9	0.99

Table No. 7 shows that in the 10 years period, i.e. 2012-2021 the single authorship articles are lower than multi author so, multi author are predominant than single authors. The multi authored articles are highest in the year 2021. Total no of Multi Authors are 3143 & total of single authors are 29 contributions respectively.

8. Most Productive Author

Table No - 8: Most Productive Author

Sr. No.	Authors	Frequency	Percentage %
1	Kumar A	7	0.22
2	Li Y	6	0.19
3	Wang W	5	0.16
4	Maggi M	5	0.16
5	Kumar S.	5	0.16
6	AttiaYA	4	0.13
7	Isidori A M	4	0.12
8	Arafa A	4	0.12
9	Kjoelbye J S	4	0.12
10	Pivonello R	4	0.12
11	Wang X	4	0.12
12	Kumar R	4	0.12
13	Three Times Author (3*18=54)	54	1.72
14	Two Times Author (2*232=464)	464	14.78
15	One Time Author (1*2565=2565)	2565	81.71
	Total	3139	100

It can be observed from Table No.08 that, the most productive authors are Kumar A who had contributed 7 Articles (0.22%). Then followed by Li Y Contributed 6articles (0.19%). The One time published Author is 2565 (81.71 %) And all other Authors are shown in table likewise contributed their work in this study.

9. To find Collaborative Index of Contribution

Table No - 9: Collaborative index

Year	Single	Two	Three	Four	Five & Above	Total Article	CI
2012	0	0	0	0	1	1	5
2013	0	0	0	0	8	8	5
2014	0	0	0	0	4	4	5
2015	0	0	0	0	1	1	5
2016	0	0	0	4	4	4	9
2017	0	0	0	0	4	4	5
2018	0	0	0	8	16	16	7
2019	1	0	1	0	9	10	4.9
2020	12	20	21	18	103	174	4.03
2021	8	30	26	21	170	255	4.23
Total	21(4.40)	50(10.48)	48(10.06)	51(10.69)	320(67.08)	477	4.33

This is one of the early measures of degree of collaboration derived by Lawani (1980).

$$CI = \frac{\sum_{i=1}^N A_i i f_i}{N}$$

It is a measure of mean number of authors. Although it is easily computable, it is not easily interpretable as a degree, for it has no upper limit. Moreover; it gives a non-zero weight to single-authored papers, which involve no collaboration.

$$CI = [(f_1) 1 + (f_2) 2 + (f_3) 3 + \dots (f_k) k] / N$$

Using data in the Table 9, during 2012-2021,

$$\begin{aligned} CI &= (21 + 50 \times 2 + 48 \times 3 + 51 \times 4 + 320 \times 5) / 477 \\ &= 21 + 100 + 144 + 204 + 1600 = 2069 \\ &= 2069 / 477 = 4.33 \end{aligned}$$

Table 9 shows the variation in the CI. It varies from 4.03 in 2020 lowest CI in the year 2020 and highest Collaboration we can notice in 2016 i.e. 9 this may be due to the geographical or environmental factors of the organization. Final total Collaborative Index is 4.33.

10. To study Collaborative Coefficient

According to Ajiferuke et al. (1988) who have shown the mean number of authors per paper, the proportion of multiple authorship as a measure of degree of collaboration in a discipline, is inadequate. Therefore, they have proposed a measure combining some of the merits of both measures into what is known as Collaborative Coefficient.

Suppose, if a paper has a single author, the author receives one credit; if two, each receives ½ credits. In general, if we have 'n' authors each receive 1/n credits. Hence, the average credit awarded to each author of a random paper is E [1/n], a value which lies between 0 and 1. If '0' is to correspond to single authorship, then the CC is defined as:

$$\begin{aligned} CC &= 1 - E [1/n] \\ &= 1 - (1/j) p (N=j) \end{aligned}$$

$$\text{And its sum } \sum \text{rate} = \frac{1 \cdot f_1 + (1/2) f_2 + (1/3) f_3 + \dots + (1/k) f_k}{N}$$

Where: f_j is the number of j-authors research papers published in a discipline during a certain period of time, N is the total number of research papers published in a discipline during a certain period of time (excluding anonymous authors) and K is the greatest number of authors per paper in a discipline. Ajiferuke et al were of the opinion that the CC incorporates the sum of the merits of both CI and DC. It lies between 0 and 1 ($0 \leq CC \leq 1$). It tends to zero as single authored papers dominate and differentiates among levels of multiple authorship.

Table No 10 Collaborative Coefficient

Year	Single	Two	Three	Four	Five & Above	Total Article	CC
2012	0	0	0	0	1	1	0.8
2013	0	0	0	0	8	8	0.8
2014	0	0	0	0	4	4	0.8
2015	0	0	0	0	1	1	0.8
2016	0	0	0	4	4	4	0.55
2017	0	0	0	0	4	4	0.8
2018	0	0	0	8	16	16	0.68
2019	1	0	1	0	9	10	0.69
2020	12	20	21	18	103	174	0.69
2021	8	30	26	21	170	255	0.72
Total	21(4.40)	50(10.48)	48(10.06)	51(10.69)	320(67.08)	477	0.71

Table 10 shows the CC has increased from 0.8 in 2012-2015, & 2017 to 0.72 in 2021 indicating that research among scientists is fairly collaborative with an average CC is 0.71.

$$CC = 1 - [f_1 + (1/2) f_2 + (1/3) f_3 + \dots + (1/k) f_k] / N$$

Based on the data in the Table 4, using the values for f1, f2, and f3, CC for the year 2001

$$CC = 1 - \{[21 + (1/2) 50 + (1/3) 48 + (1/4) 51 + (1/5) 320] / 477 N\}$$

$$= 1 - \{[21 + 25 + 15.84 + 12.75 + 64] / 477\}$$

$$= 1 - [138.59 / 477]$$

$$= 1 - 0.290$$

$$CC = 0.71$$

11. Authorship Per-capita Analysis

The analysis revealed that 3172 authors contributed 477 items during the period between 2012 to 2021. From this data, the per capita authorship could be calculated as

$$\text{Per Capita Authorship} = \text{number of items} / \text{Number of authors}$$

$$= 3172/477$$

$$= 6.65$$

The per capita authorship is 6.65

Table 11 Authorship Per capita Productivity – Year wise analysis

Year	No. of Articles	No. of Author	Per Capita
2012	1	8	8.00
2013	8	82	10.25
2014	4	42	10.50
2015	1	10	10.00
2016	4	27	6.75
2017	4	41	10.25
2018	16	148	9.25
2019	10	78	7.80
2020	174	1066	6.13
2021	255	1670	6.55
Total	477	3172	6.65

From the collected data is observed that there is large variation in the per capita authorship in each year that is shown in Table no-11. The per capita authorship ranges from 6.13 to 10.50 while the overall per capita authorship is 6.65. This indicates that the survival rate of most of the authors is more.

Conclusion:

We concluded that the present study is based on COVID 19 pandemic studies during the period of last 10 years. This study is completed with the help of PubMed database, this study is helpful for research's as well as COVID 19 Research study areas. It is good and beneficial for the researchers and also for the medical student's, practitioners for gaining new informative knowledge about this recent pandemic & Authorship trend involved in this study for purposive knowledge. Immediate and purposeful action to save lives and livelihoods should include extending social protection towards universal health coverage and income support for those most affected. These include workers in the informal economy and in poorly protected and low-paid jobs, including youth, older workers, and migrants. Different forms of support are

key, including cash transfers, child allowances and healthy school meals, shelter and food relief initiatives, support for employment retention and recovery, and financial relief for businesses, including micro, small and medium-sized enterprises. In designing and implementing such measures it is essential that governments work closely with employers and workers.

The pandemic has also revealed significant gaps in country health information systems. While high-resource settings have faced challenges related to overstretched capacity and fragmentation, weaker health systems risk jeopardizing hard-won health and development gains made in recent decades. Now is the time for global solidarity and support, especially with the most vulnerable in our societies, particularly in the emerging and developing world. Only together can we overcome the intertwined health and social and economic impacts of the pandemic and prevent its escalation into a protracted humanitarian and food security catastrophe, with the potential loss of already achieved development gains.

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